

## Simulating agricultural policy reform with ATPSM

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### Abstract

*Developing countries are demanding a greater role in the current round of multilateral trade negotiations than they received in previous rounds. Agriculture remains an important sector for most developing countries and this sector could yet be a stumbling block in the current negotiations. Avoiding an impasse requires an analysis of the potential gains and losses from further trade liberalisation. Since the Uruguay Round, analysis of trade liberalisation has been made more complex by the introduction of the tariff rate quota system of regulating access to agricultural markets.*

*The Agricultural Trade Policy Simulation Model (ATPSM) is a static, multi-commodity, multi-region, partial equilibrium trade model that takes into account the distribution of quota rent and differences in bound and applied tariff rates. The estimated annual static welfare gains from a continuation of Uruguay Round agricultural trade liberalisation are relatively modest, at around US\$9 billion. However, the distribution of the gains between countries depends significantly on the current allocation of quota rents.*

*Key words: agriculture, trade, modelling*

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The opinions expressed in this paper are those of the author and do not necessarily reflect the views of UNCTAD or its members. The designations and terminology employed are also those of the author.

## 1. Introduction

Progress in the current WTO round of multilateral trade negotiations requires that the interests of developing countries are adequately taken into account, as acknowledged in the Doha Development Agenda. The complexity of international negotiations implies that for developing countries to participate effectively, their capacity to do so must be enhanced. One contribution towards enhancing the capacity to effective negotiation is the provision of detailed tools of analysis that show the impact of liberalisation on individual countries for the tropical products.

Helping developing countries to evaluate and develop a negotiating position requires a detailed coverage of agricultural products, a high degree of country disaggregation and information on quota rents in addition to high quality data on tariff, export subsidy and domestic support policies. As negotiations may focus on reforms to each of these three areas, it is useful to know the impact of different types of reforms on different sectors and countries. Finally, the distributional effects of trade liberalisation far outweigh the welfare effects. While models typically ignore the costs of moving resources from one sector to another, it is useful to know the likely transfers between producers, consumers and taxpayers. The Agricultural Trade Policy Simulation Model (ATPSM), a deterministic, comparative static, partial equilibrium trade model, is used to assist developing countries in developing a negotiating strategy. In this paper the sources of gains (and losses) to developed, developing and least developed countries and the commodity sectors are identified.

Developing a negotiating strategy is now more difficult than ever. Changes in trading rules and policies introduced following the Uruguay Round have thrown up new challenges in modelling these gains and losses. In the case of market access, for example, the Agreement on Agriculture led to the establishment of a two-tier tariff system based on import quotas (the tariff rate quota system) for 1,379 tariff lines. Modelling market access when there is a tariff rate quota is complicated by the existence of quota rents. The impact of a change in one or both of the two tariff rates or in the quota level will depend on which instrument is binding. Changing either of these three instruments will have no impact on prices and volumes if one of the other instruments is binding<sup>1</sup>.

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1 A discussion of the analysis of tariff rate quotas can be found in de Gorter (1999).

A further complexity is the distribution of quota rents. The distribution of rents between exporters, importers and governments depends on a variety of factors, not least the manner in which the quotas are administered.

The existence of tariff rate quotas also brings about a requirement for data not previously collected. For example, data are needed for within-quota and outquota tariffs, import quotas and fill rates.

Modelling domestic support measures is also not straightforward, as it is not clear what the relationship is between domestic support levels and the level of production. Many forms of support, so-called green and blue box, are exempt from reduction commitments and thus countries are tempted to re-label production-related support into these categories. The United States would appear to have taken this approach in its recent Farm Bill (Roberts and Jotzo 2001). Most developing countries cannot afford substantial domestic support, and such measures in developed countries appear to increase global production forcing down world prices. This benefits net food importers in developing countries at the expense of net exporters. Thus, developing countries are divided on this issue.

Export subsidies are also contentious. The bulk of agricultural export subsidies are provided by the European Union. As with domestic support, the distortions introduced by export subsidies benefit some developing countries but harm others. For example, Egypt and other Mediterranean countries benefit from EU subsidised exports of beef. By contrast, Argentina is made worse off as it has to compete with subsidised exports.

A further element adding to the complexity is the existence of preferential trade arrangements. Many developing countries, particularly those that were former colonies of current EU members, have preferential access to particular developed country markets. The Lome´ Convention between the European Union and the ACP countries is one such example. A general reduction in tariffs erodes these preferences, and countries holding such preferences may not see it in their interests to press for further tariff reductions.

A range of non-trade concerns relating to the environment, labour standards, food safety, sanitary and phytosanitary provisions and other issues complicate the negotiations. These issues are beyond the scope of this paper, which focuses on tariffs and export subsidies.

The paper is laid out as follows. The next section describes the ATPSM model, including the country and commodity coverage. Section 3 describes four trade liberalisation scenarios analysed in this paper, followed by results in Section 4. The paper ends in Section 5 with policy implications, limitations and conclusions.

## 2. The ATPSM modelling framework

ATPSM is a deterministic, comparative static, partial equilibrium model. This means that there are no stochastic shocks or other uncertainties, and there is no specific time dimension to the implementation of the policy measures or to the maturing of their economic effects. The comparative static nature of the model doesn't imply that the policies take effect instantaneously. Rather, we are comparing two states at a similar point in time, one with the policy change, the other without. Finally, whereas the model aims at estimating far-reaching details of the agricultural economy, it does not deal with the repercussions of trade barrier reductions on other parts of the national economy. Thus, neither effects on the government budget (except for tariff revenues and subsidies to exports and domestic production) nor on the industrial and service sectors of the economy or the labour market are the subject to analysis. Simplifying the model in these respects allows for a detailed specifications of policies in a large number of countries for numerous commodities.

The equation system for each country can be represented as follows:

$$1) \quad \hat{D}_{i,r} = \eta_{i,i,r} \left[ \hat{P}_{wi} + \left( 1 + \hat{t}_{ci,r} \right) \right] + \sum_{\substack{j=1 \\ j \neq i}}^J \eta_{i,j,r} \left[ \hat{P}_{wj} + \left( 1 + \hat{t}_{cj,r} \right) \right];$$

$$2) \quad \hat{S}_{i,r} = \varepsilon_{i,i,r} \left[ \hat{P}_{wi} + \left( 1 + \hat{t}_{pi,r} \right) \right] + \sum_{\substack{j=1 \\ j \neq i}}^J \varepsilon_{i,j,r} \left[ \hat{P}_{wj} + \left( 1 + \hat{t}_{pj,r} \right) \right];$$

$$3) \quad \Delta X_{i,r} = X_{i,r} \hat{S}_{i,r};$$

$$4) \quad \Delta M_{i,r} = D_{i,r} \hat{D}_{i,r} - S_{i,r} \hat{S}_{i,r} + \Delta X_{i,r};$$

where,

$D$ ,  $S$ ,  $X$ , and  $M$  denote demand, supply, exports and imports respectively,

- $P_w$  denotes world price;

- $t_c$  denotes tariff on the domestic consumption goods and  $t_p$  the tariff on domestic production goods;
- $\varepsilon$  denotes supply elasticity and  $\eta$  demand elasticity;
- $\wedge$  denotes relative changes and  $\Delta$  absolute changes;
- $i$  and  $j$  are commodity indexes; and
- $r$  is a country index.

A market equilibrium requires that, globally, the sum of the change in exports equals the total change in imports for each commodity:

$$5) \quad \sum_{r=1}^N (\Delta X_r - \Delta M_r) = 0.$$

These equations can be transformed into matrix notation and the equation system solved for world prices by matrix inversion.

### Prices

It can be observed from equations 1 and 2 that domestic prices are all functions of the world market price and the border protection or domestic support measures. Thus, domestic price data is not required and transaction costs (such as wholesale and retail margins) are not taken into account. All protection measures are expressed in tariff equivalents.

The relationship between world and domestic prices is complicated by the existence of two-way trade of the one (aggregated) good. To accommodate heterogeneous goods with one price, the approach taken here is to estimate composite tariffs for determining the domestic consumption and production price. To derive a composite price products are divided into three groups: imports; exports; and production supplied to the domestic market ( $S_d$ ).

First, a domestic market price wedge ( $t_d$ ) is computed as the weighted average of two tariffs, the export tariff ( $t_x$ ) and import tariff ( $t_m$ ), where the weights are exports ( $X$ ) and imports ( $M$ ):

$$6) \quad t_d = (X t_x + M t_m) / (M + X).$$

Then, a consumer price wedge is computed as the weighted average of the import tariff ( $t_m$ ) and the domestic market price wedge ( $t_d$ ), where the weights are imports ( $M$ ) and domestic supply ( $S_d$ ):

$$7) \quad t_c = (M t_m + S_d t_d) / D.$$

Similarly, a producer price wedge is computed as the weighted average of the export tariff ( $t_m$ ) and the domestic market price wedge ( $t_d$ ), where the weights are exports ( $X$ ) and domestic supply ( $S_d$ ) plus the domestic support tariff ( $t_p$ ):

$$8) \quad t_s = (X t_x + S_d t_d) / S + t_p.$$

The consumer and producer price wedges are added to the border price to give domestic prices. These calculations are applied both to the baseline and the final tariffs.

A feature of this structure is that if there are no exports, domestic producer prices are determined by the tariff plus the domestic support. If there are no imports the export subsidy effectively determines the producer price. Finally, if there is two-way trade the share of total production or consumption influences the importance of each tariff.

The need for a composite price such as this is the requirement for one price with essentially two goods. The heterogeneous nature of imports and exports also requires a means of specifying the volume of either imports or exports. In this model exports are specified as a proportion of domestic production in equation 3 and imports are determined as the residual of production, consumption and exports. An alternative and popular approach to heterogeneous goods in international trade is to use an Armington specification which requires elasticities of substitution between goods from different sources.

### Trade revenue

Once changes in world prices and hence domestic prices are determined, volume changes can be derived from equations 1-4. Given the volume responses  $\Delta X$ ,  $\Delta M$ ,  $\Delta S$ , and  $\Delta D$ , the trade revenue and welfare effects can be computed. The trade revenue effect of the policy changes is computed for each country and each commodity as:

$$9) \quad \Delta R = (P_w + \Delta P_w)[(X + \Delta X) - (M + \Delta M)] - P_w(X - M).$$

## Welfare

The welfare change has three components. The first two are the changes in producer surplus ( $\Delta PS$ ) and consumer surplus ( $\Delta CS$ ). These changes depend on the domestic market price changes and the own price domestic demand and supply volume responses. The change in producer surplus is also dependant on the change in quota rent received. Quota rents,  $U$ , are calculated for each country and each commodity as the volume of imports times the world price times the difference between the inquota and outquota tariffs:

$$10) \quad U = cQP_w(t_{m2} - t_{m1})$$

where  $c$  is the capture rate,  $Q$  denotes the import quota,  $P_w$  world prices as previously noted and  $t_{m1}$  and  $t_{m2}$  the inquota and outquota tariff rates. Rent accrues only if the importing country is applying the outquota tariff rate. The capture rates,  $c$ , is the proportion of the rent captured by exporting producers as opposed to dissipated in some way. The change in quota rent received is added to producer surplus. For each country and commodity:

$$11) \quad \Delta PS = \Delta P_p [S + 0.5(\Delta S_d)] + \Delta U;$$

$$12) \quad \Delta CS = -\Delta P_c [D + 0.5(\Delta D_d)].$$

The third part of welfare is the change in net government revenue ( $\Delta NGR$ ), consisting of change in tariff revenue, change in export subsidy expenditure and change in domestic support expenditure. For each country and commodity:

13)

$$\begin{aligned} \Delta NGR &= \Delta TR - \Delta ES - \Delta DS \\ &= \underbrace{(t_w + \Delta t_w)(Q + \Delta Q) - t_w Q}_{\text{Change in within-quota revenue}} + \underbrace{(t_o + \Delta t_o)[(M + \Delta M) - (Q + \Delta Q)] - t_o(M - Q)}_{\text{Change in out-of-quota revenue}} \\ &\quad - \underbrace{[(t_x + \Delta t_x)(X + \Delta X) - t_x X]}_{\text{Change in export subsidy expenditure}} - \underbrace{[(t_d + \Delta t_d)(S + \Delta S) - t_d S]}_{\text{Change in domestic support expenditure}} \end{aligned}$$

The sum is the total welfare effect:

$$14) \quad \Delta W = \Delta PS + \Delta CS + \Delta NGR.$$

## **The economics of tariff rate quotas**

The tariff rate quota regime has three instruments: – within-quota tariffs, import quotas and outquota tariffs. At any time either one of these may be binding.

- (1) If the within-quota tariff is binding, the quota is unfilled, domestic prices equal world prices plus the within-quota tariff and there is no quota rent.
- (2) If the quota is binding, imports equal the quota and the rent is positive but indeterminate.
- (3) If the outquota tariff is binding, imports exceed the quota and the rent is the quota times the difference between the within-quota and outquota tariff rates.

It is claimed here that the third case, of binding outquota tariffs, is the most relevant situation. This is illustrated in Figure 1. Of interest is what happens to rents and tariff revenue as each of the three instruments is altered. It is apparent that:

- a reduction in within-quota tariffs will increase quota rents and decrease tariff revenue;
- a reduction in outquota tariffs will decrease quota rents and outquota tariff revenue; and
- an increase in the import quota may merely increase quota rents and decrease tariff revenue. If the quota is increased sufficiently it, rather than the outquota tariff, will become binding and outquota tariff revenues will be eliminated.

Ideally, the import quota fill rate should determine the domestic price. If the quota is unfilled domestic prices should be determined by the within-quota tariffs, and prices should be high only if the quota is filled or overfilled. However, it is often observed that quotas are unfilled but domestic prices are high nonetheless. This may be because administrative constraints prevent the quotas being filled. More to the point, countries with high domestic prices are unlikely to be prepared to see them eroded by a shift in the supply of imports. As a result, the assumption here is that the outquota tariffs (or possibly the applied tariffs) determine the domestic market price. This implies that global quotas should not exceed imports. The calculation of tariff revenues and rents are based on this assumption.

Observations on world market prices, within-quota and outquota tariffs, import quotas and actual imports are necessary to calculate the rent generated in each market. Quota and tariff information is notified to the WTO. World price data are readily available,

although the quality may vary. The additional information required is the initial distribution of quotas. Some countries notify bilateral quotas to the WTO but most do not. The model uses bilateral trade flows to estimate the bilateral quota distribution. The distribution of rents between countries is assumed to follow the distribution of trade. Global rents forgone equate with rents receivable. The remaining problem is the distribution of rent between consumers, producers, governments and processors. Some of the rent may be dissipated through rent seeking activities or inefficient means of quota administration. The model measures the rents forgone by importers.

APTSM is able to estimate the economic effects of changes in within-quota and outquota tariffs, import quotas, export subsidies and domestic support on production, consumption, prices, trade flows, trade revenues, quota rents, producer and consumer surplus and welfare. The assumption of filled quotas made here implies that changes in within-quota tariffs and import quotas will not have price and quantity effects, as these instruments are not binding. (They do, however, change the distribution of rents.)

#### Country and commodity coverage

The present version of the model covers 161 countries including one region, the European Union, which includes 15 countries. Those countries not covered are mostly small island economies. Countries designated here as 'developed' are defined by the World Bank as high income countries with per capita GNP in excess of \$9266 (World Bank 2001). A third group is the 49 least developed countries.

**Table 1: Country coverage in ATPSM**

| Developed        | Developing         | Developing<br>(cont.) | Least developed      |
|------------------|--------------------|-----------------------|----------------------|
| Australia        | Albania            | Latvia                | Afghanistan          |
| Brunei           | Algeria            | Lebanon               | Angola               |
| Canada           | Argentina          | Libya                 | Bangladesh           |
| China Hong Kong  | Armenia            | Lithuania             | Benin                |
| China Taiwan     | Azerbaijan         | Macedonia             | Burkina Faso         |
| Cyprus           | Bahamas            | Madagascar            | Burundi              |
| European Union   | Barbados           | Malawi                | Central African Rep. |
| French Polynesia | Belarus            | Malaysia              | Cambodia             |
| Iceland          | Belize             | Malta                 | Cape Verde           |
| Israel           | Bolivia            | Mauritius             | Comoros              |
| Japan            | Bosnia Herzegovina | Mexico                | Congo                |
| Kuwait           | Botswana           | Moldova               | Congo Dem. Rep.      |
| Macao            | Brazil             | Mongolia              | Djibouti             |
| Neth. Antilles   | Bulgaria           | Morocco               | Eritrea              |
| New Zealand      | Cameroon           | Namibia               | Ethiopia             |
| Norway           | Chad               | Nicaragua             | Gambia               |
| Slovenia         | Chile              | Nigeria               | Guinea               |
| Switzerland      | China              | Pakistan              | Guinea Bissau        |
| U. A. Emirates   | Colombia           | Panama                | Haiti                |
| United States    | Costa Rica         | Papua New Guinea      | Lao PDR              |
|                  | Croatia            | Paraguay              | Lesotho              |
|                  | Cuba               | Peru                  | Liberia              |
|                  | Czech Rep.         | Philippines           | Maldives             |
|                  | Dominica           | Poland                | Mali                 |
|                  | Dominican Rep.     | Romania               | Mauritania           |
|                  | Ecuador            | Russia                | Mozambique           |
|                  | Egypt              | Saudi Arabia          | Myanmar              |
|                  | El Salvador        | Seychelles            | Nepal                |
|                  | Estonia            | Slovakia              | Niger                |
|                  | Fiji               | South Africa          | Rwanda               |
|                  | Gabon              | Sri Lanka             | Sao Tome             |
|                  | Georgia            | St. Lucia             | Senegal              |
|                  | Ghana              | St. Vincent           | Sierra Leone         |
|                  | Grenada            | Suriname              | Solomon Islands      |
|                  | Guatemala          | Swaziland             | Somalia              |
|                  | Guyana             | Syria                 | Tanzania             |
|                  | Honduras           | Tajikistan            | Togo                 |
|                  | Hungary            | Thailand              | Uganda               |
|                  | India              | Trinidad Tobago       | Vanuatu              |
|                  | Indonesia          | Tunisia               | Yemen                |
|                  | Iran               | Turkey                | Zambia               |
|                  | Iraq               | Turkmenistan          |                      |
|                  | Ivory Coast        | Ukraine               |                      |
|                  | Jamaica            | Uruguay               |                      |
|                  | Jordan             | Uzbekistan            |                      |
|                  | Kazakhstan         | Venezuela             |                      |
|                  | Kenya              | Viet Nam              |                      |
|                  | Korea DPR          | Yugoslavia            |                      |
|                  | Korea Rep.         | Zimbabwe              |                      |
|                  | Kyrgyzstan         |                       |                      |

*Note:* Among the 49 least developed countries, Bhutan, Chad, Equatorial Guinea, Kiribati, Madagascar, Malawi, Samoa, Somalia, Sudan, Togo and Tuvalu are not included in the model.

There are 36 commodities in the ATPSM data set. This includes many tropical commodities of interest to developing countries, although many of these have relatively little trade by comparison with some of the temperate product. The 36 commodities are categorised into groups to facilitate the presentation of results.

**Table 2: Commodities in ATPSM**

|   |  |
|---|--|
| <p><b>Meat</b><br/>01100 Bovine meat<br/>01210 Sheepmeat<br/>01220 Piguemeat<br/>01230 Poultry</p> <p><b>Dairy products</b><br/>02212 Milk, fresh<br/>02222 Milk, conc.<br/>02300 Butter<br/>02400 Cheese</p> <p><b>Cereals</b><br/>04100 Wheat<br/>04400 Maize<br/>04530 Sorghum<br/>04300 Barley<br/>04200 Rice</p> <p><b>Sugar</b><br/>06100 Sugar</p> <p><b>Oils</b><br/>22100 Oil seeds<br/>42000 Vegetable oils</p> | <p><b>Vegetables</b><br/>05420 Pulses<br/>05480 Roots, tubers<br/>05440 Tomatoes</p> <p><b>Fruit</b><br/>05700 Apples &amp; pears<br/>05710 Citrus fruits<br/>05730 Bananas<br/>05790 Other tropical fruits</p> <p><b>Beverages</b><br/>07110 Coffee green bags<br/>07120 Coffee roasted<br/>07131 Coffee extracts<br/>07210 Cocoa beans<br/>07240 Cocoa butter<br/>07220 Cocoa powder<br/>07300 Chocolate<br/>07410 Tea</p> <p><b>Tobacco and cotton</b><br/>12100 Tobacco leaves<br/>12210 Cigars<br/>12220 Cigarettes<br/>12230 Other tobacco - mfr.<br/>26300 Cotton linters</p> |
|---|--|

## Data

Volume data are from 2000 and are compiled from FAO supply utilisation accounts<sup>2</sup>. The year 2000 represents the base year for the model. Most of the price data is also from FAOSTAT. Parameters on elasticities and feedshares are from FAO's World Food Model. These are based on a trawling of the literature and are not econometrically estimated specifically for the model. Some of the elasticities were modified by the author where this was considered appropriate. Within-quota tariffs, outquota tariffs and global quotas, notified to the WTO, are obtained from the AMAD database where available and aggregated to the ATPSM commodity level.<sup>3</sup> Export subsidy and setaside data are notified to the WTO. Bilateral trade flow data relate to 1995 and are from UNCTAD Comtrade database. These are used to allocate global quotas to individual countries. The UNCTAD TRAINS database is the source of information on applied tariffs. A limitation

<sup>2</sup> This is a revision of data used in previous applications of the model (Vanzetti and Sharma 2002) and results in a substantial downward revision of welfare estimates.

<sup>3</sup> AMAD database <http://www.amad.org>.

is the absence of good quality data for many developing countries. Indeed, policies for 110 countries are not currently represented in the model. Attempts are being undertaken to improve the scope of the database.

The domestic support measures used here are contentious and require a cautionary note. The Uruguay Round Agreement on Agriculture calls for reductions in production-distorting (amber box) domestic support. However, it is not clear to what extent different forms of domestic support distort production and trade. Direct income support and payments to factors of production have less effect on output than payments on output. In addition, in some instances administered prices appear to be providing domestic support, but such policies actually rely on border measures for their effect. Double counting can occur where domestic support is conflated with border protection. The ATPSM database attempts to avoid this by excluding some amber box support as well as all the green and blue box support. Exclusion of the production-limiting (blue box) items in EU domestic support is debatable. The justification for this is that it is difficult to assess whether the production limits offset the additional support. This approach implies low rates of domestic support for the European Union and the United States and few gains from reform of these policies.

The initial ATPSM dataset is used to generate tariff revenues and quota rents. For example, initial EU beef imports of 407 kt are 243 kt in excess of the import quota of 164 kt. The within-quota tariff revenue is the quota times the within-quota tariff rate times the world price, i.e.  $164\text{kt} \times 5.6\% \times \$2300/\text{t} = \$21.1$  million. The outquota tariff revenue is the outquota tariff of 88.6 per cent applied to the 243 kt of out-of-quota imports. This amounts to \$495 million. The forgone rent for EU beef is the imports under quota times the difference in the within-quota and outquota rates, i.e.  $164\text{kt} \times (88.6 - 5.6)\% \times \$2300/\text{t} = \$313$  million. The European Union makes up the bulk of the global quota rents for beef, which amount to \$376 million. These global totals are shown for beef and other commodities in table 3. Tariff revenues reflect a combination of trade flows and protection levels so this table provides a convenient summary of the existing protection. However, where tariff levels or non-tariff-barriers are prohibitive, this measure understates the level of protection. For some commodities a reduction in tariff leads to a rise in tariff revenues.

It is readily apparent here that most of the global protection in agriculture, generating around \$36 billion in tariff revenues and rents, is on temperate products, particularly beef, wheat, maize, vegetables oils and oilseeds. Among the products that can be grown in

tropical regions tobacco, sugar and poultry attract substantial protection. These products can also be grown in temperate regions or are close substitutes. There are relatively few rents on tropical products, vegetables, fruit, beverages and cotton. This reflects low trade volumes rather than low tariffs. Applied tariffs on some tropical products are over 100 or even 200 per cent.

Quota rents as measured here amount to a quarter of tariff revenues. If these rents do find their way to exporters, they amount to a substantial transfer. This is important because trade liberalisation is likely to lead to a reduction in the quota rents. This holds given that the quotas are binding and the out-quota tariffs are reduced. A decrease in inquota tariff levels or an increase in the quota may increase the quota rents.

**Table 3: Initial global tariff revenue and rents by commodity**

| <b>Commodity</b>      | <b>Outquota<br/>revenue (\$m)</b> | <b>Inquota<br/>revenue (\$m)</b> | <b>Quota<br/>rent (\$m)</b> |
|-----------------------|-----------------------------------|----------------------------------|-----------------------------|
| Bovine meat           | 2311                              | 345                              | 376                         |
| Sheepmeat             | 129                               | 4                                | 386                         |
| Pigmeat               | 451                               | 132                              | 56                          |
| Poultry               | 1555                              | 94                               | 156                         |
| Milk fresh            | 41                                | 10                               | 2                           |
| Milk concentrates     | 367                               | 225                              | 439                         |
| Butter                | 361                               | 84                               | 183                         |
| Cheese                | 740                               | 162                              | 271                         |
| Wheat                 | 1045                              | 291                              | 1837                        |
| Rice                  | 463                               | 15                               | 896                         |
| Barley                | 234                               | 28                               | 362                         |
| Maize                 | 1572                              | 248                              | 2035                        |
| Sorghum               | 59                                | 8                                | 10                          |
| Sugar                 | 1068                              | 87                               | 190                         |
| Vegetable oils        | 3143                              | 100                              | 0                           |
| Oilseeds              | 6363                              | 138                              | 188                         |
| Pulses                | 216                               | 1                                | 1                           |
| Tomatoes              | 99                                | 3                                | 35                          |
| Roots & tubers        | 18                                | 0                                | 0                           |
| Apples & pears        | 333                               | 15                               | 15                          |
| Citrus fruits         | 388                               | 29                               | 15                          |
| Bananas               | 398                               | 102                              | 280                         |
| Other tropical fruits | 178                               | 1                                | 0                           |
| Coffee green          | 108                               | 1                                | 3                           |
| Coffee roasted        | 18                                | 2                                | 0                           |
| Coffee extracts       | 3                                 | 0                                | 0                           |
| Cocoa beans           | 49                                | 0                                | 0                           |
| Cocoa powder          | 34                                | 0                                | 0                           |
| Cocoa butter          | 39                                | 0                                | 0                           |
| Chocolate             | 950                               | 31                               | 36                          |
| Tea                   | 251                               | 0                                | 0                           |
| Tobacco leaves        | 2062                              | 61                               | 20                          |
| Cigarettes            | 26                                | 0                                | 0                           |
| Cigars                | 687                               | 0                                | 0                           |
| Other mfr tobacco     | 436                               | 0                                | 0                           |
| Cotton linters        | 237                               | 1                                | 1                           |
| <b>Total</b>          | <b>26432</b>                      | <b>2218</b>                      | <b>7791</b>                 |

The allocation of quota rents to developing and least developed countries is better seen in Table 4. Exports of the specified agricultural products from developed and developing countries are at similar levels in the database but exports from the 49 least developed countries amount to less than 2 per cent of world trade. The highest proportions, at 4-5 per cent, are in the commodity groups beverages, vegetables and tobacco and cotton.

Also shown in table 4 is the share of quota rents in the value of exports. What is notable here is that the least developed countries contribute relatively little to world agricultural exports and receive an estimated share of quota rents which is disproportionately low even considering the low share of global exports. Across all agricultural product groups, developed countries receive rents amounting to \$4.9 billion (not shown in table), 5.1 per cent of the value of exports, whereas least developed countries receive less than half of one per cent, a mere \$12 million out of nearly \$8 billion in estimated global rents. A further \$2.8 billion in rents accrue to developing countries, assuming all the rents are captured by the exporting countries.

**Table 4: Exports and quota rents**

|                     | Value of exports |                   |                           | Quota rents received as proportion of export value |                 |                         |
|---------------------|------------------|-------------------|---------------------------|--|-----------------|-------------------------|
|                     | Developed<br>\$m | Developing<br>\$m | Least<br>developed<br>\$m | Developed<br>%                                     | Developing<br>% | Least<br>developed<br>% |
| Meat                | 24693            | 9162              | 325                       | 2.4  | 4.0             | 0.4                     |
| Dairy               | 8512             | 2255              | 3                         | 8.2  | 8.6             | 10.8                    |
| Cereals             | 25530            | 14185             | 63                        | 13.4   | 12.1            | 6.9                     |
| Oilseeds            | 13334            | 22615             | 179                       | 0.9  | 0.3             | 0.1                     |
| Sugar               | 2675             | 6084              | 95                        | 0.6  | 2.8             | 3.8                     |
| Beverages           | 4355             | 16576             | 996                       | 0.7  | 0.0             | 0.0                     |
| Fruit               | 3728             | 10587             | 42                        | 0.5  | 2.7             | 3.0                     |
| Vegetables          | 2008             | 1619              | 181                       | 1.4  | 0.4             | 0.0                     |
| Tobacco &<br>cotton | 11743            | 13497             | 1300                      | 0.1  | 0.1             | 0.1                     |
| <b>Total</b>        | <b>96578</b>     | <b>96580</b>      | <b>3184</b>               | <b>5.1</b>   | <b>2.9</b>      | <b>0.4</b>              |

*Source:* ATPSM database. Calculations assume all rents accrue to exporters.

In the absence of import quotas tariff liberalisation leads to significant transfers between taxpayers, consumers and producers largely within one country. Where quota rents are generated, liberalisation may involve transfers between countries over and above the terms of trade effects. For this reason, an analysis of the initial distribution of quota rents and the impact of liberalisation is important. The potential impacts are examined next.

### **3. Scenarios**

Several simulations are undertaken to illustrate the source of the gains from trade reform and to indicate the possible effects of further reform scenarios on developing countries. The first scenario involves a continuation of the Uruguay Round with moderate reductions in bound outquota tariffs, export subsidies and domestic support (table 5). The major point of interest is to determine which developing countries gain or lose from this scenario and to identify the sectors in which gains or losses occur. Most of the discussion will focus on reductions in outquota tariffs, as this has the greatest impact on most developing countries.

The second scenario involves liberalisation occurring in developed countries only. This reflects the desire of some developing countries to postpone further liberalisation until the developed countries have made genuine and substantial reductions. The simulation shows the potential impacts on developing countries from this approach as opposed to further liberalisation.

The third scenario attempts to differentiate the effects of exports subsidies and domestic support from tariff reductions. Some net food importing developing countries see the removal of export subsidies as detrimental because of the adverse terms of trade effects. (The levels of domestic support are relatively trivial in the model database, reflecting assumptions about production-distorting support.)

The final simulation addresses concerns about the assumption that all quota rents are captured by producers in exporting countries. An alternative would be to assume that part or all of the rent is captured by importers, and/or that some of the rent is dissipated. It is assumed for this scenario that all the rent is dissipated in the initial situation prior to any policy change. This means that exporters don't lose from outquota tariff reform as they do in the previous scenarios.

**Table 5: Simulation scenarios**

| Number | Label             | Description  |
|--------|-------------------|--|
| 1      | UR continuation   | A 36 per cent reduction in outquota tariffs, 21 per cent reduction in export subsidies and a 20 per cent reduction in domestic support in developed countries with two thirds of these cuts in developing countries. No reductions in least developed countries. |
| 2      | Developed only    | As for scenario 1 with reductions in developed countries only.   |
| 3      | Developed tariffs | As for scenario 1 with reductions in developed country outquota tariffs only.  |
| 4      | Rent dissipation  | As for scenario 1, with all rents dissipated prior to liberalisation.  |

In all simulations a 36 per cent tariff cut does not necessarily imply that the gap between domestic and world prices is reduced by 36 per cent. In many cases, applied tariffs are below the bound outquota rates, and the percentage actual cut is less than 36 per cent and may even be zero. In these scenarios, within-quota tariffs are only reduced if the outquota or applied rate is cut to below the within-quota rate. Finally, reductions in bound rates apply to all commodities. Countries are assumed not to have flexibility to make lesser reductions in support to politically sensitive commodities.

Where the reforms include reductions in export subsidy rates, it is assumed that the rates are binding and that domestic prices are reduced according to the proportion of exports in domestic production. Because export subsidies do not apply to all exports in a commodity sector, their influence is further reduced according to the share of subsidized exports in total exports.

#### **4 Results**

Impacts are assessed initially in terms of national welfare and export revenue effects. The sectoral effects, including commodity prices, are examined subsequently.

##### **Welfare impacts**

Welfare gains and losses by development status are shown in table 6. Looking first at the UR continuation scenario, global gains are around \$9 billion. The first observation is that most of the gains accrue to developed countries. This is partly because most of the

protection for agricultural commodities is on temperate products in developed countries, as table 4 suggests. The second reason is that 110 of the developing countries are assumed not to liberalise in the model because of lack of good quality policy data in the initial database. The developing countries gain \$1.5 billion, while the least developed countries lose \$0.081 billion. Many developing and least developed countries are net food importers and so experience negative terms of trade effects that outweigh any increase in exports. In addition, much of the loss in developing countries derives from reductions in quota rents received, \$2.14 billion, which are assumed to accrue to exporters initially and are reduced when outquota tariffs are reduced in developed countries. In least developed countries, however, quota rents increase because of the increase in exports, particularly beef, sheepmeat and bananas. For example, banana exports from Rwanda increase by 25 kt, accumulating rents of \$0.22 million. This is driven by a 12 per cent increase in banana imports into the European Union. Quota rents are merely transfers, not deadweight losses, so the changes in quota rents are redistributive effects.

**Table 6: Changes in welfare from alternative scenarios**

|                 | <b>UR<br/>continuation<br/>\$m</b> | <b>Developed<br/>only<br/>\$m</b> | <b>Developed<br/>tariffs<br/>\$m</b> | <b>Rent<br/>dissipation<br/>\$m</b> |
|-----------------|------------------------------------|-----------------------------------|--------------------------------------|-------------------------------------|
| Developed       | 7588                               | 7817                              | 5895                                 | 8896                                |
| Developing      | 1464                               | -1911                             | -1422                                | 2236                                |
| Least developed | -81                                | -47                               | -9.5                                 | -114                                |
| World           | 8971                               | 5857                              | 4463                                 | 11019                               |

*Source:* ATPSM simulations.

The importance of domestic reform rather than improved market access as a source of welfare gains for developing countries is illustrated in the results of the second scenario, labelled 'developed only'. In this scenario developing countries can benefit only from improved market access in developed country markets but not from reform in their own markets. Developing countries as a group would actually lose \$1.9 billion from liberalisation in developed countries only (second column in table 8) of which losses in quota rents amount to \$0.83 billion. They don't receive the efficiency gains gathered in the first scenario but as a group suffer from higher world prices. Least developing countries, which are assumed not to liberalise in either scenario, are not as badly off as in the first scenario because world prices have not risen so much.

The third scenario focuses on export subsidies. Only outquota tariffs in developed countries are reduced in this scenario and the results indicate that the absence of reductions in export subsidies and domestic support reduces the overall welfare impacts by a quarter. (Scenario 2 is the relevant comparison here.) Most of these forgone gains are borne by the European Union whereas the benefits of export subsidies accrue to developing and developed countries that are the recipients of subsidised exports.

The importance of the assumption that all quota rents are captured by the exporters is illustrated by the fourth scenario, 'rent dissipation'. Rents are assumed to be dissipated initially, that is, wasted through rent seeking activities or administration of quotas such that inefficient high cost producers are the major suppliers. In this situation exporters don't lose it when liberalisation occurs. Hence, trade liberalisation appears much more beneficial. In comparison with Scenario 1, global welfare gains are an additional \$2.05 billion, more than a quarter of the initial global rents of \$7.79 billion assumed for the previous scenarios. While developed and developing countries appear to benefit from not 'losing' quota rents, least developed countries do not, as they gained quota rents in the first scenario through an expansion of exports to providing enhanced market access. Their losses are greater than under the standard scenario.

At this point it is worth reiterating that ATPSM doesn't capture the trade creation and trade diversion effects of shifting quota rents. Quota rents are assumed to affect producer surplus but not prices and quantities, a reasonable approach given that import quotas are assumed to be filled. However, the absence of response implies that the losses may be overstated. In reality in the long term producers may move to more profitable activities when rents are reduced or removed.

So far the analysis has focused on countries grouped by stages of development. While this is useful for generalisations, individual countries are of course interested in how they might fare from given proposals. The pattern of welfare gains suggests that the bulk of the gains from liberalisation can be attributed to the efficiency gains from domestic reform rather than improved market access. This implies that the countries gaining the greatest are those with the greatest levels of protection. These countries are the European Union (\$3.1 billion in the UR continuation scenario), Japan (\$3.3 billion) and China (\$2.2 billion). Among the developing countries other than China the greatest gains accrue to Argentina (\$104 million), Malaysia (\$101 million), Morocco (\$159 million) and Turkey (\$127 million). However, there are numerous losers among developing countries. In fact only 46 of the 161 countries in the model appear to gain from global liberalisation. This

is because many are assumed not to liberalise, and are disadvantaged by rising world prices and loss of quota rents. The most notable losers are Mexico (\$260 million), Russia (\$135 million), Pakistan (\$88 million) and Poland (\$74 million). Among the least developed countries the major loser is Bangladesh (\$28 million).

Two further aspects of welfare are of interest. In developing countries tariffs are a major source of government revenue and tariff reform will reduce this income if reductions are sufficient. In such cases alternative sources of revenue must be found and the administrative costs of collection may be greater. However, following tariff reductions revenues may rise, particularly if tariffs were initially prohibitive. In these simulations government revenues increase in developed and developing countries. In the first scenario developed countries government revenues from the agricultural sector increases from -\$1.61 billion to \$2.44 billion and in developing countries from \$16.85 billion to \$17.32 billion (not shown in tables). There is no change in least developed countries.

Finally, on the subject of welfare, producers in developed countries lose from trade liberalisation but those in developing and least developing countries gain. For example, changes in producer surplus in the first scenarios are -\$17.22 billion, \$2.86 billion and \$0.84 billion in developed, developing and least developing countries respectively.

### Trade flows

Trade revenues do not necessarily move in the same direction as welfare. Where protection is removed, reduced trade flows are compatible with increased welfare. EU citrus is an example of falling export revenues with increasing sectoral welfare. Where market access is improved, as for New Zealand's overseas markets for beef and dairy products, increased exports lead to increased welfare. In ATPSM exports are assumed to be a constant proportion of production, an assumption that may not be valid in each and every market. There is more variability in national imports, but of course globally the change in exports equals the change in imports. In volume terms global trade flows increase for all commodities except unprocessed coffee, tobacco and cotton. In value terms there are increases in all but 87 of the 5796 (161 countries by 36 commodities) markets in the model.

The impact of the four alternative scenarios on export revenues is shown in table 7 for the major country groupings. The most obvious point is that all numbers are positive. Export revenues increase for every group for each scenario. The second observation is that developing countries enjoy a higher share of the global growth in trade than they manage

for the global increase in welfare. For countries that place a greater weighting on trade rather than welfare, the impacts of liberalisation appear more beneficial.

**Table 7: Changes in export revenue from alternative scenarios**

|                 | <b>UR<br/>continuation</b><br>\$m | <b>Developed<br/>only</b><br>\$m | <b>Developed<br/>tariffs</b><br>\$m | <b>Rent<br/>dissipation</b><br>\$m |
|-----------------|-----------------------------------|----------------------------------|-------------------------------------|------------------------------------|
| Developed       | 3261                              | 2070                             | 1528                                | 3261                               |
| Developing      | 5437                              | 3803                             | 2774                                | 5437                               |
| Least developed | 395                               | 279                              | 238                                 | 395                                |
| World           | 9093                              | 6152                             | 4540                                | 9093                               |

*Source:* ATPSM simulations.

### Sectoral effects

Although in the Uruguay Round Agreement on Agriculture similar rates of support reductions applied across commodities, sufficient flexibility was included so that sensitive products could be sheltered. For example, tariff reductions in developed countries had to average 36 per cent across a commodity group, but tariffs on sensitive items could be reduced by only 15 per cent. For this reason it is important to know the impacts of reform in each sector.

The impact of the simulated policy reforms on world prices in each sector is shown in table 8. The price changes are correlated with the level of distortions removed and are also a broad indicator of how price-taking countries are likely to be affected. In general price rises would be expected to be less significant in scenarios 2 and 3 where less reforms are undertaken, but the similar magnitudes across the scenarios for most commodities suggested that it is changes in tariffs in developed countries that drive most of the price changes. Exceptions to this are tea, tobacco, oilseeds and vegetable oils. The fourth scenario illustrates that the allocation of rents doesn't affect the price impact of reform because of the assumption that quotas are binding.

Comparing prices across the commodities confirms that dairy products, sheepmeat and oils are the sectors most affected by reform. Price changes are lower for tropical than temperate products, as the latter are more highly protected. In addition, applied and bound rates diverge more in developing countries, and as countries generally aim to

protect their domestic industries, a 36 per cent reduction leads to relatively little reform in many of the tropical products grown in developing countries.

Among the sensitive products world banana prices are estimated to rise by only 1 per cent, in spite of reform in the European Union, a major importer. US protection on tobacco (95 per cent tariff) is currently holding down the world price for that product, although once again the price change is moderate. Prices change little for the other commodities, including coffee and rice.

**Table 8: Changes in world prices from alternative scenarios**

|                       | <b>UR<br/>continuation</b> | <b>Developed only</b> | <b>Developed<br/>tariffs</b> | <b>Rent<br/>dissipation</b> |
|-----------------------|----------------------------|-----------------------|------------------------------|-----------------------------|
|                       | %                          | %                     | %                            | %                           |
| Bovine meat           | 2.3                        | 1.8                   | 1.8                          | 2.3                         |
| Sheepmeat             | 3.5                        | 2.7                   | 2.7                          | 3.5                         |
| Pigmeat               | 1.4                        | 0.4                   | 0.4                          | 1.4                         |
| Poultry               | 1.5                        | 0.6                   | 0.6                          | 1.5                         |
| Milk fresh            | 3.0                        | 2.9                   | 2.9                          | 3.0                         |
| Milk conc.            | 4.5                        | 4.4                   | 4.4                          | 4.5                         |
| Butter                | 8.4                        | 8.3                   | 8.3                          | 8.4                         |
| Cheese                | 5.0                        | 4.8                   | 4.8                          | 5.0                         |
| Wheat                 | 3.5                        | 2.6                   | 2.6                          | 3.5                         |
| Rice                  | 1.2                        | 0.6                   | 0.6                          | 1.2                         |
| Barley                | 0.3                        | 0.2                   | 0.2                          | 0.3                         |
| Maize                 | 0.9                        | 0.7                   | 0.7                          | 0.9                         |
| Sorghum               | 0.2                        | 0.2                   | 0.2                          | 0.2                         |
| Pulses                | 0.9                        | 0.7                   | 0.7                          | 0.9                         |
| Tomatoes              | 2.6                        | 2.6                   | 2.6                          | 2.6                         |
| Roots & tubers        | 0.4                        | 0.4                   | 0.4                          | 0.4                         |
| Apples & pears        | 0.9                        | 0.4                   | 0.4                          | 0.9                         |
| Citrus fruits         | 1.2                        | 1.2                   | 1.2                          | 1.2                         |
| Bananas               | 0.8                        | 0.8                   | 0.8                          | 0.8                         |
| Other tropical fruits | 0.5                        | 0.4                   | 0.4                          | 0.5                         |
| Sugar                 | 2.0                        | 2.0                   | 2.0                          | 2.0                         |
| Coffee green          | 0.0                        | 0.0                   | 0.0                          | 0.0                         |
| Coffee roasted        | 0.2                        | 0.2                   | 0.2                          | 0.2                         |
| Coffee extracts       | 1.3                        | 1.3                   | 1.3                          | 1.3                         |
| Cocoa beans           | 0.1                        | 0.0                   | 0.0                          | 0.1                         |
| Cocoa powder          | 0.6                        | 0.5                   | 0.5                          | 0.6                         |
| Cocoa butter          | 0.8                        | 0.8                   | 0.8                          | 0.8                         |
| Chocolate             | 2.1                        | 2.0                   | 2.0                          | 2.1                         |
| Tea                   | 0.7                        | 0.2                   | 0.2                          | 0.7                         |
| Tobacco leaves        | 1.5                        | 1.0                   | 1.0                          | 1.5                         |
| Cigars                | 0.2                        | 0.1                   | 0.1                          | 0.2                         |
| Cigarettes            | 0.5                        | 0.5                   | 0.5                          | 0.5                         |
| Other mfr tobacco     | 0.6                        | 0.3                   | 0.3                          | 0.6                         |
| Oilseeds              | 2.9                        | 0.3                   | 0.3                          | 2.9                         |
| Cotton linters        | 0.4                        | 0.3                   | 0.3                          | 0.4                         |
| Vegetable oils        | 2.1                        | 0.6                   | 0.6                          | 2.1                         |

*Source:* ATPSM simulations.

Welfare impacts for nine commodity groups are listed for the first scenario in table 9. As expected the major gains are in meats, dairy products and cereals. Welfare increases by an estimated \$1.75 billion in the meat sector in developed countries themselves but few gains accrue to developing and least developed countries. The major losses in developing countries occur in dairy products and cereals, for which most developing countries are importers and are adversely affected by rising world prices. Many tropical developing countries are (cane) sugar producers, and these countries as a group lose because of the removal of quota rents. Tropical countries also compete with developed countries in vegetable oil production, and it is this area where these countries gain from reform. The major beneficiary is China which has initial imports of vegetable oils and oilseeds of 15.3 million tonnes and applied tariffs of 84 per cent on vegetable oils and 113 per cent on oilseeds.

**Table 9: Welfare impacts by commodity group for UR continuation scenario**

|                  | <b>Developed<br/>countries</b> | <b>Developing<br/>countries</b> | <b>Least<br/>developed<br/>countries</b> | <b>World</b> |
|------------------|--------------------------------|---------------------------------|--|--------------|
|                  | \$m                            | \$m                             | \$m                                      | \$m          |
| Meat             | 1749                           | 50                              | 8  | 1808         |
| Dairy            | 1880                           | -280                            | -15                                      | 1585         |
| Cereals          | 2903                           | -236                            | -67                                      | 2600         |
| Oilseeds         | 118                            | 1826                            | -25                                      | 1920         |
| Sugar            | 217                            | -67                             | -12                                      | 137          |
| Beverages        | -7                             | 33                              | 0  | 25           |
| Fruit            | 278                            | -6                              | 1  | 273          |
| Vegetables       | 209                            | 15                              | 1  | 225          |
| Tobacco & cotton | 321                            | 49                              | 3  | 373          |
| <b>Total</b>     | <b>7668</b>                    | <b>1384</b>                     | <b>-106</b>                              | <b>8946</b>  |

*Source:* ATPSM simulations.

Changes in export revenue by sector attributable to policy reform are shown in table 10. Total annual trade increases from \$196 billion in the initial database to \$205 billion, an increase of \$9.2 billion or 4.7 per cent. Of this, 60 per cent accrues to developing countries and 4 per cent to least developed countries. The largest impacts are in the meat, dairy, cereals and oilseeds sectors. The most interesting observation here is the increase in revenues flowing to developing countries in these sectors. Welfare gains accrue to

developed countries because they are the group with the large protection levels and trade flows, but export changes for developing countries are more than proportionate to the initial levels. This confirms that the strategy proposed by some developing countries of opening up markets in developed countries while undertaking little reform themselves may have benefits in increased exports even though increases in welfare are limited.

In terms of changes in export revenues the major beneficiaries among the developing countries are India (\$1054 million), Argentina (\$667 million) and Brazil (\$634 million).

**Table 10: Export revenue impacts by commodity for UR continuation scenario**

|                  | <b>Developed<br/>countries</b> | <b>Developing<br/>countries</b> | <b>Least<br/>developed<br/>countries</b> | <b>World</b> |
|------------------|--------------------------------|---------------------------------|--|--------------|
|                  | \$m                            | \$m                             | \$m                                      | \$m          |
| Meat             | 874                            | 1035                            | 113                                      | 2022         |
| Dairy            | 879                            | 1030                            | 47                                       | 1956         |
| Cereals          | 775                            | 1045                            | 28                                       | 1848         |
| Oilseeds         | 462                            | 1099                            | 52                                       | 1613         |
| Sugar            | 37                             | 290                             | 5  | 331          |
| Beverages        | 84                             | 71                              | 2  | 157          |
| Fruit            | 45                             | 459                             | 100                                      | 604          |
| Vegetables       | 35                             | 421                             | 33                                       | 489          |
| Tobacco & cotton | 69                             | 118                             | 15                                       | 202          |
| Total            | 3261                           | 5567                            | 395                                      | 9223         |

*Source:* ATPSM simulations.

## **5. Implications, limitations and conclusions**

### **Implications**

Recent changes in the regulation of trade following the Uruguay Round have led to the generation of quota rents. This has had the effect of transferring wealth from governments to others, notably foreign exporters. Although it is not clear to what extent export producers have managed to capture these rents, in this analysis it has been assumed they are totally successful. To the extent that this assumption is correct, this implies that when countries liberalise, exporters to these liberalising countries may

experience a welfare loss rather than a benefit from the opening of developed country markets.

The simulations undertaken here suggest that the annual welfare gains from partial agricultural liberalisation are relatively modest at around \$9 billion. This compares for example with annual export revenues of around \$200 billion for the commodities in the model, and tariff revenues and quota rents of around \$36 billion. This modest figure for welfare gains is partly due to the erosion of quota rents. Gains would amount to an additional \$2 billion if rents were assumed to be totally dissipated initially. As expected, most of the welfare gains accrue to the countries that are liberalising, but developing countries are estimated to increase their exports more than proportionately.

Beneficial reforms are not constrained to one or two sectors, such as sugar and dairy, but are to be had across a range of commodities, including wheat, rice and oilseeds. However, there are relatively few gains in tropical products, except sugar, oilseeds and vegetable oils which are substitutable for temperate products. A wide range of commodities that benefit from liberalisation is an advantage in negotiations because it provides scope for trade-offs and increases the likelihood of mutual benefits.

From the perspective of a successful negotiation it is worth noting that of the 161 countries or regions modelled, all have positive trade flow changes. There is also an increase in global trade in all 36 commodities.

In terms of strategy, the modelling suggests that developing countries as a group are better off when they liberalise in addition to developed countries. However, pressing for developed countries to reduce export subsidies in addition to tariffs does not appear to be a sound strategy. Both developing and least developed countries are better off, in terms of welfare at least, when export subsidies are retained. For developed countries, reducing export subsidies generates significant saving, but some of these are at the expense of developing and least developed countries which subsequently must pay more for their imports.

Tariff revenues are an important source of government revenue for many developing countries. This source is eliminated if tariffs are reduced to zero. However, in many cases a partial liberalisation leads to an increase in tariff revenues, particularly if the current rates are prohibitive. For developing countries that are forgoing quota rents, one approach

may be to auction the quotas, thus capturing the rents. The disadvantage of this approach is that exporters are likely to be aggrieved and may retaliate.

### Limitations

Limitations of the analysis should be noted. First, the welfare gains, although significant, are relatively modest, even though the gains, once negotiated, are available every year. However, the model is not able to calculate dynamic gains. Trade liberalisation is likely to enhance productivity growth by introducing improved technology, increased ability to capture economies of scale and improved production efficiencies. Imported goods often embody technologies that are unavailable locally. Admittedly, this does not apply so much to trade in bulk commodities such as wheat or rice.

Intersectoral effects are not captured here. An expanding agriculture in response to liberalisation would draw capital, labour and land from sectors not included in the model. Output in these sectors would decrease. This limitation means the gains from trade liberalisation are overstated when agricultural output is increasing but understated when output falls. For these and other reasons, partial equilibrium analyses need to be complemented with general equilibrium results in order to obtain deeper insights on the impact in general and the distribution of gains and losses in particular.

In addition to concerns with partial equilibrium models in general, when considering the estimated impacts of liberalisation it is worth paying attention to the importance of particular assumptions in ATPSM. These relate to the significance of unfilled import quotas. It is assumed here that within-quota tariffs are not relevant, even where quotas are unfilled. This means that the higher outquota tariffs or applied tariffs are taken as determining domestic prices. This assumption overstates the benefits of liberalisation, as there may be cases where within-quota rates are the relevant determinant of domestic prices.

The second strong assumption is that import quota rents are captured by exporters. An alternative simulation has shown that this assumption is important. More work needs to be done to ascertain the current distribution of rents.

A third limitation is the handling of preferences. The model does not contain bilateral tariff data. The benefits of preferential access are eroded when more general liberalisation occurs, and this is not captured completely by the model. The erosion of quota rents is taken into account but the trade creation and diversion effects are not.

Finally, the usual caveats should apply to model parameters and policy data. Many countries in the model do not have policy data. Data quality is particularly an issue where there are many commodities and countries to deal with. In addition, there are problems in aggregating policy data across several tariff line items, and reliable information on applied rates, which are not notified to the WTO, is not available for some countries. There is also uncertainty as to the effects of domestic support on output. In this database the effect is assumed to be very limited. It is difficult to know how the results would be affected by better quality data, but policy makers should be aware of the limitations.

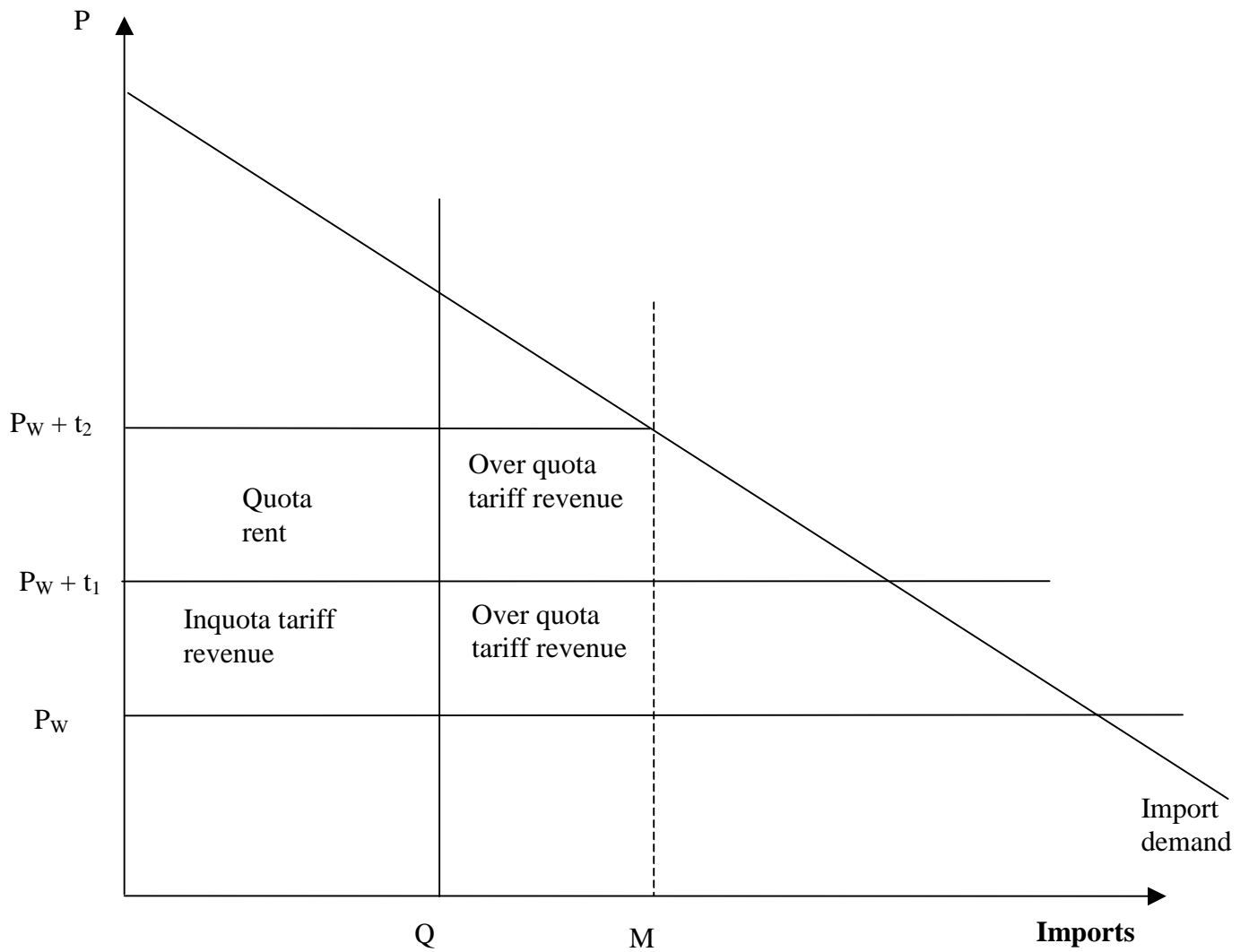
## Conclusions

The Uruguay Round delivered a new set of trade rules. The two-tier tariff system, with high tariffs triggered by the filling of import quotas, was designed to set minimum trade levels but has probably had the effect in many cases of setting maximum levels. In addition to presenting a new set of data and modelling issues, the quota system may have hindered rather than facilitated trade. At any rate, developing countries have been disappointed with the level of liberalisation actually achieved and are seeking to redress this in the current round.

ATPSM is a tool designed to help developing countries in their agricultural negotiations. It has detailed commodity and country coverage and can be used to analyse several trade policies where sound data are available. Countries can undertake their own simulations, perhaps after enhancing data referring to their own country or commodities of interest, and as a result understand what actually drives the overall impacts.

As a guide to the sort of analysis that may be undertaken with ATPSM, several simulations are presented in this paper. Policy makers should be reminded at this point that model results are best used as a guide to identifying the key variables, not as definitive estimates of potential gains from reform. Notwithstanding the limitations of the model and the data, the analysis suggests that developing countries should push developed countries to liberalise their tariffs and should in addition also open their own markets. However, there appears little to be gained for developing and least developed countries as a group to press for removal of export subsidies, given that tariff reductions are also occurring. The additional welfare gains from export subsidy removal accrue mainly to the European Union.

**Figure 1: Quota rents with binding outquota tariff**



## References

AMAD database <http://www.amad.org>.

de Gorter, H. (1999). "Market access, export subsidies and domestic support measures: issues and suggestions for new rules", contributed paper at The Conference on Agriculture and the New Trade Agenda in the WTO 2000 Negotiations, sponsored by the World Bank, October 1-2.

FAOSTAT database <http://apps.fao.org>.

Roberts, I. and F. Jotzo (2001). "2002 US Farm Bill: Support and Agricultural Trade" ABARE Research Report 01.13, Canberra.

Skully, D. (2001). "Liberalising tariff-rate quotas", chp. 3 in ERS/USDA, *Agricultural Policy Reform – The Road Ahead*, pp. 59-67, Washington DC.

UNCTAD TRAINS database <http://www.unctad.org/trains/index.htm>.

Vanzetti, D. and R. Sharma (2002). "Impact of Agricultural Trade Liberalization on Developing Countries: Results of the ATPSM Partial Equilibrium Model", invited paper at the International Agricultural Trade Research Consortium summer symposium on "The Developing Countries, Agricultural Trade and the WTO" Whistler Valley, British Columbia, Canada, 16-17 June.

World Bank (2001). "Global Economic Prospects and the Developing Countries 2001", Washington D.C. <http://www.worldbank.org/prospects/gep2001/>.