AN ECONOMIC ASSESSMENT OF THE URUGUAY ROUND AGREEMENT ON AGRICULTURE

by

Will Martin and L. Alan Winters

International Trade Division

World Bank

8 February, 1996

Abstract

The Uruguay Round agreement on agriculture was a milestone, bringing this important sector under the disciplines from which it had escaped in the early days of the GATT. The agreement limits the distortions that countries may impose on: market access, on export subsidization and domestic support. In this paper, we evaluate the direct impacts of each of these limits, and then assess the economic implications of the agreement. Our conclusion is that the gains from the agriculture agreement were reduced considerably by the slippage which occurred in its implementation. They remain important, however, and are estimated to account for around a third of the global income gains from the liberalization achieved in the Round, even though formal modeling of the outcome omits the important gains from reductions in the variability of agricultural protection. Perhaps most importantly, the agreement provides a basis for future liberalization.

Keywords: Uruguay Round, GATT, agriculture, trade, liberalization.

Invited Paper for presentation to the 40th Annual Conference of the Australian Agricultural and Resource Economics Society, Melbourne, 11-16 February, 1996.

AN ECONOMIC ASSESSMENT OF THE URUGUAY ROUND AGREEMENT ON AGRICULTURE

Prior to the Uruguay Round, the multilateral trading rules for agriculture were largely ineffective, with a plethora of non-tariff barriers being used to provide high and variable rates of protection, both in developed and in developing countries. Export subsidies were a particular source of discord, with competitive export subsidies by the EU and the United States depressing and destabilizing world prices and imposing costs on farmers in other countries. Trade was also distorted by the stimulus to production provided by a wide range of domestic support policies.

While many interests benefited from the disarray that characterized agricultural trade policies, the costs of these arrangements had become substantially larger over time, and recognition of these costs substantially greater, in part because of the work of agricultural economists. The enormous success of past GATT Rounds in taming the excesses of manufacturing tariffs in developed countries required extension of the system into areas such as agriculture and services if further gains from liberalization were to be achieved. Thus, agriculture lay at the heart of the Uruguay Round agenda in a way quite different from previous rounds. However, as is so well documented in Carolyn Tanner's paper to this conference, reaching agreement was difficult, and the final agreement differs strongly from the original targets of any of the negotiating parties.

The three major pillars of the Uruguay Round agreement on agriculture are its provisions on: market access; export subsidization; and domestic support. In each of these areas a framework of rules was agreed, and specific initial commitments on trade liberalization offered.

In the next section of this paper, we examine the key changes made in the rules governing trade in agricultural products and the policy settings put in place. Section three considers the extent to which the agreed cuts in protection will be effective in liberalizing trade and section four examines the impact on world prices. In the fifth section of the paper, we examine the available empirical evidence on the economic value of the liberalization achieved under the agreement on agriculture.

MAJOR ADVANCES WERE MADE IN THE RULES GOVERNING AGRICULTURAL TRADE.

Perhaps the major achievement of the Round in agriculture was the agreement to convert virtually all agricultural nontariff barriers into tariffs subject to agreed maximum rates (tariff bindings). This important advance provides transpareney and stability in protection rates which were previously opaque and highly volatile. At one stroke, the agreement on agriculture leapt beyond what had been achieved in forty-five years of negotiations in manufactures: bindings were introduced immediately on almost 100 percent of agricultural tariff lines.

In some cases, tariff bindings were set below the rate of protection previously applied, and hence will require tariff reductions. Unfortunately, however, many others were set above the previously applied tariff equivalents, as documented by Ingco (1995). Even these bindings can have important liberalizing implications when protection rates vary over time. By reducing the very high rates of protection that occur from time to time, bindings reduce average levels of protection. They reduce the average cost of protection even more sharply because the high rates of protection ruled out by bindings are the most costly.

While not outlawing export subsidies, the export subsidy rules introduce some disciplines into an area where the general GATT principle of banning these subsidies had not been applied. The new rules prohibit the introduction of new export subsidies and require that developed countries reduce their existing export subsidies.

The new rules on total agricultural support go beyond the general GATT rules in imposing some restraint on domestic support, with the total value of internal and border support to be reduced by 20 percent from its level in the 1986-88 base period. However, the disciplines on domestic support are weakened by the exemption of many important forms of support, such as the direct payments linked to land retirement programs, and general programs of assistance to encourage rural development in developing countries. There is no requirement to make reductions in support for individual commodities, so assistance to some commodities may increase if reductions occur elsewhere.

Minimum market access conditions were introduced in addition to disciplines on border and domestic protection. These provide specified levels of access at favorable tariff rates (tariff quotas) to ensure that market access will not be reduced even if the tariffs introduced following the Round are more restrictive than the measures previously applying. There is, of course, a risk that such measures might generate a constituency in support of the agricultural protection which makes the tariff quotas valuable. Many of these tariff quotas have been used to replace the market access which was previously provided under preference schemes such as the European Union's arrangements for African, Caribbean and Pacific (ACP) countries; in only a few cases, such as Japanese rice, do these arrangements provide additional market access opportunities.

The framework of rules on agricultural trade agreed in the Round was hard-won. Despite a number of weaknesses, this agreement represents a clear move in the direction of liberalization in accordance with past GATT principles, and appears likely to provide a strong basis for future multilateral liberalization.

The agreement will lead to less liberalization than is implied by the Agreed protection Cuts

The agreement involved substantial cuts in import tariffs on agricultural products: an average of 36 percent in developed countries over six years, with at least a 15 percent reduction on each individual tariff line. Developing countries committed themselves to average reductions of 24 percent (minimum 10 percent) over a 10 year period, while least developed countries were exempted from reduction commitments. The effectiveness of the agriculture agreement in cutting protection was less impressive than these figures would suggest, however, because the cuts take place from base levels which are frequently inflated. Increases in the base level of protection occurred in three ways: the choice of base period, the methods used to measure the protection existing prior to the Round, and the use of "ceiling" bindings in developing countries.

Where nontariff barriers were used prior to the Round, the amount of assistance provided by the pre-Round protection regime typically varied from year to year. Before protection could be cut, it was necessary to calculate the tariff which would have had the

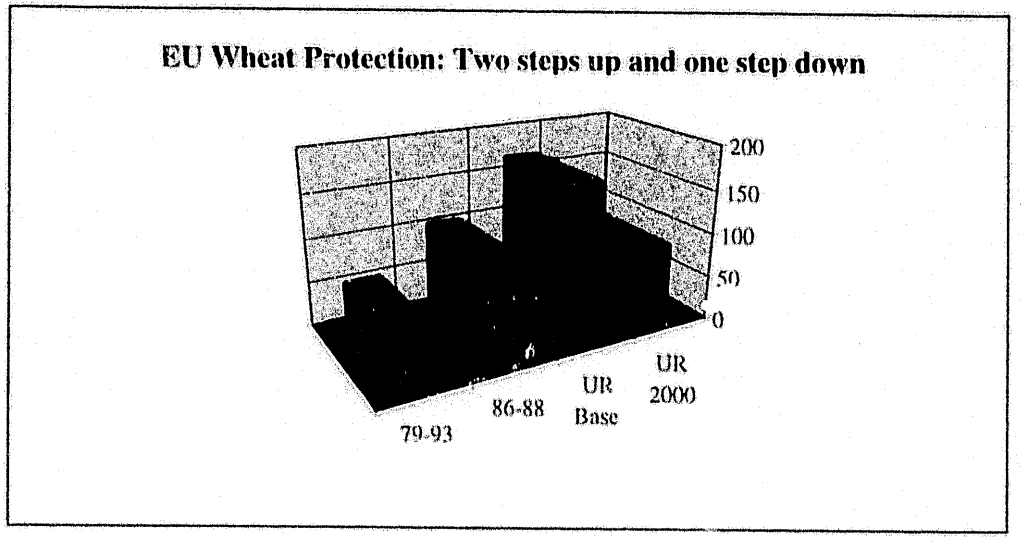
same effects as the actual protection provided in some base period. The base period chosen was 1986-88, a period of very low world prices and generally high rates of agricultural protection. The use of these years permitted a significant increase in protection relative to actual levels either in recent years or over the longer run. Moreover, in many developed countries, a process of "dirty tariffication" occurred, whereby the tariff bindings agreed between the negotiating parties permit substantially higher rates of protection than prevailed in the base period. The tariffication procedures set out in the "modalities" (GATT 1993, p8) were very specific, requiring tariff equivalents to be calculated by comparing domestic wholesale prices with import unit values (cif) at the four digit level of the Harmonized System or higher. However, these procedures were not part of the final Uruguay Round agreement and the tariff bindings included in country schedules are the definitive outcome of the Round.

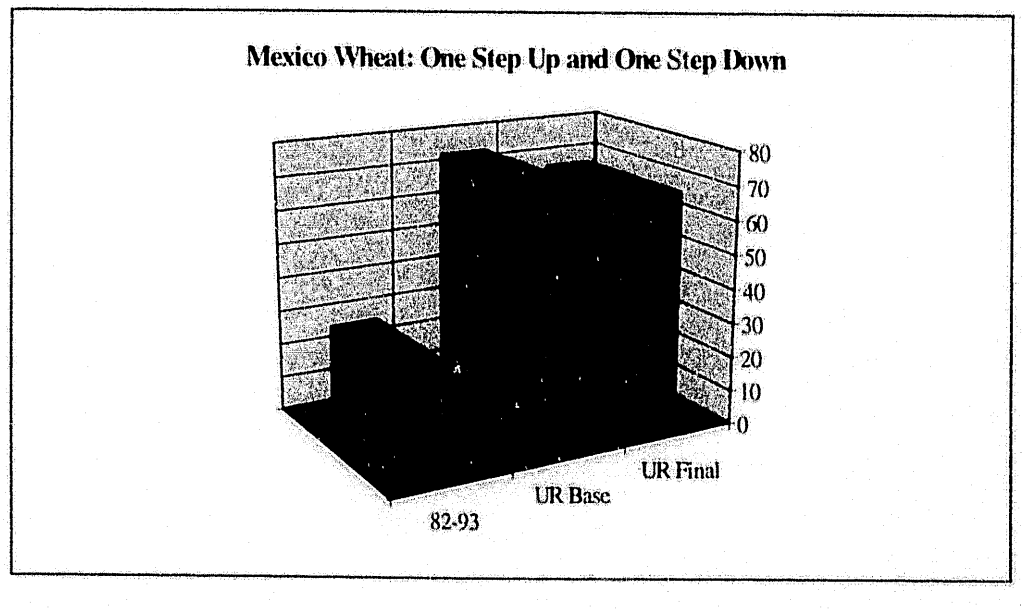
For developed countries, the agreed tariff rates frequently incorporate two steps up from average rates prevailing before the Round: one from the choice of the 1986-88 base year, and one from the way the tariff equivalents of nontariff barriers were calculated. The agreed reductions in protection take place from the resulting high levels. Figure 1 illustrates this pattern of "two steps up and one step down" for wheat import protection in the European Union

Developing countries were allowed to convert unbound tariffs into "ceiling bindings" unrelated to previous rates of protection, and many countries chose to use this freedom to set rates well above those that previously applied. In developing countries utilizing the ceiling binding option, a pattern of "one step up and one step down" is evident, with final tariff bindings frequently above the average rates of protection prevailing prior to the Round. In the lower part of Figure 1, this pattern is illustrated for Mexican wheat imports.

The effect for developed and developing countries is broadly the same: the tariff bindings resulting from the Round are frequently now higher than the average rates of protection prior to the implementation of the Round. If countries choose to use their freedom to set high tariffs, the costs to their economies could be very large.

Figure 1. Two examples of Uruguay Round Agricultural Protection Settings





Source: Ingco (1995).

Ingco (1995) evaluated the effects on post-UR border protection for major commodities in 63 participating countries. She compares the "tariff equivalents" of nominal border protection prior to the Round with post-UR *ad-valorem* "tariff equivalents" based on the agreed tariffs and the World Bank's projected prices in the year 2000. Her analysis confirms that the base for tariffication, 1986-88, was a period of high border protection and that "dirty tariffication" was extensive.

Out of seven major product groups, Ingco found dirty tariffication in six for the European Union, and for four of these even the final bound rates (i.e., after the reductions agreed in the Round) are above the 1986-88 levels of protection, let alone the 1994 levels! The largest differences between the agreed rates for 1995 and those in the base period are for rice (207 percentage points), milk (112), butter (72), sugar (64), and wheat (64). The US exhibits dirty tariffication for five out of nine products, although to a much milder degree, while Japan does so on none, having offered tariff equivalents well below 1986-88 levels. Many of Japan's levels of agricultural protection are still huge after the Round, however, with wheat having 152 percent protection, coarse grains 149 percent and sugar 58 percent.

Ingco's work also highlights the extent to which the use of "ceiling bindings" reduced the agreed reductions in agricultural protection in developing countries. For example, in the case of wheat, a major importable in many developing countries, agreed tariff offers exceed average historical tariff equivalents in, among others, India (by 98%), Pakistan (171%), and Morocco (210%). Several rice importing countries introduced bindings above current levels of protection, notably in Bangladesh, Colombia, and Mexico, and the same occurred in coarse grains in Indonesia, the Republic of Korea, Colombia, Jamaica, Mexico, and Morocco. Bangladesh offered a uniform ceiling binding of 200%; Pakistan a range from 100 to 150%; in sub-Saharan Africa Nigeria and Zimbabwe bound most rate. at 150%. Not all developing countries have missed this opportunity to discipline their agricultural policies, however. Some developing countries have bound their agricultural protection at fairly modest rates: for example, Bolivia 40%, Honduras 35%, Suriname 20%, and Madagascar 30%. Table 1 reports historical and Uruguay Round base period tariff levels for a sample of countries and commodities.

Table 1. Border protection for selected agricultural goods (percent)

	Wheat			Cane sugar			Milk			Meat		
	Pre-UR		Post UR, Bound final	Pre-UR		Post UR, Bound final	Pre-UR		Post UR, Bound final	Pre-UR		Post UR, Bound final
	actual	base		actual	base		actual	base		actual	base	
	1986-88	1995	2000	1986-88	1995	2000	1986-88	1995	2000	1986-88	1995	2000
	%	%	%	%	%	%	%	%	%	%	%	%
EU	106	170	82	234	297	152	177	289	178	96	96	76
US	20	6	4	131	107	91	132	144	93	3	31	26
Japan	651	240	152	184	126	58	501	489	326	87	93	50
Brazil[a]	98	45	45	na	55	35	21	53	46	52	25	25
Mexico[a]	1	74	67	58	173	156	3	66	54	42	50	45
Other Latin America[a]	17	34	34	41	85	80	na	75	69	na	51	47
Nigeria[b]	249		150	32		150	na		150	na		150
South Africa	10	75	47	98	124	105	30	189	89	40	150	81
Other Sub S. Africa[b]	10		133	44		100	na		100	na		100
Maghreb	36	196	151	64	220	165	50	113	87	na	303	213
Mediterranean	25	169	152	13	107	93	na	166	150	na	166	149

Notes: [a] Negative rates of protection result where exports are taxed or imports are subsidized, either directly or through state trading
[b] Nigeria and Other Sub Saharan Africa were allowed to bind only in the final period

Source: Ingco (1995)

The export subsidy disciplines require that subsidies on each commodity be reduced by 36 percent in nominal terms over a six year period, and the volume of subsidized exports by 21 percent. Developing countries must reduce their subsidies by two thirds of these amounts over a ten year period, while least developed countries are exempted from these reductions. These disciplines seem likely to be more effective than the restrictions on import protection. Since the agreement introduces limits on the value of export subsidies, and the volume of subsidized exports, and does not require estimation of tariff equivalents or allow "ceiling bindings", there was less opportunity for the types of slippage which occurred under the tariffication process.

The agreed reduction of 20 percent in total domestic support provided by developed countries is from very high base levels, and with many exceptions which weaken the discipline imposed. Nevertheless, this may encourage a shift away from production subsidies to direct income support not linked to production, with lower

internal prices and hence lower export subsidy requirements, as a means of providing support. In the EU, in particular, the limit on domestic support seems unlikely to be a tight constraint since, as Tanner (1996) notes, the payments made to support farm incomes under the old system are included in the base, while the corresponding measures after the MacSharry reforms are not included in measures of domestic support.

The "slippage" in the agriculture agreement resulting from the setting of high tariff rates and from weak disciplines on domestic support greatly restricts the gains generated by the Round. In a study focusing on agricultural liberalization, Goldin and van der Mensbrugghe (1995) conclude that the gains from the Round would have been over two and a half times greater ($137 billion, rather than $48 billion) had the agreed cuts in agricultural protection been made from the levels prevailing prior to the Round, rather than from the inflated levels resulting from the choice of a high base period, "dirty tariffication" and ceiling bindings, and had the cuts in domestic support not been weakened by exemptions. Further, the wide discretion allowed for varying tariffs below the tariff bindings reduces the gains from increased transparency of the trade regime.

The disappointing overall achievements of the Round in increasing market access for agricultural products need to be weighed against the major progress made in improving the rules for agricultural trade. The introduction of virtually universal tariff binding is a signal achievement, stemming the seemingly inexorable trend towards higher agricultural protection, and providing both immediate benefits through reductions in the average cost of protection, and systemic benefits by providing a base for future liberalization. Much of the slippage during this Round occurred during the one-off process of converting from nontariff barriers to tariffs. With tariffication completed, this will not recur, and so the Uruguay Round has provided the foundation for more extensive liberalization in future rounds. Since so little liberalization has been achieved to date, there is no room for complacency, and initiating a new Round to build upon the foundations created by the Uruguay Round is a high priority.

EVALUATING THE EXTENT OF THE TRADE LIBERALIZATION ACHIEVED UNDER THE ROUND

The liberalization brought about in each of the main areas of the agreement (market access, export subsidies, and domestic support) is effected by imposing limits on the range of allowable assistance. Thus, import protection is limited by establishing tariff bindings that place maxima on import tariff rates; export subsidies are limited by maxima on the value of export subsidies and a limit on the volume of subsidized exports; and domestic support is limited by a maximum value of total support. A related form of conditional liberalization applies in the minimum and current market access provided under the Round. In this case, market access is not guaranteed and is, in fact, bounded by the level of the tariff quota.

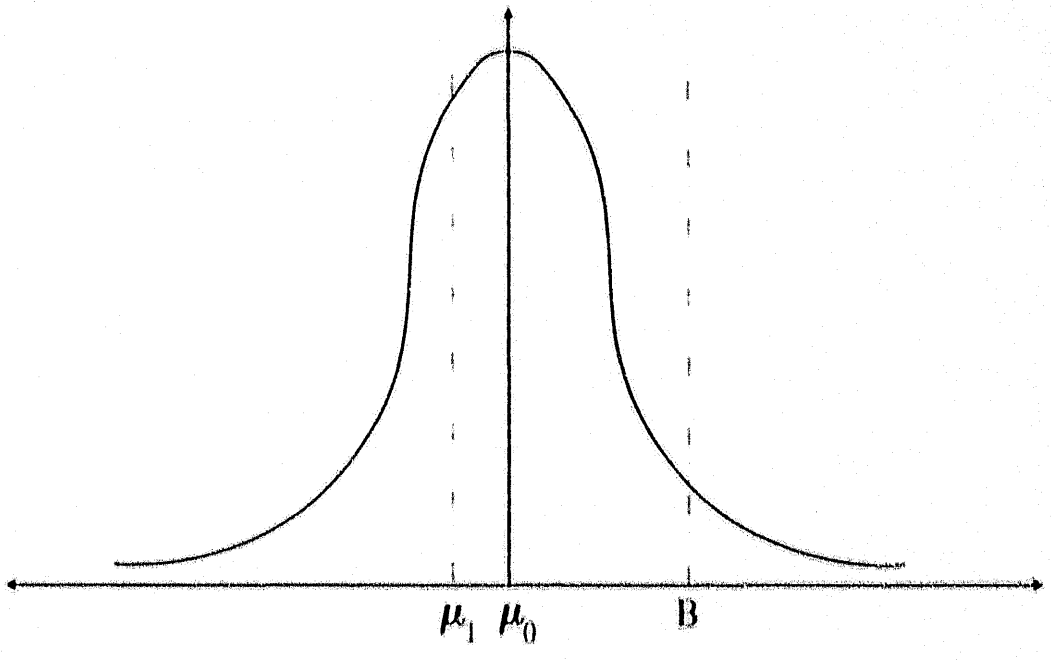
The constraints on protection resulting from the introduction of tariff bindings or similar maximum constraints on protection have two potentially very important implications for welfare. First, they tend to reduce the average rate of assistance provided over time by ruling out the highest rates of protection. Second, they tend to reduce the variability of protection rates and to reduce the expected cost of protection, which rises disproportionately with the rate of protection. In the remainder of this section, we draw on Francois and Martin (1995) to provide an indication of the potential gains from these sources.

In the absence of GATT disciplines, the agricultural policies that have emerged have typically involved highly variable rates of protection. This variation arises from a tendency to stabilize domestic prices in the face of fluctuating world prices, as well as from various political determinants of price policy decisions. Suppose that the distribution of protection for a particular commodity that results from these shocks can be depicted as in Figure 1.

The mean of the original, unconstrained, distribution of protection in Figure 1 is given by μ_0. The introduction of a binding at rate B rules out all tariff rates above B, and the resulting distribution of tariffs is winsorized at B. As long as the underlying

distribution of tariff rates does not change, the introduction of the binding must reduce both the mean and the variance of the distribution of protection. The new mean is shown as μ_1 in Figure 1.

Figure 1. The implications of a tariff binding for the applied rate of protection



The implications of a deterministic binding for the means and variances of protection rates can be undertaken by adapting one of several approaches found in the Australian literature on agricultural price stabilization. These approaches include the direct evaluation of the mean and the variance of the distribution (see Martin and Urban 1984); the mixture of distributions approach developed by Fraser (1988), and the option pricing theory approach applied by Bardsley and Cashin (1990).

Using the direct evaluation approach, the mean tariff equivalent in the presence of the binding is given by:

There is no inherent need for stockholding in such a regime of price support. If domestic prices are allowed to move flexibly in line with world market prices (ie if transmission of price changes is complete), then a constant export subsidy wedge will be required, and there is clearly no need for any non-market stockholding. Even with zero price transmission, stocks are not required; domestic market prices can be stabilized by an export subsidy that varies inversely with world market prices.

The observed tendency for large accumulations and decumulations of public stocks in both the US and the EU policy regimes can only be explained by rigidities in the implementation of these policies (Roberts *et al* 1989) . Domestic intervention prices are set for sustained periods, while world market prices change continually, and the adjustments to set-aside requirements or export subsidies required to maintain sustainable policy configurations are made only with a lag. As an example, the 1981 US Farm Bill set high and inflexible target prices and loan rates, which resulted in massive accumulation of stocks. The 1985 Farm Bill reacted to this by lowering loan rates and introducing a targeted export subsidy-- a combination of policies that led to a sharp rundown in stocks.

In Europe, the 1992 MacSharry reforms involved reductions in support prices and the introduction of land set-asides. The particular set of policies implemented, and the world market conditions that accompanied them, resulted in a substantial rundown in EU intervention stocks between 1990 and 1992. However, it was not at all clear that this would be the outcome of the reforms. Had world market conditions been weaker, but export subsidy rates and the buying-in price remained the same, domestic prices would have fallen sufficiently to trigger purchases into intervention stocks and accumulation of stocks. Since the reduction in protection levels required by the MacSharry reforms could have been associated with higher or lower stock levels, it does not seem reasonable to attribute the consequent reduction in stocks to the reduction in protection *per se*.

$$(3) \qquad \sigma_\tau^2 = \int_{-\infty}^{B} \tau^2 . f(\tau) . d\tau + \int_{B}^{\infty} B^2 . f(\tau) d\tau - \mu_\tau^2$$

allowing the impact of the binding on the variability of protection, as well as the mean rate of protection, to be evaluated. An expression analogous to equation (2) can be derived for the marginal impact of changes in the binding on the variance of protection. In contrast with equation (2), this expression (see Francois and Martin equation (9)) shows that the marginal impact of the binding on the variance does not change monotonically. The impact is close to zero for bindings that are high relative to the mass of the distribution, high for bindings near the mean of the distribution, and low for bindings well below the mass of the distribution, where the variance of the distribution is also low because of the binding.

Beginning with a fully general measure of the welfare consequences of trade liberalization provided by the Balance of Trade function (Anderson and Neary 1992; Lloyd and Schweinberger 1988), Francois and Martin generate an expression for the welfare consequences of introducing a single tariff binding:

$$(4) \qquad E(\Delta B) = -\frac{1}{2} z_{pp} E(\tau)^2 = -\frac{1}{2} z_{pp} \left(\mu_\tau^2 + \sigma_\tau^2 \right)$$

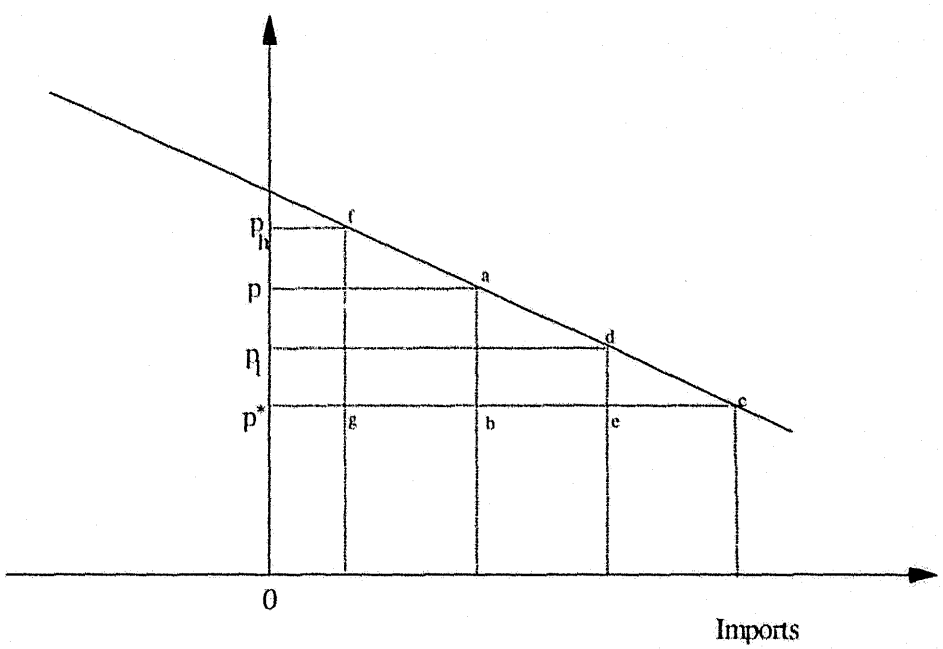
where z_{pp} is the second derivative of the net expenditure function characterizing the structure of preferences and technology in the economy and τ is the protection rate, so that μ_τ^2 is the square of the tariff mean and σ_τ^2 is the second moment of τ about its mean.

Equation (4) has a ready intuitive interpretation since z_{pp} is the slope of the compensated excess demand curve for imports of the good in question. This intuitive interpretation is perhaps most readily seen in Figure 2 drawn from Francois and Martin. The figure deals with a simple case where a [illegible] price p^* on world markets is imported subject to a variable levy that raises its [illegible] price to p_h one half of the time and to p_l the remainder of the time. The expected welfare costs of this variable levy are given by ½(*cde* + *cfg*) . Clearly, these expected costs are greater than the costs created by

a constant tariff with the same mean that allows imports to be sold at price *p*; the welfare costs of this constant tariff are represented by area *cab*.

Figure 2.

The welfare impact of varying tariff rates

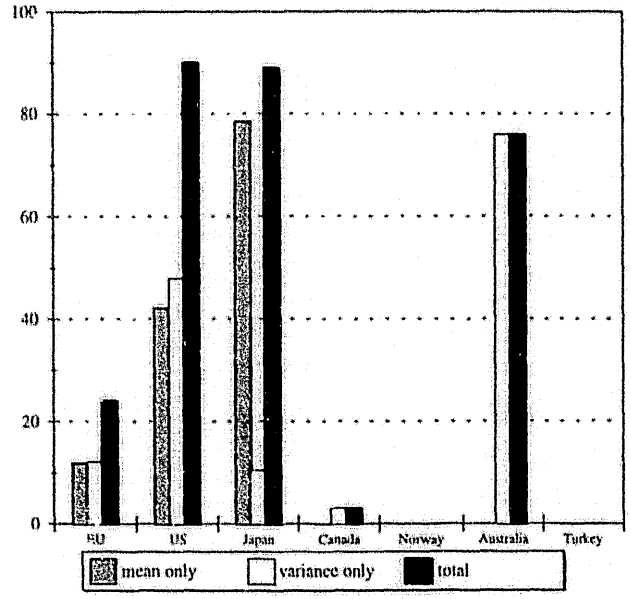


Francois and Martin provide indicative estimates for the welfare consequences of the Uruguay Round tariff bindings offered on several major agricultural commodities. Those for wheat are presented in Table 2, while Figure 3 shows the share of the measured welfare cost reductions for wheat arising from reductions in average protection rates and from reductions in the variance of protection. These results are based on distributions of protection obtained from OECD monitoring of agricultural protection (OECD 1994) and estimates of the *ad valorem* equivalents of agricultural tariff bindings prepared by Ingco (1995).

Table 2. Implications of Uruguay Round agricultural bindings

	Mean 79-93 %	Std Deviation %	Final Binding %	New Mean %	New Std Dev. %	Cost %
Wheat						
EU	56	37	82	51	30	24
US	12	14	4	1	6	90
Japan	438	153	152	151	14	89
Canada	22	18	58	22	18	3
Norway	170	126	495	170	126	0
Australia	0	1	0	0	1	76
Turkey	13	29	200	13	29	0

Figure 3. Percentage reductions in the expected cost of protection for wheat



The results presented in Table 2 and Figure 3 point to welfare gains from liberalization that are frequently larger than might be expected given the height of the tariff bindings agreed under the Round. The reduction in the variability of protection makes a substantial contribution to the overall reduction in the costs of protection in a number of cases.

The Francois and Martin analysis could potentially be extended to take into account the interactions between protection to particular commodities and their

interrelationships in production and consumption. They note that the cost of protection in this case is given by:

$$(5) \qquad E(\Delta B) = -\frac{1}{2}E(\tau' Z_{pp}\tau) = -\frac{1}{2}TR(Z_{pp}\Sigma)$$

where Z_{pp} is the matrix of compensated own and cross price effects, and Σ is the matrix of second moments of the distribution of protection about the origin. Illustrating this for the simplest multivariate case of two commodities, reveals that it implies an expected cost of protection given by:

$$E(\Delta B) = -\tfrac{1}{2}(\sigma_1^2 z_{11} + 2\sigma_{12} z_{12} + \sigma_2^2 z_{22})$$

where σ_{ij} are elements of the Σ matrix derived from an underlying political-economy model of the determinants of protection and the relationships between the protection rates for different commodities.

In general, we would expect the covariances between different protectionist instruments to be positive, in part because of their response to common exogenous shocks, and in part because increases in one tariff tend to impose burdens on other sectors and result in pressure for compensating increases in protection. Assuming most products are net substitutes in production[1] and consumption implies a tendency for the off-diagonal z_{ij} terms to be positive in sign and hence to offset the negative diagonal (z_{ii}) elements in the expression. This implies that the total expected cost of protection will be smaller than the sum of the costs estimated using only the own-protection components. However, there is no reason to expect that the proportionate rates of protection estimated for individual commodities should not be a reasonable guide to the implications estimated using the full matrices of interactions (if these could be adequately estimated), since both the diagonal and off-diagonal elements of Σ are likely to be reduced by tariff bindings.

To the best of our knowledge, no multivariate analysis of the welfare consequences of the Uruguay Round has yet been undertaken. The complexities of adequately estimating the Z_{pp} and Σ matrices will clearly make such evaluation a difficult challenge. In the absence of such analysis, the large scale empirical models used

[1] This is clearly not the case for vertically-related goods, such as livestock and feed grains, which tend to be complements in production.

to analyze the Uruguay Round have used simpler, deterministic, approaches based solely on average protection rates to assess the effects of the bindings agreed under the Round.

One simple approach used in many studies[2] evaluating the consequences of the Round compares the average rate of protection provided before the Round with the maximum rate of protection allowed under the Round agreement . If the Round maximum is below the average rate of assistance previously applied, then the Round is assumed to reduce protection by the difference between the two. If the agreed maximum is above the previous average rate, then it is assumed to result in no reduction in protection. Clearly, this approach assumes that the average rate of assistance before the Round is an adequate indicator of the counterfactual average rate of assistance after the Round; if desired, this counterfactual could, of course, be replaced by one generated using some other approach.

As a measure of the marginal impact of reductions in bindings on average protection rates, this type of measure is flawed both for bindings above and below the previous mean level of protection. When the binding is below the previous average, a marginal impact of unity is generated; this is clearly wrong since from equation (2), the marginal impact must always be less than unity. When the binding is above the mean, this simple rule implies that there is no liberalization, although equation (2) makes it clear that tariffs above the average rate do lower average rates of assistance when tariffs are stochastic.

Perhaps the best that can be said for this simple rule is that it is unlikely to be too seriously misleading when assessing the average impacts on tariff rates for a range of commodities. Since some of the impacts on mean tariff rates are biased upwards and some are biased downwards, the impact on "average" protection levels is not likely to be too badly estimated. However, the approach takes no account of the benefits obtainable from reductions in the variability of protection, and so understates the reduction in the costs of protection brought about by the Uruguay Round.

---

[2] See, for example, Brown, Deardorff, Fox and Stern (1995); Francois, McDonald and Nordström (1995); Goldin and van der Mensbrugghe (1995); Harrison, Rutherford and Tarr (1995); Hertel, Martin, Yanagishima and Dimaranan (1995).

A simple alternative approach to evaluating the liberalizing consequences of the Round is to treat the reductions in tariff bindings during the phase-in period as resulting in one-for-one reductions in protection rates. While this approach seems reasonable in the context of the Tokyo Round, where tariff reductions were concentrated in manufactures imports by developed countries, it will generate excessively large estimates of the extent of liberalization in a context such as the Uruguay Round agreement on agriculture, where tariff bindings are new, and frequently far above the rates of protection actually applied. The FAO study (FAO 1995) is one of the few to have used this approach since the completion of the Round, although it was extensively used in the analyses conducted earlier, such as Goldin, Knudsen and van der Mensbrugghe (1993) and Brandão and Martin (1993).

All of the estimates of the welfare gains resulting from the Round also suffer from a potentially serious problem of aggregation bias. The agricultural sector typically contains a large number of tariff lines, with a wide range of different rates of protection. Models typically need to be aggregated into a much smaller number of sectors and commodities and the usual procedures for such aggregation do not take into account the reductions in the variability of tariffs within sectors arising from the disciplines imposed by the Round. Preliminary work by Bach and Martin (1995) and Bach, Martin and Stevens (1995) found that the benefits of a wide-ranging tariff reduction, in their case the tariff reduction offers made by China, were roughly doubled when appropriate aggregation techniques were used.

A less optimistic possibility

All of the approaches reviewed above have yielded the conclusion that the tariff bindings and other constraints on protection will reduce average rates of protection. A less sanguine possibility exists-- that the high tariff bindings agreed under the Round will tend to pull applied rates up towards these levels.

Under some circumstances, it is possible that policy makers will fail to make, the distinction between a binding on protection and the applied rate. In this situation, the high levels of tariff bindings included in many Uruguay Round schedules could end up

becoming the applied rates, or at least attracting applied rates up towards the bindings. Finger (1994, p67) documents a phenomenon of this type in the context of antidumping, where attempts to reform very economically damaging antidumping policies have been successfully rebuffed by protectionists arguing that these policies are allowed under GATT rules. Paarlberg (1995) documents lobbying pressures in the EU and the USA designed to turn the Uruguay Round export subsidy ceilings into floors. Schiff (personal communication) reports that Guatemala recently increased its protection on rice from an average of 20 percent to 56 percent for above-quota imports, while the Central American Common Market ministers meeting to implement the Uruguay Round raised common external import tariffs on a range of sensitive products from the 5-20% range to binding rates in the 150-200% range.

In general, it seems unlikely that the presence of tariff bindings will have this effect. Protection levels are typically the outcome of a political game in which competing interest groups are pitted against each other. The presence of a binding does not directly change the strength of these competing interests and, in fact, may lower the expected returns to rent-seeking by ruling out some of the high payoff, high-protection outcomes. Further, the presence of bindings on all agricultural commodities and most manufactures reduces the pressure on interest groups to seek protection so as not to fall behind other interest groups. Thus, it seems unlikely that applied protection rates will generally be pulled up towards the GATT bindings.

Despite our overall optimism about the impacts of bindings, it is clear that serious risks remain that protectionists will be able, in some cases, to create confusion between bound and applied rates, and to use this confusion as "cover" for increases in applied rates. A major responsibility for policy economists is to clarify the issues in order to avoid this costly outcome. Continuing effort to monitor the implementation of the Round will be needed before a definitive answer to this puzzle can be found.

IMPACTS OF THE URUGUAY ROUND ON WORLD PRICES

An important component of any evaluation of the consequences of the Uruguay Round is to evaluate its consequences for world prices of major agricultural commodities. These impacts have direct welfare consequences for all net importers or exporters of agricultural commodities that may be important. The effects of the Round on world prices of staple foods has attracted additional attention recently in light of the rapid increases in world prices of many agricultural commodities during 1995. Because of the large amount of research that has been done on the impacts of the Round, we have a good base from which to evaluate its long run impacts. The effect of the Round on prices in the shorter term is a more complex question requiring us to take into account the actual implementation procedures used in the Round.

Prior to the completion of the Uruguay Round, it was not possible to say how much agricultural liberalization would be achieved. As a guide for policy making, analysts tended to simulate the consequences of fixed percentage reductions in base period protection. Not until the publication of the Dunkel draft was it possible to analyze a more specific policy proposal. Given the long run nature of the policy changes under consideration, all of the studies focused on the impact on the long run average level of prices, rather than on prices in particular periods. Here, we first consider some of the available evidence on the impact of partial agricultural liberalization like that envisaged in the Uruguay Round on long run price levels, and then turn our attention to shorter term price impacts.

Table 3. Impacts of Uruguay Round partial liberalization on world agricultural prices (%)

	Goldin *et a* (1993)	Brandão & Martin (1993)	ABARE (1994)	Goldin & van der Mensbrugghe (1995)			FAO (1995)
				79-93 base	89-93 base	w/- domestic support cuts	
Wheat	5.9	6.2	8	1.2	3.8	6.3	7
Rice	-1.9	4.0	8	-1.5	-0.9	0.8	7
Coarse Grains	3.6	3.3	5.5	0.1	2.3	3.2	4
Sugar	10.2	9.9	3	-1.0	1.8	2.5	na
Beef	4.7	7.2	3.5	0.2	0.6	1.4	8
Coffee	-6.1	1.4	na	-1.7	-1.5	-1.4	na
Oilseeds	4.1	2.9	3.5	-0.6	-0.3	3.9	4
Dairy Products	7.2	12.2	12	-1.3	1.2	2.3	7

The results of Goldin, Knudsen and van der Mensbrugghe (1993, p 91) and of Brandão and Martin (1993) were both obtained using the RUNS (Rural-Urban/North-South) model developed by the OECD and the World Bank. The results in Column 1 refer to an experiment in which all agricultural protection (positive or negative, domestic or border) was cut by 30 percent. The results in Column 3 (Brandão & Martin 1993) were based on the Dunkel draft, where only positive protection was cut by the amounts specified in that agreement. The results are broadly similar to those obtained by Goldin *et al* , except that for rice, coffee and dairy products where the absence of cuts in negative protection in the Dunkel draft scenario resulted in larger price increases.

The ABARE estimates (Andrews, Roberts and Hester 1994; Vanzetti, Andrews, Hester and Fisher 1994) are based on the Blair House Accord, and effectively on the final Uruguay Round agreement, but were prepared before the full extent of the slippage associated with dirty tariffication had become evident. These estimates are also based on the SWOPSIM partial equilibrium models, and might be expected to be somewhat higher than those obtained from complete liberalization, where world prices of manufactured goods (perhaps the most relevant deflator) would be expected to rise. Unlike the earlier estimates, they take into account the impact of the special treatment accorded to rice in Japan and Korea, where market access arrangements are expected to result in a significant increase in world trade; as a consequence, world rice prices are expected to increase by considerably more.

The Goldin and van der Mensbrugghe results presented in columns 4, 5 and 6 of the table differ from the earlier results in being based on the actual results of the Round. Their estimated price impacts are smaller than those obtained in earlier studies using the RUNS model both because of the nature of the simulations, and because of the "slippage" which occurred in the process of converting nontariff barriers into tariffs and in disciplining domestic support. A key difference in the simulations arises from the inclusion of agricultural and nonagricultural liberalization in the new simulations-- the considerable liberalization of manufacturing protection increased world import demand and raised the average OECD price of manufactures exports, the deflator in the RUNS

model. The slippage in the tariffication process (documented by Ingco 1995) resulted in many tariff bindings well above previous rates of protection, and resulted in much less liberalization than was implied by the agreed tariff cuts. The results in columns 4 and 5 are based on the assumption that the restraints on domestic support will be ineffective; the results in column 6 assume that these restraints will be effective. Clearly, these constraints would have had an impact had they been fully effective, but only of the order of 1-2 percentage points in most cases.

Because of uncertainty about the true counterfactual, Goldin and van der Mensbrugghe present two alternative scenarios for protection in the absence of the Round. The first is based on the longest available series of protection data assembled by Ingco (1995). The second utilizes data only for a relatively recent period from 1989 to 1993. The longer period has the advantage of smoothing out the relatively high volatility observed in rates of agricultural assistance and is appropriate if rates of protection are seen as varying around a long-run constant level. If, alternatively, rates of assistance are regarded as either trending, or as having undergone a structural break during the period for which data are available, then the more recent period might provide a better indicator of protection in the absence of the Round. While the results from the two experiments differ in some respects, the broad pattern of only very small changes in world prices, relative to the numeraire, is very similar between the two experiments.

The final column of the table presents the price impacts estimated by FAO (1995). These estimates are based on a partial equilibrium model which, by necessity, omits liberalization occurring in the manufacturing sector and hence raises the estimated relative price impact. This analysis is based on the detailed data on protection cuts contained in country protection schedules, ie the differences between the negotiated 'base' tariff bindings which came into effect in 1995 and the 'final' tariff bindings at the end of the implementation period. These estimates do not take into account the slippage occurring in the tariffication process between the applied rates of protection and the base tariff bindings. As equation (2) makes clear, the impact of a change in a binding on the expected price is always less than unity, so it seems reasonable to view these estimates as

providing something of an upper bound on the impacts of the Round on average protection levels and hence on food prices.

Taking the results presented in Table 1 as a whole, it appears that the reductions in protection brought about by the Round can be expected to result in relatively modest increases in the long run average levels of world prices for major agricultural commodities relative to the prices of manufactured goods. Given that the results presented in the table encompass a wide range of modeling approaches and experimental assumptions, it seems reasonable to assume that the true long run impact of the Round falls within the range estimated. These estimated long run impacts go nowhere near to explaining the sizable increases in the prices of major agricultural commodities occurring in the year following implementation of the Round.

One caveat on this conclusion must be noted. Since protection rates are largely determined by economic factors, the true counterfactual rate of protection in the absence of the Round cannot be known with confidence. If the sustained increases in protection rates documented by Anderson and Hayami (1986) are projected into the future then the counterfactual would be rates of assistance higher than those observed in the future, and the increases in world prices resulting from the Round would be correspondingly larger. Alternatively, it is possible that some of the reforms undertaken during the Round, such as the MacSharry reforms in Europe and structural adjustments in many developing countries, were part of a fundamental structural change towards more open economies. Since much of this reform took place after 1990, it had little or no impact on the benchmark rates of protection used in the models. Had these reductions been reflected in the benchmark, the estimated cuts in protection resulting from the Round would have been smaller, and the impacts on world prices correspondingly reduced.

Given the inescapable uncertainty about the counterfactual, it seems best to regard the available evidence as being indicative of the effects of changing from historically observed levels of protection, rather than from the (unknowable) rates of protection that would have prevailed in the absence of the Round.

The Uruguay Round and the 1995 price rises

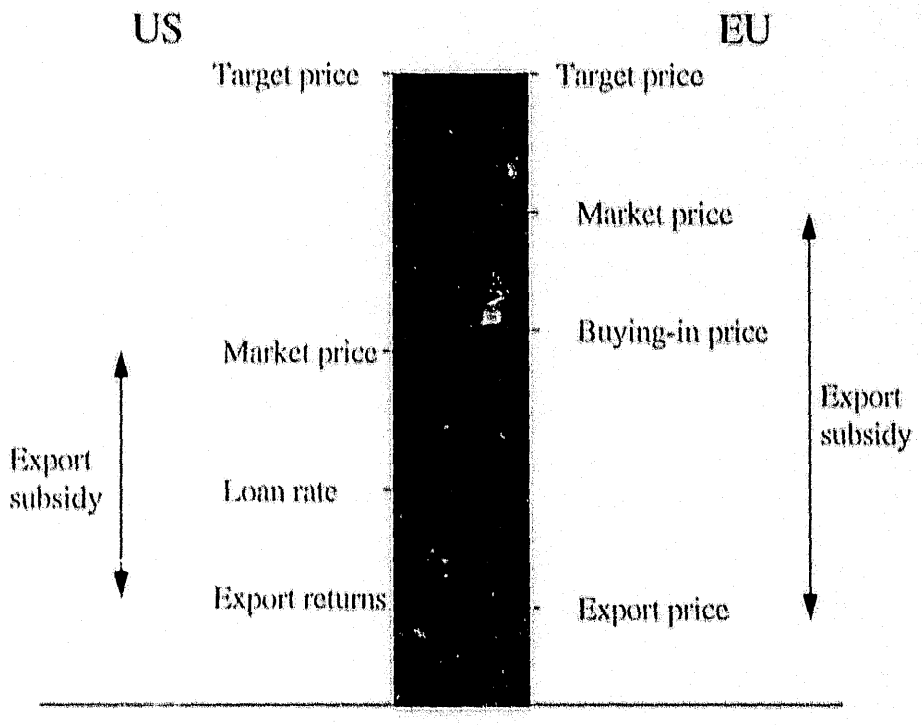
The long-run estimates presented in Table 1 refer to the complete impact of the Round agreement after it has been completely phased in, and resources have had time to adjust. Since the reductions in protection brought about by the Round are to be phased in over a six year period in the developed countries, and a ten year period in the developing countries, only a very small part of the proposed liberalization has actually taken place. Even less of the response to the reduction in protection has occurred once lags in response are considered. Thus, these long-run factors are of little use in explaining the increases of roughly 30 percent (World Bank 1995) in grain prices during 1995.

The sharp increase in prices of major agricultural commodities during 1995 is clearly associated with the low stock levels of these commodities. Casual empiricism might suggest that the Uruguay Round outcome contributed to these price rises by reducing levels of public stocks. Since one consequence of the farm policies of the USA and the EU is the accumulation of very large stocks from time to time, it seems reasonable to suppose that policies that reduce these trade distortions will reduce average stock levels.

The impact of the Uruguay Round agreement on average stock levels, however, depends in a complex way on the configuration of the protection instruments used. These policies contain a range of instruments, including output and export subsidies that can produce sustained increases in exports, land set aside requirements that can cause sustained reductions in exports, and stockholding policies which cannot change average net export levels.

The policy instruments effective in the United States and the post-MacSharry European Union for export commodities are depicted in Figure 4. In each case, there is a target price on which price support payments to producers and area set-aside programs are based. The sustainable level of internal prices is determined by world market prices plus the export subsidies available to exporters. In long-run equilibrium, the buying-in prices (the loan rate in the United States) at which stock accumulations are triggered must be below market prices as depicted, or stocks will accumulate indefinitely

Figure 4. The structure of US and EU agricultural policies.



In assessing the consequences of the Round for levels of public stocks, it is important to bear in mind that stock accumulation under the agricultural policies prevailing in the two major holders of public stocks, the USA and the EU, is triggered primarily by the relationship between the relevant stock purchasing price, and the prevailing market prices-- the higher is the price offered by the governments' stockholding authorities relative to the prices available elsewhere, the more willing producers will be to sell commodities to these agencies. The choice of whether to use stock purchases or to use export subsidies is not dictated by the Uruguay Round. If anything, the Round agreement may cause a bias towards the use of stock accumulation, rather than export subsidization, as a means of providing short term support since expenditures on stock purchases are exempted even from the restrictions on total domestic support.

THE WELFARE IMPACTS OF THE AGRICULTURE AGREEMENT

Three recent studies have provided global measures of the welfare impacts of the Uruguay Round as implemented. These are: Goldin and van der Mensbrugghe (1995); Harrison, Rutherford and Tarr (1995), and Francois, McDonald and Nordström (1995).

The Goldin and van der Mensbrugghe (1995) results refer to total GATT liberalization of merchandise trade. However, given the strong focus of the RUNS model on agricultural commodities, it seems that these results reflect primarily the effects of agricultural liberalization because agricultural goods are treated as perfect substitutes and because agriculture is much more finely disaggregated than non-agriculture in this model; this interpretation is strongly supported by previous analyses conducted with the RUNS model (Goldin, Knudsen and van der Mensbrugghe 1993) and on experiments with a RUNS-type general equilibrium model conducted by Harrison, Rutherford and Tarr (1995). The first three sets of results are presented in Table 4o match the price impacts presented in Table 3, while the final set reports the results had the agreed Uruguay Round cuts in protection resulted in corresponding cuts in applied rates of protection.

Table 4 Goldin and van der Mensbrugghe estimates of real income effects

	1982-93 Protection Base	1989-93 Protection Base	89-93 Base with Domestic Support Cut	89-93 Base and Agreed Cuts
	% of GDP	% of GDP	% of GDP	% of GDP
Australasia	-0.1	0.0	0.1	0.6
EU	0.1	0.3	0.6	0.9
USA	0.0	0.0	0.1	0.2
Japan	0.2	0.4	0.4	0.9
Africa	-0.2	-0.2	-0.3	-0.5
China	-0.1	-0.1	-0.2	-0.2
India	0.4	0.5	0.7	0.8
Brazil	0.3	0.4	0.3	0.4
World ($billion)	25.4	48.0	68.4	136.6

The estimates presented in the final column of Table 4 are those obtained by applying the agreed Uruguay Round tariff cuts to the base levels of applied protection

estimated by Ingco to have applied during a 1989-93 base period (1995). These results imply global welfare gains of $136.6 billion, and sizable welfare gains to a number of countries, including major liberalizers such as the EU and Japan, and agricultural exporters such as Australasia and India. Stepping back to the results in column 3, where the domestic support cuts are assumed to bind, but the cuts in import protection and export subsidies are based on the measures of liberalization generated by Ingco (1995) reduces the measured welfare gains by half. Moving to column 2, where the more widely accepted assumption that the domestic support measures do not bind is made, the global welfare gains fall by a further third, to $48 billion. If the long-period average rate of protection is used-- implying a less distorted counterfactual--, as in column 1, the welfare gains fall by close to half, resulting in global welfare gains of $25.4 billion.

The substantial gains to Australasia and to most of the regions that gain from the agreed cuts scenario diminish as we move left across the table. The gains to Australasia become zero in column 2, and actually negative in the simulations reported using the long run average rate of protection. Moving left across the table also causes the losses experienced by regions such as Africa and China (which does not liberalize in this scenario because it is not a WTO member) to decline. This is primarily a consequence of the much smaller increases in the world prices of temperate food crops reported in Table 3.

The welfare estimates reported by Harrison, Rutherford and Tarr (1995) are presented in Table 5 for experiments involving both agricultural liberalization and the complete Uruguay Round package of merchandise trade liberalization. The agriculture experiment is based on the 1982-93 protection benchmark and assumes that the constraints on domestic support will be binding-- thus combining features of columns 1 and 3 in Table 4. Because the Harrison, Rutherford and Tarr model is a differentiated product model, it incorporates the agreed limits on both import and export barriers.

These results are obtained from a version of their model using relatively high long-run Armington elasticities implying relatively close substitutability between domestic and imported goods-- although not infinite as in the perfect substitutes case assumed by Goldin and van der Mensbrugghe for agricultural products. This version of

the Harrison, Rutherford and Tarr model incorporates scale economies, and focuses on a steady state outcome in which the capital stock increases in response to changes in the returns to capital; these results should therefore be interpreted as indicators of potential income increases, rather than pure welfare gains from the Round, since the costs of accumulating capital have not been taken into account.

Table 5. Harrison, Rutherford and Tarr estimates of the welfare gains from agricultural liberalization and the Uruguay Round merchandise trade liberalization.

	Agriculture ($billion)	Full ($billion)	Full (% of GDP)
Australia	0.85	3.26	1.10
New Zealand	0.53	1.43	3.62
USA	3.25	26.68	0.46
Japan	16.84	22.73	0.64
Rep. of Korea	5.24	7.45	2.50
European Union	26.44	49.93	0.74
Indonesia	0.29	2.61	2.12
Philippines	1.11	2.37	4.35
Thailand	1.36	12.63	10.9
China	-0.78	2.00	0.45
Argentina	0.72	2.35	1.01
Brazil	0.14	4.27	1.12
Mexico	0.71	2.29	0.67
Sub-Saharan Africa	-0.48	-0.69	-0.40
South Asia	0.24	6.74	2.03
Developing total	13.9	55.2	1.20
Industrial total	49.7	115.4	0.63
WORLD	63.7	170.6	0.74

The income gains reported by Harrison, Rutherford and Tarr are substantially larger than those reported by Goldin and van der Mensbrugghe. In part, this is due to the use of the steady-state approach to measuring these income gains. Using the same model and experiment, Harrison, Rutherford and Tarr (forthcoming, p20) report global welfare gains of $96 billion, rather than the $170.6 billion reported in Table 5. However, the use of the steady-state assumption has only a minor impact on the results for agriculture, either in total or in any individual region-- for the world as a whole, the welfare gains

from agricultural liberalization are $58.6 billion in the static model, rather than $63.7 billion in the steady state model.

The results in Table 5 suggest that the agriculture agreement contributed roughly a third of the total gains from trade liberalization under the Round. The share contributed by agricultural liberalization was larger in developed countries than in developing, with particularly large shares arising from agricultural liberalization in the EU and Japan, paradoxically perhaps the economies least enthusiastic about liberalizing agriculture. Australia and New Zealand both registered gains from agriculture that are important both absolutely and as a share of their total income gains from the Round. In the developing countries that liberalized substantially, such as Thailand, the gains from agricultural liberalization are quite small relative to the very substantial overall gains; these results reflect the relatively low barriers to agricultural imports in many developing countries, and the modest reductions made under the Round.

The Francois, McDonald and Nordström (1995, p163) results presented in Table 6 are based on a fundamentally different assumption about the nature of the Uruguay Round agreement on agriculture-- that the reductions in tariffs and domestic support were ineffective, and that only the commitments on export subsidies and on market access had any liberalizing impact. This scenario was viewed by its authors as a minimalist one in contrast with the assumption made in previous GATT analyses, that the reductions in tariff bindings had a one-for-one impact on import protection rates.

The version of the Francois, McDonald and Nordström model used to generate these results is one of Chamberlinian monopolistic competition. With this model, liberalization increases the number of firms competing in the market, and this increase in productivity increases both productivity and consumer utility directly. Another important feature of this version of the model is the capital market closure; when liberalization increases the return to capital, the supply of capital increases until the rate of return on capital returns to its original level. Moving from a base model of perfect competition to one with Chamberlinian monopolistic competition has only a small effect on the returns to agricultural liberalization, but roughly doubles the overall gains from liberalization. Moving from a model with a fixed capital stock to one with a fixed rate of return actually

lowered the returns from agricultural liberalization while raising returns from nonagricultural liberalization.

Table 6. Francois, McDonald and Nordström estimates of the real income effects of Uruguay Round liberalization

	Agriculture $billion	Total $billion	Total % of GDP
Australasia	0.87	1.46	0.43
Japan	-0.30	14.23	0.40
United States	0.19	36.62	0.62
EU	0.91	31.85	0.48
Africa	1.4	10.72	1.41
China	0.82	17.64	3.97
East Asia	0.63	31.02	3.15
South Asia	-0.25	10.27	3.07
Latin America	1.88	20.26	1.68
TOTAL	7.08	214.46	0.94

The much smaller gains from agricultural liberalization obtained by Francois, McDonald and Nordström reflect a combination of the much smaller degree of liberalization considered, and the much more highly aggregated nature of the agricultural sector in their model. Importantly, these results include the effects of the disciplines on export subsidies that are widely viewed as one of the most important parts of the agreement; both these results and the decomposition reported by Harrison, Rutherford and Tarr (1995, p226) suggest that the income gains from this source are relatively small. Another factor likely to considerably reduce the estimated benefits of agricultural liberalization is the high level of aggregation of the agricultural sector (three commodities as against six in the Harrison, Rutherford and Tarr model, and 15 in the RUNS model). Despite this, this analysis does point to worthwhile gains for a number of countries and regions, particularly to Australasia, where over half of the estimated income gains accrue from agricultural liberalization

In considering the results of any of the quantitative studies, it is important to remember that all of the available studies include only the immediate gains from market liberalization brought about by the Round. Because of the high degree of aggregation used and difficulties in evaluating the benefits associated with estimating the gains from

reducing the variability of protection, they almost certainly understate the magnitude of the gains from liberalization. Further, they consider only the immediate impact of the liberalization agreed under the Round. They ignore the potentially enormous long run benefits from further liberalization, and any dynamic gains from induced improvements in productivity of the type that Brandão and Martin (1993) found could substantially increase the gains from liberalization, particularly in developing countries. For all of these reasons, it seems best to view the available estimates as providing lower bound estimates of the potential gains from the Round.

Conclusions

The Uruguay Round agreement on agriculture was a major achievement in terms of establishing a framework of rules for trade liberalization where the previous GATT rules had not been effective. In terms of generating immediate trade liberalization, it was considerably less successful than would be implied by the agreed cuts in protection, particularly because of the slippage resulting from "dirty" tariffication and the use of ceiling bindings in developing countries.

Comprehensive evaluation of the restraints on protection introduced under the Round needs to take into account the fact that these restraints do not always bind. Such restraints can be expected to reduce both the mean and the variance of protection rates, and both reductions reduce the expected cost of protection. Initial evaluations suggest that both of these reductions are likely to contribute substantially to reducing the expected cost of protection in many cases. One pessimistic possibility, that high tariff bindings may attract applied rates upwards, cannot be completely ruled out, and points to a need for policy economists to help in clarifying the distinction between the limits on protection agreed under the Round and the rates actually applied .

The available quantitative evaluations of the agricultural liberalization point to global real income gains of up to $60 billion, even without taking into account the benefits resulting from reductions in the variability of protection. These gains almost certainly underestimate the benefits of the Round, since they are based on relatively

aggregated models, and ignore the potentially very important dynamic gains associated with induced technical change following liberalization.

The post-Round agricultural trade regime will provide an excellent starting point for future liberalization of world agricultural trade. With tariff bindings now fixed, the "slippage" associated with the tariffication should not recur, allowing agreed cuts in bindings to bring about larger reductions in protection than they did when undertaken with the initial conversion of nontariff barriers into tariffs. The trade negotiators have been particularly kind to us as policy researchers in scheduling the next round of agricultural negotiations to begin in 1999-- far enough in the future so our best work over the next few years can be published, recognized and contribute to shaping the environment for these negotiations.

References

Anderson, J. E. and Neary, J.P. (1992), "Trade Reform with Quotas, Partial Rent Retention and Tariffs" *Econometrica* 60:57-76.

Anderson, K. and Hayami, Y., (1986), *The Political Economy of Agricultural Protection: East Asia in International Perspective*, Allen and Unwin, Sydney.

Anderson, K. and Tyers, R. (1986), 'Agricultural policies of industrial countries and their effects on traditional food exporters', *Economic Record* 62(179):385-99.

Andrews, N., Roberts, I. and Hester, S. (1994), 'The Uruguay Round outcome: implications for agricultural and resource commodities', *Outlook 94*, Australian Bureau of Agricultural and Resource Economics, Canberra.

Bach, C., and Martin, W. (1995), 'Will the right tariff aggregator please stand up?', Mimeo, International Trade Division, World Bank.

Bach, C., Martin, W. and Stevens, J. (1995), 'China's WTO accession offer', Mimeo, International Trade Division, World Bank.

Bardsley, P. and Cashin, P. (1990), "Underwriting Assistance to the Australian Wheat Industry--an Application of Option Pricing Theory." *Australian Journal of Agricultural Economics* 34(3):212-222.

Brandão, A. and Martin, W. (1993), 'Implications of agricultural trade liberalization for the developing countries' *Agricultural Economics* 8:313-43.

Brown, D. K., Deardorff, A., Fox, A. and Stern, R. (1995), 'Computational analysis of goods and services liberalization in the Uruguay Round', in Martin, W. and Winters, L. A. *eds. The Uruguay Round and the Developing Economies*, World Bank Discussion Paper No. 307, World Bank, Washington DC.

Deardorff, A. and Stern, R. (1986), *The Michigan Model of World Production and Trade*, MIT Press, London.

FAO (1995), *Impact of the Uruguay Round on Agriculture*, Food and Agriculture Organization, Rome, including supplement on "Methodological Impact and Assumptions", ESC/M/95/1.

Finger, J. Michael *ed.*, (1994), *Antidumping: How it Works and Who Gets Hurt*, University of Michigan Press, Ann Arbor.

Francois, J. and Martin, W. (1995), 'Multilateral trade rules and the expected cost of protection', Discussion Paper No. 1214, Centre for Economic Policy Research, London.

Francois, J., McDonald, B. and Nordström, H. (1995), 'Assessing the Uruguay Round', in Martin, W. and Winters, L.A. eds. *The Uruguay Round and the Developing Economies*, World Bank Discussion Paper No 307, World Bank, Washington DC.

Fraser, R. W. (1988), 'A method for evaluating supply response to price underwriting.' *Australian Journal of Agricultural Economics* 32(1):22

GATT (1993), 'Modalities for the establishment of specific binding commitments under the reform programme.' MTN.GNG/MA/W/24, 20 December, GATT, Geneva.

Goldin, I., Knudsen, O. and van der Mensbrugghe, D. (1993), *Trade Liberalisation: Global Economic Implications*, OECD and the World Bank, Paris.

Goldin, I. and van der Mensbrugghe, D. (1995), 'The Uruguay Round: an assessment of economywide and agricultural reforms' in Martin, W. and Winters, L.A. eds. *The Uruguay Round and the Developing Economies*, World Bank Discussion Paper No 307, World Bank, Washington DC.

Harrison, G. W., Rutherford, T. and Tarr, D. (1995), 'Quantifying the Uruguay Round' in Martin, W. and Winters, L.A. eds. *The Uruguay Round and the Developing Economies*, World Bank Discussion Paper No 307, World Bank, Washington DC.

Harrison, G. W., Rutherford, T. and Tarr, D. (forthcoming), 'Quantifying the Uruguay Round' in Martin, W. and Winters, L.A. eds. *The Uruguay Round and the Developing Countries*, Cambridge University Press, Cambridge.

Hertel, T., Martin, W., Yanagishima, K. and Dimaranan, B. (1995), 'The Uruguay Round and market access', in Martin, W. and Winters, L.A. eds. *The Uruguay Round and the Developing Economies*, World Bank Discussion Paper No 307, World Bank, Washington DC.

Ingco, M. (1995), 'Agricultural trade liberalization in the Uruguay Round: one step forward, one step back' Background Paper for the World Bank Conference on the Uruguay Round and the Developing Economies, Washington DC, January 26-27, 1995.

Lloyd, P. and Schweinberger, A. (1988), 'Trade expenditure functions and the gains from trade', *Journal of International Economics*, 24:275-97.

Martin, W. and Francois, J. (1994), 'Bindings and rules as trade liberalization' forthcoming in Maskus, K. ed. *Quiet Pioneering: Robert M. Stern and His International Economic Legacy*, University of Michigan Press, Ann Arbor.

Martin, W. and Urban, P. (1984), "Modelling Producer Response under Support Price and Stabilisation Schemes." Paper presented to the 28th Annual conference of the Australian Agricultural Economics Society, Sydney.

Martin, W. and Winters, L. A. *eds.* (1995), *The Uruguay Round and the Developing Economies*, World Bank Discussion Paper No.307, World Bank, Washington DC.

OECD (1995), *The Uruguay Round: A Preliminary Evaluation of the Impacts of the Agreement on Agriculture in the OECD Countries*, Organisation for Economic Cooperation and Development, Paris.

Paarlberg, R.L. (1995), 'Does the GATT agreement promote export subsidies' *Choices*, Fourth Quarter, pp 8-12.

Robert, C. and Schiff, M. (1995), 'Regional agreements and the GATT: implementation issues for agriculture in Latin America', Paper presented to FAO/World Bank Workshop on Implementing the Uruguay Round in Latin America: the case of agriculture', Santiago, Chile, 28-30 November.

Roberts, I., Love, G., Field, H. and Klijn, N. (1989), *US Grain Policies and the World Market*, Policy Monograph No. 4, Australian Bureau of Agricultural and Resource Economics, Canberra.

Tyers, R. and Anderson, K. (1992), *Disarray in World Food Markets: A Quantitative Assessment*, Cambridge University Press, Cambridge.

Vanzetti, D., Andrews, N., Hester, S. and Fisher, B. (1994), 'US-EC agricultural trade relationships and the Uruguay Round: a Cairns Group perspective' in Anania, G., Carter, C. and McCalla, A. *eds. Agricultural Trade Conflicts and GATT*, Westview Press, Boulder.

World Bank (1995), *Commodity markets and the Developing Economies*, World Bank, Washington DC.

be relocated from rich to poor countries when the former's trade barriers are lowered: some industries in the North will expand at the expense of those industries in the South, and conversely. In any case, it should not simply be assumed that relocating some production to the South necessarily worsens the environment. Recent preliminary examinations of the likely environmental effects of reducing government assistance to two of the North's most protected industries, coal and food, reveal that in both cases the global environment may well be improved by trade liberalization, especially if complementary environmental policies are in place. That outcome is possible partly because production of those goods in the North tends to be more pollutive than elsewhere. As well, reducing coal producer subsidies in Europe would raise the international price of coal, thereby discouraging its use elsewhere and so lowering global carbon emissions (Anderson 1992b, Steenblik and Coroyannakis 1995). But to get a fuller answer to the question of whether broad-based liberalizations such as the Uruguay Round would be environmentally friendly requires large-scale formal modelling analyses.

Nor need the risk of environmental damage from transport activity increase with trade reform. The lowering of import barriers to processed primary products, for example, would allow more raw materials to be processed in resource-rich countries, so reducing the bulkiness of shipments.

What of the argument that the opportunity for capital outflow breeds 'pollution havens' abroad and thereby reduces the development in high-standard countries of environmentally friendlier production technologies? Some have argued that the opportunities for such innovations are so great that raising environmental standards could boost rather than retard a country's economy (Porter and van der Linde 1996). However, that argument begs the question of why such investments would not have been made in an open economy without the imposition of stricter standards (Palmer, Oates and Portney 1996). In any case, there is little empirical evidence to suggest that raising standards stimulates innovation, just as there is little theoretical or empirical support for the opposite notion that differences in environmental standards have a significant impact on firms' competitiveness and/or their decisions to invest abroad (Jaffe et al. 1995, Wilson 1996).

The GATT/WTO and the environment

How 'green' are the rules of the GATT, how have they been adapted over time, and should they be altered further? From the outset the GATT has been a conservationist institution in the sense that its purpose has been to reduce trade barriers and thereby the inefficiency in the use of the world's resources. The heart of the GATT, agreed to by 23 original contracting parties in 1947 and since then by another 100 or so countries, is the nondiscrimination requirements of Articles I and III. These obligate parties to treat imports from any GATT contracting party no less favourably than other imports (the 'most-favoured-nation' requirement) and no less favourably, after border taxes are paid, than similar domestic products (the 'national treatment' requirement). Article XX provides exceptions to these general rules, however, including provisions for some environmental regulations. Specifically, parts (b) and (g) of Article XX allow trade restrictions "necessary to protect human, animal, or plant life or health" and "relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption", subject to the requirement that such restrictions "are not applied in a manner which would constitute a