Options for Reducing Agricultural Tariffs

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If past trade rounds are any indication, a topic of considerable debate during the next negotiations will be determining the nature of tariff cuts to be implemented. In initial negotiating proposals submitted to the WTO, countries have demonstrated a desire to reduce both the level and disparity of agricultural tariffs, as well as to confront the issue of tariff escalation. This study indicates that alternative tariff-cutting formulas address these objectives with varying results, depending on the initial height and distribution of a country's tariff schedule. Ranking formulas based on their ability to produce desired objectives can be difficult, since it depends on the criteria used to evaluate the outcomes. The conclusions reached here point to the need for negotiators to have detailed information on the tariffs their exports face in major markets, the post-liberalization tariff profiles they seek, and how close alternative formulas come to producing desired results.

Introduction

During the Uruguay Round of the General Agreement on Tariffs and Trade (GATT), the negotiating parties agreed to convert their agricultural nontariff barriers (NTB) to bound tariffs,[1] a process known as tariffication. The conversion of NTBs (which include embargoes, import quotas, and discretionary import licensing) to bound tariffs was a key achievement of the Uruguay Round Agreement on Agriculture (URAA). Since tariffs are more predictable and transparent in their application and do not establish maximum ceilings on imports, they are less trade-distorting than NTBs.

Developed countries agreed to reduce all agricultural tariffs, including those resulting from tariffication, from their base-period rates[2] by a total of 36 percent, on a simple-average basis, with a minimum cut of 15 percent for each tariff. The cuts were to take place in equal installments over 6 years, beginning with the first cut in 1995.[3] Countries were also to provide a minimum level of import opportunities for products previously protected by NTBs. This was accomplished by creating tariff-rate quotas (TRQ), which impose a relatively low in-quota tariff on imports up to a minimum access level, with imports above that level subject to a higher, over-quota tariff.

As a result of tariffication, tariffs and TRQs are now the main trade policy instruments used by governments to protect their domestic agricultural producers from foreign competition. But while the URAA began the process of liberalizing agricultural trade by reducing tariffs, protection for agricultural commodities continues to stand out as a major distorting feature of international trade. For manufactured goods, the industrial countries' import-weighted average tariff has been reduced from about 40 percent to under 4 percent since 1949 (Laird). For agricultural goods, in contrast, the simple average for industrial countries' post-Uruguay Round bound tariffs is estimated in this study to be 45 percent.[4] Clearly, substantial room exists for liberalizing agricultural tariffs, which are a highly visible and easily negotiable target for reductions (compared with NTBs) because of their generally transparent and quantifiable nature.

Among the main items in the next round of trade negotiations will be the manner and extent to which agri-

[1] Tariffs are considered legally "bound" within GATT/WTO when a country agrees not to raise them above a certain level, subject to a penalty.

[2] For tariffs that were already bound, the base was the current bound rate; for existing but unbound tariffs, the base was the 1986 tariff rate; and for duties that resulted from tariffication of NTBs, the base was the level of protection provided by NTBs during the 1986-88 period.

[3] Developing countries agreed to reduce their previously bound tariffs by 24 percent (with a 10 percent minimum cut) in equal installments over 10 years. For previously unbound tariffs only a ceiling binding was required, recognizing that the binding of these tariffs against increase was a concession equivalent to reducing them. Least developed countries were subject to tariffication and binding, but exempt from all reduction commitments.

[4] Using a slightly different methodology, Gibson et al. estimate the simple global average of post-Uruguay Round agricultural tariffs at 62 percent.

cultural tariffs will be reduced. Many have suggested that to achieve cuts in agricultural tariffs large enough to have significant trade liberalizing effects, countries should consider reducing tariffs on a formula basis (Josling, Tangermann, Anderson, et al.). In particular, there has been a considerable interest expressed in the Swiss formula, which was adopted during the Tokyo Round of trade negotiations to reduce tariffs on manufactured items. The objective here is threefold:

- to review some features of the main tariff-cutting formulas proposed in past rounds and summarize the key issues to consider when evaluating alternative formulas;
- to describe the tariff structures existing in the industrial countries, now that the Uruguay Round implementation period for these countries has drawn to a close and the last of the tariff cuts have been phased in;
- to apply standard examples of formulas to the post-Uruguay Round bound agricultural tariffs of industrial countries and illustrate how the formulas might alter the structure of tariff schedules.

Tariff-Cutting Formulas

Prior to the Kennedy Round (1963-67), tariff negotiations consisted of countries drawing up request-and-offer lists containing the tariffs they proposed that other countries reduce and/or bind as well as the concessions they were willing to make in exchange. Negotiations proceeded on a country-by-country and item-by-item basis, focusing on those items where one country was the principal import supplier of the other.

During the Kennedy Round, negotiators took a radically different approach by adopting a simple yet powerful formula to cut industrial tariffs across the board by 50 percent. One argument for a linear cut was that if all countries cut all tariffs by a fixed percent, then each would give and receive the same concession on total exports and imports, thus ensuring reciprocity in negotiations.[5]

During the Tokyo Round (1973-79), the United States proposed that tariffs be cut across the board by 60 percent. The European Economic Community (EEC), which had a fairly uniform set of moderate tariff rates across all industrial products, contended that a linear cut would not yield the reciprocity that all participants sought. Restating an argument it had made during the Kennedy Round, the EEC maintained that it would benefit less from equal, across-the-board tariff cuts than would countries with a high degree of dispersion in their tariff schedules (i.e., moderate tariff averages that were not uniform but that instead combined primarily low tariffs with occasional very high rates, or tariff peaks). The EEC argued that moderate rates, if reduced by 60 percent, would lose much of their protective effect, while high, prohibitive tariffs could remain very protective, leading to little or no trade liberalization for items subject to high rates. The EEC proposed to cut high tariffs proportionately more than low tariffs in order to reduce tariff disparity within countries' tariff schedules, contending that the greater the dispersion, the higher the level of economic and trade distortion.[6]

Two other principal participants in the negotiations, Japan and Canada, also proposed tariff-cutting formulas, and considerable time was spent debating the choice of formula. In the end, negotiators agreed to a comprehensive "harmonization" formula proposed by Switzerland, designed to result in a fairly deep overall reduction in tariffs while cutting high rates proportionately more than low ones.

The formulas analyzed here are extensions and combinations of the various approaches discussed during the Tokyo Round for cutting tariffs on manufactured goods. These formulas are intended to span the various classes of tariff-cutting formulas, which can be categorized as (1) strictly linear cuts; (2) harmonization formulas designed to cut high tariffs proportionately more than low tariffs; (3) formulas which combine linear cuts and some sort of harmonization element; (4) formulas with special treatment of tariffs below or above a certain level; and (5) "sectoral" formulas which place

[5] While the preamble to the General Agreement on Tariffs and Trade calls on members to enter into "reciprocal and mutually advantageous arrangements directed to the substantial reduction of tariffs," nowhere in the Agreement is there a definition of reciprocal or reciprocity. A number of studies cited here tie reciprocity to the pervasive belief that every dollar increase in imports should be balanced with a dollar increase in exports. Reducing one's trade barriers has traditionally been considered a concession that has to be compensated by equivalent concessions from other countries, a tenet that continues to influence today's negotiations.

[6] While a uniform tariff schedule is generally considered less distorting than one with high dispersion, the level of distortion caused by tariffs also depends on items such as relative size of import demand elasticities across commodities and the presence of economies of scale and imperfect competition. For a discussion on how factors such as these can impact the argument for uniform tariffs, see Panagariya and Rodrik.

a ceiling on tariffs based on a measure such as the global minimum or global mean for the product(s) in question.[7] The formulas used here have been modified to reflect that agricultural tariffs today are much higher than industrial tariffs were at the time of the Tokyo Round.[8]

Table 2-1 contains the four tariff-cutting formulas evaluated in this study. Formulas 1 and 2 are a variant of a harmonization formula, in that the depth of cut for the highest tariffs is generally larger than for smaller tariffs, with some exceptions. Formulas 3 and 4 are strictly harmonization formulas with the depth of cut being always larger the higher the initial tariff. All of the formulas incorporate a tariff ceiling to which all higher tariffs would have to be reduced, although the height of the ceiling differs by formula.[9] Thus each formula is designed to eliminate the megatariffs (tariffs over 100 percent) frequently found in each country's schedule.

Formula 1 is comprised of a linear component and special treatment for low and high duties. It eliminates all tariffs less than or equal to 5 percent, a concept adapted from one of the formulas submitted by Canada during the Tokyo Round, designed to eliminate low rates, sometimes referred to as "nuisance" tariffs (Laird and Yeats). It cuts all tariffs greater than 5 but less than or equal to 100 percent by half, replicating the 50-percent linear cut of the Kennedy Round. Finally, all tariffs over 100 percent are collapsed to 50 percent, thus incorporating a harmonization element in the formula.

Formula 2 combines a linear cut with a harmonization term, which reduces tariffs above 5 percent by a slightly deeper 60 percent compared with formula 1, but then adds a flat rate of 3 percent to the resulting calculation. For tariffs less than or equal to 5 percent, there is no cut; otherwise the 3-percent addition would result in a tariff above the initial rate. This tariff-cutting formula is similar to one proposed by Japan during the Tokyo Round. Japan believed that initial tariffs under 5 percent were already at satisfactorily low levels, so needed no further reduction. The effect of this formula was to cut low tariffs by small amounts, while subjecting high tariffs to essentially a linear cut of close to 60 percent. At an initial tariff of 105 percent, the calculation yields a new tariff of 45 percent, which is equal to the estimated mean of post-Uruguay Round agricultural tariffs for industrial countries. The Japanese formula is revised to include a ceiling of 45 percent for all tariffs initially above 105 percent. Thus, the ceiling in formula 2 is 5 percentage points lower than in formula 1, and assures that no new tariffs will exceed the simple agricultural tariff mean for industrial countries existing today.

Formula 3 is the compromise Swiss formula, which automatically includes a tariff ceiling equal to the parameter (a). An agreement to use this formula would also require negotiators to agree on the size of (a).

[7] The zero-for-zero tariff reduction approach is an example of a sectoral formula with a zero-tariff ceiling. This approach has resulted in elimination of certain countries' tariffs on pharmaceutical products; agricultural, medical and construction equipment; steel; furniture; beer; distilled spirits; toys; and paper (OECD, 1998a).

[8] Note that while the various formulas countries submitted for discussion during the Tokyo Round may have contained elements that were in the national interest when it came to cutting industrial tariffs, it is highly unlikely that these countries would submit the same formulas for cutting agricultural tariffs.

[9] This approach is discussed in Josling (1998).

Table 2-1—Tariff-cutting formulas

Formula number	Description	Mathematical expression
1	Sliding scale	If $t_0 \leq 5$ %, $t_1 = 0$; if t0 > 100 %, t1 = 50%; otherwise, t1 = t0 * (0.5)
2	Linear/harmonization term	If $t_0 \leq 5$ %, $t_1 = t_0$; if $t_0 > 105$ %, t1 = 45%; otherwise $t_1 = t_0 * (0.4) + 3$ %;
3	Swiss formula	$t_1 = (a \times t_0) / (a + t_0)$; a is a parameter = 45
4	Harmonization/low ceiling	If $t_0 \leq 50$ %, $t_1 = t_0 (1 - t_0)$; otherwise, $t_1 = 25$%

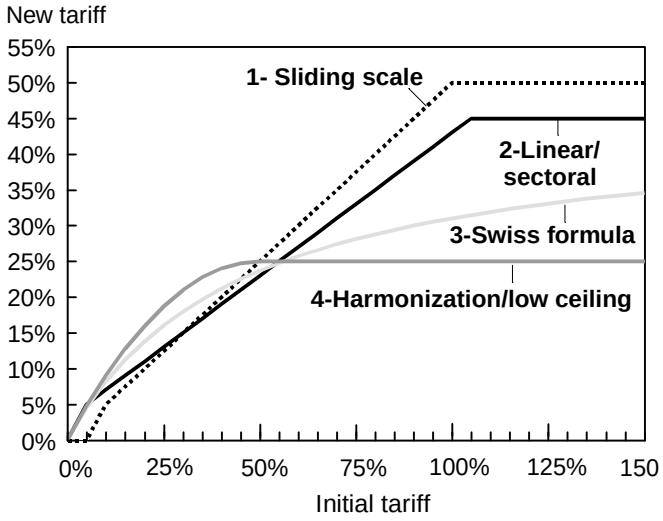
During the Tokyo Round it was proposed that this parameter be equal to 16, meaning that all industrial tariffs initially above 16 percent would be reduced to below that level. At the time of the Tokyo Round negotiations, the average of tariffs on dutiable nonagricultural imports for the industrial countries was estimated at 10.7 percent (Cline et al.), so a value for (a) equal to 16 was a reasonable choice. Because agricultural tariffs today are much higher than nonagricultural ones were during the Tokyo Round, this parameter is set here at 45, ensuring, as in formula 2, that no new tariffs will be above the industrial countries' post-Uruguay Round average. In this case, however, the ceiling is more restrictive since it is approached gradually (note in figure 2-1 that an initial tariff of 125 percent would be cut to 33 percent).

Formula 4 is based loosely on one of the harmonization formulas proposed by the EEC during the Tokyo Round, with the percentage cut in the tariff equal to the tariff itself. An initial rate of 40 percent would be cut by 40 percent, yielding a new tariff of 24 percent. Note that this formula works only for tariffs equal to or less than 50 percent. Above this level, the formula can yield rates that are significantly below those calculated for tariffs below 50 percent. As an example, consider an initial tariff of 80 percent. The formula would generate a new rate of 16 percent, which is below the above calculation for an initial 40-percent tariff. As a result, for tariffs above 50 percent, formula 4 generates the same rate that would result from cutting a 50-percent tariff. The effect is to leave low tariffs virtually untouched, while imposing a very low ceiling (25 percent) on high tariffs.

Figure 2-1 depicts the depth of cut associated with each formula, with the initial tariff shown on the x-axis and the new tariff on the y-axis. Formula 1 is the most trade-liberalizing for products subject to low tariffs, but contains the highest tariff ceiling, while formula 4 is the most trade-liberalizing for products subject to high tariffs, but tends to cut low tariffs by the least amount. In general, as we move from formula 1 to formula 4, the lower the formula number, the greater the cut to lower tariffs, while the higher the formula number, the greater the cut to higher tariffs.

There are numerous criteria that can be used when evaluating the impact of a formula on a country's tariff structure. The extent to which tariffs are reduced by the formula is perhaps the most important criteria.

Figure 2-1
Comparing the effects of alternative tariff-cutting formulas



Source: Economic Research Service, USDA

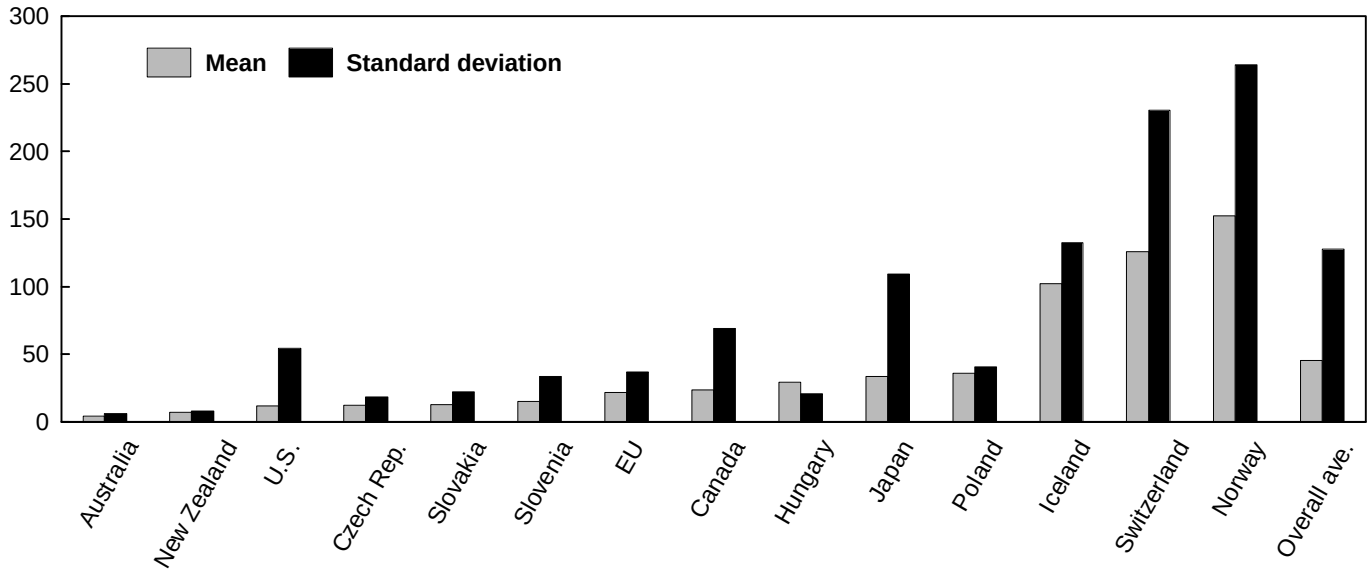
Because the economic and trade distortions associated with a country's tariff structure depend not only on the average size of its tariffs, but also on the distribution of tariffs across products, the level of dispersion is another criteria often used. Closely related to tariff dispersion within countries is the problem of tariff escalation, which refers to the situation where tariffs are low or zero on primary products, then increase or escalate as the product undergoes additional processing. Since tariff escalation can result in significant bias against trade of processed products, the ability of a formula to reduce escalation is also an important criterion. The next section presents tariff profiles for industrial countries' post-Uruguay Round bound agricultural tariffs, and serves as a useful point of departure and standard of comparison for the formula-generated tariffs presented later.

Post-Uruguay Round Agricultural Tariffs

The means and standard deviations found in figure 2-2 provide one backdrop against which to evaluate each of the four tariff-cutting formulas.[10] The means represent the simple, unweighted average of all bound agricultural tariffs in each country's schedule, with the notable exception of the in-quota tariffs associated with tariff-rate quotas. The URAA did not require that

[10] Please refer to the technical appendix, page 56, for a discussion of the biases associated with alternative methods of calculating tariff means.

Figure 2-2
Post-Uruguay Round tariff means and standard deviations



Source: Economic Research Service, USDA

reductions be made in these tariffs, only that they be set at a "low or minimal." While no numerical rule defined "low or minimal," the size of some in-quota rates suggests a need to negotiate some disciplines on these tariffs as well. However, we have chosen not to include them in this exercise.

The most striking characteristic of the tariff means is the broad range of average protection across countries. The means range from lows of below 10 percent for Australia and New Zealand to above 100 percent for three members of the European Free Trade Association (EFTA) — Norway, Switzerland, and Iceland. While we would caution against interpreting these means as indicative of the overall restrictiveness of a country's trade policy, clearly the EFTA countries apply tariff protection of a different magnitude than the others. Their agricultural tariffs are so high that they raise the overall industrial country mean to a level above that of all the other countries. The U.S. mean, at 11.9 percent, is the third lowest among these individual countries, followed by three Central and Eastern European (CEE) countries, each of which is in line for membership into the European Union (EU). The relatively low tariff means of these three countries implies that some alternative market access compensation may have to be offered when they join the EU and assume the generally higher tariffs found in the EU schedule. The EU and Canada have tariff means of 21.4 and 23.7, placing them in the middle of the ranking. Two other prospective EU members, Hungary and Poland, currently have tariff means higher than the EU. Finally, Japan, one of the world's largest agricultural importers, has a mean tariff of 33.4, among the highest of the countries being examined in this study.

Based on the standard deviations (SD) in figure 2-2, it is clear that a significant degree of tariff dispersion[11] characterizes the tariff schedules of almost all of these countries. At the highest and lowest levels, the SDs follow the pattern of the means, with Norway, Switzerland, and Iceland combining very high means with very high SDs, while Australia and New Zealand have both the lowest means and SDs. The United States, on the other hand, has one of the lowest means, but a high rate of dispersion across agricultural tariffs, as measured by the SD. Six of the countries have means higher than the United States, but have SDs that are lower.[12] Hungary, which has a fairly high mean, has one of the lowest levels of tariff dispersion.

[11] We use the term significant, not in the statistical sense, but rather because, with the exception of Hungary, all of the countries have a standard deviation that is greater than the mean. See the technical appendix for a discussion of what this implies.

[12] A comparison of the coefficients of variation (CV), which measure relative dispersion across countries by dividing the SD by the country mean, shows that the United States has the highest CV within this group.

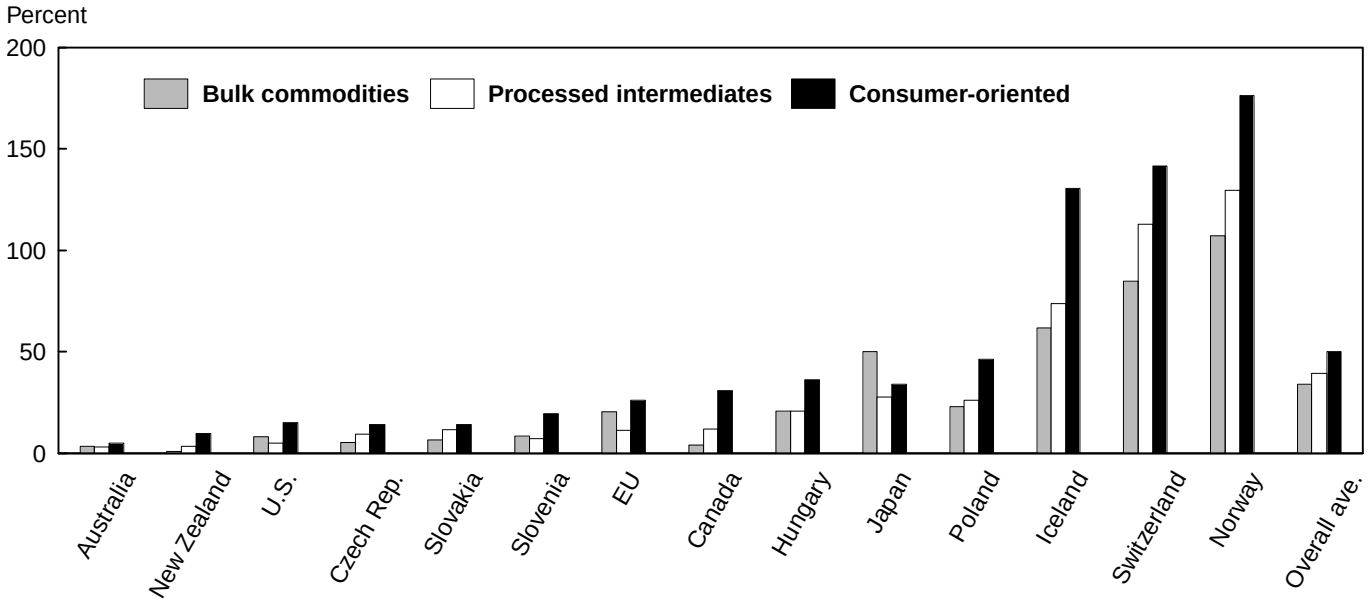
With regard to tariff escalation, the issue is addressed at an aggregate level by identifying the appropriate stage of processing for all tariffs, according to the USDA BICO categories.[13] Figure 2-3, which displays tariff means by BICO category, gives a rough indication of the extent to which escalation of tariffs along the processing chain exists in each country. When averaged over the group, the means demonstrate that modest escalation exists between the bulk level, 34.1, and the processed intermediates level, 37.9. For consumer-ready products, however, the mean jumps to 50.9. This observed tariff pattern, and the amplifying rates of protection it insinuates, has negative implications for processing raw materials in the country where they are produced. When tariffs on products escalate with the stage of processing, the effective rate of protection, or the tariff expressed as fractions of value-added after deducting intermediate inputs from the product value, also increases. In addition, there is ample evidence that demand import elasticities tend to increase as commodities undergo additional processing, thus increasing the trade restrictiveness of the tariff (Yeats).

[13] The BICO classifies agricultural products moving into world markets as bulk, processed intermediate, or consumer-oriented products. More information on the BICO is available at: http://www.fas.usda.gov/reports/bico/about.htm.

Looking at individual countries, there are signs of tariff escalation in some, while in others there is evidence of tariff de-escalation. With the exception of Japan, all countries have an overall mean for consumer-ready items higher than those for bulk and semi-processed items. In terms of percentage points, the escalation in average protection levels between bulk and consumer-ready products is most pronounced in the EFTA countries. Mean tariffs in each of these countries jump by over 60 percentage points as items undergo additional processing. In terms of relative magnitudes, New Zealand demonstrates the highest tariff escalation, with tariffs on consumer-ready items averaging over 12 times those of bulk commodities. Even though New Zealand's tariff on consumer-ready items is relatively small, the effective rate of protection for products in this category could be much higher than would be expected on the basis of the product's nominal tariff, given the even lower tariffs on raw materials.

In several countries, including the EU, Japan, and the United States, the mean tariff on bulk commodities is higher than on semi-processed products. Other studies of tariff escalation suggest that tariff de-escalation is particularly common in the case of multiple outputs (Lindland). Thus, while a tariff on vegetable oil might be higher than that on the raw material (the oilseed), the joint output (in this case, the oilmeal) may have a

Figure 2-3
Mean tariffs by BICO category[1]



[1]BICO refers to the USDA method of classifying traded agricultural products as bulk, processed intermediate, or consumer-oriented.
Source: Economic Research Service, USDA

lower tariff than the raw material. This is especially true when the processed import is itself an input. In agriculture, a pattern of tariff de-escalation might also be partially explained by the level of support provided by farm programs, which, to be effective, might require high border protection on primary products. The results suggest that even though there might be an indication of tariff escalation at an aggregate level, additional work is needed to identify the extent of escalation within individual agricultural processing chains.

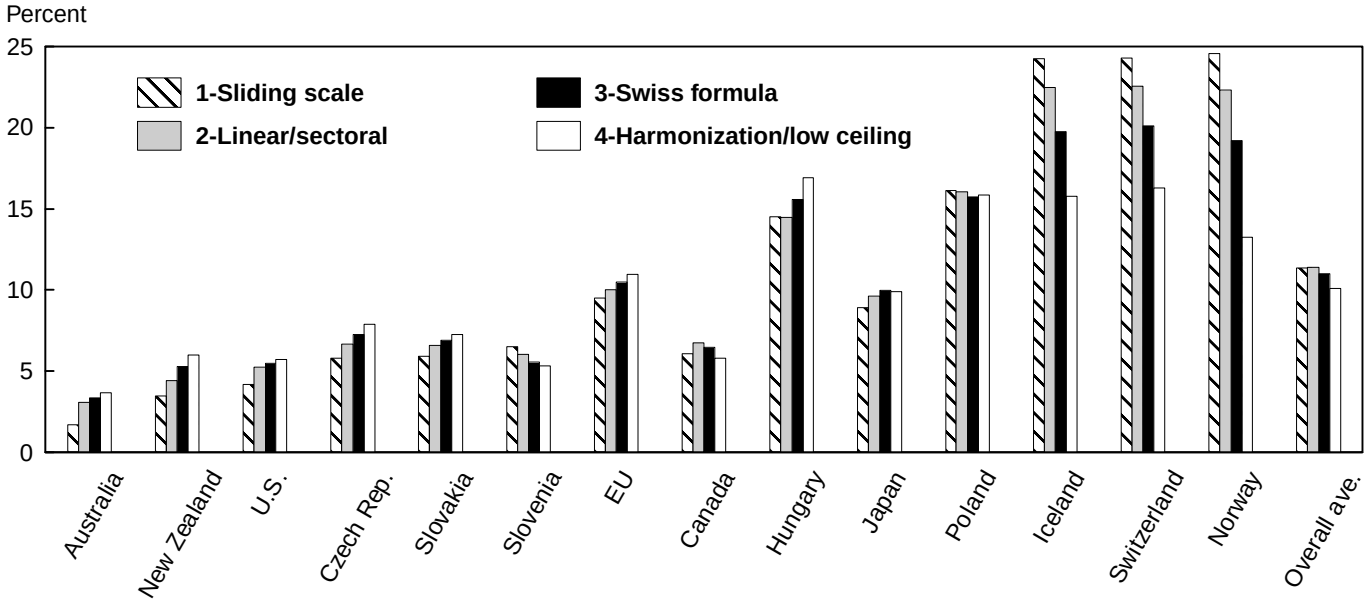
Overall, it is clear that, despite the many positive benefits of tariffication — most significantly that global agricultural protection is now predominantly tariff-based — many agricultural tariffs were set at extremely high levels in the Uruguay Round. In addition to being much higher on average than industrial tariffs, agricultural tariffs are also highly uneven across countries and commodities. The reductions in industrial tariffs seen in eight previous rounds of multilateral trade negotiations have only begun for agricultural tariffs. The following section examines alternative ways to begin reducing agricultural tariffs to levels that approach those of industrial products.

Effects of Alternative Tariff-Cutting Formulas on Uruguay Round Tariffs

Figure 2-4 presents the new tariff means calculated after applying the four tariff-cutting formulas to each country's post-Uruguay Round bound tariffs. All of the formulas do a good job of cutting the overall mean of industrial country tariffs, which was estimated at 45 percent before the formulas were applied. The new *overall* tariff means range from a high of 11.4 (a reduction of 75 percent) in the case of formula 2 to a low of 10.1 (a reduction of 78 percent) for formula 4. Although the formulas result in very similar overall means, some individual country means vary considerably depending on the formula used.

Fully half of the countries have their means reduced by the greatest amount under formula 1, even though we saw that this formula does not result in the lowest overall mean. These countries all have schedules containing a relatively high proportion of low tariffs (below 25 percent) and a low proportion of high tariffs (over 50 percent). Of the four formulas, number 1 tends to cut low tariffs by the greatest amount and high tariffs by the least amount, so the results are not surprising. Formula 4, which yielded the deepest cut in the overall mean, also provided the deepest cut in the means of five of the countries (Norway, Iceland,

Figure 2-4
Simple tariff means, by country, after applying tariff-cutting formulas



Source: Economic Research Service, USDA

Switzerland, Slovenia, and Canada). These five also happen to contain a high proportion of megatariffs which formula 4 subjects to the deepest cuts.[14] For only one country, Hungary, does formula 2 give the lowest mean, while Poland is the only country for which the Swiss formula (3) produces the deepest cut in its mean.

Figure 2-4 ranks countries from low to high, based on their post-Uruguay Round tariff mean (same order as figure 2-2). It is clear, however, that this ranking no longer holds. In particular, Canada and Japan, whose tariff means are initially higher than the EU, are lower after each of the tariff-cutting formulas is applied. To illustrate why this occurs, we need to understand how the distribution of tariffs in each country affects the formula outcomes. All of the countries in this analysis have tariff schedules characterized by a relatively large proportion of low tariffs and a small proportion of very high tariffs.[15]

This is illustrated in figure 2-5 for the United States, the EU, Canada, and Japan. Figure 2-5 contains frequency distributions of each country's dutiable, or nonzero tariffs.[16] Note that Canada and Japan have a larger proportion of tariffs in each tail of their distribution (>0-5 and >100 percent) than the EU. Thus, on the low end, fewer of the EU's tariffs are cut to zero under formula 1, while on the high end, fewer of the EU's tariffs undergo the severe cuts that the other three formulas impose on megatariffs. Because the EU already has a fairly uniform tariff schedule compared with Canada and Japan, none of these harmonization formulas cut the EU's tariff mean by as much as those of Canada and Japan. The deepest cut in the EU's mean occurs under formula 1, a reduction of 56 percent, while the range of cuts in Canada's and Japan's means, over all the formulas, is between 70 and 76 percent. Clearly, the impact of each formula on a country's tariff structure will vary depending on the initial height and distribution of the individual tariff rates making up the country's schedule.

How does the U.S. tariff mean fare under each of the formulas? The United States is one of seven countries that are subject to the deepest cut (65 percent) when formula 1 is applied, which is not surprising given its high proportion of tariffs at or below 5 percent (figure 2-5). Formula 4, on the other hand, imposes the smallest overall cut (52 percent) for the U.S. mean. Coincidentally, formula 4 also results in the sharpest cut (78 percent) to the overall tariff mean of the rest of the group. Thus the United States would see the gap between its mean and the overall mean of the other countries narrow by the largest amount when formula 4 is used.

Before turning to how the formulas fare in reducing tariff dispersion and tariff escalation, one final observation on tariff means is in order. Multilateral tariff negotiations tend to be first and foremost a quest for reciprocity, or an attempt to share the costs and benefits of tariff reductions. This is considered a necessity if a country's export opportunities are to expand along with the opening of its domestic market to increased imports.

With this in mind, the estimated cuts in the simple means are the most unevenly distributed under formula 4, which, at most, would require an average cut in Norway's tariffs of over 90 percent, while requiring Australia to cut its tariffs only by an average of 14 percent. This formula is designed to compress tariffs within a narrow range (zero to 25 percent), and most of Australia's tariffs are already in this range, while most of Norway's are considerably larger. The least disparate cuts would occur under formula 1, with Norway still subject to a deep overall tariff cut of 84 percent, but with Australia's tariff mean also reduced significantly, by 60 percent. New Zealand and Hungary would sustain the smallest cuts under this formula, with their means reduced by just over 50 percent.

Figure 2-6 contains frequency distributions for initial and new tariffs. In this case we include a category for duty-free tariffs on the left-hand side of the distribution while on the right-hand side the highest tariff after the formulas are applied will not exceed 50 percent. Even though the overall means were shown to be very similar across formulas, the overall distributions prove

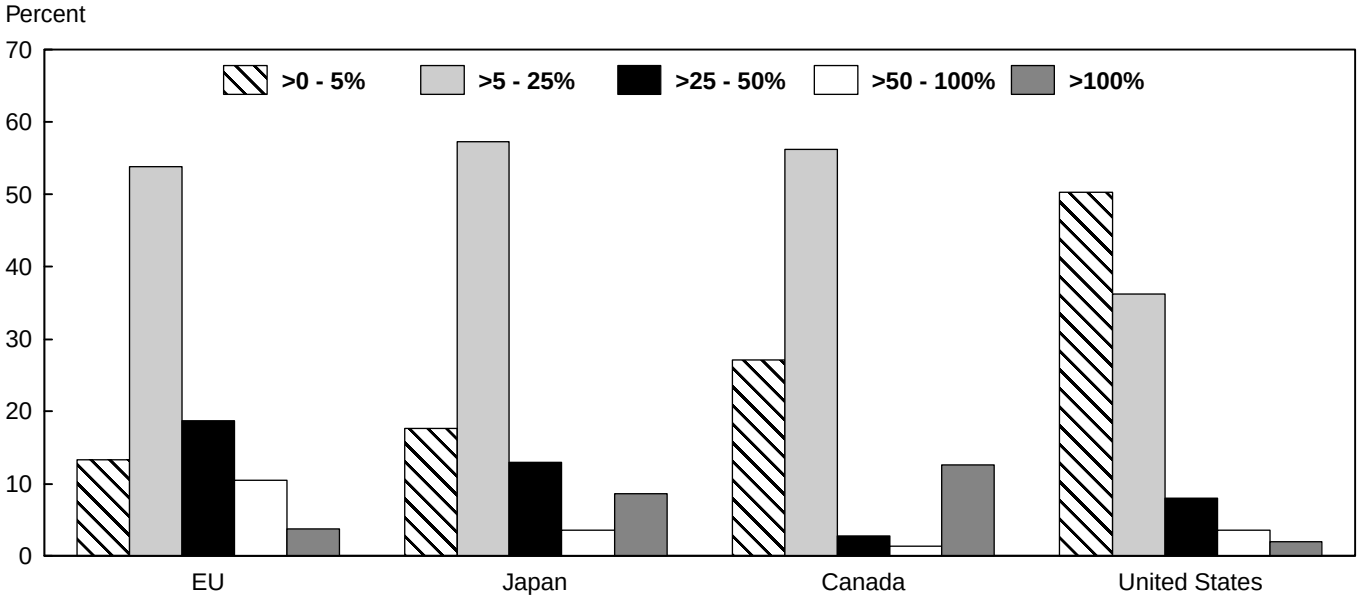
[14] How is it that Slovenia has a low tariff mean, but a high proportion of megatariffs? It's because 76 percent of its tariffs have been bound at zero. Of the remaining 24 percent (or, those that are being subject to cuts) over half are above 50 percent.

[15] As a result, they have tariff schedules whose distributions are skewed to the right, meaning that the tariffs continue much farther to the right of the mean than to the left. This explains why the standard deviations are so high, since they are distorted by a few very high rates.

[16] In figure 5, unlike the rest of the figures in this chapter, the focus is only on non-zero tariffs, since these are the tariffs being reduced by the formulas. Note, however, that each country's entire tariff schedule, including zero tariffs, was used in calculating the means and standard deviations.

Figure 2-5

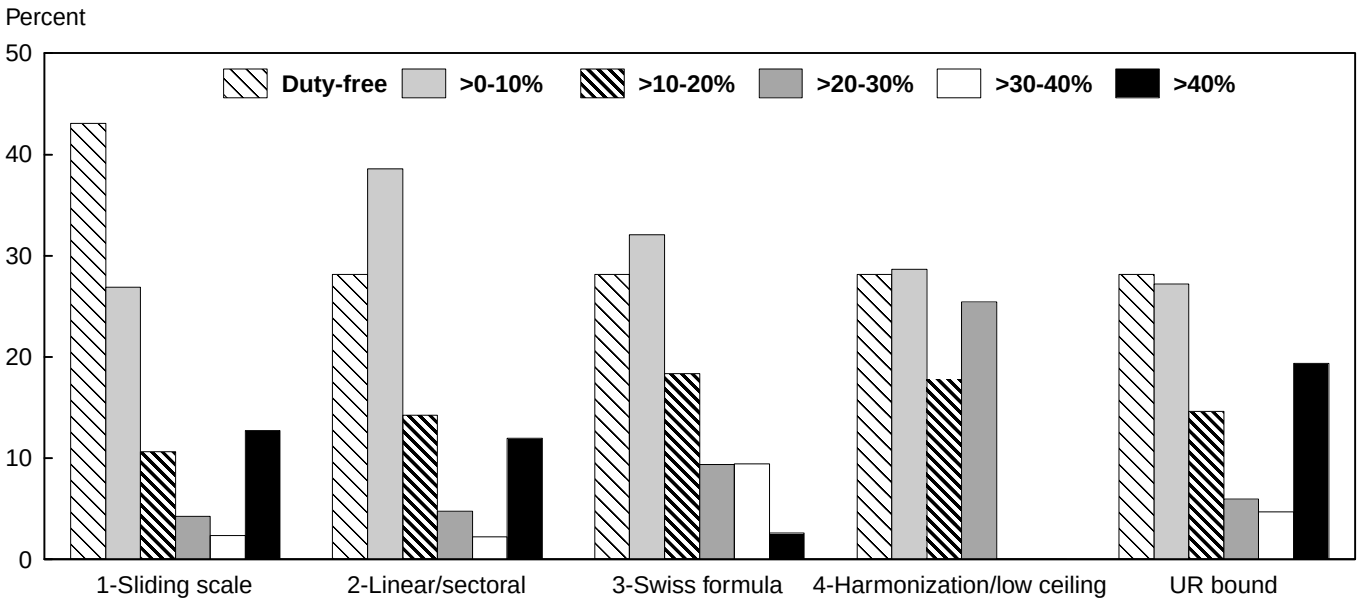
Frequency distributions of post-Uruguay Round dutiable tariffs—selected countries[1]



[1]Duty-free tariffs are not included in this chart.
Source: Economic Research Service, USDA

Figure 2-6

Frequency distributions for Uruguay Round rates and after applying tariff-cutting formulas



[1]Duty-free tariffs are not included in this chart.
Source: Economic Research Service, USDA

to be quite different. Initially, duty-free tariffs account for the largest proportion (28 percent) of tariffs in the six categories. This proportion increases to 43 percent when formula 1 (the only formula mandating some tariffs be reduced to zero) is applied. Formula 2, like 3 and 4, does not result in an increase in duty-free tariffs, but it does result in the greatest expansion in the proportion of tariffs in the >0-10 percent category, from an initial 27 percent to 39 percent.

At the other end of the distribution, however, the proportion of tariffs above 40 percent under formulas 1 and 2 remains fairly high, especially compared with formulas 3 and 4. Formula 3, the Swiss formula, results in a more even distribution across the various size categories than formula 2, with a smaller proportion in the >0-10-percent and >40-percent categories but a higher proportion in the middle categories. Finally, under formula 4 all tariffs get compressed to 25 percent or below, so the highest two categories are empty while the proportion of tariffs in the 20-30-percent range increases dramatically. Since formula 4 cuts low tariffs by the least amount, the proportion in the lower size categories, as well as the overall mean of tariffs in these categories, changes little.

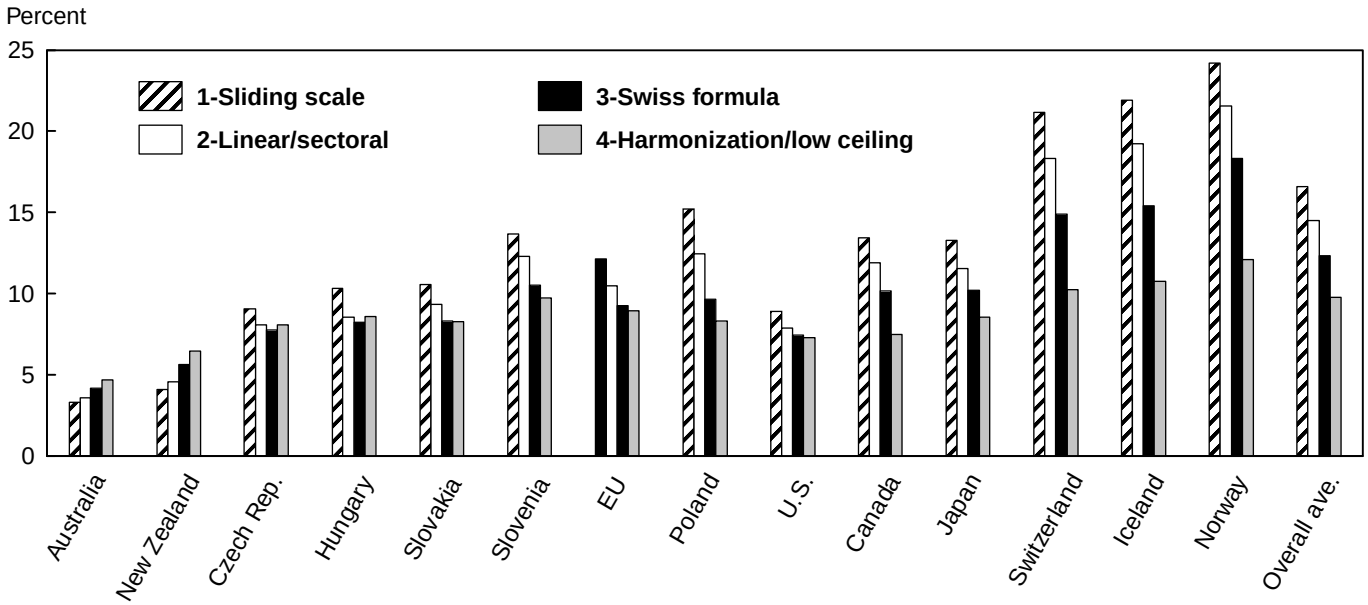
Figure 2-7 contains the standard deviations associated with the new tariff structures, ranked according to the size of the country's initial standard deviations. Formula 4, which results in the lowest SD in 10 of the countries, does the best overall job of cutting dispersion across the entire group. Formula 1 results in the lowest standard deviations in Australia and New Zealand, while in the Czech Republic and Hungary, formula 3 cuts dispersion by the greatest amount. In virtually every case, the cut in the SDs is greater than the cut in the mean. This, of course, is a characteristic of harmonization formulas, which are designed to produce deep cuts in tariff dispersion.[17] The dispersion over all tariffs within the group is reduced by impressive amounts, with the overall SD declining by between 92 percent under formula 4 and 87 percent using formula 1. Within individual countries, the deepest cut in dispersion occurs for Switzerland under formula 4, which results in a new SD 96 percent lower than the original. The smallest reduction, also when formula 4 is applied, occurs in New Zealand, which sees its SD cut by only 21 percent under that formula.

As with the means, the original rankings from low to high no longer hold in some cases. Nowhere is this more evident than for the United States, whose SD is initially among the highest. Under each formula, the U.S. SD drops from being ninth highest to third highest, exceeded only by Australia and New Zealand. The fact that each of these harmonization formulas cuts the U.S. SD by such a large amount is another indication of how effective they are in reducing dispersion, especially when the initial level is very high.

[17] A linear cut, on the other hand, results in an equal cut in the mean and the standard deviation; thus cutting all tariffs by 50 percent would reduce the mean and the standard deviation by 50 percent as well.

Figure 2-7

Standard deviations, by country, after applying tariff-cutting formulas



Source: Economic Research Service, USDA

It is not always the case, however, that the formula that yields the largest overall reduction in the mean also results in the lowest level of tariff dispersion. The rule is that when a country has both a low initial mean and SD, formula 1 will result in the deepest cuts in both measures, while for countries with high initial means and SDs, formula 4 delivers the deepest cuts. In the case of other countries it is harder to generalize. For the United States, the EU, and Japan, formula 1 results in the lowest mean but the highest SD.

Table 2-2 contains tariff means by BICO category for each country's initial tariffs and those calculated after applying each formula. As measured by nominal tariff wedges between categories, the wedge, averaged across all countries, between bulk and processed intermediate levels declines from an initial 3.9 percentage points to between 0.5 (formula 1) and 0.8 (formula 2) percentage points. The larger wedge existing between processed intermediate and consumer-oriented items narrows from 12.9 to between 2.1 (formula 1) and 3.7 (formula 4) percentage points. All of the formulas are effective in decreasing both tariff escalation and de-escalation (where the wedge is initially negative). Formula 4 results in the lowest overall mean in each category, but formula 1 compresses the three categories closest together. It is difficult, however, to say which formula would do the best job of reducing tariff escalation based on the aggregate results of table 2. In general, one would expect that when tariff escalation is extremely high (low tariffs on raw materials and high ones on finished products), formula 4 would be the most effective in reducing the spread between the tariffs. In other cases, the results are more ambiguous.

Conclusions

Among the main objectives of the next trade round will be to achieve further cuts in agricultural tariffs. High agricultural tariffs increase food prices to consumers and divert and waste resources by encouraging output in high-cost, protected countries (and commodities) while curtailing output in low-cost unprotected ones. It is in the interest of each country to reduce its tariff protection in order for its processors and consumers to obtain cheaper sources of supply and attain the higher level of economic activity permitted by more efficient allocation of resources.

If past rounds are any indication, a topic of considerable debate will be to determine the precise nature of the tariff cuts to be negotiated. In this analysis, we considered four harmonization formulas. The statistical measures presented here demonstrate that the effect of alternative tariff-cutting formulas on criteria such as the magnitude of tariffs, the level of tariff dispersion, and level of tariff escalation varies, depending on the initial height and distribution of a country's tariff schedule. We did not evaluate any strictly linear formulas in this analysis, primarily because the results are obvious — a 50-percent linear cut will cut a country's tariff mean and standard deviation by 50 percent. The great advantage of a linear cut, however, lies in its simplicity.

Perhaps most important is that, unlike a harmonization formula, a linear cut does not require that an ad valorem equivalent be provided for all specific tariffs, something that is not a trivial requirement. It has been suggested that a relatively simple alternative to protracted tariff negotiations would be to repeat the cuts of the Uruguay Round. These cuts have already been negotiated and accepted and they have the advantage that an ad valorem equivalent need not be calculated beforehand. The URAA allowed countries to cut tariffs on non-sensitive commodities by large amounts, even by 100 percent, while cutting tariffs on politically sensitive commodities by the minimum and still satisfy their URAA commitments. Obviously, any cuts of 100 percent would not be repeated a second time around, so the average tariff reduction would fall short of 36 percent. A straight 36 percent across-the-board linear cut would result in greater trade liberalization than a repeat of the URAA cuts even if it would still leave some very high tariffs. Only a harmonization formula, however, provides a means of getting megatariffs down to levels where trade can take place at the tariff-inclusive price.

Evaluating which formula is best for a particular country depends on the objective that a country hopes to achieve in the negotiations. Given the mercantilist view that most countries bring to tariff negotiations, one might expect that each country would tend to prefer that formula which produces the largest increase in its trade balance. The reality is, however, that for some countries to experience an increase in their trade balance, others must experience a decrease. But even if a country's tariffs and trade base are such that liberalization would result in a decrease in its trade balance, it may still pursue multilateral tariff cuts in order to

Table 2-2—Tariff means by BICO categories for post-Uruguay Round tariffs and tariffs after applying formula[1]

	1-Sliding scale	2-Linear/ sectoral	3-Swiss formula	4-Harmonization/ low ceiling	UR bound tariffs
			Percent		
Bulk commodities					
Australia	1.3	2.2	2.5	2.8	3.4
Canada	2.0	2.4	2.3	2.3	4.2
Czech Rep.	2.6	3.1	3.2	3.4	5.4
European Union	8.5	8.2	7.7	7.3	23.3
Hungary	10.4	10.7	11.4	12.4	21.1
Iceland	18.2	16.8	13.8	10.3	61.8
Japan	9.7	9.4	8.7	7.1	50.1
New Zealand	0.4	0.6	0.6	0.7	0.8
Norway	18.1	16.4	14.2	9.3	107.1
Poland	11.0	11.8	11.9	12.5	23.1
Slovakia	3.2	3.5	3.7	3.9	6.6
Slovenia	4.3	3.9	3.6	3.4	8.7
Switzerland	24.3	22.2	18.9	15.4	80.3
United States	3.6	4.2	4.2	4.3	8.3
Overall average	9.6	9.3	8.4	7.2	34.1
Processed intermediates					
Australia	1.0	2.3	2.4	2.6	3.1
Canada	3.1	4.0	4.0	4.0	11.8
Czech Republic	4.3	4.8	5.0	5.3	9.1
European Union	4.8	5.7	5.9	6.1	11.1
Hungary	10.0	10.8	11.5	12.4	20.7
Iceland	22.6	20.9	16.6	12.6	73.7
Japan	6.7	7.3	7.1	6.8	7.1
New Zealand	1.6	2.1	2.5	2.8	3.3
Norway	22.8	20.9	17.6	12.3	129.5
Poland	11.5	12.2	12.4	12.8	26.2
Slovakia	5.6	5.9	5.8	6.0	11.5
Slovenia	3.6	3.3	3.3	3.4	7.1
Switzerland	25.5	23.3	19.8	15.5	114.0
United States	1.9	2.9	2.9	2.9	5.0
Overall average	10.1	10.1	9.1	7.9	37.9
Consumer-oriented					
Australia	2.2	3.7	4.1	4.5	5.1
Canada	7.8	8.4	8.0	7.0	31.1
Czech Republic	6.7	7.8	8.6	9.3	14.1
European Union	11.7	12.1	12.7	13.4	25.9
Hungary	18.0	17.4	18.8	20.5	36.1
Iceland	26.7	24.8	23.2	19.2	130.6
Japan	9.8	10.6	11.3	11.6	43.0
New Zealand	4.8	6.0	7.3	8.2	9.8
Norway	26.9	24.4	21.2	14.7	176.3
Poland	20.9	20.0	19.2	19.0	46.5
Slovakia	6.4	7.4	7.8	8.3	14.0
Slovenia	8.5	7.8	7.1	6.8	19.5
Switzerland	23.7	22.3	20.6	16.9	141.6
United States	5.1	6.3	6.6	7.0	15.1
Overall average	12.2	12.4	12.3	11.6	50.9

[1]BICO refers to the USDA method of classifying traded agricultural products as bulk, processed intermediate, or consumer-oriented.

obtain the economic efficiency gains from tariff liberalization.

The analysis presented here reveals little about the realization of economic benefits from tariff reductions. To be able to say something about this would require consideration of a host of factors, including commodity and cross-commodity responses to price changes, the structure of markets, time lags in the adjustment process, and even the positive social value that governments may attribute to protection. This work should be viewed as only the initial step in analyzing the effects of reducing or eliminating agricultural tariffs. The next phase in analyzing tariff reduction would be to use these formulas in world trade models in order to be able to rank them based on criteria such as trade creation and estimated welfare effects.

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Technical Appendix - Data and Methodology

The data used are from the Agricultural Market Access Database (AMAD). The AMAD was developed jointly by several organizations, including USDA's Economic Research Service, the Organization for Economic Cooperation and Development, Agriculture and AgriFood Canada, the European Commission, the United Nations Conference on Trade and Development, and the Food and Agriculture Organization of the United Nations. AMAD contains data at the tariff-line[18] level on market access commitments (Uruguay Round base and bound tariffs and tariff-rate quotas) for about 50 WTO members, as well as all available information on TRQ implementation, trade, applied tariffs, and commodity production and consumption. In this analysis, country coverage is limited to 14 industrial countries/regions (the United States, the EU, Canada, Japan, Australia, New Zealand, Switzerland, Norway, Iceland, the Czech Republic, Slovakia, Hungary, Poland, and Slovenia). The analysis assumes full implementation of each country's Uruguay Round commitments.

Almost three-fourths of the agricultural tariffs in the countries analyzed are expressed in ad valorem terms, with a number of countries denominating all or most of their agricultural tariffs as ad valorem rates.[19] In all but a few cases, ad valorem equivalents (AVE) of specific duties were approximated for Uruguay Round tariffs, generally using an average of 1995-97 import value and volume data.[20]

Where available, a country's own trade data were used to calculate the import unit values needed to approxi-

[18] The term tariff-line refers to the product or products to which the legally established tariff applies.

[19] Since most countries tended to express their in-quota tariffs as ad valorem rates, this figure would be even higher if these tariffs had been included.

[20] Not all countries registered imports for every commodity over each year. In these cases, the average might be made up of less than three years.

mate the AVEs. When this information was not available, world import unit values were used.[21] In some cases, tariffs were expressed in both ad valorem and specific terms, with the higher of the two determining which rate applies. In these cases, when import unit values were not available, the ad valorem rate was used. In some cases it was not possible to approximate an AVE, either because import unit values were not available, or because the tariff was structured in a way that made calculation of an AVE impossible.

Once AVEs are calculated, relevant comparisons of tariffs across countries require the calculation of a tariff mean. There are a number of ways to compute tariff means, none of which is without bias. The most common — a simple (unweighted) arithmetic average — was used. Some consider applying no weighting scheme inferior to weighting, since a "simple average" gives equal weight to kumquat imports and wheat imports, if each enters as a single tariff-line item under the national tariff nomenclature. Unfortunately, there is no ideal weighting scheme.

Import-weighted averages were used in past rounds to determine overall reductions in countries' industrial tariffs. Weights based on import values, however, tend to bias average tariff estimates downward, because items with the highest tariffs will receive virtually no weight, as little or no imports will enter under these tariffs. Weights based on shares of the value of production would be preferable, since highly protected commodities produced in large amounts would get large weights. But production data at the tariff-line level are rarely available. Because of this, tariffs are often aggregated in the form of simple (unweighted) averages to a level where data on appropriate production weights are available to calculate a national average.

Tariffs used in this study were only those bound as most favored nation (MFN) rates during the Uruguay Round. A great deal of trade takes place at tariff levels below the bound rate (including preferential rates under trade agreements such as the NAFTA). If the applied tariffs at which trade took place were used, many of the statistics would be considerably lower. If previous negotiations are an indication, countries' bound MFN tariffs, not their applied rates, will be the focus of future negotiations. In past rounds, when bound tariffs were higher than applied rates, countries rarely consolidated the reduced rate into their GATT tariff schedule without extracting the maximum compensation they could through negotiation (Evans).

One additional observation should be mentioned. In order to measure the effects of alternative tariff-cutting formulas with some precision, it is necessary to use data at the actual tariff-line level for each country, rather than broader average tariffs for commodity groupings. Most industrial countries bound their tariffs at the HS 8-digit level. In many cases, however, we find tariffs bound at either a more aggregate (e.g., HS 6-digit) or a more detailed (e.g., HS 10-digit) level. While we could have, for the sake of consistency, aggregated all tariffs to an HS 6-digit level, a formula applied to an average tariff can yield substantially different results from that obtained by applying the formula to the individual tariff-lines.

[21] There are a number of different ways to calculate AVEs. In the Gibson, et al. analysis, world import unit values were used rather than calculating import unit values with a country's own trade data.