WTO Negotiations on Market Access in Agriculture: A Comparison of Alternative Tariff Cut Scenarios for the EU and the US

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Summary. *This paper provides a summary measure of the possible new commitments in the area of market access undertaken by the European Union and the United States, using the Trade Restrictiveness Index (TRI) as the tariff aggregator. Indicators such as the TRI, based on welfare theory, integrate economic behavioural assumptions within a balance of trade framework. We take the 2000 bound tariffs as the starting point and attempt to assess how much liberalisation in agriculture could be achieved in the European Union and the United States as a result of the present negotiations. We compute the index for agricultural commodity aggregates assuming a specific (Constant Elasticity of Substitution) functional form for import demand. The present levels of the TRI under the actual commitments of the Uruguay Round are computed and compared with three hypothetical cases: a repetition of the same set of commitments of the Uruguay Round, a uniform 36 percent reduction of each tariff, an harmonization formula based on the "sliding scale" scheme. This makes it possible to infer how reducing tariff dispersion would help improve market access in future trade agreements.*

Keywords: *international agricultural trade; agricultural price, income, policy analysis*

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1. Introduction

One major achievement of the Uruguay Round Agreement on Agriculture (URAA) was the prohibition of non-tariff barriers to agricultural trade (except for some specific derogations), requiring that all such trade takes place under a tariff-only regime. Each WTO member established a base schedule, containing both pre-existing and new tariffs resulting from the conversion of non-tariff measures, following an international commodity classification scheme (referred to as the Harmonised System).

The adoption of a tariffs-only approach for agriculture was a sweeping reform that went a long way toward subjecting agricultural trade to the same disciplines applied to other traded goods. However, many authors have pointed out that the URAA agreement achieved only minor reductions in protection (Hathaway and Ingco, 1995; Tangermann, 1995, Wainio et al, 1998). One of the reasons for this conclusion is the rather lax method of conversion of non-tariff measures into their tariff equivalents. Furthermore, it is also often pointed out that Member countries were allowed a significant flexibility in the allocation of tariff rate cuts. For instance, the tariff cutting formula was based on a simple average, thus by making rather large percentage cuts in low tariffs, or in tariffs for commodities that do not compete with domestic production, countries could meet the overall 36% average objective with only minimal cuts in politically sensitive tariffs (Josling and Tangermann, 1995). In the new WTO negotiations on agriculture, then, there is ample room for further tariff reductions and improved transparency of tariff commitments.

As the present round of agricultural trade negotiations moves ahead, one of the challenges WTO members face is finding an agreement for further reduction of the bound tariffs, in the spirit of the long-term objective of the reform process in agriculture. Although what matters as a policy concern on a day-to-day basis is the applied rate, bound rates define the extent of the flexibility to vary the applied rates upward in response to particular economic circumstances. Hence, the setting of bound rates is a matter of strategic importance.

To assess the overall effect of an uneven reduction in a large number of tariffs, one faces the problem of finding the appropriate index. Recent developments in the theory of index numbers have led to new indicators of the aggregate impact of trade policy, such as the Trade Restrictiveness Index (TRI, Anderson and Neary, 1996). The TRI, based on economic theory and integrating standard economic behavioural assumptions within a balance-of-trade framework, makes it possible to assess the welfare effects of possible approaches to reduce bound tariffs in the present round for the European Union (EU) and the United States (US). Our contribution is the following :

- First, using the TRI, we assess the magnitude of the effect of new tariff cuts in the EU and the US. Using the TRI makes it possible not only to confirm that the possible new commitments will lead to an increase in welfare, but also to measure (and compare across countries) the magnitude of this welfare increase.
- Second, we compare the index based on economic theory to other *a-theoretic*, *ad hoc* indexes of tariff reductions. Theoretically sound indexes such as the TRI are unlikely to be used for

defining objectives during the present round of trade negotiations. Nevertheless, it is informative to assess how readily computed indicators like the simple arithmetic average of tariff cuts (adopted in the URAA) or the trade-weighted average (often proposed as a more appropriate way to measure the level of tariff reduction) compare to a theoretically correct index.

- Third, we measure the magnitude of the "dilution effect" that could result from the distribution of large and small or minimal cuts across tariff lines. This is done by comparing the welfare effects of a repetition of the URAA tariff cuts to a hypothetical situation where countries had to cut all tariffs by 36% (starting, in both cases, from the final bound tariff levels).
- Fourth, we assess the importance of reducing tariff dispersion, rather than reducing only average tariffs. We evaluate the relative impact of tariff dispersion and average tariff on welfare by applying the so-called "sliding scale" formula (USDA, 2001) to the final bound tariff structure of the UE and the US. Comparisons with the repetition of the URAA commitments make it possible to assess the potential consequences of using alternative formula that reduce tariff dispersion in the present round of trade negotiations.

The paper is organised as follows : Section 2 describes the possible approaches to reduce bound tariffs; Section 3 presents the theoretical issues underlying the development of the TRI; Section 4 discusses the empirical issues; Section 5 summarises the results, and Section 6 concludes.

2. Possible approaches to reduce bound tariffs

Historically, trade negotiations have taken two broad approaches to tariff reform: formula and sectoral approaches. Although sectoral approaches can be more effective than formula approaches in achieving greater market access for specific commodities, they can leave protection in place for the least competitive industries, creating (and possibly increasing) cross-commodity distortions (USDA, 2001).

While a formula approach has some distinct advantages, it can produce very different outcomes depending on the type of formula that is adopted. What is the most effective formula in terms of achieving greater market access? The determination of the appropriate level of bound tariffs is a fairly complex task as this involves judgement on several factors, such as future movements of world market prices and exchange rates, the evolution of domestic competitiveness, availability of contingency measures, revenue considerations, and so on. A comparison of tariff cutting schemes using formulas that reduce dispersion or provide for uniform tariff reduction make it possible to define the relative importance, in terms of both welfare and imports, of reducing tariff dispersion as well as its average level.

In this paper, we focus of the analysis is on the tariff reduction commitments. That is, we *do not* address the issue of tariff rate quotas. In addition, we do not consider the issue of the "gap" that is sometimes observed between applied and bound tariffs (the "water in tariffs" issue).

We assume that the ongoing trade negotiations use the tariffs resulting from the URAA implementation as a basis. Note, however, that this assumption is not necessarily realistic from a political standpoint, since it would imply that for developing countries, new concessions could only start being implemented after 2006. In this perspective, a possible alternative would be the use of the same base as in the Uruguay Round. This approach would have some other advantages, such as a larger tariff cut obtained through the same percentage reduction commitment, a sense of the “continuity” of the process of reform, and full “credit” for unilateral reductions during the negotiations period (FAO, 2000).

No method or formula for further reduction of the tariffs has been identified as yet within the present round - in fact, this itself is a crucial subject for negotiations. However, reflecting the importance of this matter, this subject has attracted considerable attention from analysts. What follows is a summary of various ideas, albeit all informal, by which tariffs may be reduced.

Aggregate reduction with conditions on minimum cuts. This was the formula used in the URAA (36 percent average reduction with a 15 percent minimum per tariff line). Although tariffs were reduced by an average of 36 percent, the method left many tariff peaks, as countries had the freedom to cut tariffs on "sensitive" products by only the minimum 15 percent while reducing by more for others, in order to reach the (un-weighted) average of 36 percent.

Indeed, a careful observation of the tariff schedules for developed countries shows that the reduction in tariffs was very unequal across commodities, suggesting that the allocation of tariff cuts across tariff lines could be due to political motivations. The legally binding documents are designed so that tariffs must be reduced by 36% over a set of roughly 2500 commodities (Harmonised system at the 8 digit level for the food and agricultural chapters, even though some countries set bound tariffs at some more aggregated level). Since for an individual tariff line, the minimum reduction can be as small as 15%, countries are tempted to apply this minimum reduction to the most politically sensitive commodities. And much larger tariff reductions are applied to non-sensitive commodities, that is, those that do not compete with domestic production or where the initial tariff level is very small.

If the same formula had to be implemented, it is reasonable to assume that the same pattern of cut allocation would be followed again. Our benchmark scenario, then is to assume that the “new Uruguay Round commitments” would be implemented by the EU and the US exactly in the same way as they did in the previous round. This would mean that both countries would reduce tariffs by only a small percentage on certain specific commodities. This is the case of olive oil, sugar, wine, selected fruits and vegetables in the EU, and sugar and dairy products in the US, for example. Larger reductions would be concentrated again on products with small tariffs, or on tropical products. Similar selectivity is evidenced in the US with large decreases in initial small tariffs.

Across-the-board linear (i.e. uniform) reduction. A linear reduction formula is simply $T_n = (1-r)*T_0$, where T_n and T_0 are new and original tariff rates respectively, and r is agreed reduction rate. This method was applied in the Kennedy Round with the "r" set at 50 percent. The approach is both simple and transparent. While tariffs could be cut significantly if the reduction rate is high, a linear cut would still leave many tariff peaks in agriculture.

Harmonization of tariff rates. As it was mentioned, following the 1994 Marrakesh Agreement, several countries have allocated tariff cuts in a "strategic" way. That is, they have allocated larger cuts (in percentage) on products that were initially subject to very low tariffs, or products that did not compete with local production, or products whose consumption would always remain very small because of limited demand. The consequence is that high tariffs persist for some particular commodities (the so-called "tariff peaks"). Another consequence is that tariff dispersion has increased in some countries, after the Uruguay Round. This is hardly a satisfactory outcome, since economic theory shows that a high variance of tariffs can have large negative effects on welfare and trade, and that reducing tariff dispersion should be an objective for trade negotiations, in addition to reducing the average tariff level.

An uneven tariff structure, as a matter of fact, can result in more severe welfare and trade distortions than a slightly higher, but more balanced overall level of protection (Tangermann, 1994). Economists have shown that the welfare effects of tariff dispersion can be very large and that tariff reductions should aim at lowering the dispersion. It would therefore, be useful to evaluate the impact of the tariff dispersion as well as the average tariff level in any empirical assessment of the effects of tariff liberalization. To do this the indicators used should take into account for both the tariff level and tariff dispersion, as in the case of the TRI.

In order to reduce tariff peaks and reduce tariff dispersion, it has been suggested to impose larger cuts on high tariffs, such as in the case of the Swiss Formula[1] used in the Tokyo Round to harmonize tariff peaks on industrial products left as a result of the linear formula used in the Kennedy Round. Very similar results in terms of harmonization can be obtained using an alternative scheme, which Josling and Rae (1999) refer to as a "cocktail" approach. Such an approach combines a reduction formula with a set of constraints. The first constraint could be a maximum rate to which all higher tariffs would have to be reduced over an agreed period. Since it has been suggested that very low tariffs should be set to zero, because they act mainly as administrative barriers[2], a second constraint could be represented by the elimination of *nuisance* tariffs – those below a specified level.

Note that any scenarios tackling the "tariff peaks" issue would raise practical difficulties, since these scenarios are meaningless unless specific tariffs[3] are converted into ad valorem equivalents. However, such a conversion is always imprecise and questionable, since it requires a reference (world) price for all commodities. Statistics are not available at such a detailed level. In addition, countries do not have the obligation to notify ad valorem equivalents to the WTO. There is therefore no official series, and discussions on such a topic can be controversial.

3. Measuring liberalization and harmonization

Finding a single number that can summarise a set of tariffs and relate them to their economic impacts is the essence of the tariff index number problem. The simple answer, and the one often adopted in practice, is to aggregate tariffs, weighting them by the imports (or domestic consumption) of each commodity (Josling and Tangermann, 1994). This approach, however, immediately runs into difficulties because the weight applied to any individual tariff falls as the tariff increases. More generally, if there is a positive correlation between demand elasticities and tariff levels, high tariffs receive a low weight whereas low tariffs receive a high weight. This suggests that trade-weighted averages are in general misleading.

Since a larger dispersion in the tariff structure implies larger costs in terms of efficiency and welfare, one can think of using the variance of the tariff set as an indicator of the effect of an

[1] The Swiss formula is $T_n = (a_{max} * T_0)/(a_{max} + T_0)$, where a_{max} is the upper bound on all resulting tariffs. With a_{max} = 50, for example, an initial tariff of 40 percent would be reduced to 22 percent while a 100 percent tariff would be reduced to 33 percent.

[2] And because the persistence of small tariffs can be used for further "dilution" in future rounds, since these very small tariffs could be cut by a large extent with practically no impact on imports, raising the possibility of achieving average reduction target with smaller reductions for more sensitive products.

[3] Specific tariffs (e.g. in dollars or euros per kilo) tend to lead to a larger protection against low unit value imports such as raw materials, compared to higher value imports such as processed products. A combination of specific and *ad valorem* tariffs, if carefully designed, can help protecting specific segments of the markets. In addition, since specific tariffs are expressed in domestic currency, specific and *ad valorem* tariffs can have different effects according to inflation.

overall change in a tariff schedule. However, a satisfactory indicator should account for the reduction in both mean and variance. More generally, all purely statistical measures ("tariff moments") lack an economic basis and it is not easy to interpret the information that such indicators convey (Josling, 1990).

The economic theory of index numbers has long shown that indicators should be based on producer and consumer theory. The main empirical advantage of such indexes is that they are based on explicit assumptions regarding production technologies and preferences of consumers, are theoretically consistent, and their interpretation is non-ambiguous (Bureau and Kalaitzandonakes, 1995). But the suitability of any particular method of aggregation depends on the use of the indicator and the type of information we wish to summarise. This implies that by applying different methods of aggregation to a set of data we can define several alternative indexes. Each of them leads to a single number, which is equivalent to the original data set in terms of the information of interest.

Here, we are interested in summarising the effects of alternative outcomes of present trade negotiations on the economy in terms of domestic welfare. The reference to domestic welfare comes from the idea that the correct tariff aggregator should be defined keeping constant the utility of a single representative agent. Indeed, many economic indexes, including the consumer price index, are defined with reference to the concepts of equivalent or compensating variations, where utility is constant.

Our starting point is the trade behaviour of the economy, expressed through the trade expenditure function $E(p, u, z)$, which summarises the optimal behaviour of consumers and firms. It is obtained as the difference between the expenditure function $e(p, u)$ and the gross domestic product function $R(p, z)$. The standard assumptions of the representative agent apply to both components of the trade expenditure function. This means that the representative consumer seeks to minimise expenditure at given prices (p) for a given level of utility (u), while the producer allocates resources so as to maximise the value of output (national product) for given domestic prices, subject to given factor supplies and the technology.[4] These assumptions yield consumption and output quantities and their difference yields the net trade expenditure.

Making use of the properties of duality, we know that: *i/* the derivatives of the expenditure function with respect to each price equal consumption of the corresponding good; *ii/* the derivatives of the gross domestic product function with respect to each price are the economy's general equilibrium net supply functions; *iii/* the trade expenditure function is homogeneous of degree one in prices and its derivatives with respect to prices are the compensated import demand functions $x_i(p, u, z)$ which are homogeneous of degree zero in prices.

These elements formally characterise the private sector structure of supply and demand of an economy under perfect competition, under the small country assumption. When tariffs are imposed, government behaviour in collecting tariff revenues and redistributing them in lump sum fashion needs to be incorporated in the behaviour of the economy. Both government and private behaviour are summarised by the balance of trade function $B(p, u, z)$. It represents the external budget constraint, and is equal to the net transfer required to reach a given level of aggregate domestic welfare, u , for a given set of domestic prices. It also summarises the three possible sources of funds for procuring imports: earnings from exports, earnings from tariff revenues and

[4] Here, the $p=(p_1,...,p_N)$ denotes the domestic price vector of the N goods $i=(1,...,N)$ and the vector z includes all the variables assumed exogenous, such as world prices or fixed endowments of factors of production.

international transfers. Assuming that the latter are equal to zero and that tariffs (vector *t*) are the only trade policies, the balance of trade function is:

$$B(p,u,z) \equiv e(p,u,z) - R(p,z) - (p - p^*)' I(p,u) = 0 \ , \qquad (1)$$

where $p^* = (p_1^*,...,p_N^*)$ denotes the international price vector, and $X = (x_1,...,x_i)$ denotes the import demand vector. The vector $(p-p^*)$ is the *tariff wedge.* Note that, throughout the paper, we assume that tariffs denoted by *t* are *ad valorem* tariffs so that for a good *i*, $p_i = (1+t_i)p_i^*$.

The balance of trade function *B(p,u,z)* therefore summarises the trade behaviour of the entire economy and is the basis of the TRI. Note however that the balance of trade function does not possess the nice homogeneity property of the trade expenditure function.

The TRI (Δ), proposed by Anderson and Neary (1996) is defined as the uniform scaling factor (or uniform price deflator) that, when applied to period 1 prices, permits the representative consumer to attain his initial level of utility u^0 while holding the balance of trade constant at its original (period 0) level:

$$\Delta(p^1,u^0,z) \equiv \left[\Delta : B(p^1/\Delta, u^0, z) = 0\right] . \qquad (2)$$

It is analogous to the concept of the true cost of living index for a consumer (Konüs, 1939), which gives the uniform scaling factor by which period 1 prices must be deflated to compensate the (expenditure minimising) consumer for the change in prices prevailing in period 0. There are however, significant differences between these two indexes: the TRI focuses on the balance of trade function and not only the consumer's expenditure function, and the variable of interest is the uniform tariff rather than the uniform rate of inflation on the basket of consumer goods. Consider the case of complete trade liberalisation, so that all tariffs are set to zero in period 1. The scalar ($1/\Delta$ -1) is the uniform tariff which, if applied to all imported goods, would lead to the same level of welfare as in period 0, when the economy was subject to protection.

4. Empirical issues

Having defined the TRI, for the empirical implementation we model import demand through a Constant Elasticity of Substitution (CES) functional form. This function imposes restrictive assumptions on separability. This function is nevertheless widely used in the CGE literature (Hertel, Ianchivichina, and McDonald 1997).

We assume that the overall basket of goods can be partitioned into *J* aggregates denoted *j=1,…J.* This requires that the utility function of the representative consumer is separable, so that it can be written as a sum of *J* functions ϕ_j:

$$U(x) = \sum_j \phi_j(u_j(x_j)). \qquad (3)$$

That is, the overall utility function *U* is built up from lower level subutility function u_j. Each vector x_j containts N_j elements. We assume that u_j is a CES function in x_j. We use the popular Armington (1969) assumption that imports are imperfect substitutes of domestic goods. We partition the consumption vector x_j within the *j*th group into an aggregated domestic good denoted with a suffix *d* and N_j*-1* traded goods denoted with an index *i*.

$$u_j(x) = \left(b_{dj}(x_{dj})^{\rho_j} + \sum_i b_{ij}(x_{ij})^{\rho_j} \right)^{\frac{1}{\rho_j}}, \quad i=1,...N_j. \qquad (4)$$

Denoting $\sigma_j = \frac{1}{1-\rho_j}$ the elasticity of substitution within the *j* group, the expenditure devoted to each aggregate *j* is

$$e_j(p,u) = \left(\beta_{dj}(p_{dj})^{1-\sigma_j} + \sum_i \beta_{ij}(p_{ij})^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} u_j . \qquad (5)$$

The parameters β_{ij} can be calibrated to the initial values of the expenditure shares in the base data, when all domestic prices are set to 1. The compensated demand functions of each of the *i=1,.., N$_j$-1* imported goods can be found by Shephard's lemma:

$$x_{ij} = \beta_{ij}\left(\frac{P_j}{p_{ij}}\right)^{\sigma} u_j^0 . \qquad (6)$$

With the price index

$$P_j = \left(\beta_{dj}(p_{dj})^{1-\sigma_j} + \sum_i \beta_{ij}(p_{ij})^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} . \qquad (7)$$

Since the compensated import demand function is homogenous of degree zero in the prices of traded goods, defining a uniform tariff equivalent requires selecting an untaxed good as a reference: we solve the problem by taking the domestic good as a *numéraire*.[5]
Following Bach and Martin (2001), we define a simplified balance of trade function, B_j, for each commodity group as the difference between total domestic expenditure and tariff revenue.

$$B_j(p_j,u_j) \equiv e(p_j,u_j) - R(p_j,u_j), \qquad (8)$$

The TRI uniform tariff equivalent τ_j for each aggregate *j* is found by setting the value of the simplified balance of trade function with the uniform tariff equivalent equal to the value with the disaggregated tariff set (corresponding to the final bound tariffs - year 2000 - or to those resulting from different tariff reduction schemes - to be negotiated -) B_j^0,

$$B_j^0 = \left(\beta_{dj}(p_{dj})^{1-\sigma_j} + \sum_i \beta_{ij}\left(p_{ij}^*(1+\tau_j)\right)^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} u_j^0 - \left(\sum_i \beta_{ij}\left(\frac{P_j^\tau}{p_{ij}^*(1+\tau_j)} \right)^{\sigma} p_{ij}^* \tau_j \right) u_j^0 \qquad (9)$$

where P_j^τ is the price index:

$$P_j^\tau = \left(\beta_{dj}(p_{dj})^{1-\sigma_j} + \sum_i \beta_{ij}\left(p_{ij}^*(1+\tau_j)\right)^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} . \qquad (10)$$

The uniform tariff equivalents for each aggregate commodity *j* are found using an optimization routine in the GAMS package (Brooke et al. 1998), solving for τ_j in equations (9) and (10).

The world prices are the average unit values of imports (CIF) over the 1994-96 period. The volumes of imports are taken directly from the respective U.S. and EU data sets (U.S. International Trade Commission and Eurostat's Comext data set). The Schedule XX that the EU and the US submitted to the WTO provides the base and bound tariffs at the 8-digit level of the Harmonized System (HS) classification. The URAA schedule therefore provides information on

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[5] More generally, Neary (1998) shows how the failure to select a reference untaxed good leads to misleading results in the theory of trade policy.

tariffs in 1995 (that is, after the Uruguay Round tariffication process) and in 2000 (that is, after the implementation of the mandatory 36 percent average reduction in tariffs). The domestic prices are constructed by multiplying the world price p^* by the ad valorem tariff structure (initial, final, or counterfactual tariffs) that we are interested in.

The EU-15 tariff reduction commitments cover 1,764 tariff lines, while the U.S. schedule includes 1,377 tariff lines. Both the EU and the US apply their bound tariffs on products traded in a Most Favored Nation framework. That is, using the URAA schedules as a source of information on tariffs gives a good image of the actual tariff structure, although lower tariffs are applied in the framework of preferential agreements that we did not consider here. For purposes of calculation, we converted specific tariffs into ad valorem equivalents, adopting the following conventions:

- Specific tariffs were converted into *ad valorem* equivalents by using the 1995 unit values of imports;
- For those commodities that were not imported, the 1995 unit values of extra-EU exports were used as proxies;
- When the tariff line mentioned a threshold (i.e. minimum tariffs or maximum tariffs), the highest possible tariff was considered;

The data on the total expenditure are taken from the Global Trade Analysis Project (GTAP) version 4 data set (McDougall, Elbehri, and Truong 1998). This comprehensive data set is widely used in applied analysis, and researchers might be interested in tariff aggregates that match the GTAP classification for simulation purposes. Moreover, the conversion tables from detailed tariff structures (HS 8-digit) to the GTAP sectors are fully available, which makes it possible to aggregate the very detailed list of tariffs of the URAA Schedule into a restricted number of products that correspond to the GTAP system of classification. Finally, the data set provides the information that is necessary for distinguishing between expenditures on domestic products imports for the various aggregates and also provides elasticities of substitution σ_j that match the list of aggregates.

The original GTAP data set distinguishes *J=20* agricultural and food aggregate products. In order to include nonfood other commodities listed in the URAA schedules (mainly agricultural goods listed in chapters 25 to 53 of the HS classification) we defined an extra aggregate, which does not exist in the original GTAP classification (see Table 1). We ignore one GTAP sector (raw milk) because there is no trade for the corresponding commodity. Overall, we aggregated 1,764 tariff lines in the EU (1,377 tariff lines in the U.S.) at the 8-digit level of the HS classification up to 20 aggregate products described in Table 1. It is noteworthy that the number of tariff lines in each commodity aggregate is very uneven. Table 1 shows, for example that there are only three tariff lines in the aggregate "paddy rice," while the aggregate "fruits and vegetable" tariff includes 183 tariff lines listed in the EU schedule.

5. Results

The computation of the TRI uniform tariff equivalent τ_j provides an estimate of the trade restrictiveness of the actual tariff structure. It is calculated for the year 2000 for both the EU and the US, making it possible to compare the trade effect of EU and U.S. tariff structure prior to the beginning of the new negotiations. The structure of bound tariffs in the EU and the US differs in several aspects.

Table 2 shows that three product categories in the EU face zero tariffs (oilseeds, fibres, wool) while all aggregates tariffs in the US face a strictly positive average tariff. However, this mainly reflects the particular structure of the GTAP classification. Overall, the original 1995 EU tariff schedule included 245 lines with zero tariffs, while the U.S. schedule included 303 lines with zero tariffs. The average nonweighted base tariff was 7.0 percent in the US, while in the EU the average tariffs were 18.1 percent.[6]

Table 1. GTAP agricultural commodities and HS-8 tariff lines

Commodities [1]	*GTAP Classification*	*Number of tariff lines EU*	*Number of tariff lines US*
Paddy rice	1	3	3
Wheat	2	3	3
Cereal grains	3	13	12
Vegetables, fruits, nuts	4	183	186
Oilseeds	5	31	16
Sugar cane, sugar beet	6	3	2
Plant based fibers	7	4	7
Other crops	8	111	116
Cattle, sheep, goats, horses	9	14	12
Other animal products	10	73	50
Raw wool, cocoons and hair	12	9	17
Meat: cattle, sheep, goats, horses	19	77	34
Other meat products	20	199	61
Vegetable oils and fats	21	112	70
Dairy products	22	121	118
Processed rice	23	2	3
Sugar	24	10	15
Other food products	25	580	489
Beverages and tobacco	26	87	84
Nonfood items (goods listed in URAA, beyond Chapter HS 24)	other	130	79

Note : Raw milk (GTAP code 20) is excluded because of absence of trade.

In most sectors, the EU average tariff is larger than the U.S. average tariff, the gap being particularly wide in the grains, meat, sugar, and rice sectors. It is worth noting, though, that in the EU, the trade-weighted average tariff is usually larger than the nonweighted average, while it is generally the opposite in the US. A trade-weighted average tariff that is smaller than the nonweighted one can result from prohibitive tariffs or may simply mean that larger tariffs are set on commodities whose demand is particularly elastic. This suggests that higher tariffs are set on sensitive products, in the sense that the government is willing to protect domestic production from imports, as is the case in the U.S. dairy sector.

[6] The nonweighted average tariffs that are presented here differ significantly from those computed by Gibson et al. (2001), even though we use the same initial tariff data, i.e., the WTO schedules. The main difference lies in the convention for converting specific tariffs into ad valorem equivalents. We use a four-year average of unit values of either imports or exports (when imports are small or inexistent) at the 8-digit level, while Gibson et al. use world prices at a more aggregated level. We believe that with our convention, we minimize the risk of constructing artificial tariff peaks, which is often the case when one converts specific tariffs into ad valorem using reference prices for more aggregated commodities. It is also worth recalling that the U.S. schedule includes specific tariff lines for in-quotas tariffs (in the case of commodities subject to a tariff rate quota). These tariff lines were excluded from our analysis.

Table 2. Actual bound tariffs (year 2000)

Commodities	*Nonweighted average tariff (%)*		*Trade-weighted average tariff (%)**		*TRI tariff (%)*	
	EU	*US*	*EU*	*US*	*EU*	*US*
Paddy rice	37.5	1.9	51.5	1.1	53.0	1.3
Wheat	37.0	2.7	73.0	2.5	73.0	2.5
Cereal grains	28.6	0.4	53.4	0.3	68.4	0.5
Vegetables, fruits, nuts	12.6	4.7	44.5	3.2	96.5	7.5
Oilseeds	0	18.8	0	3.0	0	24.5
Sugar cane, sugar beet	32.2	1.3	11.3	1.6	15.6	1.6
Plant based fibers	0	9.1	0	2.1	0	3.5
Other crops	3.1	2.0	3.2	1.2	9.8	3.5
Cattle, sheep, goats, horses	19.2	0.9	22.7	0	57.5	0
Other animal products	3.0	0.6	1.4	0.2	5.8	0.5
Raw wool, cocoons, hair	0	1.1	0	4.1	0	11.4
Meat: cattle, sheep, goats, horses	39.2	5.3	60.0	0.6	81.3	1.7
Other meat products	22.3	2.9	15.4	0.7	22.9	1.3
Vegetable oils and fats	10.0	3.3	4.2	2.3	14.7	4.1
Dairy products	46.5	21.8	45.6	6.9	63.7	27.4
Processed rice	63.5	5.0	80.9	2.1	84.1	2.3
Sugar	31.3	20.3	51.1	5.7	62.0	15.3
Other food products	19.9	9.0	14.4	4.2	37.8	8.7
Beverages and tobacco	9.6	3.4	17.0	0.8	36.9	2.0
Nonfood items	5.4	1.6	1.3	1.3	3.3	2.8

**weighted by 1995 import values*

On the other hand, the trade-weighted average is larger than the nonweighted average tariff when low tariffs are set on products whose demand is structurally limited, either because these are niche market products (e.g., processed products, peculiar types of fruits, beverages, and condiments in the EU), or because local producers are competitive (e.g., pig meat and poultry meat in the EU). This may also mean that higher tariffs are set on goods with a relatively inelastic demand for imports. This is typically the case in the EU, in the beef, sugar, and grain sectors.

Table 2 shows significant differences between the TRI and the nonweighted tariff average. This is not surprising, since the nonweighted tariff average bears little relationship with theoretically sound indexes like the TRI. On the other hand, the values for the trade-weighted average tariffs are often quite close to those given by the MTRI tariff. This empirical finding converges with those of Bach and Martin (2001) who show that the trade-weighted average tariff is a linear approximation to the tariff aggregator based on the expenditure function. In other terms, the trade-weighted average tariff plays the same role as the Laspeyres price index in consumer theory, providing a fixed-weight approximation that underestimates the "true" height of tariffs because it neglects substitution induced by tariff changes.

Looking at Tables 1 and 2, it is also obvious that the TRI and the trade-weighted index give very similar results when the number of tariff lines in the aggregate is very small, or when there is little dispersion in tariffs within an aggregate. The difference between the TRI uniform tariff and the trade-weighted average depends on the tariff dispersion, something that is confirmed by elementary descriptive statistics. For the aggregates with a large number of products, the gap between the two indexes can be very large (as in the case of vegetables, oilseeds, dairy products, and sugar for the US, or in the case of vegetables, meat, oils, dairy, and beverages for the EU). In general, when the aggregate includes a large number of heterogeneous tariff lines that differ from unity, the trade-weighted average is a poor indicator of the restrictiveness of the tariff structure.

The computation of the TRI for the year 2000 provides the benchmark according to which we evaluate the trade restrictiveness of the tariff structures that could result from the present negotiations. Comparing different tariff reduction schemes, we also want to assess the relative effects of reducing the tariff average and tariff dispersion. We focus on three scenarios, which may be summarized as follows:

- Scenario 1. *Uruguay Round bis*. Starting from the final bound tariffs in year 2000, each tariff line is reduced of the same percentage it was reduced due to the implementation of the Uruguay Round Agreement: $t_i^{new} = t_i^{2000} * (t_i^{2000} / t_i^{1995})$. This implies that each tariff line is reduced at least by 15% and a non-weighted average reduction around 36%.
- Scenario 2. *Uniform reduction.* This method assumes that a uniform 36% reduction is applied to all tariff lines: $t_i^{new} = t_i^{2000} * 0.64$. This will obviously result in the same average reduction as in the previous case, but it would prevent strategic allocation of tariff reductions across tariffs lines and therefore the "dilution" of commitments. It is also consistent with one of the few robust results of economic theory, that a uniform tariff reduction has a positive effect on aggregated domestic welfare, regardless of the substitutions between goods[7].
- Scenario 3. *Sliding scale*. This scenario, suggested in USDA (2001), provides an example of harmonization formula through a *cocktail approach*. It sets the highest rates (>50%) to 50%, and the low tariffs (<5%) to zero. Tariffs within the "band" 5%-50% are reduced by 50%:

$$t_i^{new} = \begin{cases} t_i^{2000} > 50\% \Rightarrow 50\% \\ 50\% > t_i^{2000} > 5\% \Rightarrow t_i^{2000} * 0.5 \\ t_i^{2000} < 5\% \Rightarrow 0 \end{cases}.$$

Comparing the values of the TRI-uniform tariff equivalents of the 2000 tariffs (third column in Table 2) with the TRI-uniform tariff equivalents for the counterfactual scenarios (Table 3), we can assess the possible impact of the present negotiations in terms of market access. We register an overall decrease in protection, since all formulas lead to the reduction of each of the TRI-uniform tariffs both in the EU and in the US.

The absolute values of the reductions are much smaller in the case of the US, as could have been expected given the low values of the TRI-uniform tariff equivalents in the initial period (see Table 2). This is also consistent with the results of Bureau, Fulponi and Salvatici (2000) suggesting that the Uruguay Round led to a larger reduction of trade distortions in the EU than in the US.

As it can be expected, for each country, the effects of tariff reduction formulas will depend on its own tariff profile. Overall, the results show that the various ways of cutting tariffs only have a very limited impact on the overall access to the U.S. market, due to the low levels of tariffs in the first place. In the US, the *sliding scale* scheme leads to a significant decrease in trade restrictions, especially because it eliminates low, or “nuisance,” tariffs which are quite common in the US

[7] All other tariff cuts described by the "piecemeal reforms theory" only have positive effects under certain assumptions regarding substitutions between consumption goods.

Schedule (USDA, 2001). In the EU, on the contrary, there are quite a few instances (e.g., cereals, beverages) where the harmonization approach does not perform better than the linear reduction.

Table 3. TRI-uniform tariff equivalents (%): counterfactual scenarios

Commodities	*Uruguay Round bis*		*Uniform reduction*		*Sliding scales*	
	EU	*US*	*EU*	*US*	*EU*	*US*
Paddy rice	34.0	0.5	34.0	0.8	40.9	0
Wheat	46.8	1.0	46.7	1.6	50.0	0
Cereal grains	44.3	0.1	44.3	0.3	48.4	0
Vegetables, fruits, nuts	79.0	4.2	66.0	5.0	44.5	2.6
Oilseeds	0	17.3	0	19.1	0	9.2
Sugar cane, sugar beet	12.6	0.5	10.2	1.0	8.0	0
Plant based fibers	0	1.7	0	2.3	0	0.8
Other crops	7.7	1.8	6.5	2.3	5.1	1.1
Cattle, sheep, goats, horses	38.9	0	38.9	0	36.8	0
Other animal products	3.9	0.2	3.9	0.3	3.0	0.1
Raw wool, cocoons, hair	0	8.6	0	7.4	0	4.0
Meat: cattle, sheep, goats, horses	53.2	0.8	53.2	1.1	48.4	0.5
Other meat products	15.0	0.6	15.0	0.8	11.9	0.3
Vegetable oils and fats	12.3	2.2	10.5	2.7	13.1	1.3
Dairy products	43.4	17.3	42.3	19.7	37.5	13.1
Processed rice	54.1	0.9	54.1	1.5	48.7	0.3
Sugar	49.9	9.8	40.2	11.3	47.3	6.9
Other food products	32.8	4.9	29.0	5.8	18.0	3.1
Beverages and tobacco	24.9	0.8	25.1	1.3	30.4	0.6
Nonfood items	2.1	1.3	2.2	1.8	1.5	0.6

Note: All three scenarios compare a counterfactual tariff structure with free trade. See text for details.

Table 3 also shows that the URAA formula decreases trade restriction in a way that is very comparable to what results from a uniform tariff reduction in most sectors. This means that both countries have not used (in the previous Round, at least) their "degrees of freedom" to allocate tariff cuts in a very "strategic" way, as could have been expected since most tariffs were cut by 36 percent. However, there is evidence of a more "strategic" allocation of tariff cuts by the EU, since the TRI-uniform equivalents resulting form the uniform reduction are never larger than in the case of the URAA formula, while the opposite is generally true for the US.

The results of our comparison of tariff indexes and tariff reduction scenarios should be used with caution in policy analysis. Indeed, figures do not give a proper image of trade restrictiveness of agricultural trade policy, especially in the EU. The reason is that, for the purpose of comparison between scenarios, the world price was kept the same as in the 1995. We did not account for policy changes either, such as the fall in intervention price for grains in the EU, which has an effect on the level of tariffs (the entry price capped to 155 percent of the intervention price). In addition, the actual protection of EU agriculture is clearly overestimated because we focused on the MFN tariffs. That is, we ignore preferential tariffs, which account for roughly 50 percent of the value of EU imports. Imports under regional agreements face very small tariffs in general and in quota tariffs are around one-third of the MFN tariff in the EU (see Bureau and Tangermann 2000).

6. Conclusions

This paper attempts to measure how much liberalisation in agricultural trade could be attributed to a further tariff reduction in the EU and US as a result of the negotiations undertaken within the WTO. It should be seen as a first exploration of the possible effects of alternative scenarios on the EU and US tariff structures, taking into account the impact of changes in a large number of tariff lines. Although the US and the EU tariff schedules are the examples used, the analysis permits a limited amount of generalisation regarding the implications of tariff cutting procedures under different initial tariff configurations.

We evaluated the impacts of alternative tariff-cutting procedures, using the TRI as the tariff aggregator. Under the assumptions presented in the paper, the TRI is the correct way to measure the consequences of tariff barriers on the volume of imports. We were able to compute the index for particular commodity aggregates without using a full-blown CGE model but we assumed a specific functional form for import demand. Such an approach is easy to implement, since it requires only information on tariffs, import values, and total expenditure on each commodity (in addition to the knowledge of the parameters of the demand function).

In constructing the TRI, we made restrictive assumptions that may not hold in reality. This is obviously the case for the small country assumption. We also ignored the substitutions and complementarities that may exist between imports. The theoretical assumptions underlying the construction of the trade balance functions (single utility-maximising consumer, competitive markets) are often made, but are nonetheless restrictive. These assumptions allowed us to focus on the contribution of trade policy to efficiency, but they should be kept in mind when interpreting the results. Some of these shortcomings could be overcome using more sophisticated economic models (Salvatici, 2001).

The computation of a theoretically sound index makes it possible to compare the strategies in the allocation of tariff reductions taking into account the difference in the initial (bound) tariffs of the EU and US. We computed and compared the percentage change in the TRI (welfare changes) assuming a repetition of the *URAA commitments*, as well as two other hypothetical cases, the *sliding scale* formula and a *uniform* 36% tariff reduction of each tariff. The use of the alternative tariff reduction formulas makes it possible to shed some light on the welfare as well as market access consequences of emphasising reductions in tariff dispersion in the next round of negotiations.

We were also able to assess the consequences of emphasizing reductions in tariff dispersion in terms of getting a (more) level playing field between the EU and the US. Our results suggest that the strategy of tariff reductions implemented in the EU, with a selective differentiation of tariff cuts across commodities, may limit the welfare gains that could have been reaped by the agreement. On the contrary, the comparison of the TRI in the *URAA bis* and *uniform* scenarios shows that the uneven allocation of tariff cuts has a limited effect in the US.

With initial low levels of protection, the US choice of a particular tariff cutting formula does not make much difference to the results. The choice of any specific tariff cutting procedure matters less here than in countries where the tariff structure is more distorting. In this respect, one might expect that the US is unlikely to resist adopting one formula rather than another in the present round of negotiation. The EU tariff structure suggests that the choice of a particular tariff cutting

formula makes a greater difference to the EU than to the US, and may be more of a contentious issue if market access is a major objective.
As a matter of fact, technical aspects will have a considerable importance on the actual consequences of a future agreement on market access. However, behind discussions on different conventions on the way tariffs are to be reduced, the issue at stake is the sustainability of present agricultural policies, or the need for a reform of market organisations in some sector.
Looking at the new Round, it is difficult to envisage the actual use of the TRI in order to express tariff reduction commitments. However, even if the theoretically sound indexes are not explicitly used to express commitments, they do provide a necessary benchmark for evaluating tariff commitments.

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