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WTO NEGOTIATIONS ON MARKET ACCESS IN AGRICULTURE: A COMPARISON OF ALTERNATIVE TARIFF CUT PROPOSALS 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 agricultural 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 20 agricultural commodity aggregates under the actual commitments of the Uruguay Round assuming a specific (Constant Elasticity of Substitution) functional form for import demand. Then, we estimate the deadweight losses implied by each tariff structure in order to assess the benefits of future trade agreements in terms of increased efficiency. We compare the present levels of the TRI with three hypothetical cases: a repetition of the same set of tariff cuts commitments of the Uruguay Round according to the EU proposal, a uniform 36 percent reduction of each tariff, an harmonization ("Swiss") formula based on the US proposal.

Keywords: Commercial Policy; Trade Negotiations; Agriculture in International Trade

J.E.L. code: F130, Q170

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WTO NEGOTIATIONS ON MARKET ACCESS IN AGRICULTURE: A COMPARISON OF ALTERNATIVE TARIFF CUT PROPOSALS FOR THE EU AND THE US

1. Introduction

One major achievement of the Uruguay Round Agreement on Agriculture (URAA) was the prohibition of quantitative 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 Harmonized System or HS).

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. 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. So far, two major approaches have emerged for tariff reductions. One would be based on the outcome of the Uruguay Round negotiations which used an average reduction over all products, allowing some variation for individual products provided a minimum reduction was met. Another, based on mechanisms such as the so-called "Swiss formula", envisages a reduction of tariff dispersion through larger reductions on higher tariffs.

All studies on market access run into some major difficulties that limit the scope of the analyses. Some of these difficulties are linked to methodological questions, but others are linked to data availability and international inconsistencies in classifications. These empirical aspects are perhaps the main reason why the various studies differ so much when measuring the degree of market access in one given country.[1] However, methodological issues should not be dismissed. 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 behavioral 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, assuming a specific functional form for the import demand, we are able to estimate the deadweight losses implied by the 2001 bound tariffs for 20 agricultural commodity aggregates, as well as the TRI resulting from the implementation of the URAA.

- Second, we compare an index based on economic theory, such as the TRI, 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 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 these welfare increases. In this respect, we focus on two possible tariff cutting scenarios: a repetition of the URAA tariff agreement as proposed by the EU, and a "Swiss formula" based

[1] For example, estimates of the EU average agricultural tariff for agriculture after the Uruguay Round range between less than 9.7% (Gallezot 2002) and 40% (Messerlin 2001).

on the US proposal. The assessment of the potential consequences of different tariff reduction commitments shed some light on the possible outcome of present negotiations.[2]

- Fourth, 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).

The paper is organized 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 summarizes 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. Following Panagariya (forthcoming), we could distinguish two types of sectoral approaches:

- the 'zero-for-zero' approach, where all WTO members may liberalize imports within specific sectors;
- the 'cherry picking' approach, where each member may seek liberalization from its trading partners in sectors of its comparative advantage.

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).

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[2] The *Draft Cancún Declaration*, as forwarded by the Chairman of the General Council and the WTO Director-General to ministers, established that the formula applicable for tariff reduction by developed countries shall be a blended formula, with a certain percentage of tariff lines subject to a Swiss formula and another percentage subject to an average tariff cut.

The increase in the number of active participants in the negotiations increases the difficulties involved in sector-by-sector type procedures, and increases the attraction of across-the-board negotiations according to pre-specified formulas. An appealing feature of such an approach is that it creates a package involving gains to exporters as well as costs to import-substituting firms, reducing the ability of individual sectors to lobby for favored treatment (Francois and Martin, 2003).

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 makes it possible to define the relative importance, in terms of both welfare and imports, of reducing tariff dispersion as well as its average 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. 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 this paper, the focus of the analysis is on the tariff reduction commitments. That is, we ignore a very significant set of measures that limit agricultural imports. Non-tariff bariers (NTBs) include administrative barriers, sanitary, phytosanitary and technical barriers. Clearly, the role of national regulations that impose such barriers is considerable in agriculture (OECD, 1999). There are entire sectors for which trade is limited to a few countries because of fears of epidemics (such as the Foot and Mouth Disease) or invasive species and plagues (fruits, vegetable and horticultural products in particular), for example.

It is nevertheless difficult to include quantitative assessments of NTBs in trade restrictiveness measurement, as shown by Beghin and Bureau (2001) who investigate the various methods for measuring the impacts of NTBs. Among the various methods, frequency indexes on regulations or detentions do not provide quantitative assessments (not all regulations have similar effects, and not all of them are notified the same way by the different countries to international bodies). Surveys of exporters also fail to provide reliable information. Price wedge methods that compare import prices after adjusting for quality and taxes, are only satisfactory in a limited number of sectors. Gravity based techniques are a promising area of research, but there has been so far only limited measures of tariff equivalents of the various regulations (see Otsuki et al 2000, for example). More generally, constructing a tariff equivalent is often questionable from a conceptual point of view: barriers to imports often consists in imposing regulations on production methods in the exporting countries (i.e. a particular type of slaughterhouse, a particular technique for processing products). These are typically not border measures, and the estimates of a tariff equivalent, that would for example, be plugged in a general equilibrium model, make little sense.

The term "non tariff barrier" often includes quantitative import limitations. In agriculture, since 1995, import quotas were replaced by bound tariffs in the EU and US. There are however some tariff rate quotas, which are not considered here. Finally, it should be noted that we do not take into account the issue of the "gap" that is sometimes observed between applied and bound tariffs (the so-called "binding overhang"). This issue is particularly relevant in the case of developing countries, which are not included in our analysis, but it is worth recalling that both EU and US apply tariffs that are much lower than their bound tariffs under preferential agreements: roughly half of the value of imports of agricultural and food products enter the EU within preferential agreements, and only 9 countries export food products to the US without access to some tariff preferences (Chevassus-Lozza and Gallezot, 2003; Wainio and Gibson, 2003).

Clearly, trade under bound tariffs does not give the whole picture. However, even if focusing on bound tariffs does not make it possible to account for the actual market openness, bound rates are still relevant, since countries may always decide to increase the applied tariff up to this ceiling. That is, bound rates define the extent of the flexibility to vary the applied rates upward in response to particular economic circumstances (Francois and Martin, forthcoming). Hence, the setting of bound rates is a matter of strategic importance.

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 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.

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. The growing attention toward this issue has brought about a proliferation of proposals both in the actual negotiations and in the literature. It is useful, then, to develop a typology that summarizes the approaches adopted in the previous rounds according to two dimensions: *dependence* (of the rate of reduction) from the initial tariff rate, and *flexibility* (of national governments) in accommodating different preferences over tariff maxima and rates of reduction. We combine both of them in the two-by-two matrix presented in Figure 1.

By column, we represent the level of "flexibility", where with this term we refer to the freedom governments have in the allocation of the tariff reductions across different products. Flexibility ranges from LOW to HIGH according to the possibility for policy-makers to avoid the (or at least minimize) the tariff reduction for specific sectors. More precisely, *low flexibility* implies that the formula dictates what is the rate of reduction for each tariff line. Conversely, *high flexibility* would mean that the formula is expressed in aggregate (i.e., average) terms, allowing policy-makers to shift the burden of the reduction from one sector to the other.

By row, we represent whether the rate of reduction is dependent or independent on the initial level of the tariff. In the case of *tariff independent* formulas, the original tariff rate is not a determinant of the rate of reduction. In other words, all tariff rates will be reduced by the same (percentage) amount. Conversely, in the case of *tariff dependent* formulas the rate(s) of reduction are a function of the initial tariff profile. In practice, these formulas aim to get higher reductions for higher tariffs: hence, they are known as "harmonising" formulas (WTO, 2002).

Combining these two dimensions, we obtain four typologies of commitments:

Figure 1: Typologies of commitments

	Low Flexibility	High Flexibility
Tariff Independent	Linear reductions (e.g., Kennedy Round)	Aggregate reductions (e.g., Uruguay Round)
Tariff Dependent	Harmonization formulas (e.g., Tokyo Round)	"Cocktail" (e.g., Doha Agenda Draft Agreement)

What follows is a summary of various possible approaches by which tariffs may be reduced.

Aggregate reductions (high flexibility, tariff independency). This was the formula used in the URAA (36 percent non-weighted average reduction). If there were not any constraints on the minimum tariff reduction to be implemented, countries would be tempted to exempt from liberalization the most politically sensitive commodities, while much larger tariff reductions would be applied to non-sensitive commodities, that is, those that do not compete with domestic production or where the initial tariff level is very small. As a consequence, the URAA included conditions on minimum cuts, with a 15 percent minimum reduction per tariff line. Nonetheless, the legally binding documents were designed so that tariffs had to be reduced over a set of roughly 2500 commodities (HS at the 8 digit level for the food and agricultural chapters, even though some countries set bound tariffs at some more detailed or more aggregated levels). 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 consequence is that high tariffs persist for some particular commodities (the so-called "tariff peaks"), and 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.

Linear (i.e. uniform) reductions (low flexibility, tariff independency). 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. It is consistent with one of the few robust results of "piecemeal reforms theory", that under certain assumptions regarding substitutions between consumption goods multilateral radial tariff reduction raises world welfare (Hatta, 1977). On the other hand, even if the approach is both simple and transparent, and tariffs could be cut significantly if the reduction rate is high, a linear cut would still leave many tariff peaks in agriculture. This method was applied in the Kennedy Round with the "*r*" set at 50 percent. In order to get a meaningful comparison with the previous scenario, in our empirical analysis "*r*" is going to be set at 36%. A uniform reduction applied to all tariff lines, as a matter of fact, will obviously result in the same average reduction, but it does not permit countries to allocate the adjustment across commodities.

Harmonization formulas (low flexibility, tariff dependency). The main feature of these formulas is that they imply higher reductions for higher tariffs, so that the overall dispersion of the tariff profile is reduced. Although there is a whole class of reduction commitments that are a function of the initial tariff (WTO, 2002), the most well-known is certainly a specific non-linear formula: the so-called Swiss Formula used in the Tokyo Round. Formally, the formula is $T_n=(T_{max}*T_0)/(T_{max}+T_0)$, where T_{max} is the upper bound on all resulting tariffs. With $T_{max} = 25$, as proposed by the US in the present negotiations, an initial tariff of 40 percent would be reduced to 15 percent while a 100 percent tariff would be reduced to 20 percent.

Although it is well-known that welfare effects of tariff dispersion can be very large, it must be recognized that in the transition towards free trade harmonization formulas will results in some countries (initially more protected) opening their markets more than others. Accordingly, this approach "is clearly based on achieving reciprocal concessions in terms of final *outcomes* rather than *additional* market access" (Panagariya, forthcoming). This issue could be particularly contentious in the case of the present agricultural negotiations. By the time the Swiss formula was applied in the Tokyo Round, as a matter of fact, the participants (a relatively small number in comparison with actual WTO membership) had been through six previous rounds of negotiations on industrial products, while the current negotiations are only the second for agriculture.

Moreover, it should be noted that any scenarios tackling the "tariff peaks" issue would raise practical difficulties, since harmonizing formulas imply that specific tariffs[3] are converted into *ad*

[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

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: since there is not a consensus on the methodology to be followed in the calculation of these equivalents, as a matter of fact, there could be the risk that national government may use the "*ad valorem* tariffication" in order to introduce additional tariff peaks in their schedules.

"Cocktail" (high flexibility, tariff dependency). Such an approach implies an aggregate (average) reduction commitment, which varies according to the initial tariff values. There are no examples of this typology of commitments in the previous rounds, but according to the Draft Agreement prepared by the Chair of the Agriculture Committee S. Harbinson, in the present negotiations the "cocktail recipe" may have been the following:

"(i) For all agricultural tariffs greater than [90 per cent ad valorem] the simple average reduction rate shall be [60] per cent subject to a minimum cut of [45] per cent per tariff line.

(ii) For all agricultural tariffs lower than or equal to [90 per cent ad valorem] and greater than [15 per cent ad valorem] the simple average reduction rate shall be [50] per cent subject to a minimum cut of [35] per cent per tariff line.

(iii) For all agricultural tariffs lower than or equal to [15 per cent ad valorem] the simple average reduction rate shall be [40] per cent subject to a minimum cut of [25] per cent per tariff line." (WTO, 2003).

Apparently, in terms of flexibility retained by the national governments in implementing the tariff reduction commitments, these requirements would be definitely more constraining than those included in the URAA.

3. Measuring liberalization and harmonization

Finding a single number that can summarize 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

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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.

one often adopted in practice, is to aggregate tariffs, weighting them by the imports (or domestic consumption) of each commodity. 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 (Anderson, 1995a).

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 overall change in a tariff schedule. However, as it was mentioned in the previous section, 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 summarize. 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 summarizing 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 behavior of the economy, expressed through the trade expenditure function $E(p, u, z)$, which summarizes the optimal behavior of consumers and firms (Dixit and Norman, 1980). 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 minimize expenditure at given prices (*p*) for a given level of utility (*u*), while the producer allocates resources so as to maximize 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 characterize the private sector structure of supply and demand of an economy under perfect competition, as well as under the small country assumption. When tariffs are imposed, government behavior in collecting tariff revenues and redistributing them in lump sum fashion needs to be incorporated in the behavior of the economy. Both government and private behavior are summarized 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 summarizes the three possible sources of funds for procuring imports: earnings from exports, earnings from tariff revenues and 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:

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

where $p^* = (p_1^*,...,p_N^*)$ denotes the international price vector, and $x = (x_1,...,x_i)$ denotes the import demand vector. The vector $(p\text{-}p^*)$ 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*, $p_i = T_i p_i^* = (1+t_i)p_i^*$. The variable T_i is called the *tariff factor*.

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[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.

The balance of trade function *B(p,u,z)* therefore summarizes the trade behavior 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:

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

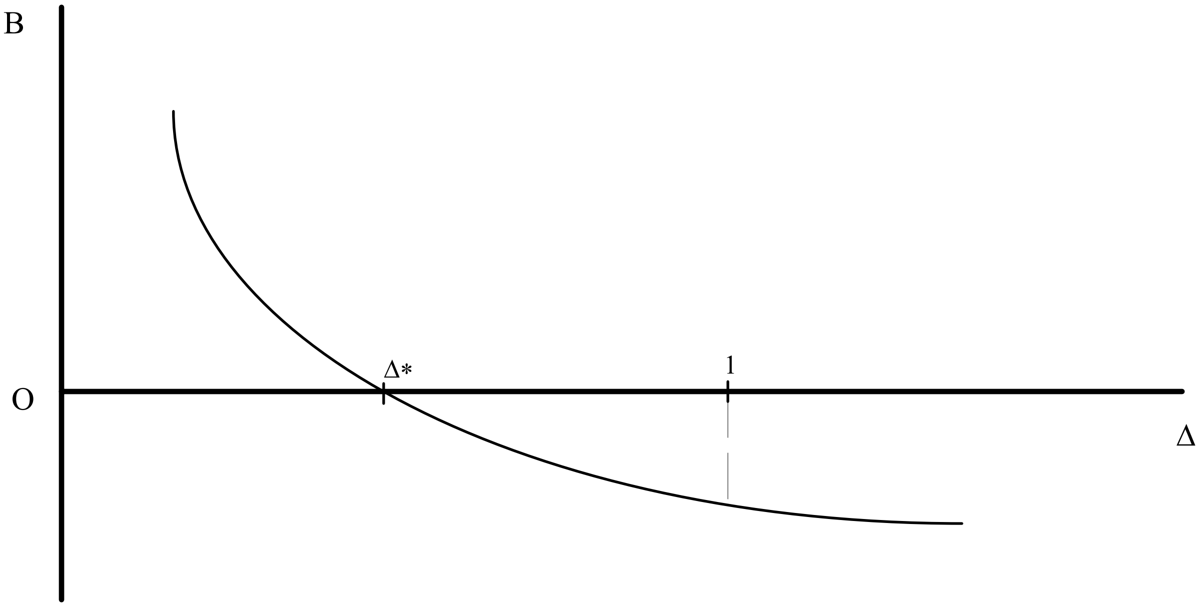
It is analogous to the concept of the true cost of living index for a consumer (Konüs, 1939), which gives the uniform scaling factor by which period 1 prices must be deflated to compensate the (expenditure minimizing) consumer for the change in prices prevailing in period 0. There are however, significant 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 liberalization, 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.

Apparently, the small country assumption adopted in the definition of the TRI rules out any possible terms of trade effect. This is certainly a questionable assumption, since our empirical analysis deals with US and EU, namely the two major traders on the world agricultural market. Moreover, in the next section we adopt quite a popular approach in the international trade literature, especially in the context of global models, namely that product differentiation has to do with exogenous considerations linked to the country of origin (Armington, 1969). This implies that each importer, however small the country may be, has some degree of market power, and is therefore able to influence world prices. Finally, some recent contributions have questioned the traditional idea that the GATT/WTO principles do not make economic sense, arguing that there is a direct linkage between the terms of trade and market access (Bagwell and Staiger, 2002).

In order to understand what are the implications of ruling out the small country assumption in the TRI definition, it is necessary to have a closer look at the functioning and the properties of the index. The TRI is *implicitly* defined in (2), but an explicit relation as $\Delta=f(\pi,u,k)$ may not exist or may exist but not be unique. Given the *locus* defined by $B(p^1/\Delta, u^0, z^0)=0$, the

Implicit function theorem provides the sufficient conditions for the local existence of the explicit relation. The important condition is $(\partial B/\partial\Delta)\neq 0$ and the first derivative of *B(·)* in terms of Δ is $B_\Delta = -B_p{}'p/\Delta^2$. Note that $B_\Delta(0)$ is unbounded, so *B(·)* approaches $\Delta = 0$ asymptotically. $B_p{}'p$ is certainly positive under the assumption of "efficient protection" (i.e., if it is not possible to increase welfare through a uniform tariff increase). If B_Δ is restricted to one sign, the uniqueness of Δ is guaranteed as illustrated in Figure 1.

Figure 1: "Well-behaved" TRI



In Figure 1, the price level after the trade policy reform – that is maintaining $\Delta=1$ – implies $B<0$; that is, a monetary transfer from the country would be required in order to maintain utility constant. The solution Δ^* shows that the same level of utility is achieved through a decrease of trade restrictiveness.

As a matter of fact, in order to relax the small country assumption we would need to re-define the uniform tariff equivalent making the vector of domestic prices *p* a function of the tariff factors vector *T* (Salvatici, 2001). Accordingly, the definition of the TRI [see equation (2)] would be modified as follows

$$\Delta^W\left[p\left(T^1\right),u^0,z\right]=\left\{\Delta^W : B\left[p\left(T^1\right)/\Delta^w,u^0,z\right]=0\right\} \quad (3),$$

where (Δ^w) is the TRI with endogenous world prices and *dT* denotes the change in domestic price minus the change in world price, ($dT = dp - dp^*$). Totally differentiating equation (3) we get

$$\frac{B_p' p_T}{\Delta^w} dT - \frac{B_p' p_T T}{\left(\Delta^w\right)^2} d\Delta^w = 0 \qquad (4),$$

then

$$\hat{\Delta}^w = \sum_i \left(\frac{B_{p_i} p_{T_i} T_i}{B_p' p_T T} \right) \hat{T}_i \qquad (5).$$

Equation (5) makes it clear why the small country assumption is important in order to have a *well-behaved* uniform tariff equivalent function. Counterintuitive "second best”" results, as a matter of fact, can be ruled only if we deal with an *efficient protection*, that is if it is not possible to get an higher welfare through tariff increases (formally, this implies $\partial B / \partial T_i > 0$). For a small country this is the normal case, although there is always the possibility of unusually large cross price effects. However, if we allow the importer to benefit from a reduction in the world price, it will be much easier to obtain welfare improvements through tariff increases.

The small country assumption is a convenient, though admittedly unrealistic feature of the TRI. Tariffs do not influence world prices, rather they may enhance welfare only improving the allocative efficiency within the country. In a small country setting, then, we are able to gauge protection by the degree of a country's "self-inflicted harm". Since it is well understood that tariffs may impact domestic welfare by altering the world prices, the TRI can be considered a sort of upper bound in terms of the measurement of the overall welfare impact.[5]

In addition to the small country assumption, which can be considered "embedded" in the TRI definition, we introduce two specific simplifications in order to allow explicit calculation of the TRI with feasible data requirements. The first is the adoption of a partial equilibrium perspective. Because we are concerned with trade restrictions on a single industry only, we assume that the importing country's expenditure function is separable with respect to the partition between agricultural products and other goods. Assuming the conditions for two-stage analysis

[5] Anderson and Neary (2003), argue (footnote 8) that , "there is a rationale for a ceteris paribus trade restrictiveness index that fixes world prices even when these prices are in fact endogenous". Such a “rationale” may be represented by the fact that, by keeping world price constant, we focus on the component of welfare explained by allocative inefficiency within the country, and not by the degree of market power of the country.

have been satisfied, in the next section we introduce subexpenditure functions for agricultural products with a constant elasticity of substitution (CES).

The second simplifying assumption is that output and exports of the domestic good are determined at the aggregate level, and the gross domestic product function *R(·)* is omitted from the balance of trade function. This allows the definition of a "simplified balance of trade function" (Bach and Martin, 2001), B_j, for each commodity group as the difference between total domestic expenditure and tariff revenue.

$$B_j(p_j, u_j, z_j) \equiv e(p_j, u_j, z_j) - (p_j - p_j{*})x_j(p_j, u_j) = 0 \qquad (6).$$

Since both the expenditure function and tariff revenue are homogeneous of degree 0 in a uniform tariff equivalent, with *Nj* distorted prices the TRI cannot be calculated: any uniform tax would be welfare equivalent to free trade.[6] This difficulty of evaluating the TRI can be circumvented if i) there is a designated "reference good",[7] so that the price vectors refer to prices relative to such a good; or if ii) the number of distorted prices is less than *Nj*. In our case we associate each group of import goods with a single, composite, domestic good, partitioning the price vector into a domestic price, p_{dj}, and $N_j - 1$ traded goods.[8] Accordingly, the sectoral TRI is defined as the uniform price deflator which preserves real 'income' in sector *j*, implicitly solved as Δ_j in

$$\Delta_j(p_j^1, u_j^0, z_j) \equiv \left[\Delta : B_j\left(\frac{p_j^1}{p_{dj}\Delta}, u_j^0, z_j\right) = 0\right] \qquad (7).$$

This allows us to define aggregator functions for the commodity groups, provided that the price of the domestic good is treated as exogenous in the formation of the commodity aggregates, although domestic goods' prices are clearly endogenous at the higher level (Bach and Martin, 2001).

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6 This observation is in consonance with Neary's third "potentially misleading proposition" (Neary, 1998).

7 In a general equilibrium framework this would obviously be considered as the *numeraire*, but in our case the term could create some confusion, since we would apply it to more than one good at a time.

8 Alternatively, we could make each sector's consumption be purely imported, using the price of the least distorted good in each sector as the "numeraire". Such an approach would avoid the need to include the domestic good in the subexpenditure function (as suggested by one referee). On the other hand, since there are some sectors (such as dairy, sugar, beef in the EU, for example) in which all products face a strictly positive tariffs, and using the least distorted good (in each sector) as the reference would not allow to draw meaningful comparisons across sectors and/or countries.

The shortcomings of these assumptions are apparent. We ignore interactions between sectors, that may notably be important through input-output relationship, as well as changes in the prices of domestic goods and factors: the increasing opportunity cost of production factors for a given sector and the feedback effect through income are thus absent. By not taking into account these relations, our measures are likely to overstate the TRI estimate.

On the other hand, it must be acknowledged the difficulty of deriving the TRI from the disaggregated set of tariffs in a fully general equilibrium structure. With typically thousands of tariff lines, this necessarily implies a highly simplified structure of the model, and even then it may be difficult to implement (Anderson, 1995b). Specializing the TRI to a partial equilibrium context allows to calculate the level of trade protection at the most detailed level. Indeed, the impact of a trade liberalization scenario on average protection changes when the shock is applied at different level of aggregations.[9]

As it was mentioned in the previous section, a major issue of contention in the present multilateral negotiations is the introduction of a non-linear reduction of tariffs, in order to even out their structure. However, where tariff peaks are mixed together with many other products, to a large extent, the evening out is already made before running the model. Averaging before reducing tariffs or reducing tariffs before calculating the average does not lead to very different results if the dispersion of tariffs across tariff lines is not too large, but exercises concerning sectors comprising numerous tariff peaks (as in the case of agriculture) request detailed information (Bouët et al., 2003).

Finally, we evaluate the actual value of the welfare cost of protection, using the conventional deadweight loss definition: the difference between the rise in expenditure due to the trade restriction, and the revenue generated from it. Letting L denote the deadweight loss, we have

$$L = e(p,u) - e(p^*,u) - (p - p^*)' x(p,u) \quad (8).$$

The first two terms in (8) are import expenditures with and without the trade restriction, and the third term is tariff revenue.

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[9] Arce and Reinert (1994), and Boüet et al (2003) show the high sensitivity of CGE results to the degree of aggregation when simulating tariff changes.

4. Empirical issues

As it was mentioned in the previous section, for the empirical implementation we model import demand through a CES functional form. This function imposes well-known restrictive assumptions on separability, nonetheless it is widely used in the literature since it is remarkably economical of parameters: for any one good there is just one parameter to characterise the price response – the elasticity of substitution (Hertel, Ianchivichina, and McDonald 1997). Gorman (1959) has shown that if the utility function is homogeneously separable, commodities may be consistently aggregated in the sense that one may form composite commodities which may be treated in the same manner as the primary commodities. Accordingly, we assume that the overall basket of goods can be partitioned into *J* aggregates denoted *j=1,…J*, and the utility function of the representative consumer can be written as:

$$U = \phi\left(u_1(x_1),\dots,u_J(x_J)\right), \qquad (9)$$

where ϕ is continuous, twice differentiable, and strictly quasi concave and the u_i are continous, twice differentiable functions, homogeneous of degree one (Lloyd, 1975). When focusing on the J sectoral TRIs, a convenient (albeit restrictive) assumption is to assume ϕ to be a Cobb-Douglas function (implying that the expenditure function is also a Cobb-Douglas one in prices with utility entering multiplicatively). In such a case, we avoid the issue of allocation of consumer expenditure across sectors, which in a general equilibrium model, is affected by tariffs within a particular aggregate *j*.[10]

In our application, 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*.

$$u_j(x) = \left(b_{dj}\left(x_{dj}\right)^{\rho_j} + \sum_i b_{ij}\left(x_{ij}\right)^{\rho_j} \right)^{\frac{1}{\rho_j}}, \quad i=1,\dots N_j. \qquad (10),$$

[10] As pointed out by an anonymous referee, with more general separable functions, the sectoral results presented here are generally inconsistent with general equilibrium.

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

$$e_j(p,u) = \left(\beta_{dj} (p_{dj})^{1-\sigma_j} + \sum_i \beta_{ij} (p_{ij})^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} u_j \,. \qquad (11).$$

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:

$$x_{ij} = \beta_{ij} \left(\frac{P_j}{p_{ij}} \right)^{\sigma} u_j^0 \,. \qquad (12),$$

with the price index

$$P_j = \left(\beta_{dj} (p_{dj})^{1-\sigma_j} + \sum_i \beta_{ij} (p_{ij})^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} . \qquad (13)$$

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 in year 2000 or to those resulting from different tariff reduction schemes to be negotiated) B_j^0,

$$B_j^0 = \left(\beta_{dj} (p_{dj})^{1-\sigma_j} + \sum_i \beta_{ij} \left(p_{ij}^* (1+\tau_j) \right)^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} u_j^0 - \left(\sum_i \beta_{ij} \left(\frac{P_j^\tau}{p_{ij}^* (1+\tau_j)} \right)^{\sigma_j} p_{ij}^* \tau_j \right) u_j^0 \qquad (14),$$

where P_j^τ is the price index:

$$P_j^\tau = \left(\beta_{dj} (p_{dj})^{1-\sigma_j} + \sum_i \beta_{ij} \left(p_{ij}^* (1+\tau_j) \right)^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} . \qquad (15).$$

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 (14) and (15). The same program also computes the sector specific deadweight loss (L_j) implementing equation (16) as follows

$$L_j = \left(\beta_{dj} \left(p_{dj} \right)^{1-\sigma_j} + \sum_i \beta_{ij} \left(p_{ij} \right)^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} u_j - \left(\beta_{dj} \left(p_{dj} \right)^{1-\sigma_j} + \sum_i \beta_{ij} \left(p_{ij}^* \right)^{1-\sigma_j} \right)^{\frac{1}{1-\sigma_j}} u_j - \left(\sum_i \beta_{ij} \left(\frac{P_j}{p_{ij}} \right)^{\sigma_j} p_{ij}^* t_{ij} \right) u_j$$

(16)

The volumes of imports are taken directly from the respective US and EU data sets (US 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 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 EU-15 tariff reduction commitments cover 1,764 tariff lines, while the US schedule includes 1,596 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;

It is noteworthy, and it will be obvious when we present non weighted average tariffs in the following section, that the methodology used here differs 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. Note 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.

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 and imports for the various aggregates, and it also includes estimates of the elasticities of substitution (σ_j) matching the list of aggregates.

Since the value of the elasticities is of fundamental importance in determining our results, it is quite bothersome that not only the elasticities taken out of the GTAP data set are the same for the two countries, but very few different numbers are used for the different sectors. There is little doubt that estimation of these elasticities is a challenging task (Erkel-Rousse and Mirza, 2002), and providing a new measurement is certainly out of the scope of this work. However, the estimates from the literature provide little guidance on the correct point estimate to apply to a given commodity in a given model for a given aggregation (McDaniel and Balistreri, 2002). Moreover, using estimates coming from different sources would have raised the general issue of consistency between the structure of the econometric models used to estimate the parameter and the structure of the model used in our simulation. As a consequence, although GTAP elasticities cannot be considered much more than "educated guesses"[11], we decided to rely on this admittedly simple assumption widely used in the literature. Nonetheless, we undertook a limited number of sensitivity tests to examine the possible effects of different elasticity values on the measurement of TRI/MTRI changes: the results are presented in the appendix.

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[11] Hillberry et al. (2002), interpreting calibration parameters as conceptual equivalents to econometric residuals, evaluate the fit of the GTAP framework. They find that "much higher elasticities of substitution are necessary if modelled behaviour is to fully explain observed variation in bilateral trade flows" (p.14).

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 EU and US tariff lines 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.

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

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 non-weighted base tariff is 7.0 percent in the US, while in the EU the average tariff is 18.1 percent. The expectation of larger welfare costs for the EU is confirmed by the last column of Table 2, where the welfare cost of tariff protection is expressed as a percentage of import expenditure: while the welfare cost of tariff protection never exceeds 7 percent of import expenditure in the US, it can reach 51 percent of import expenditure in the case of the EU.

In most sectors, the EU average tariff is larger than the US 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 non-weighted average, while it is generally the opposite in the US. A trade-weighted average tariff that is smaller than the non-weighted 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 where the welfare cost rises to 6.8 percent of import expenditure.

Table 2. Actual bound tariffs (year 2000)

Commodities	*Non-weighted average tariff (%)*		*Trade-weighted average tariff (%)**		*TRI tariff (%)*		*Welfare cost / Import expenditure (%)*	
	EU	*US*	*EU*	*US*	*EU*	*US*	*EU*	*US*
Paddy rice	37.5	1.9	51.5	1.1	52.7	1.3	7.42	0.02
Wheat	37.0	2.7	73.0	2.5	73.0	2.5	20.67	0.06
Cereal grains	28.6	0.4	53.4	0.3	66.9	0.5	17.56	0.00
Vegetables, fruits, nuts	12.6	4.7	44.5	3.2	91.3	7.2	21.68	0.46
Oilseeds	0	18.8	0	3.0	0	21.9	-	3.65
Sugar cane, sugar beet	32.2	1.3	11.3	1.6	15.3	1.6	1.68	0.02
Plant based fibers	0	9.1	0	2.1	0	3.5	-	0.11
Other crops	3.1	2.0	3.2	1.2	9.7	3.4	0.50	0.09
Cattle, sheep, goats, horses	19.2	0.9	22.7	0	49.8	0	18.87	0.00
Other animal products	3.0	0.6	1.4	0.2	5.2	0.5	0.00	0.00
Raw wool, cocoons, hair	0	1.1	0	5.4	0	9.3	-	0.06
Meat: cattle, sheep, goats, horses	39.2	5.3	60.0	0.6	77.8	1.6	27.08	0.03
Other meat products	22.3	2.9	15.4	0.7	21.8	1.3	3.49	0.02
Vegetable oils and fats	10.0	3.3	4.2	2.3	13.6	4.0	1.46	0.17
Dairy products	46.5	21.8	45.6	6.9	60.2	25.3	18.45	4.92
Processed rice	63.5	5.0	80.9	2.1	83.5	2.2	22.60	0.03
Sugar	31.3	20.3	51.1	5.5	61.1	15.0	19.48	1.64
Other food products	19.9	9.0	14.4	4.2	33.8	8.5	6.76	0.61
Beverages and tobacco	9.6	3.4	17.0	0.8	32.6	1.8	10.16	0.04
Nonfood items	5.4	1.6	1.3	1.3	3.2	2.8	0.07	0.05

**weighted by 1995 import values*

On the other hand, the trade-weighted average is larger than the non-weighted 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 higher tariffs are set on goods with a relatively inelastic demand for imports (as in the case of the sugar and grain sectors in the EU).

Table 2 shows significant differences between the TRI and the non-weighted tariff average. This is not surprising, since the non-weighted 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 TRI 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 appears 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.

In general, when the aggregate includes a large number of heterogeneous tariff lines and the elasticity of substitution differ from unity, the trade-weighted average is a poor indicator of the restrictiveness of the tariff structure. For the aggregates with a large number of products, the gap between the two indexes can be very large. This is the case of oilseeds, dairy products, and sugar for the US, or the case of vegetables, meat, dairy, and beverages for the EU: these are also the sectors where the magnitude of welfare costs represents a larger share of import expenditure.

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. *The EU WTO Agriculture Proposal ("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%. If the same formula had to be implemented again, as proposed by the EU, in our empirical analysis we assume that the EU and the US would follow the same pattern of cut allocation 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, for example, of olive oil, sugar, wine, selected fruits and vegetables in the EU, and sugar and dairy products in the US. 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.

- 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.
- Scenario 3. *The US WTO Agriculture Proposal ("Swiss formula")*. The US proposes the use of a harmonizing formula (the "Swiss formula") for reducing out-of-quota duties and tariff-only items that will cut high tariffs more than low tariffs, ensuring no individual tariff exceeds 25 percent after a five-year-phase-in period. We apply the proposed formula to the bound tariffs in year 2000, assuming that specific tariffs were transformed into *ad valorem* ones: $t_i^{new} = (0.25 * t_i^{1995})/(0.25 + t_i^{1995})$. In the actual proposal, though, tariff cuts are to be implemented from applied rates and WTO members are required to fix a specific date for the eventual elimination of all agricultural tariffs.

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 on the level of protection. We register an unambiguous decrease in trade distortions, since all formulas lead to the reduction of each of the TRI-uniform tariffs both in the EU and in the US. This is certainly reassuring, since in the case of a partial move in the direction of free trade it is a challenge to identify, among the many possible paths of rate reduction, those that would allow for expanded gains from trade along the reform path (Kowalczyk, 2002). On the other hand, such an outcome is hardly surprising, given that any terms of trade impact is ruled out by the small country assumption, and the partial equilibrium nature of our model greatly reduces the scope for indirect (i.e., "second-best") effects.

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 limited impact on the overall efficiency in the U.S. market, due to the low levels of tariffs in most sectors. The only exceptions are oilseeds and dairy products, where there are large distortions and the Swiss formula would lead to much smaller uniform tariff equivalents.

The larger gains in efficiency obtained through the harmonization approach are also apparent in the EU case. In this respect, it should be noted that in the case of the Swiss formula the magnitude of the reduction is inversely related to the value of the coefficient representing the maximum possible tariff level. Since the same coefficient were applied to each country, the EU non-weighted average tariff reduction is much larger than in the case of the US. In the same vein, while the first two scenarios can be considered *coeteris paribus*, since they achieve the same non-weighted average tariff reduction of 36%, the latter implies a larger reduction, especially in the case of the EU.

On the other hand, percentage reductions required by the Swiss formula are smaller than the ones computed in the uniform reduction scenario when the initial tariff are below 15%. Consequently, tariff independent formulas (i.e., uniform reduction and URAA) outperform the Swiss formula in those sectors where there is a large number of low tariffs: this never happens in the EU food sector, while it is quite common in the case of the US.

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

Commodities	*Uruguay Round bis*		*Uniform reduction*		*Swiss formula*	
	EU	*US*	*EU*	*US*	*EU*	*US*
Paddy rice	33.8	0.8	33.9	0.5	16.9	1.2
Wheat	46.8	1.6	46.7	1.0	18.6	2.3
Cereal grains	43.4	0.2	43.4	0.2	18.0	0.5
Vegetables, fruits, nuts	75.2	6.1	62.9	3.7	18.8	4.5
Oilseeds	0	20.1	0	16.5	0	6.6
Sugar cane, sugar beet	12.3	0.7	10.0	0.7	8.5	1.5
Plant based fibers	0	2.7	0	1.4	0	2.9
Other crops	7.7	2.8	6.4	1.4	6.0	2.7
Cattle, sheep, goats, horses	34.3	0	34.3	0	14.8	0
Other animal products	3.5	0.4	3.5	0.2	3.3	0.5
Raw wool, cocoons, hair	0	8.0	0	3.8	0	8.1
Meat: cattle, sheep, goats, horses	51.1	1.1	51.1	0.7	18.4	1.3
Other meat products	14.3	0.9	14.3	0.5	10.6	1.1
Vegetable oils and fats	11.4	3.4	9.7	1.8	5.8	3.1
Dairy products	41.4	22.6	40.1	15.0	16.7	8.9
Processed rice	53.7	1.4	53.7	0.9	19.2	2.0
Sugar	49.3	13.1	39.7	10.3	17.2	6.1
Other food products	29.2	7.2	25.8	4.2	10.9	5.2
Beverages and tobacco	22.2	1.1	22.3	0.8	12.4	1.6
Nonfood items	2.1	2.1	2.1	1.1	2.5	2.4

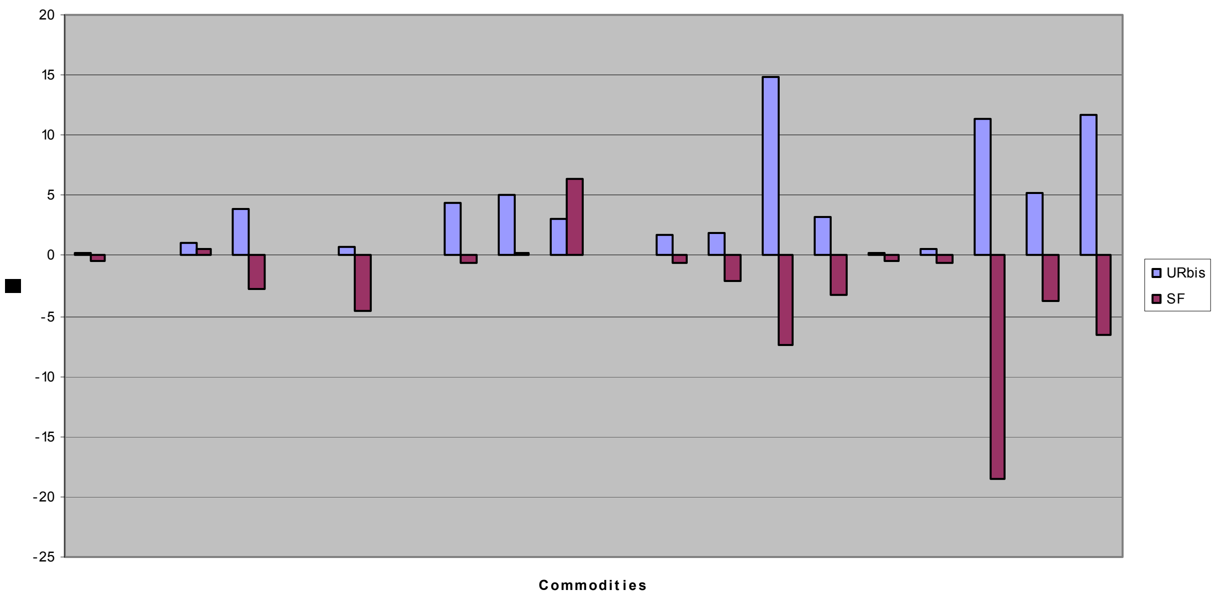
Note: All three scenarios compare a counterfactual tariff structure with free trade. See text for details.

The comparison between the URAA and the uniform reduction scenario shows some light on how these countries used their "degrees of freedom" in the implementation of the previous round agreement. Only in a few cases, all regarding sectors with very low tariffs, governments' strategies lead to uniform tariffs that are lower than in the case of a linear reduction. In most sectors, though, the URAA formula decreases trade restriction in a way that is very comparable to what results from a uniform tariff reduction. This shows that both countries did not exhaust all potential dilution possibilities of the tariff reduction commitments. Indeed, most tariff lines were exactly cut by 36 percent.

We argued before that traditional indexes are poor indicators of the trade restrictiveness of the tariff structure. Nonetheless it is interesting to compare the TRI evaluation of the tariff reduction scenarios with the trade-weighted average evaluation. As a matter of fact, even if the trade-weighted average underestimates the *level* of protection, it could still be the case that it correctly evaluates changes in policy. Indeed, this is what it may be expected, since Anderson and Neary (2003) argue that theoretically based index numbers are more important when there are conflicting tendencies in trade reform, whereas in our cases all tariffs move in the same direction.

Although it is actually (and obviously) true that all indexes move in the same direction, the difference between the rates of changes of the two measures can be significant and of unpredictable sign. Figure 2 compares the difference between the rates of change of the TRI uniform tariff and the trade-weighted average in the case of the EU for the Uruguay Round bis and the Swiss formula scenarios.

Figure 2: Comparison of changes in the TRI uniform tariffs and the trade-weighted averages (EU)



The bar diagram confirms that the largest differences are registered for the commodity groups presenting an high number of tariff lines and a significant tariff dispersion. It is also worth noting that the rate of change in the trade-weighted average overestimates the rate of change in the TRI uniform tariff in the Uruguay Round bis scenario, while the opposite is true in the case of the Swiss formula scenario.

Finally, 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.

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 evaluate the impacts of alternative tariff-cutting formulas, 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 in terms of efficiency. However, unless we assume a national-income-maximizing government, the relevance of efficiency considerations may be questioned. In the context of trade negotiations, as a matter of fact, it might be quite interesting to calculate the "Mercantilist TRI", where the balance of trade constraints are replaced by import volume constraints (Anderson and Neary, 2003).[12]

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

[12] Bureau and Salvatici (2003) provide an assessment of the agricultural negotiations using the Mercantilist TRI.

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. Such an assumption allowed us to focus on the contribution of trade policy to efficiency, but they should be kept in mind when interpreting the results. The theoretical assumptions underlying the construction of the trade balance functions (single utility-maximising consumer, competitive markets) are often made, but are nonetheless restrictive. We also ignored the substitutions and complementarities that may exist between import groups. General equilibrium analysis would clearly have the capacity to tell a fuller story than our partial equilibrium estimates. Although CGE modeling is becoming more widely used in policy appraisal it is not always applicable at an economically meaningful level of aggregation. In such circumstances, we think that our estimates, used judiciously, can still be quite useful.

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 change in the TRI (i.e., welfare changes) assuming a repetition of the *URAA commitments* (EU proposal), as well as two other hypothetical cases, a *Swiss formula* (US proposal), and a *uniform* 36% tariff reduction of each tariff.

The use of alternative tariff reduction formulas makes it possible 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 be 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. From the importing sectors' point of view, then, one might expect that the US are 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 may be more of a contentious issue in Europe. Although the EU has large welfare benefits to reap, there is necessarily a tension between the twin objective of balancing a bargain and achieving greater efficiency across sectors and countries. As a matter of fact, in the transition towards the final (more) equal level of protection, sectors and/or countries that are initially more protected will be required to make a greater adjustment. Moreover, 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 common market organisations in some sectors. To overcome these problems, new formulas have been suggested in the literature, such as a *flexible Swiss formula* – introducing a "compensation" parameter that would allow the same average tariff cut to be achieved with somewhat smaller reductions in peak tariffs (Francois and Martin, 2003) –, or the *panoply approach* – mixing together commitments in terms of both the average and the variance of the tariff structure (Konandreas, forthcoming). In this perspective, one of the Draft Ministerial Text discussed in Cancun provided for a minimum simple average tariff reduction to be achieved through a "cocktail" including the Uruguay Round approach, the Swiss formula, as well as the elimination of tariffs on selected items.

Finally, looking at the new Round, it is certainly quite 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, our work shows that they do provide a necessary benchmark for evaluating alternative reduction formulas.

Appendix: Sensitivity analysis

Because a functional form is explicitly introduced in the estimation of the sector level TRI, it is necessary to assess how sensitive the results are to the parameters that characterize this function. In particular, the estimates presented in Table 3 are based on a set of elasticities extracted from the GTAP dataset. Even though they are widely used by applied analysts around the world, their relevance is questionable. There are several reasons to believe that the GTAP elasticities are low, compared to what is consistent with recent econometric estimates of import elasticities (see e.g. Hummels, 1999, Herkel-Rousse and Mirza, 2002, Romalis, 2002).

In order to assess the sensitivity of the results to the choice of the parameters of the CES function, we calculated the TRI under the assumption that the elasticities (that typically range between 2 and 3.8 according to the various sectors) are multiplied by a scalar that ranges between 0.6 and 4 in Table 4. While these simulations were made for the three scenarios and the two countries, we report the results for the TRI under the Swiss formula scenario. Other results are in line with those in Table 4.

Table 4. TRI-Uniform equivalents (%) according to various elasticities of substitutions

Commodities	*US*				*UE*			
Elasticities	*0.6*σ*	*1.3* σ*	*2* σ*	*4* σ*	*0.6* σ*	*1.3* σ*	*2* σ*	*4* σ*
Paddy rice	1.19	1.20	1.20	1.22	16.87	16.94	16.99	17.12
Wheat	2.25	2.25	2.26	2.26	18.62	18.63	18.62	18.63
Cereal grains	0.48	0.48	0.48	0.48	17.50	18.20	18.57	18.86
Vegetables, fruits, nuts	4.21	4.53	4.89	6.18	17.14	19.81	21.33	22.40
Oilseeds	4.40	7.55	12.28	20.81	0	0	0	0
Sugar cane, sugar beet	1.54	1.54	1.54	1.54	8.25	8.63	9.01	10.00
Plant based fibers	2.81	2.86	2.90	3.04	0	0	0	0
Other crops	2.54	2.62	2.70	2.97	5.78	6.13	6.50	7.58
Cattle, sheep, goats, horses	0.02	0.03	0.03	0.03	13.22	15.90	17.70	19.30
Other animal products	0.47	0.47	0.48	0.49	3.14	3.44	3.78	4.91
Raw wool, cocoons, hair	7.89	7.73	7.59	7.23	0	0	0	0
Meat: cattle, sheep, goats, horses	1.23	1.27	1.13	1.50	17.78	18.73	19.31	20.32
Other meat products	1.11	1.12	1.14	1.19	10.25	10.82	11.38	12.78
Vegetable oils and fats	2.96	3.06	3.17	3.50	5.22	6.34	7.77	13.00
Dairy products	7.03	9.43	12.22	17.88	16.10	17.14	17.99	19.45
Processed rice	2.01	2.02	2.03	2.05	19.09	19.20	19.29	19.43
Sugar	5.35	6.63	8.73	17.23	16.82	17.47	17.84	18.21
Other food products	4.88	5.24	5.66	8.05	9.76	12.22	16.43	22.91
Beverages and tobacco	1.45	1.51	1.56	1.78	11.32	13.26	14.91	17.21
Nonfood items	2.33	2.37	2.40	2.50	2.42	2.48	2.56	2.83

Table 4. shows that there are significant differences in the TRI based tariff equivalent when the substitution elasticity varies, for the sectors that include a significantly large number of heterogeneous tariff lines. This is the case of dairy products and sugar in the US, and of vegetables, cattle, beverages and food in the EU. For chapters where protection is high, but in which there is less variability across tariffs (e.g. sugar and meat in the EU), the TRI is less sensitive to the value of the elasticity.

References

Anderson, J.E. "Tariff index theory," *Review of International Economics*, 3, 1995a, 156-173.

Anderson, J.E. "Trade Restrictiveness Benchmarks," Paper presented at the Conference on *Recent Developments in International Economics*, Aix en Provence, France, 1995b.

Anderson, J.E. and J.P. Neary "A new approach to evaluating trade policy," *Review of Economic Studies*, 63, 1996, 107-125.

Anderson, J.E. and J.P. Neary "The mercantilist index of trade policy," *International Economic Review*, 44:2, 2003, 627-649.

Arce H.M. and K.A. Reinert "Aggregation and the Welfare Analysis of US Tariffs," *Journal of Economic Studies*, 21(6), 1994, 26-30.

Armington, P.A. "A Theory of Demand for Products Distinguished by Place of Production," *International Monetary Fund Staff Papers*, 16, 1969, 159-76.

Bach, M and W. Martin "Would the right tariff aggregator please stand up ?" *Journal Of Policy Modeling* 23(6), 2001, 621-635.

Bagwell, K. and R. W. Staiger *The economics of the world trading system*, The MIT Press, Cambridge, USA, 2002.

Beghin J.C. and J.C. Bureau "Quantitative Policy Analysis of Sanitary, Phytosanitary and Technical Barriers to Trade," *Economie Internationale*, 87, 2002, 107-130.

Bouët, A., J.-C. Bureau, Y. Decreaux, and S. Jean "Is Northern agricultural liberalization beneficial to developing countries?" Paper presented at the 6th Annual Conference on *Global Economic Analysis*, The Hague(The Netherlands), June 12-14, 2003.

Brooke, A., D. Kendrick, A. Meeraus, and R. Raman *GAMS, A User's Guide.* GAMS Development Corporation, Washington, D.C. 1998.

Bureau, J.C. and N. Kalaitzandonakes. “Measuring effective protection as a superlative index number,” *American Journal of Agricultural Economics* 77, May 1995, 279-290.

Bureau, J.C., L. Fulponi, and L. Salvatici “Comparing EU and US Trade Liberalisation under the Uruguay Round Agreement on Agriculture,” *European Review of Agricultural Economics* 27(3), 2000, 1-22.

Bureau, J.C. and L. Salvatici “WTO Negotiations on Market Access: What We Know, What We Don't and What We Should” Paper Presented at the International Conference *Agricultural policy reform and the WTO : where are we heading ?*, Capri(Italy), June 23-26 2003.

Chevassus-Lozza E. and J. Gallezot “Preferential agreements – Tariff Escalation: What are the consequences of the multilateral negotiations for the access of developing countries to the European market?” Paper Presented at the International Conference *Agricultural policy reform and the WTO : where are we heading?*, Capri(Italy), June 23-26 2003.

Dixit, A. K. and V. Norman *Theory of International Trade: a Dual, General Equilibrium Approach.*, London: Cambridge University Press, 1980.

Erkel-Rousse, H., and D. Mirza “Import Price Elasticities Elasticities: Reconsidering the Evidence,” *Canadian Journal of Economics* 35, 2002, 282-306.

Francois, J. and W. Martin “Formula Approaches for Market Access Negotiations,” *World Economy* 26(1), 2003, 1-28.

Francois, J. and W. Martin “Commercial Policy Variability, Bindings, and Market Access,” *European Economic Review*, forthcoming.

Gallezot J. “Accès au marché agricole et agro-alimentaire de l'Union européenne: Le point de vue du négociateur à l'OMC et celui du douanier,” *Economie Rurale*, 267, 2002, 43-54.

Gibson, P., J. Wainio, D. Whitley, and M. Bohman “Profiles of Tariffs in Global Agricultural Markets,” *USDA Agricultural Economic Report* 796, U.S. Department of Agriculture, Economic Research Service, Washington D.C., 2001.

Gorman, W.M. “Separable Utility and Aggregation,” *Econometrica* 27, 1959, 469-481.

Hathaway, D. and M. Ingco “Agricultural trade liberalization in the Uruguay Round : One step forward, one step back?” Paper presented at the World Bank Conference on the Uruguay Round and the Developing Economies, Washington D.C., January 26-27 1995.

Hatta, T. “A Theory of Piecemeal Policy Recommendations,” *Review of Economic Studies*, 44, 1977, 1-21.

Hertel, T.W., E. Ianchivichina, and B.J. McDonald "Multi-region General Equilibrium Modeling," In *Applied Methods for Trade Policy Analysis: A Handbook*. Edited by J.F. Francois and K.A. Reinert. Cambridge, UK: Cambridge University Press, 1997, 258-299.

Hillberry, R., M.A. Anderson, E.J. Balistreri, and A.K. Fox. Taste Parameters as Model Residuals: Assessing the 'Fit' of an Armington Trade Model. *Working Paper Series*, International Trade Commission - Research Division, USA, 2002.

Hummels, D. "Toward a Geography of Trade Costs," *GTAP Working Paper* 17, Global Trade Analysis Project, Purdue University. 1999.

Josling, T. "Of models and measures: Some thoughts on the use and abuse of policy indicators," Paper presented at the Annual meeting of the International Agricultural Trade Research Consortium San Diego, USA, December 1990.

Konandreas, P. "A compromise formula for tariff cuts in agriculture," *Food Policy*, forthcoming.

Kowalczyk, C. "Reforming Tariffs and Subsidies in International Trade," *Pacific Economic Review* 7, 2002, 305-318.

Lloyd, P.J. "Substitution Effects and Biases in Nontrue Price Indices," *The American Economic Review* 65(3), 1975, 301-313.

McDaniel, C., and E.J. Balistreri. "A Discussion on Armington Trade Substitution Elasticities," *Office of Economics Working Paper*, U.S. International Trade Commission, Washington D.C., 2002.

Messerlin, P. *Measuring the Costs of Protection in Europe: European Commercial Policy in the2000s*, Institute for International Economics. Washington D.C, 2001.

Neary, J.P. "Pitfalls in the Theory of International Trade Policy: Concertina Reforms of Tariffs and Subsidies to High-Technology," *Scandinavian Journal of Economics* 100(1), 1998, 187-206.

OECD *Food safety and quality issues: Trade considerations*, Report prepared by J.C. Bureau, E. Gozlan and S. Marette, Organisation for Economic Co-operation and Development, Paris, 1999.

Otsuki, T., J.S. Wilson and M. Sewadeh "Saving two in a Billion: A case Study to Quantify the Trade Effect of European Food Safety Standards in African Exports," World Bank, Washington D.C., 2000.

Panagariya, A. "Alternative Approaches to Reciprocal Tariff Liberalization," In B. Hoekman (ed.) *A* *guide for negotiations for developing countries*, forthcoming.

Romalis, J. *NAFTA's and CUSTA's impact on North American trade*, mimeo, University of Chicago, 2002.

Salvatici, L. “Trade Distortion Indexes and Multi-Regional AGE Models: The Case of the Common Agricultural Policy,” *Working paper of the Dipartimento di Economia Pubblica*, 45, 2001.

Tangermann, S. *Implementation of the Uruguay Round Agreement on Agriculture by major developed countries*, UNCTAD, Geneva, 1995.

USDA “The Road Ahead: Agricultural Policy Reform in the WTO,” *Agriculture Economic Report*, 797, Washington D.C., 2001.

Wainio, J., Hasha, G. and D. Skully “Market access issues,” In M.A. Normile ed. *Agriculture and the WTO*, Economic Research Service - United States Department of Agriculture, WRS-98-4, Washington D.C., 1998.

Wainio J. and P. Gibson “The Significance of Nonreciprocal Trade Preferences for Developing Countries,” Paper Presented at the International Conference *Agricultural policy reform and the WTO : where are we heading ?*, Capri(Italy), June 23-26 2003.

WTO *Formula Approaches to Tariff Negotiations*. TN/MA/S/3/Rev.1, Geneva, 2002.

WTO *Negotiations on Agriculture. First Draft of Modalities for the further committments*. TN/AG/W/1/Rev.1, Geneva, 2003.