Tariffication with Supply Management: The Case of the U.S.-Canadian Chicken Trade

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ABSTRACT

This paper considers the conversion of import quotas into tariffs, as may arise in the current round of General Agreement on Tariffs and Trade (GATT) negotiations, when the internal market of the country imposing the quota is not perfectly competitive. This case is illustrated by the chicken market in Canada, where producers exercise market power by restricting supply. In this setting, tariffs and import quotas are not equivalent. If a tariff reflecting current price differences between Canada and the United States replaced the import quota system, the price in Canada would be unchanged but chicken imports would be driven to zero. On the other hand, the tariff that would preserve chicken imports at their current levels upon abolition of the import quota is much lower, and would result in a considerable decline in the Canadian chicken price.

TARIFFICATION WITH SUPPLY MANAGEMENT: THE CASE OF THE U.S.-CANADIAN CHICKEN TRADE

One of the fundamental principles underlying the General Agreement on Tariffs and Trade (GATT) is that commercial policies should be achieved through bound tariffs. This principle is reinforced by GATT's article XI, which generally prohibits the use of quantitative restrictions such as import quotas. However, an important exception to this rule allows countries to impose import restrictions for agricultural products to enforce government measures to restrict domestic marketing or production. This has allowed Canada to develop a distinctive set of "GATT-legal" policies relying on import quotas to maintain formula prices through domestic production controls (supply management) for poultry, eggs, and milk.

As part of the effort to bring agriculture more fully under GATT rules, the special role of import quotas and other nontariff barriers (NTBs) in agriculture is being scrutinized in the current round of multilateral trade negotiations. Perhaps the most ambitious action towards liberalization of NTBs is the U.S. proposal for "tariffication." In essence, this proposal tries to improve market access by converting all NTBs into bound tariffs that would then be reduced over time. As such, the special treatment accorded to agriculture under article XI would be eliminated.

The tariffication proposal raises a number of conceptual and practical issues (Moschini 1990; IATRC 1989). With regard to supply management, which enjoys widespread political and producer support in Canada, tariffication of import quotas would change a fundamental instrument of the existing program and might result in a drastic change in its nature. Also, supply management has important implications for implementing tariffication. Because supply is restricted below the competitive level, the price gap between the domestic and international markets reflects both the

border protection of import quotas and the degree of market power exercised by marketing boards. It follows that the use of this price gap to determine the equivalent tariff of import quotas, as suggested by the U.S. proposal for the practical implementation of tariffication, may be somewhat problematic.

This paper analyzes the effects of tariffication in the context of supply management schemes with a specific application to the Canadian chicken market. This paper reviews the tariffication proposal, discusses the nature of tariffication with supply management, and illustrates the main issues that arise when it is applied to the Canadian chicken market. Some general conclusions examine benefits as well as potential limitations of the proposal.

The Tariffication Proposal

The concept of tariffication represents a relatively new addition to the growing body of proposals put forward to deal with NTBs in the ongoing GATT multilateral trade negotiations. The idea of tariffication was introduced by the United States in November 1988 as a way to improve market access (USTR 1988), and a role for this concept is explicitly recognized in the Geneva Accord that followed the Uruguay Round midterm review (GATT 1989). The tariffication program was further elaborated in the U.S. submission on comprehensive agricultural trade reform (USTR 1989b) as the main tool to deal with import access.[1]

The tariffication proposal includes converting all existing NTBs into bound tariffs and scheduling the phased reduction to zero or low levels of all tariffs (USTR 1989a). Specifically, in addition to eventually replacing NTBs with tariffs, the U.S. proposal suggests eliminating all waivers, protocols of accession, and grandfather clauses that restrict imports of agricultural products. It also explicitly suggests that the GATT provision allowing import restrictions of agricultural products to implement domestic supply management programs [GATT article XI:2(c)] be eliminated.

According to the tariffication proposal, liberalization is to be achieved over a ten-year period, and during the transition period a tariff-rate quota system is envisaged. Although the tariff-rate quota

may be of some importance during the transition period (Moschini 1990), afterwards the sole mode of protection would be a bound tariff. The proposal also suggests that the new system's initial tariff can be calculated from the price gap between domestic and world prices for some recent period, and that over the transition period this tariff should be progressively reduced to the final bound tariff rate.

Tariffication and Supply Management

It is useful to distinguish between the two essential features of the tariffication proposal: the conversion of NTBs into tariffs and the reduction of trade barriers. From an economic point of view, the desirability of the latter is due to the gains from trade usually associated with freer trade. Changing to tariffs is also desirable because quantitative restrictions are typically a source of avoidable inefficiencies.

In general, quantitative trade restrictions limit market operations more than tariffs and adversely affect the efficiency of a competitive price system. Whereas NTBs tend to insulate markets, tariffs provide an explicit link between trading countries that allows transmission of market signals. This is what Anderson (1988) calls "arbitrage efficiency." Thus, using tariffs instead of NTBs should result in more efficient and stable world markets. Also, GATT's predilection for tariff use is grounded on their transparency, which makes the protection level easy to assess and to negotiate.

When the domestic market is not perfectly competitive, quantitative restrictions allow market power to be exercised to a greater degree than under tariffs, leading to the "competitive inefficiency" of quotas (Anderson 1988). For example, import quotas generally have a different effect than tariffs when domestic producers have monopoly power, a case originally analyzed by Bhagwati (1965).[2] This situation is relevant to the tariffication of Canadian markets under supply management. Import quotas are used to insulate the domestic market for milk, dairy products, poultry, and eggs, and marketing boards charge prices above the competitive level by restricting domestic production. Whether or not these industries achieve a monopolistic pricing solution is a debatable point. What is

certain is that the domestic price is set well above competitive levels because farmers actively bid for the right to produce, and production and/or marketing quotas have a high market value (Meilke and Warley 1990; Moschini and Meilke 1988; Schmitz 1983).

The relevant features of supply management for the specific case of the chicken industry are illustrated in Figure 1. Here, D is domestic demand and S is domestic supply. Virtually all imports originate from the United States, and the industry's relative size in the two countries allows Canada legitimately to be considered a small country. Thus, the U.S. price P_{US} plus transportation costs T represent the relevant border price for Canadian imports. Canadian imports are restricted by an import quota and by an ad valorem import tariff, t.[3] Consequently, the bold piecewise line D_d represents the demand facing domestic producers, where the horizontal displacement of D_d from D represents the import quota. The intersection of the demand curve D_d with the domestic supply curve S is the competitive domestic equilibrium under existing trade restrictions. However, as argued above, the fact that farmers actively bid for the right to produce at the domestic price suggests a departure from this competitive pricing solution. If this is the case, supply management results in a solution like the one in Figure 1, with P_C the Canadian price, Q_S domestic supply, Q_D domestic demand, and the difference $(Q_S - Q_D)$ imported from the United States.

Tariffication in this market requires eliminating import quotas with a tariff as the only method of protection. This situation is illustrated in Figure 2. The import price plus tariff $[P_{US}(1 + t) + T]$ puts a ceiling on the domestic price so that the bold piecewise line D_d represents the demand facing domestic producers.[4] The crucial feature here is the height of the tariff. When the tariff is large enough to raise the import price plus tariff above the autarkic solution, as in diagram (a) of Figure 2, the competitive solution is found at the intersection of D_d with domestic supply S resulting in Q_C for both domestic demand and supply. However, for a marketing board whose objective is to maximize producer returns, there may still be an opportunity to reduce domestic output below this competitive

Figure 1 - Canadian Chicken Market

Supply management with import quota and tariff

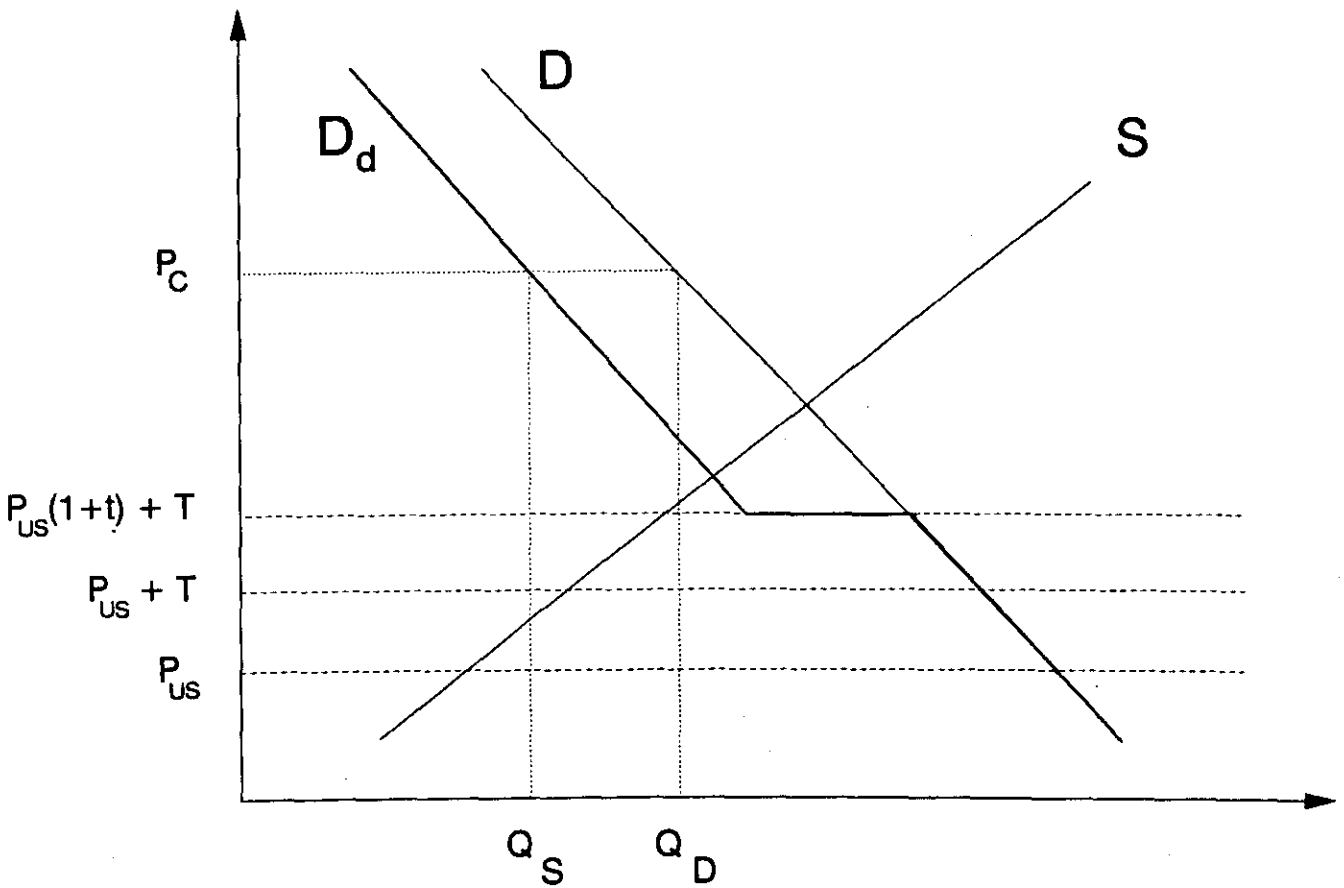
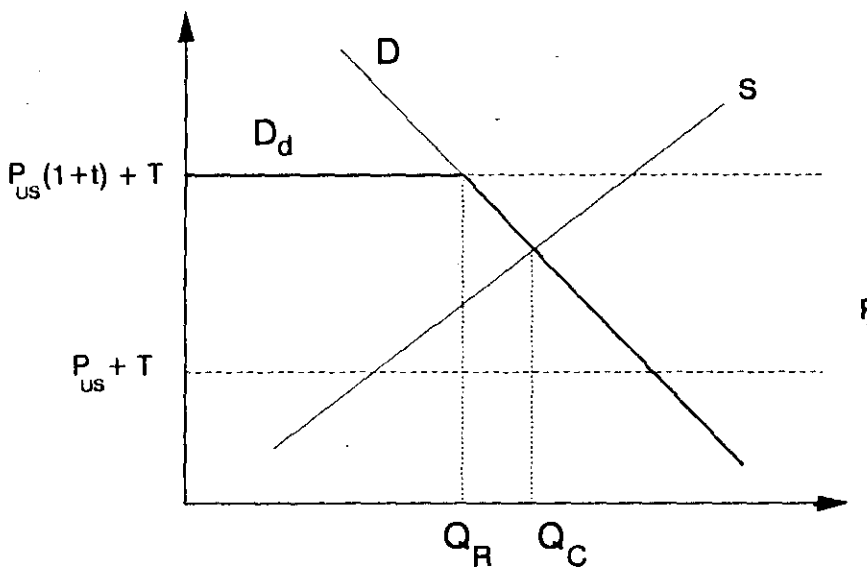
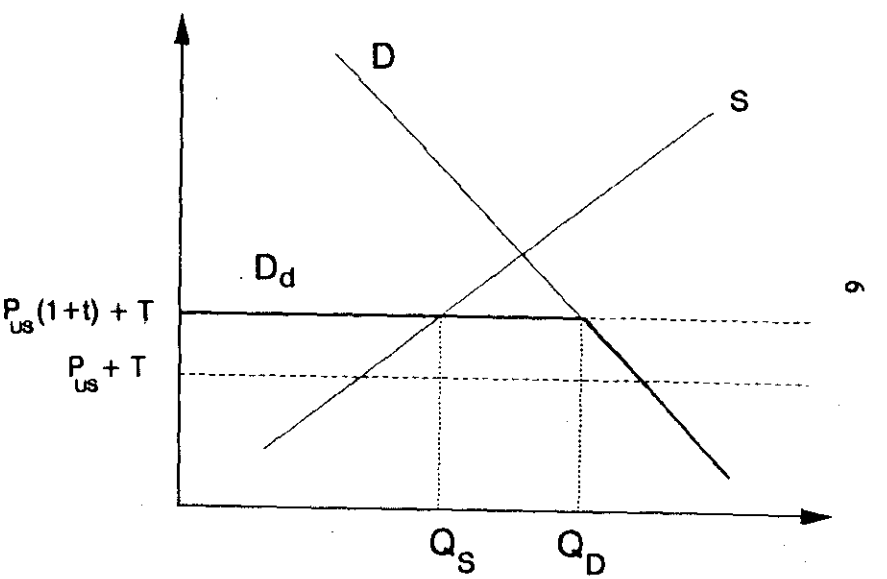


Figure 2 - Tariffication of the Canadian Chicken Market

Supply management with tariff on imports



(a) Large Tariff



(b) Small Tariff

solution. Because of the ceiling on domestic prices due to the access to U.S. production allowed by the tariff, it is not optimal to restrict domestic production further than the point Q_R. In both cases of competitive solution and restricted production, the domestic market is filled by domestic production and no product is imported.

When the import price plus tariff is below the autarkic solution, such as in Figure 2 (b), then there will be some imports from the United States. In this case, a marketing board maximizing producers' returns will have no incentive to restrict domestic production below the competitive solution Q_S because there is no price effect associated with domestic supply restrictions.

The Canadian Chicken Market

It is therefore apparent that replacing import quotas with tariffs could have significant effects on Canadian industries subject to supply management. The changed mode of protection would alter the scope for supply restrictions to increase producers' returns, and the volume of imports would also be affected by changed domestic production and consumption levels. In particular, it is possible to choose a large enough tariff that would preserve the price in Canada at the same level as with import quotas. However, as depicted in Figure 2(a), this case would not be associated with the same level of imports if marketing boards are allowed to maximize producers' returns. If the tariff is chosen at a lower level to induce the same import level, as illustrated in Figure 2(b), Canada's domestic price will fall.

To gain some insight into the relevant trade-offs, this section develops an empirical example for the Canadian chicken market. The analysis is carried out at the wholesale level, which is the marketing level where trade takes place. Consider first the data for 1980-89 reported in Table 1. The first two columns report Canadian and U.S. wholesale chicken prices, both expressed in Canadian cents per kilogram.[5] It is apparent that prices in Canada have been considerably higher than those in the United States during the 1980s. Assuming that this is due exclusively to the effects

Table 1. Chicken prices and implicit tariffs in the 1980s

Year	Canadian Price[a]	U.S. Price[b]	Transport Cost	Implicit Tariff
	— Canadian $/kg —			Percent
1980	1.662	1.207	0.094	29.9
1981	2.007	1.225	0.096	56.0
1982	1.955	1.193	0.098	55.6
1983	2.092	1.340	0.098	48.8
1984	2.286	1.594	0.104	36.9
1985	2.032	1.534	0.110	25.3
1986	2.182	1.744	0.111	18.8
1987	2.082	1.390	0.106	42.1
1988	2.115	1.527	0.098	32.1
1989	2.478	1.535	0.094	55.3

[a]Wholesale price in Ontario (Agriculture Canada).
[b]U.S. 12-city wholesale price (USDA) in Canadian currency.

of trade restrictions, the implicit tariff levels underlying these price differences can be calculated. For example, the U.S. tariffication proposal suggests computing such a tariff by $t = (P_d - P_w)/P_w$, where P_d is the domestic price of the country imposing the trade restrictions, and P_w is the world (import) price. For this expression to be applicable, the latter price must take into account transportation costs. Hence, the third column of Table 1 reports estimated transportation costs.[6] Given this, the last column reports the implicit tariffs computed as:

$$t = \frac{P_C - P_{US} - T}{P_{US}}, \tag{1}$$

where t is the implicit tariff, P_C is the price of chicken in Canada, P_{US} is the price of chicken in the United States, and T is the estimated transportation cost.[7]

The implicit tariffs reported in Table 1 vary considerably from year to year. This is not surprising because one of the effects of NTBs is to insulate domestic markets, thus preventing the transmission of price signals (Bale and Lutz 1979). This makes it clear that with price variability a tariff cannot be fully equivalent to an import quota, so equivalence should either be defined in a contingent sense or, more restrictively, in an expected value sense.[8] Variability aside, the implicit tariff for Canadian chicken imports based on U.S.-Canadian price differences is large. For the ten years considered in Table 1, the average implicit tariff is 40.1 percent. However, these implicit tariffs are equivalent to current import quotas only in the sense of allowing the domestic price to be preserved at the same level (under the assumption that marketing boards will continue to exercise their market power to the extent allowed by the tariff). In particular, with this tariff there is nothing to guarantee that market access for U.S. exports will be preserved at the current import quota level.

An important question that emerges in this setting concerns the level at which the tariff should be set to induce a Canadian import level at least equal to current import quotas. For this question,

however, information regarding Canadian chicken demand and supply parameters are needed. To provide an exploratory empirical analysis, a simple simulation model is developed. This model assumes a linear domestic demand, a linear domestic supply, and postulates that Canada is a small country for this product, implying that imports are available at a constant U.S. price augmented by transportation costs. The model is calibrated on the average of observed quantities and prices for 1987-89, the last three years of the period.[9] If $\overline{Q}_D$ denotes the average quantity demanded and $\overline{P}_D$ denotes the average (demand) price for these three years, then the linear demand curve calibrated on these points can be written as:

$$D = \overline{Q}_D + \epsilon \frac{\overline{Q}_D}{\overline{P}_D} (P - \overline{P}_D) , \tag{2}$$

where ϵ is the elasticity of demand evaluated at $(\overline{Q}_D, \overline{P}_D)$.

A similar procedure can be followed for the linear supply curve. In this case, though, the relevant supply price (marginal cost) is lower than the observed wholesale price because supply management reduces domestic output below the competitive level. Let $\overline{P}_S$ represent the average supply price and $\overline{Q}_S$ denote the average quantity supplied for the last three years. Then a linear supply curve calibrated on these points can be represented as:

$$S = \overline{Q}_S + \eta \frac{\overline{Q}_S}{\overline{P}_S} (P - \overline{P}_S) , \tag{3}$$

where η represents the elasticity of supply at the point $(\overline{Q}_S, \overline{P}_S)$. Because P_S is not observable, we define $\overline{P}_S = \theta \overline{P}_D$, where θ is a constant to be determined that illustrates the extent of the current departure from marginal cost pricing.

To make the model operational, three parameters are required: the demand elasticity ϵ, the supply elasticity η, and the constant θ indicating the departure from marginal cost pricing at the wholesale level. To provide some sensitivity analysis for these results, for each of these three parameters we assume three distinct values. For the elasticity of demand ϵ these values are: -0.3, -0.5, and -0.7.[10] For the elasticity of supply η these values are: 0.5, 1.0, and 1.5.[11]

The difficult problem in this framework is to choose an appropriate value for θ. It should be clear that what we want is a competitive supply curve at the wholesale level, which is essentially a marginal cost relationship at the production level augmented by the cost of marketing services. Under the assumption of competitive marketing margins, the difference between market price and supply price at the wholesale level is the same as that at the farm level, and the latter is simply the rental value of production quotas. The rental value of production quotas can be estimated by discounting observed capital values of production quotas. Using this procedure we get an estimate of $\theta = 0.74$.[12] An alternative is to assume that Canadian producers are as efficient as their U.S. counterparts at the current production level. This is equivalent to assuming $P_S = P_{US}$, and for the three years under consideration this yields (approximately) $\theta = 0.67$. We look at the implications of both these assumptions and also consider the case of $\theta = 0.80$ under the assumption that Canadian producers are far less efficient that their U.S. counterparts.

For 1987-89, domestic production averaged 521.1 million kilograms and imports averaged 40.0 million kilograms. Ignoring exports and changes in stocks, both negligible, domestic consumption is approximated by the sum of production and imports. Hence, $\overline{Q}_S = 521.1$ and $\overline{Q}_D = 561.1$. Also, from Table 1, it is possible to compute the average for these three years of the Canadian wholesale price ($\overline{P}_D = 222.5$), of the U.S. wholesale price ($\overline{P}_{US} = 148.4$), and of transportation costs ($\overline{T} = 10.0$).

Given these assumptions, some relevant equivalent tariff levels can now be computed. First, we can compute the tariff that could keep the domestic price in Canada at the pretariffication level. This "price-preserving" equivalent tariff, denoted t_p, is computed as:

$$t_p = \frac{\overline{P}_D - \overline{P}_{US} - \overline{T}}{\overline{P}_{US}} . \tag{4}$$

This tariff is not affected by alternative assumptions about ϵ, η, and θ, and its estimated value is t_p = 43.2 percent. This is essentially the mean of the implicit annual tariffs reported in Table 1 for the last three years, and it is the equivalent tariff that we find using the price gap formula suggested in the U.S. tariffication proposal (USTR 1989a, 1989b). Although domestic production could be restricted at the observed level of 521.1 million kilograms with a tariff of 43.2 percent, it should be clear that there is no incentive for Canadian producers to do so. A marketing board trying to maximize producer revenue under this tariff constraint would increase domestic production to satisfy total demand, thereby driving U.S. imports to zero.

An equivalent tariff (denoted t_m) that would preserve imports at the level of the current quota, presumably the minimum access commitment for exporters to Canada to support tariffication, is:

$$t_m = \frac{P_m - \overline{P}_{US} - \overline{T}}{\overline{P}_{US}}, \tag{5}$$

where P_m solves $D - S = \overline{Q}_D - \overline{Q}_S$; that is:

$$P_m = \frac{\eta \overline{Q}_S - \epsilon \overline{Q}_D}{\eta \dfrac{\overline{Q}_S}{\theta \overline{P}_D} - \epsilon \dfrac{\overline{Q}_D}{\overline{P}_D}} .$$

The value of t_m depends on the assumptions about ϵ, η, and θ.[13] Table 2 reports the estimated t_m that emerges from all possible combinations of the assumed parameters. Clearly, the value of t_m is larger as demand is assumed more elastic and as supply is assumed more inelastic. Also, as the current departure from marginal cost pricing in Canada is smaller (θ increases towards 1) the value of t_m increases.

For the midrange of the parameter values considered (ϵ = -0.5; η = 1.0; and θ = 0.74), the analysis is summarized and illustrated in Figure 3. In this case the import-preserving equivalent tariff is t_m = 15.4 percent. Hence, the tariff required to preserve imports of U.S. chicken at their current levels is considerably smaller than the tariff required to preserve the price in Canada at the current level, which was estimated at t_p = 43.2 percent. Note that a tariff of 15.4 percent would be associated with a much lower domestic price, an expanded domestic production, and an expanded consumption. It is interesting to consider the implications of these results in the context of a tariff-rate quota system as a transitional device for tariffication, as proposed by the United States (USTR 1989b). If the quota were set at the current level with a zero within-quota tariff and an over-quota tariff equal to t_p, then cutting the over-quota tariff would result in a decline of Canadian prices but would not improve market access for the United States until the over-quota tariff was cut by two-thirds of its calculated value using the price gap approach.

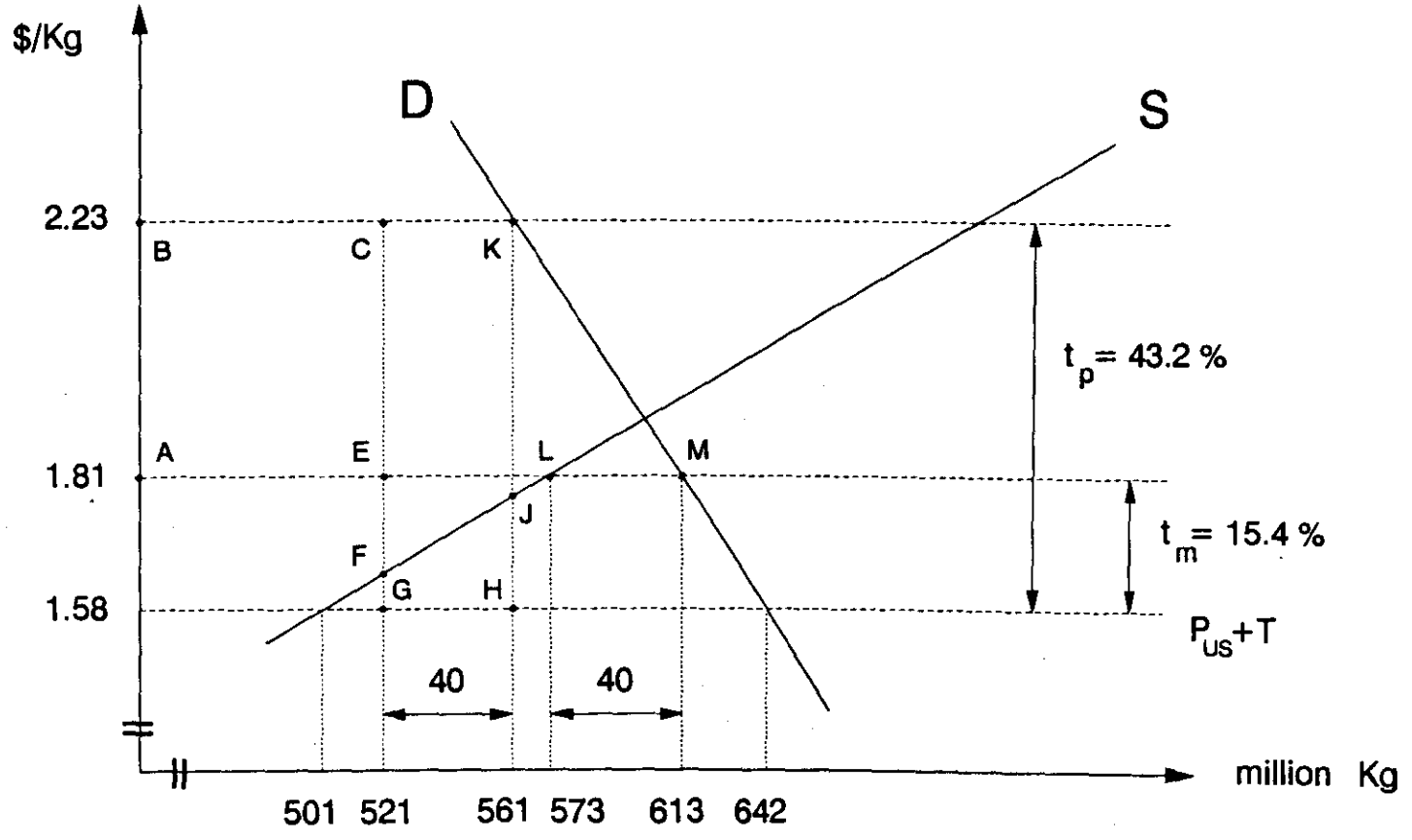
Who gains and who loses from tariffication depends crucially on what level of equivalent tariff is chosen. If the tariff is chosen to preserve domestic prices (t_p = 43.2 percent), then Canadian producers can take over the entire domestic market and would be the major beneficiaries. For the case illustrated in Figure 3, we can calculate an increase of producer surplus of $20.6 million (area FCKJ).[14] Canadian consumers are indifferent as long as they have to pay the same price. Whether Canada as a whole gains or loses depends on who is currently receiving the import quota rent (GCKH) under the import quota system. If Canada were receiving the entire import quota rent,

Table 2. Trade-preserving equivalent tariffs (percent)

		$\epsilon = -0.3$	$\epsilon = -0.5$	$\epsilon = -0.7$
$\theta = 0.67$	$\eta = 0.5$	8.3	14.2	18.3
	$\eta = 1.0$	2.1	6.5	10.0
	$\eta = 1.5$	-0.4	2.9	5.8
$\theta = 0.74$	$\eta = 0.5$	16.9	21.5	24.8
	$\eta = 1.0$	11.8	15.4	18.2
	$\eta = 1.5$	9.6	12.4	14.8
$\theta = 0.80$	$\eta = 0.5$	23.5	27.1	29.6
	$\eta = 1.0$	19.4	22.3	24.5
	$\eta = 1.5$	17.7	19.9	21.8

Figure 3 - Canadian Chicken Market 1987-1989

Equilibrium with alternative tariffication schemes



then, for the case illustrated in Figure 3, tariffication with t_p results in reduced welfare as this rent is dissipated, and efficient U.S. production is displaced by increased (relatively inefficient) domestic production, leading to the welfare loss of trapezoid GFJH.

If the equivalent tariff is chosen to preserve import volumes at the same level as with the import quota system (t_m = 15.4 percent), the outcome would be quite different. Canadian producers and processors would lose area ABCE and gain area FEL, resulting in a net producer surplus loss of $211.3 million. Canadian consumers, on the other hand, would gain area ABKM, equal to $242.9 million. Canada as a whole would unequivocally gain from this process. The main feature of this case would be the large transfer of welfare from domestic producers and processors back to domestic consumers. The gain in consumer surplus represents approximately $28 per Canadian household, while the loss in producer surplus represents about $70,000 per broiler farm. Even allowing for the possibility that a portion of this loss might be born by processors, it is apparent that Canadian producers are not likely to support this type of tariffication.

Finally, if tariffication were successfully implemented and the equivalent tariff reduced to zero, the free-trade competitive solution of this model, illustrated in Figure 3, implies a domestic price of $1.58 per kilogram, domestic production of 501 million kilograms, and domestic consumption of 642 million kilograms. Thus, free trade would entail a modest decline in domestic production from its current level, and an increase in domestic consumption leading to a threefold increase of imports from the United States.

Concluding Remarks

Tariffs and quotas are equivalent under perfect competitive conditions, and in this case conversion of quotas into tariffs is a fairly straightforward process. However, what motivates tariffication is the nonequivalence of tariffs and quotas under a number of scenarios. One of these

scenarios arises when the domestic market is not perfectly competitive, which is the case of the Canadian markets subject to supply management. Tariffication in this context requires choosing equivalence. This paper has presented an equivalent tariff that would preserve Canadian domestic prices at the same level as with an import quota, and an equivalent tariff that would preserve imports at the same level as with import quotas. These two tariffs are quite different. Because of the competitive inefficiency built into the current price gap between Canada and the United States, the equivalent tariff required to maintain Canadian prices at the same level as with the import quota system is almost three times the equivalent tariff that would guarantee the same level of imports from the United States.

ENDNOTES

1. In this document, four interrelated areas of trade reform were indicated: (1) import access, (2) export competition, (3) internal support, and (4) sanitary and phytosanitary measures. The tariffication program was also the object of an earlier discussion paper released by the United States (USTR 1989a).

2. Related nonequivalence cases are obtained when monopolistic elements are allowed in the holding of import quotas and/or in foreign production (Shibata 1968; Bhagwati 1968).

3. The level of import quota agreed to in the Canada-U.S. free-trade agreement is 7.5 percent of domestic consumption. The import tariff for broiler chicken was set at 12.5 percent and starting in 1989 is scheduled to be phased out by 1999.

4. Note that formulating the import price in this manner assumes that the tariff is levied on the FOB chicken price (excluding transportation costs), which conforms with the current Canadian code.

5. For Canada, this is the wholesale price in Ontario, whereas for the United States this is the 12-city composite wholesale price. Ontario prices are typically similar to Quebec prices, and Ontario and Quebec account for most of the chicken imports into Canada.

6. Average transportation costs for the recent period are estimated at about 8 U.S. cents per kilogram, or about U.S. $1,450 for a 40,000-lb truckload. Because U.S. chicken exports to Canada originate from the southeast, this estimate is on the higher side of data estimates given by Ward and Farris (1989). Given that visa transportation rates have been reasonably stable in recent years, we assume that the cost of 8 U.S. cents per kilogram holds for the entire period under consideration. The data in Table 1 are then obtained by converting this cost to Canadian currency.

7. This formula assumes that the tariff applies only to the chickens and not to transportation costs, as noted earlier.

8. Under uncertainty a tariff results in a distribution of import volumes, whereas an import quota results in a distribution of implicit tariffs. Hence, the issue of price variability transmission requires some consideration in the analysis of equivalent tariffs, especially if we want to allow for risk aversion. It should be clear, however, that from the Canadian perspective it is not only a matter of foreign price instability transmission, as the variability of the computed implicit tariff is just as dependent on the variability of the Canadian price. For example, the big changes in the implicit tariff from 1980 to 1981 and from 1988 to 1989 depend almost exclusively on changes in Canadian prices, given fairly stable U.S. prices.

9. Using data for some recent period to calculate appropriate equivalent tariffs for NTBs is explicitly advocated in the U.S. tariffication proposal (USTR 1989b). From Table 1 it is clear that the three years chosen provide an accurate representation of Canadian-U.S. price differences in the 1980s.

10. This range is consistent with recent estimates (Young 1987). Note, however, that published demand elasticities typically are estimated at the retail level and cannot be related to our level of analysis (wholesale) without some arbitrary assumption about the behavior of marketing margins.

11. The midvalue of these elasticities may provide a reasonable assumption for the intermediate run. Chavas (1978) estimates a long-run elasticity of broiler supply of approximately 0.8 for the United States. Canadian supply may be more elastic than this because of unused capacity and unexploited scale economies at the farm level due to supply restrictions.

12. The capital value of chicken quotas in Ontario for 1987-89 averaged approximately $16 per unit (Michael Katz, Agriculture Canada, personal communication), where a unit of quota allows a producer to market 9.5 kilograms (live weight) of chicken per year. Converting this to eviscerated weight and applying a discount rate of 25 percent yields a rental value of per kilogram quotas of $0.575. [Using a fairly high discount rate is warranted by arguments in Barichello (1984) and Lermer and Stanbury (1985) and by the fact that exchange of quotas until 1989 was tied to physical facilities.] Given an average wholesale price of $2.225 per kilogram, this gives (approximately) $\theta = 0.74$.

13. Note that the special case of $\theta = 1$ (no supply restrictions) yields $P_m = P_D$ and $t_m = t_p$.

14. The limitations of producer and consumer surplus as welfare measures are well known (Just, Hueth, and Schmitz 1982). The objective of this section is simply that of outlining the broad welfare implications of tariffication.

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