Transmission of Price Variability under Tariffication

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GATT Research Paper 90-GATT 7
July 1991

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This material is based upon work supported by the Cooperative State Research Service, U.S. Department of Agriculture, under Agreement No. 89-38812-4480.

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ABSTRACT

Recent proposals to the General Agreement on Tariffs and Trade (GATT) have called for the conversion of all nontariff trade barriers into their tariff equivalents and the subsequent reduction of these tariff equivalents over time. The purpose of tariffication is to provide a methodology to quantify nontariff trade barriers to make them more visible and to provide a framework within which to reduce them. Many of these barriers are designed to stabilize domestic prices by breaking the link to world prices and, thus, the link with the variability of world prices.

Whereas the purpose of the tariffication proposal is to quantify and slowly eliminate price wedges, the proposal has the side effect of replacing domestic price-stabilizing policies with a policy that dramatically increases domestic price variability. For example, if a country replaces its nontariff trade barriers with a 100 percent tariff and world prices then increase from $2 to $4, the domestic price would increase from $4 to $8. This example illustrates that ad valorem import tariffs magnify world price variability, which will affect the political acceptability of the tariffication proposals.

This paper examines the transmission of price variability under tariffication. Alternative tariff reduction formulas are considered, including a proposed modification of an existing formula that would slowly introduce world price variability into domestic markets while reducing the price wedge over time. A two-country, one-commodity model, which includes random error terms in the supply and demand equations, demonstrates the effects of tariffication and the reduction of the tariff equivalent by using both existing formulas and the proposed reduction formula. Simulation results obtained by using a two-country, one-commodity trade model indicate that the new formula gradually transmits world price variability to domestic markets.

TRANSMISSION OF PRICE VARIABILITY UNDER TARIFFICATION

Recent proposals to the General Agreement on Tariffs and Trade (GATT) have called for the conversion of all nontariff trade barriers into their tariff equivalents and for the subsequent reduction of these tariff equivalents over time. The purposes of tariffication are to provide a methodology to quantify nontariff trade barriers, thereby making them more visible, and to provide a framework within which to reduce them. Many nontariff trade barriers are designed to stabilize domestic prices by breaking the link to world prices and, thus, the link to the variability of world prices.

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This paper examines the transmission of price variability under tariffication. Alternative tariff-reduction formulas are considered, including a proposed modification of an existing formula that is developed to slowly introduce world price variability into domestic markets while reducing the price wedge over time. A two-country, one-commodity model, which includes random error terms in the supply and demand equations, demonstrates the effects of tariffication and the reduction of the tariff equivalent using both existing formulas and the proposed reduction formula.

First, the advantages and disadvantages of existing tariff-reduction formulas are presented. One of the existing formulas is then modified to slow the transmission of price variability from world to domestic markets. Next, the results of simulating tariffication and reducing the tariff equivalent by using the two-country, one-commodity model are presented. Finally, a summary of important results is presented.

Tariff Equivalent Reduction Formulas

Several alternative adjustment formulas for the tariff are available. Perhaps the most intuitive and reasonable from a modeling viewpoint is to reduce the tariff by $1/X$ of the *initial* tariff level in each year, where X is the number of years over which the tariff is to fall to zero. Unfortunately, this concept may not appeal to trade negotiators because the measured tariff levels in each year would depend on domestic policies and world price levels. Countries are not likely to agree to a tariff adjustment system that makes domestic agricultural policy a function of potentially volatile world prices. Indeed, the motivation for the protectionist policies of many countries is to insulate domestic markets from the frequent wild swings in world prices. Hence, those countries will be reluctant to accept a proposal that would immediately transfer this volatility to domestic prices and markets, at least until the impact of liberalization has stabilized world prices. The agreed-upon adjustment path, therefore, needs to allow for annual changes in world price levels.

A second alternative is the Swiss formula considered in the Tokyo Round of the GATT negotiations (Tangermann, Josling, and Pearson 1987). This formula can be written as

$$t_t = \frac{At_{t-1}}{A + t_{t-1}}, \tag{1}$$

where t_t is the tariff level that must be achieved in a given year, t_{t-1} is the tariff level in the previous year, and A is the negotiated coefficient of adjustment.

The formula allows for a lagged response to changes in world price levels. The tariff adjustment is not instantaneous, however. Tariffs in this formula are determined in advance;

consequently, large changes in world prices have an impact on domestic prices. The tariff will adjust to these world price changes, but the adjustment occurs a full year after world prices change. In addition, the nature of the formula guarantees that, for all probable levels of the negotiated coefficient, the brunt of the adjustment will be borne in the early years of the agreement. This concept is demonstrated in Figure 1, in which the tariff adjustment paths for several values of A (the adjustment coefficient) are presented. The rapid adjustment of tariffs with this formula may be more suited to the industrial trade barriers considered in the Tokyo Round of the GATT negotiations than to agriculture. Adjustment costs in agriculture would be relatively high. At the same time, the level of protectionism in agriculture is greater now than was the case during the Tokyo Round. Also, the Swiss formula does not allow for a reduction of a given tariff to zero over a specified number of years. Unless the value of the adjustment coefficient is zero, the value of the tariff will never reach zero.

The following proposed modification of the Swiss formula addresses the problems inherent in the first two alternatives.

$$t_t = \frac{(\frac{r}{n})A t^a_{t-1}}{(\frac{r}{n})A + t^a_{t-1}}, \tag{2}$$

$$t^a_{t-1} = \frac{(P_{d,t-1} - P_{w,t})}{P_{w,t}}, \tag{3}$$

where t^a_{t-1} is the ex-ante tariff, n is the negotiated length of the adjustment period, r is the number of years remaining in the agreement, P_d is the domestic price, and P_w is the world price. This formula allows for a wide range of adjustment paths, as shown in Figure 2. The advantages of the proposed

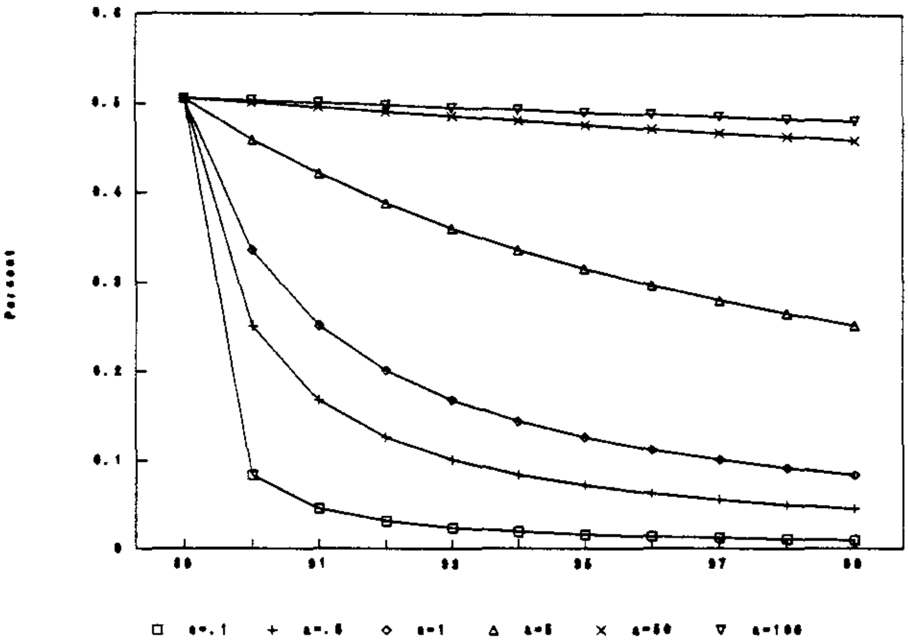

Figure 1. Alternative Swiss formula adjustment paths

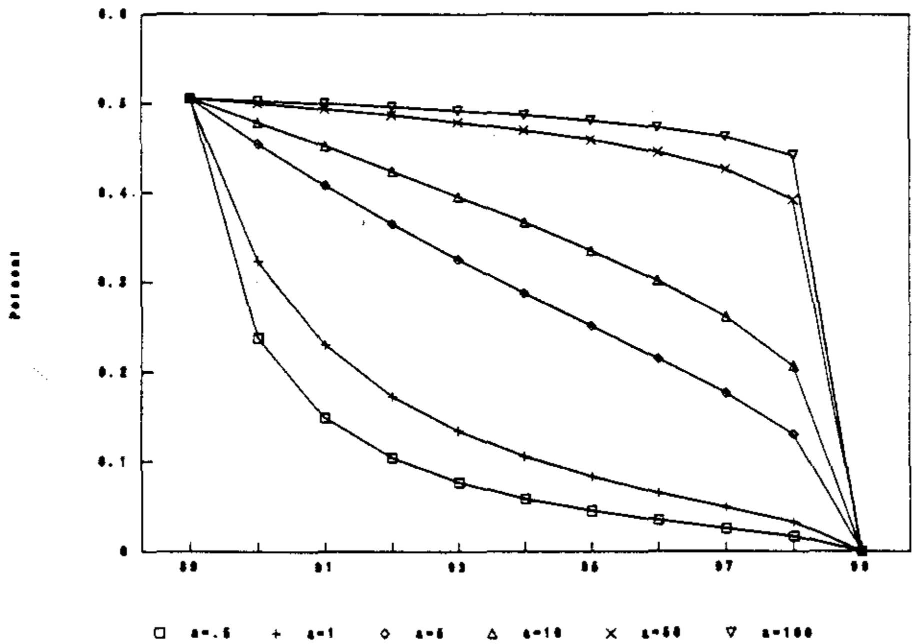

Figure 2. Alternative modified Swiss formula tariff-reduction adjustment paths

formula are that a target date by which zero trade barriers must be achieved can be stipulated and that the formula automatically adjusts the tariff to allow for world price movements.

In addition, under the proposed formula, the tariff adjusts instantaneously to compensate for changes in world prices, which serves to isolate the domestic market from changes in world prices without transmitting domestic price variability to the world market.

A second alternative is to replace $P_{d,t-1}$ with $P_{d,t}$ in (3). This substitution is feasible but would allow the tariff to adjust for domestic disturbances and would allow the importing country to export domestic price variance to the world market. This version of the formula would be unacceptable to exporting countries.

The practical implications of these alternatives can best be understood with a simple example. Consider an importing country that uses a variable export levy to maintain domestic price stability. This policy essentially exports the effects of domestic disturbances to world markets. Should this country shift to an ad valorem tariff, disturbances in world markets would be transmitted to domestic markets. The modified Swiss formula shown in (2) and (3) would at first isolate the effects of domestic and world disturbances; that is, prices in the importing country would reflect disturbances in that country, whereas prices in world markets would reflect disturbances in world markets. As world and domestic prices moved together, then so too would the variance of world and domestic prices. In the last year of the agreement, the two disturbances would be identical. (Presumably world price variance would be lower after trade barriers are removed.)

An Empirical Example

To demonstrate this theory, we have constructed a simple empirical model. For realism, we have used actual prices and elasticities; however, the model is too simplistic to provide real-world predictions. These results are presented only to demonstrate the concepts that underlie the formula just discussed. Any attempt to introduce more realism (such as introducing other countries and commodities) would unduly complicate the model and disguise the more relevant results.

This model contains two countries (the United States and the European Community). The United States begins as a net importer and the European Community as a net exporter. However, these situations are reversed as markets are liberalized. We assume in the base case that the European Community replaces its variable import levy when this occurs. Table 1 presents the base year data and assumed elasticities.

The supply and demand specifications for each country take the general form

$$QS_i = f_i(P_i, \alpha_i, \tau_i),\ i = 1, 2 \tag{4}$$

$$QD_i = g_i(P_i, \beta_i, \nu_i), \tag{5}$$

$$ES_1 = QS_1 - QD_1, \text{ and} \tag{6}$$

$$ED_2 = QD_2 - WS_2, \tag{7}$$

where QS_i is the quantity supplied in country i, QD_i is the quantity demanded in country i, ES_1 is the excess supply in country 1, ED_2 is the excess demand in country 2, P_i is the price in country i, α_i is a supply shifter in country i, β_i is a demand shifter in country i, and τ_i and ν_i are randomly distributed mean zero error terms with variance σ_i and ω_i, respectively.

The world market is represented by

$$ES_1 = ED_2, \tag{8}$$

$$P_2 = (E \bullet Z_1 \bullet P_1) + Z_2, \tag{9}$$

$$Z_1 = E(1 - s_1)(1 - s_2)(1 + t_1)(1 + t_2), \text{ and} \tag{10}$$

$$Z_2 = E(T_1 - S_1 + C) + T_2 + S_2, \tag{11}$$

Table 1. Base year data and assumed elasticities

	United States (Country 1)	European Community (Country 2)
Elasticities		
Supply	0.65	0.55
Demand	-0.70	-0.70
1986 Data		
Supply	11.292	7.445
Demand	12.031	6.991
Net imports	0.739	-0.454
Price	1.878	3.221
Coefficients		
f_{i1}	3.952	3.350
f_{i2}	3.908	1.271
τ_i	1.271[a]	0.596[a]
g_{i1}	20.453	11.885
g_{i2}	-4.484	-1.519
ν_i	0.352[b]	0.444[b]

Note: The base year is 1986. The data and elasticities are taken from Roningen and Dixit 1988.

[a] Variance of the random term in the supply equation in country i.
[b] Variance of the random term in the demand equation in country i.

where E is the exchange rate, s_1 is an ad valorem export subsidy, S_1 is a specific export subsidy, s_2 is an ad valorem import subsidy, S_2 is a specific import subsidy, t_1 is an ad valorem export tariff, T_1 is a specific export tariff, t_2 is an ad valorem import tariff, T_2 is a specific import tariff, and C is the transportation cost between country 1 and country 2.

Several alternative policies can be represented by (10) and (11). For example, to examine the effects of changes in the import tariff on the importer's price, (10) reduces to $E \bullet (1 + t_2) \bullet P_1$, and (8) reduces to $E \bullet C$.

Under a variable levy, the link between the importer's price and world prices, equation (10), is replaced by a constant import price, $\bar{P}_2$. The effect is to prevent the transmission of world price variability into the importer's markets.

To analyze the transmission of variability under various trade policies, the model was simulated for 100 iterations by using the program @RISK. The program solves for the equilibrium prices and quantities for a given set of disturbance terms. A new set of disturbance terms is then generated and new equilibrium values are found. This process is then repeated 100 times to generate a price distribution for each policy and/or year. The parameters of the resulting price distributions can then be used as proxies for those of the true distributions.

The policies include no trade, free trade, ad valorem import and export subsidies and tariffs, and a variable levy. The resulting means and variances of the endogenous variables are presented in Table 2.

Table 2. Mean prices and variances under various trade policies

		U.S. Price		EC Price	
Policy Level	Protection (percent)	Mean ($/kg)	Variance	Mean (ECU/kg)	Variance
No Trade	NA	1.97	0.0261	3.05	0.0682
Free Trade	0.00	2.18	0.0214	2.53	0.0242
U.S. Export Subsidy	0.50	2.50	0.0242	1.55	0.0069
U.S. Export Tariff	0.50	1.93	0.0264	3.28	0.2597
EC Import Subsidy	0.50	2.50	0.0215	1.55	0.0061
EC Import Tariff	0.50	1.93	0.0258	3.29	0.2469
EC Variable Export Restitution	0.75	1.87	0.0320	3.44	0.0000

In the no-trade scenario, the EC price is much higher than is the U.S. price. Under free trade, the prices differ only by the transportation costs, and the variances are similar. Under an import or export subsidy, U.S. prices rise and EC prices fall relative to the free-trade levels, and the variance of EC prices falls. Under an export or import tariff, U.S. prices fall and EC prices rise relative to free-trade levels, and the variability of EC prices increases by a factor of 10. Under a variable levy, the U.S. prices fall and variability increases relative to free trade, whereas the EC prices are much higher than the free-trade results. The variability of EC prices under the variable levy is zero because the prices are set exogenously. The implication for tariffication is that U.S. prices will increase and their variability will decrease, whereas EC prices decrease as their variability increases. The extent of the increase in variability of EC prices will depend on the formula chosen to decrease the tariff equivalent over time.

Tariffication of the EC Variable Levy

The tariff equivalent of the variable levy can be found in this two-country, one-commodity model by driving a wedge between the prices until prices and quantities under the tariff are exactly equivalent to those under the variable levy. The calculated tariff equivalent of the variable levy is 0.64. The tariff equivalent is then reduced over time by using the modified Swiss and the Swiss formulas.[1]

The results of simulating the reduction of the tariff equivalent over 10 years are presented in Figures 3 through 8. The modified Swiss formula is used in Figures 3, 5, and 7 and the Swiss formula is used in Figures 4, 6, and 8. The results presented are for year 1 (Figures 3 and 4), year 5 (Figures 5 and 6), and year 10 (Figures 7 and 8).

As shown in Figures 3 and 4, the variability of EC prices is less in year 1 under the modified Swiss formula because this formula adjusts the tariff as the world price changes, so world price

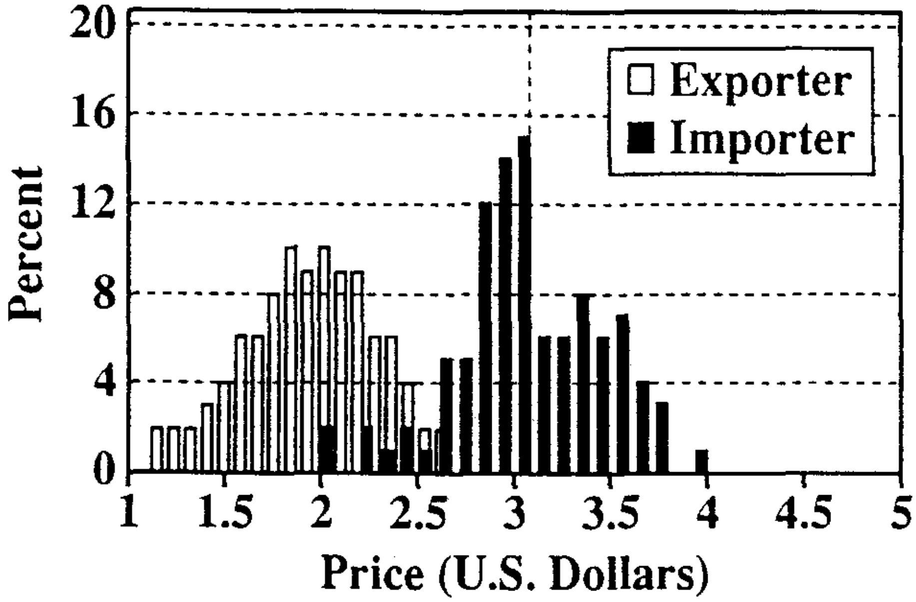

Figure 3. Exporter and importer price distributions for year 1 of tariff reduction using the modified Swiss formula

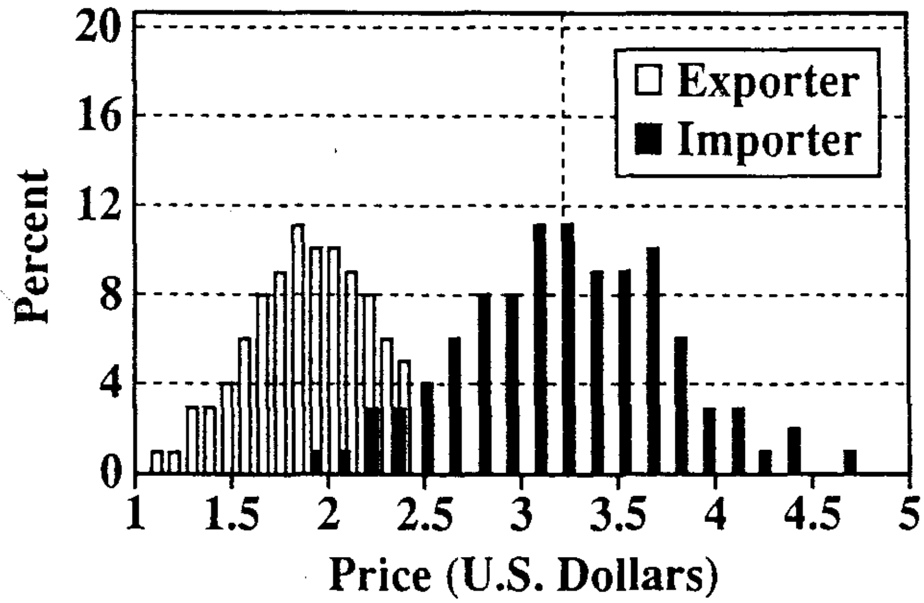

Figure 4. Exporter and importer price distributions for year 1 of tariff reduction using the Swiss formula

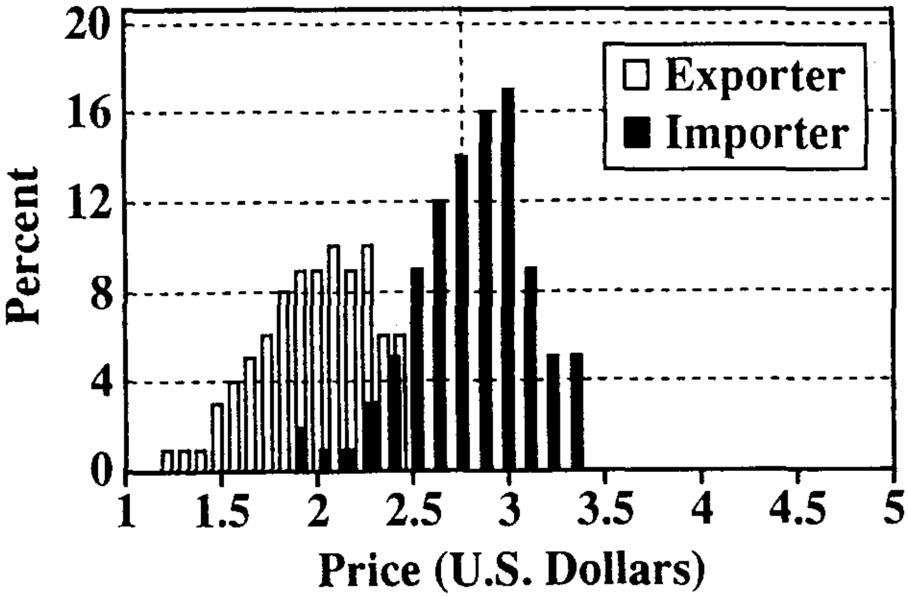

Figure 5. Exporter and importer price distributions for year 5 of tariff reduction using the modified Swiss formula

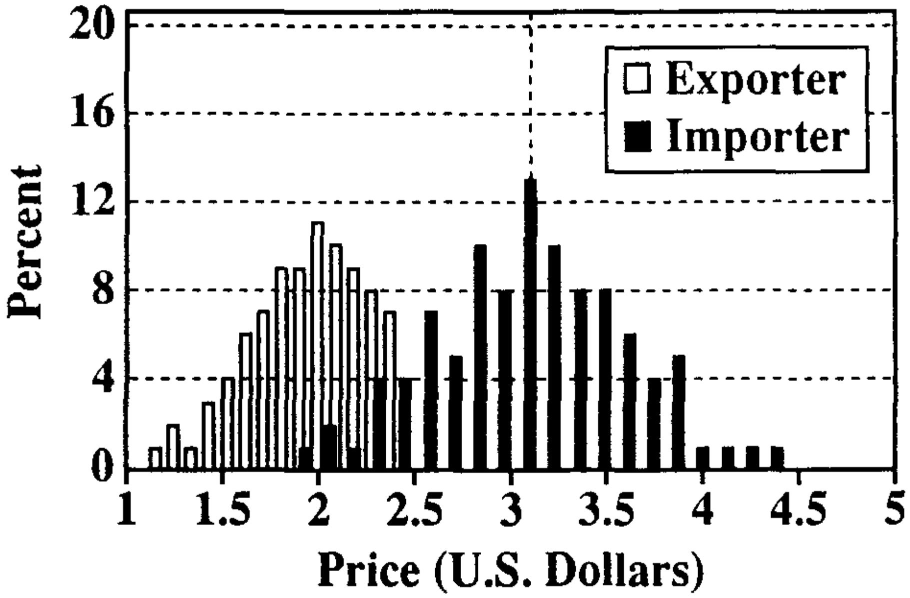

Figure 6. Exporter and importer price distributions for year 5 of tariff reduction using the Swiss formula

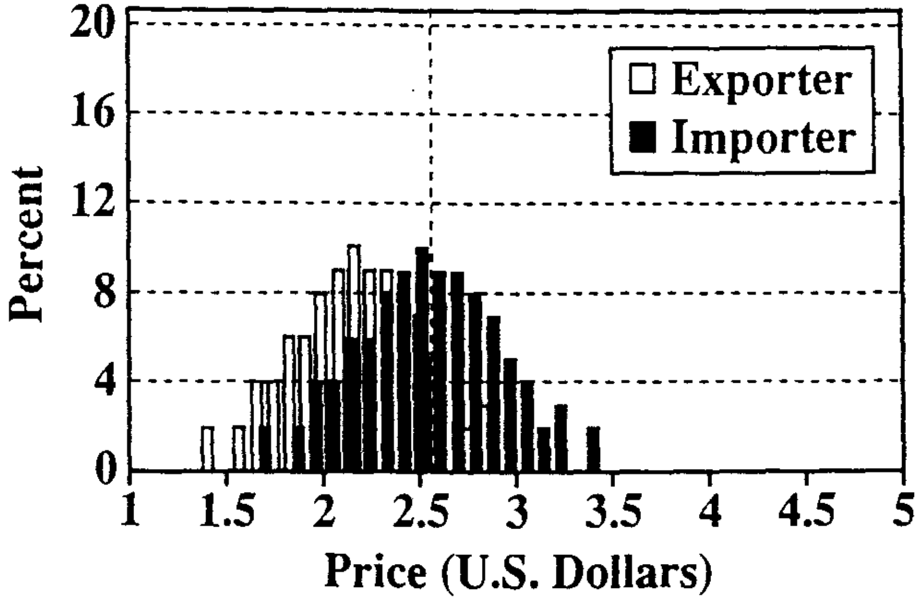

Figure 7. Exporter and importer price distributions for year 10 of tariff reduction using the modified Swiss formula

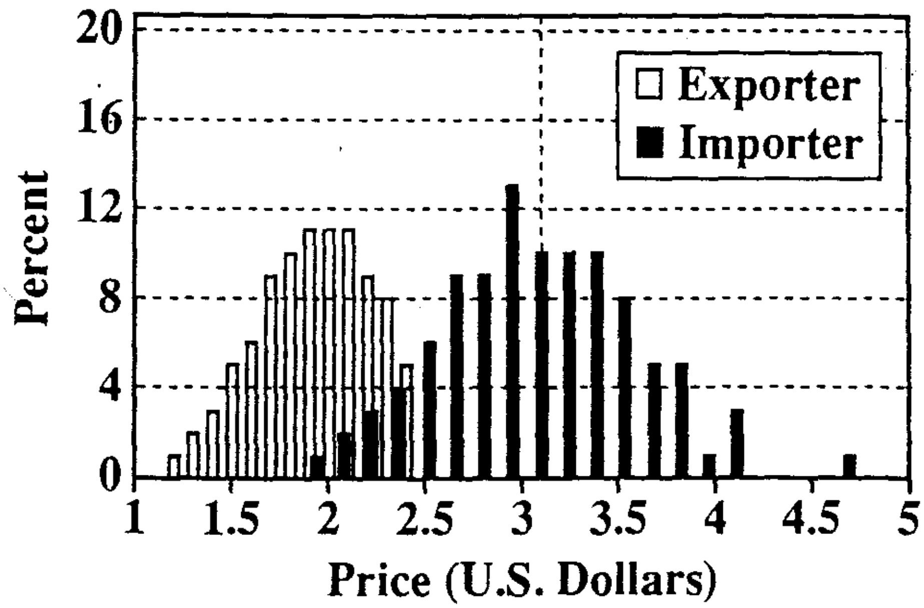

Figure 8. Exporter and importer price distributions for year 10 of tariff reduction using the Swiss formula

variability is not transmitted into the domestic market. The variability of domestic prices is attributed to only domestic disturbances and not to variability in world markets.

Tariffication of a variable levy results in domestic producers being subjected to price variability where none existed. This would be the case for tariffication of all nontariff trade barriers that are designed to set price levels. Other nontariff trade barriers that allow some degree of domestic price variability, such as quotas, would have a modest increase in domestic price variability under tariffication using the modified Swiss formula but a much larger increase when the Swiss formula is used.

In the fifth year of the reduction, the means of the distributions for the exporter and importer move closer as the tariff is reduced (Figures 5 and 6). However, the variance of prices under the modified Swiss formula continues to decrease, whereas the Swiss formula maintains a larger variance.

By the last year of the reduction, the price distributions under the modified Swiss formula are separated only by transportation costs, whereas the price distributions under the Swiss formula remain widely separated because the Swiss formula does not force the tariff equivalent to reach zero by the end of the agreement (Figures 7 and 8).

Summary and Conclusions

The tariffication proposals to the GATT promise to provide a framework for reducing trade barriers. A drawback of such proposals, however, is that ad valorem tariffs cause domestic price variance to be greater than world price variability. Given that many trade barriers have been implemented to reduce price variability, it is likely that a policy that dramatically increases price variability would be politically unacceptable.

A proposed tariff-reduction formula that gradually transmits world price variability to domestic markets is presented. Simulation results using a two-country, one-commodity trade model support the viability of this proposed new formula.

ENDNOTE

1. A small-country assumption was necessary because the degree of simultaneity in the large-country version caused convergence problems.

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