Effects of Multilateral Trade Liberalization on Prices[*]

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Abstract

To analyze the effects on prices of simultaneous tariff reductions by multiple importing countries, we construct a simple three-country model where a good is produced by a monopolist with non-constant marginal cost and imported by two countries. We specifically compare two representative tariff-reduction formulas: the "fixed-amount" and the "uniform percentage" reductions. The uniform percentage reductions may increase the consumer price in the importing country whose initial tariff is lower. Thus, importing countries with relatively low tariffs may prefer a bilateral trade agreement to a multilateral one to ensure consumer gains.

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1 Introduction

Multilateral trade negotiations under GATT/WTO have succeeded in reducing trade barriers among its member countries. Countries mutually lower their tariffs under multilateral trade liberalization. Thus, an important aspect of multilateral trade liberalization is that tariffs imposed on a particular good may be lowered simultaneously by all countries that import it. Although trade economists have analyzed tariffs extensively, theoretical work has paid little attention to this aspect. In many models, a particular good is assumed to be imported by a single country.

Moreover, when trade policies under imperfect competition are examined in the partial equilibrium framework, both segmented markets and constant marginal cost (MC) are often assumed. These assumptions are imposed to eliminate the complication that firm's choices in different markets are connected through the dependence of MC on the total output. The assumptions shut down any spillover effect across markets. Therefore, a tariff reduction by an importing country does not affect the prices in the other countries at all. This implies that even if tariffs are simultaneously reduced by importing countries, the effects of each reduction are independent from each other. Once MC becomes non-constant, however, we have to take some spillover effect into account. There are some studies which examine trade policies with non-constant MC.[1] To our best knowledge, however, simultaneous tariff reductions by multiple importing countries have not been analyzed when MC is not constant.

The purpose of this paper is to investigate the effects of tariff reductions with multiple importing countries in the presence of the spillover effects. To this end, we construct a simple three-country model where a monopolist produces a good in one of the countries with a non-constant MC technology and serves all three countries.[2] Both importing countries impose tariffs whose initial levels could be different.[3]

We first consider a tariff reduction by one of the importing countries (which we call a unilateral tariff reduction) as a benchmark case and then tariff reductions by both importing countries (which we call simultaneous tariff reductions). The comparison between unilateral and simultaneous tariff reductions would give us a new insight into bilateral and multilateral trade liberalization. The effects of simultaneous tariff reductions on the importing countries would depend not only on its own tariff reduction but also on the other country's reduction.

Furthermore, we compare the price effects of different tariff-reduction methods. In the GATT/WTO negotiations, many formulas of simultaneous tariff reductions have been considered and negotiated. When there is a dispersion in initial tariffs between countries, different formulas would have different effects on prices. We specifically consider two formulas. In the "fixed-amount" reductions, countries cut their tariffs by the same amount, while in the "uniform

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[1] See for example, Krugman (1984), Okuguchi and Serizawa (1996), Zhang and Zhang (1998), and Ishikawa (2000).

[2] This setting is the simplest model to make our point. We can obtain similar results even in the framework of oligopoly.

[3] Even if there is no production in the importing countries, they may have an incentive to impose tariffs to shift the rent from the monopolist. For details, see Brander and Spencer (1984).

percentage" reductions, countries decrease their tariffs proportionally. The latter is used in the Kennedy Round of the GATT and considered as a simple formula in GATT/WTO negotiations.[4] There have been few attempts to analyze various formulas in international trade theory.[5] Our analysis also sheds a light on various formulas discussed in multilateral negotiations.

We find that the uniform percentage reductions may increase the consumer price in the importing country whose initial tariff is lower. A negative relationship between trade costs and consumer prices in an importing country is known as the "Metzler paradox". There are only a few studies that explore the Metzler paradox in the presence of imperfect competition.[6] Fixed-amount reductions, on the other hand, always lower prices in both importing countries. An interesting implication is that importing countries with relatively low tariffs may prefer a bilateral trade agreement to a multilateral one to ensure consumer gains.[7]

The rest of the paper is organized as follows. Section 2 provides the basic structure of our model. Section 3 investigates price effects of unilateral and simultaneous tariff reductions under two different formulas. Section 4 concludes the paper.

2   The Model

We consider a world where there exist three countries (countries 1, 2 and 3) or where the good in question is traded between only three countries. Let $N = \{1, 2, 3\}$ denote a set of countries. The good is produced and supplied to all three countries by a monopolist located in country 1. The demand function in country $i \in N$ is given by

$$x_i = D_i(p_i); \quad D_i' < 0, \tag{1}$$

where x_i and p_i are, respectively, the demand and consumer price of the good in country i. We define the elasticity of the slope of the inverse demand function for the following analysis:

$$\epsilon_i \equiv \frac{D_i D_i''}{(D_i')^2}.$$

The (inverse) demand curve is concave if $\epsilon_i \leq 0$ and convex if $\epsilon_i \geq 0$. We assume that the markets are segmented. Let t_i denote a specific import tariff imposed by country i.[8] The profit function

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[4]In the WTO, the same percentage reductions of tariffs are called the "flat-rate percentage reductions". See The Secretariat of the WTO "Formula approaches to tariff negotiations" (TN/MA/S/3/Rev.2), 11 April, 2003.

[5]Exceptions are Hatta and Fukushima (1979) and Jørgensen and Schröder (2005). The welfare effects of different tariff reduction formulas are studied in a two-good, n-country, general equilibrium model in the former and in a two-country, monopolistic competition model in the latter.

[6]Panagariya (1982) shows in a general equilibrium model that the presence of monopolist in the domestic import-competing industry increases the likelihood of the Metzler paradox. Benston and Hartigan (1983) show that an import tariff may induce the domestic firm to lower its price in a spatial duopoly model.

[7]Freund (2000) shows in a different framework that a country prefers regional trade agreements to multilateral trade agreements when its initial tariff is low enough.

[8]$t_1 = 0$. Even if the tariffs are an ad valorem type, the essence of our results would not change.

of the monopolist is defined by.

$$\Pi(P;T) = \sum_{i \in N}(p_i - t_i)D_i(p_i) - C(\sum_{i \in N} D_i(p_i)), \qquad (2)$$

where $C(\cdot)$ is the cost function which is twice differentiable with $C' > 0$. For simplicity, we assume $t_2 = t_3/\alpha \equiv t$ where α is a parameter and $0 < \alpha \leq 1$ (i.e., $t_2 \geq t_3$). A small α implies that country 2's tariff is higher than country 3's and $\alpha = 1$ implies that the tariffs imposed by both countries are the same. The first-order conditions of the profit maximization are

$$\frac{\partial \Pi}{\partial p_i} = D_i + (p_i - t_i - C')D_i' = 0, \quad i \in N. \qquad (3)$$

Since the slope of the MR curve is given by $D_i'(2 - \epsilon_i)$, the MR curve in country i is downward-sloping if and only if $\epsilon_i < 2$. We assume $\epsilon_i < 2$ in the following.[9]

We assume that the second-order sufficient conditions are satisfied $(i, j \in N)$:

$$D_i'(2 - \epsilon_i) - C''(D_i')^2 \equiv \Psi_i < 0, \qquad (4)$$

$$[D_i'(2 - \epsilon_i) - C''(D_i')^2][D_j'(2 - \epsilon_j) - C''(D_j')^2] - (C''D_i'D_j')^2 \equiv \Omega_{ij} > 0 \quad (i \neq j), \qquad (5)$$

and $|A| < 0$ where

$$A \equiv \begin{pmatrix} D_1'(2 - \epsilon_1) - C''(D_1')^2 & -C''D_1'D_2' & -C''D_1'D_3' \\ -C''D_2'D_1' & D_2'(2 - \epsilon_2) - C''(D_2')^2 & -C''D_2'D_3' \\ -C''D_3'D_1' & -C''D_3'D_2' & D_3'(2 - \epsilon_3) - C''(D_3')^2 \end{pmatrix}.$$

Solving the first-order conditions, we have

$$p_i = \frac{\theta_i(p_i)}{\theta_i(p_i) - 1}[C'(\cdot) + t_i],$$

where θ_i denotes the price elasticity in country i.[10] Substituting these prices into the demand functions, the supply to each market can be obtained.

3 Effects of tariff reduction on prices

We now examine the effects of changes in tariffs. Totally differentiating (3), we obtain:

$$\begin{pmatrix} dp_1 \\ dp_2 \\ dp_3 \end{pmatrix} = A^{-1} \begin{pmatrix} 0 \\ D_2'dt_2 \\ D_3'dt_3 \end{pmatrix}.$$

We can easily confirm that if $C'' = 0$, $dp_i/dt_i > 0$ $(i = 2,3)$ and $dp_j/dt_i = 0$ $(j \in N; j \neq i)$, that is, any change in the tariff in an importing country does not affect the consumer prices in the other countries. In the following, therefore, we focus on the case with $C'' \neq 0$.

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[9] In Ishikawa and Mukunoki (2004), we examine the effects of trade liberalization when the MR curve is upward-sloping.

[10] θ_i is not necessarily assumed constant in our analysis. If it is constant, however, $\epsilon_i = 1 + 1/\theta_i$ holds.

3.1 Unilateral tariff reduction

We first analyze the case of a unilateral tariff reduction where only one importing country reduces its tariff. The effects of a change in t_i $(i = 2, 3)$ on p_i and p_k $(k \in N, k \neq i)$, given t_j $(j = 2, 3; j \neq i)$ being constant, are

$$\frac{dp_i}{dt_i} = \frac{D_i' \Omega_{1j}}{|A|} > 0; \ (i, j = 2, 3; j \neq i), \tag{6}$$

$$\frac{dp_k}{dt_2} = \frac{(2 - \epsilon_j) C'' D_1' D_3' (D_2')^2}{|A|}; \quad (k, j = 1, 3; k \neq j), \tag{7}$$

$$\frac{dp_k}{dt_3} = \frac{(2 - \epsilon_j) C'' D_1' D_2' (D_3')^2}{|A|}; \quad (k, j = 1, 2; k \neq j). \tag{8}$$

This implies

$$\frac{dp_k}{dt_i} \gtreqless 0 \iff C'' \lesseqgtr 0. \tag{9}$$

Thus, a decrease in t_i $(i = 2, 3)$ necessarily lowers the consumer price in country i but raises (lowers) that in country k $(k \in N, k \neq i)$ if and only if $C'' > 0$ (< 0). The intuition is straightforward. When the tariff in country 2 falls, the monopolist has an incentive to increase the supply to country 2. This is the *direct effect* of the tariff change. The increase in the supply to country 2 raises (lowers) the MC when $C'' > 0$ (< 0). This in turn decreases (increases) the supplies to both countries 1 and 3. We call this effect the *spillover effect* of the tariff change. Thus, a decrease in the tariff imposed by country 2 necessarily benefits the consumers in country 2. The consumers in country 1 and 3 lose (gain) if and only if $C'' > 0$ (< 0).

3.2 Simultaneous tariff reductions

We now analyze the case of simultaneous tariff reductions by both countries 2 and 3. We specifically consider two formulas: (i) the fixed-amount reductions $(dt = dt_2 = dt_3)$, and (ii) the uniform percentage reductions in the specific tariffs $(dt_2/t_2 = dt_3/t_3)$. In the latter case, the amount of the tariff change satisfies $dt = dt_2 = dt_3/\alpha \geq dt_3$ and the reduction is larger in the country whose initial tariff is higher. The effects on p_i $(i \in N)$ of the uniform percentage reductions are given by

$$\frac{dp_1}{dt} = \frac{C'' D_1' D_2' D_3' [\alpha D_3' (2 - \epsilon_2) + D_2' (2 - \epsilon_3)]}{|A|}, \tag{10}$$

$$\frac{dp_2}{dt} = \frac{D_2' \left[\Omega_{13} + \alpha (2 - \epsilon_1) C'' D_1' (D_3')^2 \right]}{|A|}, \tag{11}$$

$$\frac{dp_3}{dt} = \frac{D_3' \left[\alpha \Omega_{12} + (2 - \epsilon_1) C'' D_1' (D_2')^2 \right]}{|A|}. \tag{12}$$

Note that the effects of the fixed-amount reductions can be obtained by substituting $\alpha = 1$ into the above equations.

From (10), simultaneous tariff reductions raise (lower) p_1 if and only if $C'' > 0$ (< 0). The effects in countries 2 and 3 are more complicated, because there exist the spillover effects from the other importing country as well as the direct effect of its own tariff reduction. When $C'' < 0$, $dp_i/dt > 0$ ($i = 2, 3$). When $C'' > 0$, on the other hand, dp_2/dt is decreasing in α in country 2 and we have

$$\left. \frac{dp_2}{dt} \right|_{\alpha=1} = \frac{(2 - \epsilon_3) D_2' D_3' \Psi_1}{|A|} > 0. \tag{13}$$

Hence, $dp_2/dt > 0$. In country 3,

$$\frac{dp_3}{dt} \gtreqqless 0 \Longleftrightarrow \alpha \gtreqqless \widetilde{\alpha} \equiv -\frac{(2 - \epsilon_1) C'' D_1' (D_2')^2}{\Omega_{12}} > 0. \tag{14}$$

Since $1 - \widetilde{\alpha} = (2 - \epsilon_2) D_2' \Psi_1 / \Omega_{12} > 0$, $0 < \widetilde{\alpha} < 1$.

We obtain the following proposition.

Proposition 1 *Suppose that $t_2 > t_3$. The simultaneous tariff reductions by countries 2 and 3 increase the price in country 1 if and only if $C'' > 0$, always decrease the price in country 2, and decrease the price in country 3 if $C'' < 0$. When $C'' > 0$, the fixed-amount reductions necessarily lower the price in country 3 but the uniform percentage reductions lower it if and only if $0 < \alpha < \widetilde{\alpha}$.*

When the MC is decreasing, both the direct effect of its own tariff reduction and the spillover effect of the other importing country work in the same direction regardless of the type of simultaneous tariff reductions. The exporting country experiences only spillover effects. Thus, the prices in all countries fall. When the MC is increasing, however, the direct effect lowers its domestic price and the spillover effect raises it. When the simultaneous tariff reductions follow the fixed-amount formula, the direct effect always dominates the spillover effect, regardless of the initial tariff gap or the demand conditions. Under the uniform percentage formula, on the other hand, $dt_2 > dt_3$ and hence the direct effect is relatively large (small), while the spillover effect is relatively small (large) in country 2 (country 3). The uniform percentage reductions necessarily benefit the consumers in the importing country whose initial tariff is higher. The consumers in the importing country whose initial tariff is lower, however, may lose if the tariff gap and hence the relative magnitude of the spillover effect from the other country's tariff reduction is large enough (i.e., $\alpha < \widetilde{\alpha}$).

We also have

$$\frac{\partial \widetilde{\alpha}}{\partial \epsilon_1} = -\frac{(2 - \epsilon_2) (D_1' D_2')^3 (C'')^2}{(\Omega_{12})^2} < 0, \tag{15}$$

$$\frac{\partial \widetilde{\alpha}}{\partial \epsilon_2} = -\frac{(2 - \epsilon_1) \Psi_1 D_1' (D_2')^3 C''}{(\Omega_{12})^2} > 0, \tag{16}$$

and $\partial \widetilde{\alpha} / \partial \epsilon_3 = 0$.

We thus have the following proposition.

Proposition 2 *When $C'' > 0$, the uniform percentage reductions are more likely to increase the price of the lower-tariff country when the elasticity of the slope of the inverse demand function in the exporting country (the other importing country) is low (high).*

The intuition is as follows. Recall that ϵ_i represents the convexity of the inverse demand curve in country i and that the slope of the MR curve in country i is given by $D_i'(2 - \epsilon_i)$. When country 2 reduces its tariff, the monopolist's supply to country 2 and hence the MC rises (the first spillover effect). The magnitude becomes larger as ϵ_2 becomes larger and hence the slope of the MR curve in country 2 becomes flatter. Accordingly, the degree of the MC-increase and hence the decrease in the supply to country 3 from country 2's tariff reduction is large when ϵ_2 is large. The increased MC, on the other hand, decreases the supply to country 1 and this magnitude has a positive relation with ϵ_1. This reduces the MC and increases the supply to country 3 (the second spillover effect). The second spillover effect mitigates the supply change by the first spillover effect and hence the Metzler paradox is less likely in country 3 when ϵ_1 is large. Since the magnitudes of both first and second spillover effects rise with ϵ_3 in country 3, ϵ_3 has no effects.

The following should be noted. The demand in the exporting country does not play any role in deriving the main result in Proposition 1. However, Proposition 2 reveals that it could play an important role when tariffs are proportionally lowered.

Next we briefly discuss the welfare effects of tariff reductions. The welfare measure we adopt is the standard total surplus in the market. The monopolist gains from tariff reductions, because we obtain

$$\frac{d\Pi}{dt} = \frac{\partial \Pi}{\partial t} = -(D_2 + D_3) < 0.$$

Thus, the welfare of country 1 improves if $C'' < 0$ but may deteriorate if $C'' > 0$.

As shown by Brander and Spencer (1984), using a tariff, the importing country could extract some of the monopoly rent and hence raise welfare. That is, there exists the optimal level of the tariff. A small decrease in the tariff raises welfare if the initial tariff is higher than the optimal level but reduces welfare if it is lower than the optimal level.[11] It is obvious that country 3 loses when its consumer price rises by tariff reductions.

4 Concluding remarks

We have examined the price effects of simultaneous tariff reductions in the framework of monopoly. It has been shown that simultaneous tariff reductions could increase the price of the lower-tariff country. It occurs when the MC is increasing, the tariff gap between two importing countries is large, and the elasticities of the slope of the inverse demand function are small in the exporting

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[11]It is well known that the optimal tariff is positive if and only if $(dp_i/dt_i)|_{t_i=0} < 1$ (that is, an increase in the consumer price caused by a tariff is less than the size of the tariff). For details, see Brander and Spencer (1984) and Ishikawa and Mukunoki (2004).

country and large in the importing country whose tariff is higher. Therefore, importing countries with relatively low tariffs may prefer a bilateral trade agreement to a multilateral trade agreement to ensure consumer gains.

Our results also suggest the choice of a formula of simultaneous tariff reductions is important. The proportional tariff reductions may not guarantee consumer gains in the world with heterogeneous countries. We can easily extend our results to other formulas discussed in the GATT/WTO negotiations. For example, the harmonizing formulas, such as the Swiss formula in the Tokyo Round and the Uruguay Round approach, would increase the likelihood of the Metzler paradox, because these formulas require high-tariff countries to reduce their tariffs more than low-tariff countries.[12] To avoid such a problem, the fixed-amount reductions or some anti-harmonizing formulas should be employed.

In concluding this paper, two final remarks are in order. First, we have used the simplest framework, i.e., the monopoly framework to make our point as clearly as possible. The spillover effects obviously arise among importing countries even in an oligopoly framework and hence similar results are expected under certain conditions. Second, when both importing countries impose binding quotas, simultaneous changes in quota levels never lead to the Metzler paradox. This is because quotas shut off the spillover effects. Any policy change in country 2 that increases its imports never raises country 1's supply as long as the quota remains binding in country 3.[13] In the WTO, members are obligated in principle to replace all quantitative restrictions with tariffs and then lower the tariffs. This replacement may lead to different outcomes. With respect to these two remarks, further investigations are required.

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[12] The Swiss formula was proposed by Switzerland in the 1973–79 Tokyo Round negotiations.

[13] See Ishikawa and Mukunoki (2004) for details.

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Table 1 : Simultaneous tariff changes with $t_2 > t_3$

	dp_1/dt	dp_2/dt	dp_3/dt
$C'' < 0$	$+$	$+$	$+$
$C'' > 0$ & the fixed-amount reductions	$-$	$+$	$+$
$C'' > 0$ & the uniform percentage reductions			
$\quad \widetilde{\alpha} < \alpha \leq 1$	$-$	$+$	$+$
$\quad \alpha = \widetilde{\alpha}$	$-$	$+$	0
$\quad 0 < \alpha < \widetilde{\alpha}$	$-$	$+$	$-$