

KEIO UNIVERSITY  
MARKET QUALITY RESEARCH PROJECT  
(A 21<sup>st</sup> Century Center of Excellence Project)

KUMQRP DISCUSSION PAPER SERIES

DP2007-030

Which Country Should a Tariff Be Imposed on?

Motoyuki Tsutsui \*

**abstract**

The present study examines the effect of a tariff which a country imposes on only a part of its trading partner countries. In a three- country and two-good model, it demonstrates the welfare effect of the tariff and reveals the property of the foreign country on which the home country should impose the tariff. The determinants of the tariff imposition are the foreign country sizes and the price elasticities of import demand.

\*Graduate School of Economics, Keio University

Graduate School of Economics and Graduate School of Business and Commerce,  
Keio University  
2-15-45 Mita, Minato-ku, Tokyo 108-8345, Japan

# Which Country Should a Tariff Be Imposed on?

Motoyuki Tsutsui\*  
Graduate School of Economics,  
Keio University

February 25, 2008

## Abstract

The present study examines the effect of a tariff which a country imposes on only a part of its trading partner countries. In a three-country and two-good model, it demonstrates the welfare effect of the tariff and reveals the property of the foreign country on which the home country should impose the tariff. The determinants of the tariff imposition are the foreign country sizes and the price elasticities of import demand.

## 1 Introduction

In general equilibrium trade models, the effect of a tariff has been analyzed in the setting in which a country imposes a uniform tariff on all of its trading partner countries. In the real world economy, however, a country usually imposes a tariff on only a part of its trading partner countries, which I call a partial tariff in this study. It is quite difficult for a country to impose a tariff on all of its trading partner countries in the real world since the country's decision is restrained by some exogenous factors, such as international agreements and domestic sentiments.

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\*I am grateful to my supervisor Professor Makoto Yano for his invaluable guidance. Evidently, I am responsible for any remaining errors. Address: Mita Toho Bldg. 5th Floor, 3-1-7 Mita, Minato-ku, Tokyo 108-0073, Japan. E-mail: due21\_motoyuki@yahoo.co.jp.

Despite such importance in the real world, in the existing literature, a partial tariff has not been examined in a theoretical framework. In order to analyze the effect of a partial tariff, we need to provide a setting in which a country has more than one trading partner country.

The present study introduces a three-country and two-good model, and demonstrates which trading partner country a tariff should be imposed on. In the real world, the countries on which a tariff is imposed are determined exogenously, so that there are no grounds that they are most desirable for the tariff-imposing country. From the theoretical viewpoint, this study helps to consider whether or not a certain partial tariff has economic rationality. The results are as follows. When the two foreign countries have the same size, the home country should impose a tariff on the foreign country whose import demand is less elastic than the other. When the two foreign countries have the same elasticity of import demand, the home country should impose the tariff on the foreign country whose size is larger than the other.

This study is related to the literature on customs union. One of the major topics on customs union theory is how the formation of a customs union affects the welfare of a member country. From a single country viewpoint, it concerns which trading partner countries a tariff should be cut from. This topic is exactly the opposite to what the present study explores.

Some studies have focused on tariff policy in the setting in which a country imposes a tariff on a part of its total import items. Yano, Takahashi and Kenzaki (2006) builds a two-country model in which the home country imports two middle products and imposes a tariff on only one of the two imports. Besides, it is well known that tariff policy could be substituted for competition policy. Honryo and Yano (2006) builds a two-country and two-sector model in which the home country produces two final consumption goods from one tradable product and suppresses the competition in one of its two final goods market.

In the remainder of the paper, we present a model and demonstrate the conclusions mentioned above.

## 2 Model

In this section, we introduce a model and demonstrate the property of the foreign country on which the home country should impose a tariff. There are three countries, the home country and the foreign country 1 and 2. They are

involved in trading two goods, good 1 and 2. Assume that the home country exports good 1 and imports good 2, and that the both foreign countries export good 2 and import good 1. Denote by  $D_i$  and  $x_i$  the home country's consumption and production of good  $i$  ( $i = 1, 2$ ), respectively. Thus the amount of the home imports is defined as  $M \equiv D_2 - x_2$ . Similarly, those of the foreign imports are  $M^*$  ( $\equiv D_1^* - x_1^*$ ) and  $M^{**}$  ( $\equiv D_1^{**} - x_1^{**}$ ), while superscripts “\*” and “\*\*” denote the variables of the foreign country 1 and 2, respectively. Then, in the state of free-trade, the home country imposes a small partial tariff: The government of the home country imposes a tariff on the good 2 which is imported from the foreign country 1, or imposes the same tariff on the good 2 which is imported from the foreign country 2.

In order to analyze the welfare effect of the partial tariff, consider the basic structure for the home country. First, price differs among countries because of the partial tariff. Let  $p$  be the price of good 2 in terms of that of good 1 in the home country. If the home country imposes a tariff on the foreign country 1 at the rate of  $t_1$  ( $> 0$ ), then

$$p = (1 + t_1) p^*.$$

On the other hand, if the home country imposes a tariff on the foreign country 2 at the rate of  $t_2$  ( $> 0$ ), then

$$p = (1 + t_2) p^{**}.$$

Totally differentiating these expressions yields

$$dp = (1 + t_1) dp^* + p^* dt_1, \tag{1}$$

$$dp = (1 + t_2) dp^{**} + p^{**} dt_2. \tag{2}$$

Next we focus on each country's demand for imports. In the case of the home country, it is represented as a function of the price of imports,  $p$ , and the home country's utility level,  $u$ .

$$M = M(p, u)$$

In the case of the two foreign countries, the import demands are represented as a function of the price of imports.

$$M^* = M^* \left( \frac{1}{p^*} \right),$$

$$M^{**} = M^* \left( \frac{1}{p^{**}} \right)$$

Totally differentiating these three expressions yields

$$dM = \frac{\partial M}{\partial p} dp + \frac{\partial M}{\partial u} du, \quad (3)$$

$$dM^* = \frac{M^*}{p^*} \varepsilon^* dp^*, \quad (4)$$

$$dM^{**} = \frac{M^{**}}{p^{**}} \varepsilon^{**} dp^{**}, \quad (5)$$

where

$$\varepsilon^* \equiv -\frac{\left(\frac{1}{p^*}\right)}{M^*} \frac{dM^*}{d\left(\frac{1}{p^*}\right)} \text{ and } \varepsilon^{**} \equiv -\frac{\left(\frac{1}{p^{**}}\right)}{M^{**}} \frac{dM^{**}}{d\left(\frac{1}{p^{**}}\right)}.$$

Now consider the utility function for the home country of the general form  $u = u(D_1, D_2)$ . Denote by  $dy$  the change in the home country's real income measured in units of good 1. This can be defined as the domestic price-weighted sum of the changes in consumption.

$$dy = dD_1 + p dD_2$$

The budget constraint for the home country is

$$D_1 + pD_2 = x_1 + px_2 + t_1 M^* \left( \frac{1}{p^*} \right) + t_2 M^{**} \left( \frac{1}{p^{**}} \right).$$

Differentiate this constraint totally and substitute into  $dy$ . Thus the change in the home country's utility level,  $du$ , is expressed as

$$\frac{1}{\frac{\partial u}{\partial D_1}} du = -M dp + t_1 \frac{M^*}{p^*} \varepsilon^* dp^* + t_2 \frac{M^{**}}{p^{**}} \varepsilon^{**} dp^{**} + M^* dt_1 + M^{**} dt_2. \quad (6)$$

Furthermore, the values of imports balance among three countries in the equilibrium.

$$M(p, u) = \frac{1}{p^*} M^* \left( \frac{1}{p^*} \right) + \frac{1}{p^{**}} M^{**} \left( \frac{1}{p^{**}} \right)$$

Taking total differentials in this condition yields

$$\frac{\partial M}{\partial p} dp + \frac{\partial M}{\partial u} du = \left(\frac{1}{p^*}\right)^2 M^* (\varepsilon^* - 1) dp^* + \left(\frac{1}{p^{**}}\right)^2 M^{**} (\varepsilon^{**} - 1) dp^{**}. \quad (7)$$

Finally, we demonstrate the effect of the partial tariff on the home country's utility level by solving the differentiated equations. That is, we reveal the relationship among the change in the home country's utility level,  $du$ , and those in the partial tariffs,  $dt_1$  and  $dt_2$ , by solving four equations (1), (2), (6) and (7), which consist of six variables. Note that  $t_1 = 0$  and  $t_2 = 0$  (i.e.,  $p = p^* = p^{**}$ ) since we are focusing on the tariff imposition in a state of free-trade. Moreover, we must take note of the local-stability condition in our model. Define the compensated price elasticity of demand for the home imports with its real income held constant, which reflects only the substitution and production effects, as

$$\varepsilon \equiv -\frac{p}{M} \frac{\partial M}{\partial p}.$$

Denote by  $\mu^*$  and  $\mu^{**}$  the relative amounts of the foreign imports, which are regarded as the foreign country sizes.

$$\mu^* = \frac{M^*}{p^* M} \quad \text{and} \quad \mu^{**} = \frac{M^{**}}{p^{**} M}$$

Then the stability condition is

$$\Delta \equiv \varepsilon + \mu^* \varepsilon^* + \mu^{**} \varepsilon^{**} - 1 > 0.$$

Thus, the relationship among the change in the home country's utility level and those in the partial tariffs can be written as

$$\left(\frac{\partial M}{\partial u} + \frac{\Delta}{p} \frac{1}{\frac{\partial u}{\partial D_1}}\right) du = M\mu^* (\Delta + 1 - \varepsilon^*) dt_1 + M\mu^{**} (\Delta + 1 - \varepsilon^{**}) dt_2. \quad (8)$$

By the relationship (8), we can compare the welfare effects of the two partial tariffs,  $dt_1$  and  $dt_2$ . Theorem 1 focuses on the case in which the effect of  $dt_1$  is larger than that of  $dt_2$ ; the home country should impose a partial tariff on the foreign country 1.

**Theorem 1** *It is desirable for the home country to impose a partial tariff on the foreign country 1 if and only if*

$$\mu^* (\Delta + 1 - \varepsilon^*) > \mu^{**} (\Delta + 1 - \varepsilon^{**}) \quad (9)$$

*holds.*

**Proof.** *When the home country imposes a tariff only on the foreign country 1 (i.e.,  $dt_1 > 0$  and  $dt_2 = 0$ ), the relative magnitude of its effect on the home country's utility level is measured by the coefficient of  $dt_1$  in equation (8). On the other hand, when the home country imposes only on the foreign country 2 (i.e.,  $dt_1 = 0$  and  $dt_2 > 0$ ), the relative magnitude of its effect is measured by the coefficient of  $dt_2$  in equation (8). Therefore, in order to conclude that the home country should impose a partial tariff on the foreign country 1, it is necessary that the coefficient of  $dt_1$  is larger than that of  $dt_2$ , that is, inequality (9) holds. Conversely, it is sufficient that inequality (9) holds in equation (8). ■*

Theorem 1 shows that there are two kinds of determinants of tariff imposition; the foreign country sizes,  $\mu^*$  and  $\mu^{**}$ , and the price elasticities of import demand,  $\varepsilon$ ,  $\varepsilon^*$  and  $\varepsilon^{**}$ . On the basis of this finding, we can interpret Theorem 1 in two ways. First, suppose that the sizes (or the shares in the amount of trade) are the same between the two foreign countries, i.e.,  $\mu^* = \mu^{**}$ . Then inequality (9) is equivalent with

$$\varepsilon^* < \varepsilon^{**}.$$

This means that the home country should impose a tariff on the country whose price elasticity of demand for imports is smaller. Second, suppose that the price elasticities of import demand are the same between the two foreign countries and that for the home country is not equal to zero, i.e.,  $\varepsilon^* = \varepsilon^{**}$  and  $\varepsilon \neq 0$ . Then inequality (9) is equivalent with

$$\mu^* > \mu^{**}.$$

This means that the home country should impose a tariff on the country whose size is larger.

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