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NATION CLAUSE**

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# **DISCRIMINATORY TARIFFS AND THE 'MOST FAVORED NATION' CLAUSE**

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## **Abstract**

The aim of this paper is to shed light on the impact the degree of product differentiation has on discriminatory tariffs, on MFN tariffs and on welfare. It is shown that under both tariff regimes, discriminatory and MFN, the equilibrium levels of tariffs, outputs and profits are positively related to the degree of product differentiation. The importing country and the less cost efficient exporter are both worse off, whereas the more cost efficient country and the world as a whole are better off when the MFN principle is applied. However, all those welfare changes are lesser in magnitude as the degree of product differentiation increases.

**Keywords:** MFN principle; Discriminatory tariffs; Product differentiation; Welfare analysis.

**JEL Classification:** F12; F13; F14.

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## 1.1 Introduction

It is widely accepted that one of the "pillars" of the WTO (World Trade Organization), as well as its predecessor, the GATT (General Agreement in Tariffs and Trade), is the principle of **non-discrimination** (see, for instance, Horn and Mavroidis 2001.)

The principle of non-discrimination, or the Most Favored Nation (MFN) clause as it is more widely known, is a norm under which a member-country (or a customs union) must adopt the same unified tariff schedule for imports against all its trading partners.

Gatsios (1990) offers a simple explanation for the need for an international agreement such as the MFN principle. In a model with two exporting countries-firms producing a homogeneous product, subsidizing their exports and competing for the market of a third importing country, he shows that in the absence of MFN the importing country's optimal tariff policy would be to tariff discriminate by imposing a higher tariff on the more cost efficient exporter. Moreover, he shows that although that MFN principle is well justified in terms of world production efficiency by diverting production from the less to the more cost efficient country, increasing in this way world welfare, its distributional effects favor only the more developed (and more cost-efficient) countries while they harm the other two countries.

Hwang and Mai (1991) produce a similar result. Moreover, they show that if the two exporting firms sell differentiated products with linear technologies, then with linear and symmetric demands, the weaker the degree of product differentiation the greater the tariff difference, under tariff discrimination, compared with the cost difference.

Saggi (2004) extends Gatsios' results using a  $n \geq 3$  country oligopoly model of intra-industry trade in a homogenous good. He confirms that the non-cooperative tariff equilibrium results into a preferential tariff regime in which each country imposes higher tariffs on low cost producers relative to high cost ones. He also confirms that the adoption of MFN tariffs by each country improves world welfare by eliminating the inefficient trade diversion generated by tariff discrimination. Finally, he shows that high cost countries refuse reciprocal MFN adoption with others and that they lose even in the case where others engage between them in reciprocal MFN adoption.

Choi (1995) brings up the role of the MFN principle as a commitment mechanism that helps to resolve the time-inconsistency problem facing the importing country. In particular, he allows exporting firms to endogenize their cost levels by investing in some cost reducing activity, like R&D. He then explores the effects of an active trade policy on the choice of technology by the producers, to show that under MFN a lower marginal cost technology will

be chosen by the exporters, leading to welfare gains by the importing country. The source of inefficiency stems from the fact that ex post technology choice, the importing country prefers discriminatory tariffs.

Bagwell and Staiger (1999), develop a general equilibrium trade model that takes into account political-economy considerations relating to the possibility of distributional concerns in the preferences of governments, in addition to those of national income maximization. They establish that both the MFN principle as well as that of reciprocity can be viewed as simple rules assisting governments in the implementation of efficient trade agreements. As a consequence, they argue that the preferential agreements undermine the WTO's (GATT's) ability to establish efficient multilateral outcomes.

Another reason for importing countries wanting to abide by the MFN principle is provided by To (1999). He develops a dynamic model in which governments lack the ability to precommit, while consumers are facing switching costs. When these costs are sufficiently high, then discriminatory tariffs, by reducing the value of market share, may lower the importing country's welfare. That creates an incentive for importers to stick by the MFN rule.

Saggi and Yildiz (2005) present a case where tariff discrimination may be preferred to MFN from a world welfare perspective. In particular, they develop an oligopoly model of trade between two exporting countries and one importing country to show that if the two exporting countries are asymmetric with respect to both cost and market structure, then when high-cost exporters are merged it is possible that tariff discrimination is welfare preferred to MFN .

McCalman (2002) explores the interaction between private information and the MFN clause in trade negotiations. He shows that the MFN principle, by aggregating uncertainty over a number of trading partners, may offer an improvement over a set of bilateral trade negotiations. This improvement is more pronounced the larger the number of countries involved in such negotiations.

In a similar fashion Ozerturk and Saggi (2005) examine how the incomplete information on behalf of the importing country regarding the costs of the two exporting firms affect the case for MFN tariffs. They show that, despite the lack of complete information, the importing country still prefers tariff discrimination to MFN. However, equilibrium tariff dispersion is lower and, as a result, the global welfare gains from MFN, although positive, are smaller under incomplete information relative to the case of complete information.

This paper develops a simple model of two exporting firms/countries each producing a variety of a differentiated product solely for exports in a third importing country, to focus on

the impact that the degree of product differentiation has on discriminatory and MFN tariffs, as well as welfare. We show that both under tariff discrimination and MFN tariffs, the equilibrium levels of tariffs, outputs and profits are all positively related to the degree of product differentiation. This is because the more differentiated the two varieties are, then the higher degree of monopoly power enjoyed by the two exporting firms results to higher profits; the higher import tariffs, then, reflect the desire of the importing country to capture a part of those increased profits. However, we also show that under both regimes the difference between the two firms' equilibrium profit levels gets smaller the more differentiated the two varieties are. As a result, the welfare effects of moving from a regime of discriminatory tariffs to MFN tariffs are less pronounced the higher the degree of product differentiation. The importing country and the less cost efficient exporter are both worse off, whereas the more cost efficient country and the world as a whole are better off when the MFN principle is applied. However, all those welfare changes are lesser in magnitude as the degree of product differentiation increases.

The rest of this paper is organized as follows. In section 1.2 we present the model, while sections 1.3 and 1.4 examine the equilibrium outcomes under, respectively, discriminatory and MFN tariffs. In section 1.5 we compare the tariff and the welfare levels under the two regimes and relate them to the degree of the product differentiation. Section 1.6 concludes.

## 1.2 The model

There are two exporting firms, denoted by  $i = 1, 2$ , each one of which is located in a different country. Each firm produces a variety of a differentiated good and they both compete for the market of a third importing country. For simplicity, we assume that the two varieties are produced solely for exports and that they are not produced in the third country. This is a facilitating assumption; it does not affect our main results. We denote by  $q_i$  the amount of the differentiated products supplied by firm  $i$ ,  $i = 1, 2$ .

Following Dixit (1979) and Singh and Vives (1984) we assume the following (inverse), symmetric and linear demand structure for the two varieties:

$$p_i = \alpha - q_i - \gamma q_j \quad i, j = 1, 2 \text{ and } i \neq j \quad (1)$$

These demand functions come from a strictly concave, quadratic utility function

$$U(q_1, q_2) = a + \alpha(q_1 + q_2) - \frac{1}{2}(q_1^2 + q_2^2) - \gamma q_1 q_2 \quad (2)$$

Strict concavity of the utility function is ensured by assuming that  $\gamma^2 < 1$ . Moreover, we assume that  $\gamma > 0$ . Therefore, our restrictions on the values of  $\gamma$  become  $1 > \gamma > 0$ . They imply, in turn, that the own price effects dominate the cross price effects,  $\gamma < 1$ , and that the goods are substitutes in consumption,  $\gamma > 0$ .<sup>1</sup>

The measure for the degree of product differentiation is given by the value of  $\gamma$ . The two varieties are highly differentiated if  $\gamma$  is close to zero (so that  $c = \frac{\partial q_i}{\partial p_j} \rightarrow 0$ ), whereas they are said to be almost homogeneous if  $\gamma$  is close to 1 (so that  $c = \frac{\partial q_i}{\partial p_j} \rightarrow \frac{\partial q_i}{\partial p_i} = b$ ).

The two firms operate under a constant marginal cost, denoted by  $c_i$ , and no fixed costs. Without any loss of generality, we will be assuming throughout that firm 1 is more cost-efficient. Namely,  $c_1 < c_2$ .<sup>2</sup> Finally, we assume that the importing country levies a specific tariff,  $t_i$ , on its imports from country  $i$ .

The game in hand is a two-stage game: in the first stage, the government of the importing country chooses its tariff schedules to maximize its own welfare. We will distinguish two cases here; one in which it follows a preferential tariff regime and one in which it follows a non-preferential one according to the MFN clause. In the second stage, firms compete in outputs à la Cournot. We are looking for the sub-game Nash equilibria of the game.

### 1.3 Preferential tariff regime ( $t_1 \neq t_2$ )

Starting from the second stage of the game, the exporting firms choose their output levels so as to maximize their profits; that is

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<sup>1</sup> To see all this find the direct demand functions, by inverting the system of equations (1) to get

$q_1 = a - bp_1 + cp_2$  and  $q_2 = a - bp_2 + cp_1$ , where  $a \equiv \frac{\alpha}{1+\gamma}$ ,  $b \equiv \frac{1}{1-\gamma^2} > 0$ ,  $c \equiv \frac{\gamma}{1-\gamma^2} > 0$ . Clearly, the own

price effects dominate the cross price effects if  $b > c$  or, equivalently,  $\gamma < 1$ , and the two goods are substitutes (rather than complements) in consumption if  $c > 0$  or, equivalently,  $\gamma > 0$ .

<sup>2</sup> Clearly, both  $c_1$  and  $c_2$  must be smaller than the vertical intercept of the (symmetric) inverse demand functions,  $\alpha$ , i.e.,  $\alpha > c_2 > c_1$ . In fact, to ensure that quantities are positive under both tariff regimes we assume that  $\alpha > 4c_2$ .

$$\max_{q_i} \pi_i(q_i, q_j) = (\alpha - q_i - \gamma q_j)q_i - c_i q_i - t_i q_i \quad i, j = 1, 2 \text{ and } i \neq j \quad (3)$$

One can easily see that the conditions governing the parameters of the model ensure that the profit function of firm  $i$  is strictly concave in its own output,  $\frac{\partial^2 \pi_i}{\partial q_i^2} = -2 < 0$ ,  $i = 1, 2$  and that

the usual stability condition holds,  $\frac{\partial^2 \pi_1}{\partial q_1^2} \frac{\partial^2 \pi_2}{\partial q_2^2} - \frac{\partial^2 \pi_1}{\partial q_1 \partial q_2} \frac{\partial^2 \pi_2}{\partial q_1 \partial q_2} = 4 - \gamma^2 > 0$ . Moreover, the two

varieties are strategic substitutes,  $\frac{\partial^2 \pi_i}{\partial q_i \partial q_j} = -\gamma < 0$ ,  $i, j = 1, 2$  and  $i \neq j$ .

The first-order necessary conditions yield the best response functions of the two exporting firms, given by:

$$q_i(q_j) = \frac{\alpha - (c_i + t_i)}{2} - \frac{\gamma}{2} q_j \quad i, j = 1, 2 \text{ and } i \neq j \quad (4)$$

As expected, the best response functions are downward sloping in the output space (outputs are strategic substitutes.) Moreover, the effect of the import tariff on firm  $i$  is to shift its best response function inwards:  $\partial q_i / \partial t_i = -1/2$ . Solving jointly the best response functions (4) we get the equilibrium outputs of the two exporting firms under tariff discrimination,  $q_i^D$ , as a function of the import tariffs

$$q_i^D(t_i, t_j) = \frac{\alpha(2 - \gamma) + \gamma(c_j + t_j) - 2(c_i + t_i)}{4 - \gamma^2} \quad i, j = 1, 2 \text{ and } i \neq j \quad (5)$$

This completes the second stage of the game. The effects of the tariff  $t_i$  on the two exporting firms' equilibrium output levels and profits are quite standard: it reduces both output and profits of firm  $i$  and increases those of its rival.<sup>3</sup>

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<sup>3</sup> Moreover, there is an incomplete "pass through" of the tariff:  $0 < \frac{\partial p_i}{\partial t_i} = \frac{2 - \gamma^2}{4 - \gamma^2} < 1$ .

In the first stage of the game, the government of the importing country chooses its tariff policy to maximize its welfare, being the sum of consumer's surplus plus tariff revenues; that is

$$\max_{t_i, t_j} W(t_i, t_j) = U(q_i, q_j) - p_i q_i - p_j q_j + t_i q_i + t_j q_j \quad i, j = 1, 2 \text{ and } i \neq j \quad (6)$$

where  $U(q_i, q_j) - p_i q_i - p_j q_j$  is the consumer's surplus and  $t_i q_i + t_j q_j$  is tariff revenues.

The first-order necessary conditions yield the importing country's discriminatory tariff rule, given by

$$t_i^D = \frac{\left( \frac{\partial p_i}{\partial t_i} - 1 \right) q_i + \frac{\partial p_j}{\partial t_i} q_j - t_j \frac{\partial q_j}{\partial t_i}}{\frac{\partial q_i}{\partial t_i}} \quad i, j = 1, 2 \text{ and } i \neq j \quad (7)$$

Substituting (5) into (7) and solving jointly we get, after some routine calculations, the optimal discriminatory tariff levels,  $\hat{t}_i^D$ , imposed by the importing country on its imports from country  $i$ , as well as the equilibrium output levels of the two firms,  $\hat{q}_i^D$ . Those are given by

$$\hat{t}_i^D = \hat{q}_i^D = \frac{\alpha(3-\gamma) - 3c_i + \gamma c_j}{9-\gamma^2} \quad i, j = 1, 2 \text{ and } i \neq j \quad (8)$$

Substituting into (3) we derive the equilibrium profit levels of the two firms

$$\hat{\pi}_i^D = \frac{\left[ 3(\alpha - c_i) - \gamma(a - c_j) \right]^2}{(9 - \gamma^2)^2} = (\hat{q}_i^D)^2 \quad i, j = 1, 2 \text{ and } i \neq j \quad (9)$$

There are a few interesting remarks we can make at this point. First we observe that, in equilibrium, the more cost efficient firm produces more, gains more and its exports are taxed more:  $\hat{t}_1^D = \hat{q}_1^D > \hat{t}_2^D = \hat{q}_2^D$  and  $\hat{\pi}_1^D > \hat{\pi}_2^D$ . Put differently, the importing country follows a



policy of tariff discrimination and imposes a higher tariff on the exports of the most cost efficient firm. In particular,

$$\hat{t}_1^D - \hat{t}_2^D = \hat{q}_1^D - \hat{q}_2^D = \frac{c_2 - c_1}{3 - \gamma} > 0 \quad (10)$$

and since  $\hat{t}_1^D + \hat{t}_2^D = \hat{q}_1^D + \hat{q}_2^D = \frac{2\alpha - c_1 - c_2}{3 + \gamma}$  we get that

$$\begin{aligned} \hat{\pi}_1^D - \hat{\pi}_2^D &= (\hat{t}_1^D)^2 - (\hat{t}_2^D)^2 = (\hat{t}_1^D + \hat{t}_2^D)(\hat{t}_1^D - \hat{t}_2^D) \\ &= \frac{(2\alpha - c_1 - c_2)(c_2 - c_1)}{9 - \gamma^2} > 0 \end{aligned} \quad (11)$$

Notice in (10) that tariff discrimination, as an optimal policy for the importing country, is entirely driven by cost differences, not by product differentiation; irrespective of the value of  $\gamma \in (0,1)$  tariff discrimination will be followed so long as there is a cost difference between the two exporters. Moreover, the larger that cost difference is, the larger the difference between the optimal discriminatory tariffs will be. The reason behind this result is similar to that in the case of homogenous products as in Gatsios (1990): in the absence of import tariffs, the more cost efficient firm would be producing more and, given the symmetry of demands, would be earning more in equilibrium. The greater the cost difference is, the greater the difference in profits, as (11) testifies. Hence, as import tariffs are used to extract rent from the exporting firms, not only the tariff imposed on the more cost efficient exporter will be higher than the one imposed on the less cost efficient one, but their difference would get larger as their cost differences (and, hence, their profit differences) get more pronounced.

Second, we observe that, the optimal tariffs given by (8) are decreasing in  $\gamma$ ,  $\partial \hat{t}_i^D / \partial \gamma < 0$ . (See, Appendix A.1) Clearly, the same applies for outputs and profit levels. Therefore, the more differentiated the two varieties are, i.e., the smaller the value of  $\gamma$  is, the higher the import taxes and the larger the firms' outputs and profits will be. At the same time, however, one observes from (10) and (11) that those differences are all increasing in  $\gamma$ . Therefore, the more differentiated the two varieties are, the less pronounced the differences between the discriminatory tariffs, the output levels and the profits become.

We summarize our results in the following proposition.

**Proposition 1.** *Under import tariff discrimination, the importing country sets a higher import tariff on the variety produced by the more cost efficient firm. Although the equilibrium values of tariffs, outputs and profits are all positively related to the degree of product differentiation, their respective differences become smaller the more differentiated the two varieties are.*

#### 1.4 Non-Preferential (MFN) tariff regime ( $t_1 = t_2 \equiv t$ )

We now turn to the case of MFN tariffs. Proceeding in an analogous manner to that of the previous section, in the second stage of the game the equilibrium output levels of the two firms under MFN,  $q_i^{MFN}$ , are given by (5) where we set  $t_i = t_j \equiv t$ ; that is

$$q_i^{MFN}(t) = \frac{\alpha(2-\gamma) - 2c_i + \gamma c_j - t(2-\gamma)}{4-\gamma^2} \quad i, j = 1, 2, i \neq j \quad (12)$$

We immediately observe that, as expected, for any MFN tariff level, the equilibrium output of the most cost efficient firm will be larger than that of the less cost efficient one,  $q_1^{MFN} > q_2^{MFN}$ . This will be useful below.

In the first stage of the game, the importing country chooses its MFN tariff schedule to maximize its welfare, i.e.,

$$\max_t W(t) = U(q_1, q_2) - p_1 q_1 - p_2 q_2 + t(q_1 + q_2)$$

The first order necessary condition yields the optimal non-discriminatory tariff rule, given by

$$t^{MFN} = \frac{\sum_{i=1}^2 \left( \frac{\partial p_i}{\partial t} - 1 \right) q_i}{\sum_{i=1}^2 \frac{\partial q_i}{\partial t}} > 0^4 \quad (13)$$

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<sup>4</sup> The expression is positive since  $0 < \partial p_i / \partial t = (1+\gamma)/(2+\gamma) < 1$ , that is, there is an incomplete “pass through” of the tariff, and since the tariff exerts a negative effect on output levels, i.e.,  $\partial q_i / \partial t = -1/(2+\gamma) < 0$ .

Substituting (12) into (13) and solving jointly we derive, after some routine calculations the optimal MFN tariff,  $\hat{t}^{MFN}$ , and the output levels of the two exporting firms,  $\hat{q}_i^{MFN}$ . In particular,

$$\hat{q}_i^{MFN} = \frac{2\alpha(2-\gamma) - 5c_i + c_j(2\gamma+1)}{2(3+\gamma)(2-\gamma)} \quad (14)$$

and

$$\hat{t}^{MFN} = \frac{1}{2}(\hat{q}_1^{MFN} + \hat{q}_2^{MFN}) = \frac{2\alpha - c_1 - c_2}{2(3+\gamma)} > 0 \quad (15)$$

Substituting (14) and (15) into (3) we derive the equilibrium profit levels of the two exporting firms. It turns out that

$$\hat{\pi}_i^{MFN} = \frac{[2\alpha(2-\gamma) - 5c_i + c_j(2\gamma+1)]}{4(3+\gamma)^2(2-\gamma)^2} = (\hat{q}_i^{MFN})^2 \quad (16)$$

As expected, since both firms face the same import tariff, the most cost efficient of them will be exporting more and will be making higher profits, in equilibrium:  $\hat{q}_1^{MFN} > \hat{q}_2^{MFN}$  and  $\hat{\pi}_1^{MFN} > \hat{\pi}_2^{MFN}$ . In particular,

$$\hat{q}_1^{MFN} - \hat{q}_2^{MFN} = \frac{c_2 - c_1}{2-\gamma} \quad (17)$$

and since  $\hat{q}_1^{MFN} + \hat{q}_2^{MFN} = \frac{2\alpha - c_1 - c_2}{3+\gamma}$  we get that<sup>5</sup>

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<sup>5</sup> Observe that the sum of equilibrium outputs are the same under both regimes; namely

$$\hat{q}_1^D + \hat{q}_2^D = \hat{q}_1^{MFN} + \hat{q}_2^{MFN} = \frac{2\alpha - c_1 - c_2}{3+\gamma}$$

$$\begin{aligned}\hat{\pi}_1^{MFN} - \hat{\pi}_2^{MFN} &= (\hat{q}_1^{MFN})^2 - (\hat{q}_2^{MFN})^2 = (\hat{q}_1^{MFN} + \hat{q}_2^{MFN})(\hat{q}_1^{MFN} - \hat{q}_2^{MFN}) \\ &= \frac{(2\alpha - c_1 - c_2)(c_2 - c_1)}{(3 + \gamma)(2 - \gamma)} > 0\end{aligned}\quad (18)$$

Moreover, we observe from (15) that the MFN tariff is decreasing in  $\gamma$ ; the more differentiated the two varieties are (i.e., the smaller the value of  $\gamma$ ) the higher the import tariff will be:  $\partial \hat{t}^{MFN} / \partial \gamma < 0$ . The same applies to outputs and profits; they both increase as product differentiation becomes more prominent:  $\partial \hat{q}_i^{MFN} / \partial \gamma < 0$  and  $\partial \hat{\pi}_i^{MFN} / \partial \gamma < 0$ . At the same time, however, (17) and (18) suggest that the differences between the outputs produced and the profits gained by the two exporters are increasing with  $\gamma$ ; they become smaller the more differentiated the two varieties are.

We summarize these findings in the following proposition

**Proposition 2.** *Under MFN tariffs, the more differentiated the two varieties are, the higher the equilibrium levels of the MFN tariff, the outputs and the profits are. However, the respective differences between the two exporters' output and profit levels become less pronounced the more differentiated the two varieties are.*

### 1.5 Comparing the two regimes: tariffs, welfare and product differentiation

Comparing the two tariff regimes, the discriminatory and the MFN, we can derive a number of interesting results.

First, the optimal MFN tariff lies between the two discriminatory ones:  $\hat{t}_2^D < \hat{t}^{MFN} < \hat{t}_1^D$ . That is, the original result by Gatsios (1990) for the case of homogeneous products carries through in the case of product differentiation as well: in the absence of the MFN clause in the WTO, the importing country would have an incentive to discriminate its import tariffs by setting a higher tariff on its imports coming from the more cost efficient country.

To show this, simply differentiate the welfare function of the importing country given by (6) with respect to  $t_i$  and evaluate the derivative at the optimal value of the MFN tariff given by (15). If that derivative is positive (respectively, negative) then it would imply that the optimal discriminatory tariff  $\hat{t}_i^D$  is larger (respectively, smaller) than the optimal MFN tariff  $\hat{t}^{MFN}$ .

Indeed, it is easy to see that

$$\left. \frac{\partial W}{\partial t_i} \right|_{t_i = \hat{t}^{MFN}} = \frac{1}{4 - \gamma^2} \left( 1 + \frac{\gamma}{2} \right) (\hat{q}_i^{MFN} - \hat{q}_j^{MFN}) \quad (19)$$

Hence, since  $\hat{q}_1^{MFN} > \hat{q}_2^{MFN}$ , it immediately follows that  $\left. \frac{\partial W}{\partial t_2} \right|_{t_2 = \hat{t}^{MFN}} < 0 < \left. \frac{\partial W}{\partial t_1} \right|_{t_1 = \hat{t}^{MFN}}$ , which in turn confirms our claim, namely,  $\hat{t}_2^D < \hat{t}^{MFN} < \hat{t}_1^D$ .

In fact, we can claim something more than that. The value of the optimal MFN tariff lies in the middle between the values of the discriminatory ones; namely,  $\hat{t}^{MFN} = \frac{1}{2}(\hat{t}_1^D + \hat{t}_2^D)$ . To see this, recall that  $\hat{t}_i^D = \hat{q}_i^D$ ,  $i = 1, 2$  (eq. 8) and that  $\hat{t}^{MFN} = \frac{1}{2}(\hat{q}_1^{MFN} + \hat{q}_2^{MFN})$  (eq. 15). At the same time, as we have already noted and as one can easily confirm from (8) and (14), the total amount of imports remains unchanged under the two regimes,  $\sum_{i=1}^2 \hat{q}_i^{MFN} = \sum_{i=1}^2 \hat{q}_i^D$ . The application of MFN tariffs has simply diverted production from the less to the more cost efficient firm. In particular,

$$\sum_{i=1}^2 \hat{q}_i^{MFN} = \sum_{i=1}^2 \hat{q}_i^D = \frac{2\alpha - c_1 - c_2}{3 + \gamma} \quad (20)$$

This, immediately, establishes our claim.

We now turn to examining the welfare effects of moving from a regime of tariff discrimination to that of MFN tariffs on the exporting countries, the importing country and the world as a whole. Moreover, we are interested in examining in which way the degree of product differentiation affects those welfare changes.

We start from the two exporting countries. Since we have assumed that the two exporting firms produce solely for exports, the comparison of welfare levels amounts to comparing the profit levels under the two regimes. But, since  $\hat{\pi}_i^{MFN} = (\hat{q}_i^{MFN})^2$  and  $\hat{\pi}_i^D = (\hat{q}_i^D)^2$ , what is needed is to compare output levels. To do so, we recall that from (10) and (17) we know that

$$\hat{q}_1^D - \hat{q}_2^D = \frac{c_2 - c_1}{3 - \gamma} > 0$$

and

$$\hat{q}_1^{MFN} - \hat{q}_2^{MFN} = \frac{c_2 - c_1}{2 - \gamma}$$

$$\text{Consequently, } (\hat{q}_1^{MFN} - \hat{q}_1^D) + (\hat{q}_2^D - \hat{q}_2^{MFN}) = (\hat{q}_1^{MFN} - \hat{q}_2^{MFN}) - (\hat{q}_1^D - \hat{q}_2^D) = \frac{c_2 - c_1}{(2 - \gamma)(3 - \gamma)} \quad (\text{i})$$

But we also know from (20) that  $\hat{q}_1^{MFN} + \hat{q}_2^{MFN} = \hat{q}_1^D + \hat{q}_2^D$ . Or, equivalently, that  $\hat{q}_1^{MFN} - \hat{q}_1^D = \hat{q}_2^D - \hat{q}_2^{MFN}$  (ii)

Combining (i) and (ii), we get

$$\hat{q}_1^{MFN} - \hat{q}_1^D = \hat{q}_2^D - \hat{q}_2^{MFN} = \frac{c_2 - c_1}{2(2 - \gamma)(3 - \gamma)} > 0 \quad (21)$$

That is,  $\hat{q}_1^{MFN} > \hat{q}_1^D$  and  $\hat{q}_2^D > \hat{q}_2^{MFN}$ . Therefore, since  $\hat{\pi}_i^{MFN} = (\hat{q}_i^{MFN})^2$  and  $\hat{\pi}_i^D = (\hat{q}_i^D)^2$ , we conclude that  $\hat{\pi}_1^{MFN} > \hat{\pi}_1^D$  and  $\hat{\pi}_2^D > \hat{\pi}_2^{MFN}$ . Moreover, it is immediate from (21) that the more differentiated the two varieties are, i.e. the smaller the value of  $\gamma$  is, the smaller these differences in welfare are.

At this point, it will be useful for future purposes to see what the difference is in the total welfare (profits) of the two exporting countries under the two regimes. Denoting by  $\hat{\Pi}^j$ ,  $j = MFN, D$  the sum of the two firms' profits under the two regimes and recalling that  $\hat{\pi}_i^j = (\hat{q}_i^j)^2$ ,  $i = 1, 2$   $j = MFN, D$  we get

$$\begin{aligned} \hat{\Pi}^{MFN} - \hat{\Pi}^D &= (\hat{\pi}_1^{MFN} + \hat{\pi}_2^{MFN}) - (\hat{\pi}_1^D + \hat{\pi}_2^D) = (\hat{\pi}_1^{MFN} - \hat{\pi}_1^D) + (\hat{\pi}_2^{MFN} - \hat{\pi}_2^D) \\ &= \left[ (\hat{q}_1^{MFN})^2 - (\hat{q}_1^D)^2 \right] + \left[ (\hat{q}_2^{MFN})^2 - (\hat{q}_2^D)^2 \right] \\ &= (\hat{q}_1^{MFN} + \hat{q}_1^D)(\hat{q}_1^{MFN} - \hat{q}_1^D) + (\hat{q}_2^{MFN} + \hat{q}_2^D)(\hat{q}_2^{MFN} - \hat{q}_2^D) \end{aligned}$$

Since  $\hat{q}_1^{MFN} - \hat{q}_1^D = \hat{q}_2^D - \hat{q}_2^{MFN}$  (eq. 21) we get

$$\begin{aligned} \hat{\Pi}^{MFN} - \hat{\Pi}^D &= (q_1^{MFN} - q_1^D) \left[ q_1^{MFN} + q_1^D - q_2^{MFN} - q_2^D \right] \\ &= (q_1^{MFN} - q_1^D) \left[ (q_1^{MFN} - q_2^{MFN}) + (q_1^D - q_2^D) \right] \end{aligned}$$

Finally, using (10), (17) and (21) we conclude that

$$\Pi^{MFN} - \Pi^D = \frac{(5-2\gamma)(c_2-c_1)^2}{2(2-\gamma)^2(3-\gamma)^2} > 0 \quad (22)$$

We observe that the total welfare (profits) of the exporting countries (firms) increases under MFN. That would imply that the welfare gains enjoyed by the more cost efficient country under MFN tariffs outweigh the corresponding welfare losses incurred by the less cost efficient one. Moreover, we observe, again, that that difference in the total welfare of the two exporters is decreasing with the degree of product differentiation.

We now turn to the importing country. As it does not produce the differentiated good domestically, its welfare is composed of tariff revenues,  $TR^j$ ,  $j = MFN, D$  and consumer surplus,  $CS^j$ ,  $j = MFN, D$ . Regarding tariff revenues, these are higher under tariff discrimination rather than under MFN. In particular, recalling that  $\hat{t}^{MFN} = \frac{1}{2}(\hat{t}_1^D + \hat{t}_2^D)$  and that  $\hat{q}_1^D + \hat{q}_2^D = \hat{q}_1^{MFN} + \hat{q}_2^{MFN}$ , we get

$$\begin{aligned} TR^D - TR^{MFN} &= \hat{t}_1^D \hat{q}_1^D + \hat{t}_2^D \hat{q}_2^D - \hat{t}^{MFN} (\hat{q}_1^{MFN} + \hat{q}_2^{MFN}) \\ &= \hat{t}_1^D \hat{q}_1^D + \hat{t}_2^D \hat{q}_2^D - \frac{1}{2}(\hat{t}_1^D \hat{q}_1^D + \hat{t}_2^D \hat{q}_2^D)(\hat{q}_1^D + \hat{q}_2^D) \\ &= \frac{1}{2}(\hat{t}_1^D - \hat{t}_2^D)(\hat{q}_1^D - \hat{q}_2^D) = \frac{1}{2}(\hat{q}_1^D - \hat{q}_2^D)^2 \end{aligned}$$

since  $\hat{t}_i^D = \hat{q}_i^D$ ,  $i = 1, 2$ . Using (10) we finally get that

$$TR^D - TR^{MFN} = \frac{1}{2} \left( \frac{c_2 - c_1}{3 - \gamma} \right)^2 > 0 \quad (23)$$

Therefore, moving from tariff discrimination to MFN tariffs, the importing country experiences a reduction in its tariff revenue. That reduction, however, is smaller the more differentiated the two varieties are (i.e., the smaller the value of  $\gamma$ .)

Although tariff revenues decrease under MFN tariffs, consumer surplus increases. To see this recall that  $CS = U(q_1, q_2) - p_1 q_1 - p_2 q_2$  and use (1) and (2) to get, after some

manipulations, that  $CS = a + \frac{1}{2}(q_1^2 + q_2^2) + \gamma q_1 q_2$ . Therefore, the difference in consumer surplus between the two regimes is

$$\begin{aligned} CS^{MFN} - CS^D &= \frac{1}{2} \left[ (\hat{q}_1^{MFN})^2 + (\hat{q}_2^{MFN})^2 - (\hat{q}_1^D)^2 - (\hat{q}_2^D)^2 \right] + \gamma (\hat{q}_1^{MFN} \hat{q}_2^{MFN} - \hat{q}_1^D \hat{q}_2^D) \\ &= \frac{1}{2} (\hat{\Pi}^{MFN} - \hat{\Pi}^D) (1 - \gamma) > 0 \end{aligned}$$

where the last equality is derived by recalling that  $\hat{\pi}_i^j = (\hat{q}_i^j)^2$ ,  $i=1, 2$   $j = MFN, D$  and by

observing that  $\hat{q}_1^{MFN} \hat{q}_2^{MFN} - \hat{q}_1^D \hat{q}_2^D = \frac{1}{2} (\hat{\Pi}^D - \hat{\Pi}^{MFN})$ .<sup>6</sup>

Using (22), the above expression becomes

$$CS^{MFN} - CS^D = \frac{(5-2\gamma)(1-\gamma)(c_2-c_1)^2}{2(2-\gamma)^2(3-\gamma)^2} > 0 \quad (24)$$

Interestingly, controlling for the cost differential, we observe that the change in consumer surplus is due entirely to product differentiation. As the two varieties become more alike (i.e., as  $\gamma \rightarrow 1$ ) the difference in consumer surplus under the two regimes tends to zero.

Combining (23) and (24) and after some routine calculations we get that the welfare of the importing country is reduced under MFN tariffs. That is, the ensuing loss is tariff revenue overtakes the gains in consumer surplus. In particular, it turns out that

$$W_3^D - W_3^{MFN} = \frac{(c_2 - c_1)^2}{4(3-\gamma)(2-\gamma)^2} > 0 \quad (25)$$

We observe, however, that the more differentiated the two varieties are, the less is the welfare loss experienced by the importing country under MFN tariffs. This is because, as we noticed

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<sup>6</sup> The latter holds because

$$\begin{aligned} \hat{\Pi}^D - \hat{\Pi}^{MFN} &= \sum_{i=1}^2 (\hat{q}_i^D)^2 - \sum_{i=1}^2 (\hat{q}_i^{MFN})^2 = (\hat{q}_1^D + \hat{q}_2^D)^2 - 2\hat{q}_1^D \hat{q}_2^D - (\hat{q}_1^{MFN} + \hat{q}_2^{MFN})^2 + 2\hat{q}_1^{MFN} \hat{q}_2^{MFN} \\ &= 2(\hat{q}_1^{MFN} \hat{q}_2^{MFN} - \hat{q}_1^D \hat{q}_2^D) \end{aligned}$$



above, under MFN tariffs the losses in tariff revenues get smaller the more differentiated the two varieties are and, at the same time, the gains in consumer surplus partly offset those losses. In the opposite case, as the two varieties become more similar the losses in tariff revenue increase while the gains in consumer surplus evaporate.

We have seen, up to this point, that moving from discriminatory tariffs to MFN tariffs is welfare improving for the more cost efficient exporter and welfare deteriorating both for the less cost efficient exporter and the importer of the differentiated products. Moreover, we have noticed that these welfare losses and gains are less pronounced the more differentiated the two varieties are. We now turn to examining the corresponding effects on world welfare. World welfare, being the sum of the welfare levels of the three countries, is composed of consumer surplus, tariff revenue and total profits. Therefore, denoting world welfare under the two regimes by  $WW^j$ ,  $j = MFN, D$  we get

$$\begin{aligned} WW^{MFN} - WW^D &= (CS^{MFN} - CS^D) + (TR^{MFN} - TR^D) + (\hat{\Pi}^{MFN} - \hat{\Pi}^D) \\ &= \left(\frac{3-\gamma}{2}\right)(\hat{\Pi}^{MFN} - \hat{\Pi}^D) + (TR^{MFN} - TR^D) \end{aligned}$$

where the last equality follows from the fact that  $CS^{MFN} - CS^D = \frac{1}{2}(\hat{\Pi}^{MFN} - \hat{\Pi}^D)(1-\gamma)$ .

Using (22) and (23) and after some routine calculations the above expression becomes

$$WW^{MFN} - WW^D = \frac{(7-3\gamma)(c_2-c_1)^2}{4(3-\gamma)^2(2-\gamma)^2} > 0 \quad (26)$$

Therefore, world welfare increases under MFN. Although both the less cost efficient country and the importing country loose under MFN, the welfare gains of the most cost efficient one overtake those losses. This is due to the improvement in world production efficiency: the application of the MFN tariffs diverts, as we have seen, production from the less to the more cost efficient country. However, these welfare gains are less significant as the varieties become more differentiated.

We summarize our results in the following proposition

**Proposition 3.** *In the absence of the MFN clause, the importing country would have an incentive to discriminate its import tariffs by setting a higher tariff on its imports from the more cost efficient country. Compared to tariff discrimination, the application of MFN tariffs is welfare improving for the more cost efficient exporter, while it is welfare deteriorating for both the less cost efficient and the importing country. At the same time, MFN tariffs are welfare improving for the world as a whole, as they result in the improvement of world production efficiency. However, all these gains and losses are less pronounced the more differentiated the two exported varieties are.*

### **1.6 Concluding Comments**

In a simple model with two exporting countries/firms each producing a variety of a differentiated product and one importing country, we have seen that, in the absence of the MFN clause, the importing country would have an incentive to discriminate its import tariffs by imposing a higher tariff on its imports from the more cost efficient producer. The application of the MFN clause leads to a (uniform) tariff level lying in between the two discriminatory ones. However, under both regimes, the optimal tariff levels are positively related to the degree of product differentiation. So are output and profit levels. Switching from a regime of tariff discrimination to one of MFN tariffs results to an improvement of world production efficiency, as production is diverted from the less to the more cost efficient producer. But it also has distributional effects. Although world welfare is increasing, due to the improved production efficiency, the distribution of those welfare gains is pretty asymmetric. It is only the more cost efficient exporter who benefits; both the less cost efficient exporter and the importer stand to lose. So, one can understand the tensions existing between more and less developed countries regarding the application of the MFN principle. However, we have also shown that the welfare implications, positive or negative, are less acute the more differentiated the two varieties are. As the bulk of trade is in differentiated products, that would imply that the tensions between the more and the less developed countries we were referring to before may not be or should not be as severe. At the same time, one also must note that, for precisely the same reasons the welfare gains for the world as a whole may also be not as great as one might think.

## APPENDIX

A.1 To show that  $\frac{\partial \hat{q}_i^D}{\partial \gamma} < 0$ ,  $i = 1, 2$ .

We know that  $\hat{q}_1^D - \hat{q}_2^D = \frac{c_2 - c_1}{3 - \gamma}$  (see, eq. 10) and that  $\hat{q}_1^D + \hat{q}_2^D = \frac{2\alpha - c_1 - c_2}{3 + \gamma}$  (see, eq. 20).

So,  $\frac{\partial \hat{q}_1^D}{\partial \gamma} - \frac{\partial \hat{q}_2^D}{\partial \gamma} > 0$  and  $\frac{\partial \hat{q}_1^D}{\partial \gamma} + \frac{\partial \hat{q}_2^D}{\partial \gamma} < 0$ . The latter inequality implies that at least one of the two derivatives is negative and this must be the smaller of the two; according to the first inequality this must be  $\frac{\partial \hat{q}_2^D}{\partial \gamma}$ .

So we only need to show that  $\frac{\partial \hat{q}_1^D}{\partial \gamma} = \frac{6\gamma(\alpha - c_1) - (9 + \gamma^2)(\alpha - c_2)}{(9 - \gamma^2)^2} < 0$ . It suffices that the

numerator is negative, which can be written as  $\alpha(6\gamma - 9 - \gamma^2) - 6\gamma c_1 + (9 + \gamma^2)c_2 < 0$ . It suffices that  $\alpha(6\gamma - 9 - \gamma^2) + (9 + \gamma^2)c_2 < 0$  or  $-\alpha(\gamma - 3)^2 + (9 + \gamma^2)c_2 < 0$  or  $\alpha > \frac{9 + \gamma^2}{(\gamma - 3)^2} c_2$ . However, the final inequality always holds as  $\alpha > 4c_2$  and the RHS is always less than  $4c_2$ .

A.2 To show that  $\frac{\partial \hat{q}_i^{MFN}}{\partial \gamma} < 0$ ,  $i = 1, 2$ .

We know that  $\hat{q}_1^{MFN} - \hat{q}_2^{MFN} = \frac{c_2 - c_1}{2 - \gamma}$  (see, eq. 17) and that  $\hat{q}_1^D + \hat{q}_2^D = \frac{2\alpha - c_1 - c_2}{3 + \gamma}$  (see, eq. 20).

Following the same reasoning as above, we only need to show that

$\frac{\partial \hat{q}_1^{MFN}}{\partial \gamma} = \frac{(c_2 - \alpha) + (1 + 2\gamma)\hat{q}_1^{MFN}}{(3 + \gamma)(2 - \gamma)} < 0$  or, simply, that  $(1 + 2\gamma)\hat{q}_1^{MFN} < \alpha - c_2$ . Substituting

for  $\hat{q}_1^{MFN}$  (eq. 14) and noticing that  $(1 + 2\gamma) = (3 + \gamma) - (2 - \gamma)$  the latter inequality becomes

$$2\alpha(2-\gamma)[(3+\gamma)-(2-\gamma)] + c_2[(3+\gamma)-(2-\gamma)]^2 - [(3+\gamma)-(2-\gamma)]5c_1 < 2(3+\gamma)(2-\gamma)(\alpha - c_2)$$

Hence it suffices to show that

$$2\alpha(2-\gamma)[(3+\gamma)-(2-\gamma)] + c_2[(3+\gamma)-(2-\gamma)]^2 < 2(3+\gamma)(2-\gamma)(\alpha - c_2)$$

or, after some routine calculations, that  $2\alpha(2-\gamma)^2 > [(3+\gamma)^2 + (2-\gamma)^2]c_2$ . Since

$3+\gamma > 2-\gamma$  for all  $\gamma \in (0,1)$  it suffices to show that  $2\alpha(2-\gamma)^2 > 2(3+\gamma)^2 c_2$  or,

simply, that  $\alpha > \frac{(3+\gamma)^2}{(2-\gamma)^2} c_2$ . However, the final inequality always holds as  $\alpha > 4c_2$  and

the RHS is always less than  $4c_2$ .

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