Tariff discrimination versus MFN under incomplete information

Saltuk Ozerturk and Kamal Saggi*
Department of Economics
Southern Methodist University
Dallas, TX 75275-0496
October 2002

Abstract

Does the presence of incomplete information affect a country’s incentive to discriminate across exporters with different costs? If so, how? From a global perspective, does the presence of incomplete information weaken or strengthen the case for MFN? We examine these questions in a model of imperfect competition with two asymmetric exporters and a single importing country who is imperfectly informed about exporters’ costs. While the importing country prefers discrimination to MFN, equilibrium tariff dispersion is lower under incomplete information. As a result, the global welfare gain from MFN, while still positive, is smaller under incomplete information relative to the case of complete information.

Keywords: Tariffs, Most Favored Nation Clause, Oligopoly, Trade policy.
JEL Classifications: F13, F12.

1 Introduction

The most favored nation (MFN) principle is one of the cornerstones of major multilateral trade agreements such as the General Agreement on Tariffs and Trade (GATT) and the General Agreement on Trade in Services (GATS) (see Hoekman and Kostecki,
2001). In fact, almost all agreements that govern trade relationships between members of the World Trade Organization (WTO) include an MFN clause. Hence, it is important to understand the economic rationale behind the MFN principle.

The main economic principle underlying MFN is non-discrimination. Yet, the case for non-discrimination in trade policy is not immediately obvious (see Staiger, 1995, for a through discussion). The goal of this paper is to contribute to our understanding of the effects of MFN. In particular, we extend the literature on tariff discrimination under imperfect competition by asking whether and how the case for MFN depends upon the assumption that tariffs are chosen under complete information. Important contributions to this literature include Brander and Spencer (1984), Gatsios (1990), Choi (1995), and Hwang and Mai (1991).

It is quite unlikely that governments have complete information at their disposal while choosing their tariffs. In particular, information about foreign exporters may be hard to come by. While the assumption of perfect information can be a useful simplification, it is worth knowing how the effects of MFN depends upon this assumption. For example, is the adoption of MFN more or less costly for a country when it lacks information about the costs of exporters? A related, and perhaps more important issue is how the global gains from MFN adoption depend upon the degree of information available to governments.

We examine the above questions in a model of imperfect competition with two asymmetric exporters and a single importing country where the importing country government is imperfectly informed about the costs of foreign exporters. Unlike Bagwell and Staiger (1999) but like Choi (1995), Hwang and Mai (1991), Gatsios (1990), and Saggi (2002), the importing country is motivated to employ tariffs to extract rents from exporters who compete a la Cournot (as in Brander and Spencer, 1984). Thus, we extend the research on the effects of MFN under imperfect competition by highlighting the role played by incomplete information.¹ Our main result is that while the importing country prefers discrimination to MFN even under incomplete information, equilibrium tariff dispersion is lower under incomplete information relative to complete information. In other words, the lack of complete information weakens the extent of tariff discrimination practiced by the importing country. An important

¹Like the literature on MFN under imperfect competition, this paper does not examine how MFN affects trade liberalization. For analyses of this important issue, see Caplin and Krishna (1998), Ludema (1991), and McCalman (2002).
implication of this result is that the global welfare gain from MFN, while still positive, is smaller under incomplete information relative to complete information.

To the best of our knowledge, the only other paper that considers the effects of MFN under imperfect information is McCalman (2002). He considers a Ricardian model of trade where one large country trades with many small ones and has imperfect information about the size of the gains from trade of each partner. He too finds that MFN adoption improves world welfare over bilateral trade negotiations by aggregating uncertainty over a number of trading partners. His focus, though, is on the way information is processed under different institutions which give rise to different bargaining environments: bilateral versus MFN negotiations. Our paper complements his analysis by finding positive effects of MFN under incomplete information in a fundamentally different model of trade.

2 Model

There are three countries; an importing country (home) and two exporting countries (foreign). There are two goods: $x$ and $y$ and preferences over these goods are quasi-linear:

$$U(x, y) = u(x) + y$$

Good $y$ is the numeraire good produced under perfect competition with constant returns to scale technology. Good $x$ is produced by a single firm in each country. We shall refer to the output of country $i$’s firm as simply the output or (exports) of country $i$, where $i \in \{0, 1, 2\}$ where 0 stands for the home country. The marginal cost of production for firm $i$ is constant and it equals $c_i > 0$.

It is common knowledge that country 1’s firm has marginal cost $c_1 = c$ and that the marginal cost of the home firm is given by $c_0$. However, the marginal cost of country 2’s firm $c_2$ is her private information. In particular, the distribution of firm 2’s cost is as follows:

$$\begin{cases} 
  c_2 = c_l = c - a \text{ with probability } \lambda \\
  c_2 = c_h = c + a \text{ with probability } 1 - \lambda 
\end{cases}$$

The parameter $a$ measures the dispersion of technology between the two exporters.

Firms compete in quantities (Cournot competition) and we restrict attention to the equilibrium in the home market. The exporting firm $i$ faces a specific tariff $t_i$ for $i \in \{1, 2\}$. These tariffs are endogenously determined (see below).
In what follows, what is important is that the home country makes its tariff choice under incomplete information: whether or not firm 2 itself knows its production cost is immaterial. In other words, our analysis holds for the case where firm 2 must choose its output level without knowing its true cost (i.e. under uncertainty). We will proceed with the assumption that firm 2 knows its own cost.

2.1 Tariffs under MFN and discrimination

In this section, we compare the home country’s tariff schedule under discrimination to that under MFN. We consider a two stage game. In the first stage, the home country sets its tariffs. In the second stage, firms engage in Cournot competition (i.e. simultaneously choose their output levels).

Consider the output stage. The home firm chooses its output $x_0$ to maximize its expected profits:

$$Max_{x_0} E(\pi_0(t_1, t_2)) \equiv \lambda(p(X^l)x_0) + (1 - \lambda)(p(X^h)x_0) - c_0x_0$$

where $X^h \equiv x_0 + x_1 + x^h_2$ and $X^l \equiv x_0 + x_1 + x^l_2$ denote the type dependent aggregate output levels. Since firm 2 may be one of two types, we denote the type dependent output of country 2 with $x^i_2$ where $i \in \{l, h\}$: $x^h_2$ denotes the output of firm 2 when its cost equals $c_h$ and $x^l_2$ denotes its output when its cost equals $c_l$.

Similarly, firm 1 solves

$$Max_{x_1} \lambda(p(X^l)x_1) + (1 - \lambda)(p(X^h)x_1) - (c + t_1)x_1$$

Firm 2’s problem depends upon its type. Firm 2 of type $i \in \{l, h\}$ solves

$$Max_{x_2^i} p(X^i)x^i_2 - (c_i + t_2)x^i_2$$

If firm 2’s cost equals $c_l$, then the product market equilibrium $(x_0, x_1, x^l_2)$ solves the following first order conditions:

$$p + x_0p^l = c_0$$
$$p + x_1p^l = c + t_1$$
$$p + x^l_2p^l = c_l + t_2$$

Replacing $c_l$ by $c_h$ in the third equation above and solving the three equations gives the market equilibrium $(x_0, x_1, x^h_2)$ under the case where firm 2’s cost equals $c_h$. As
is well known, firms 0 and 1 choose their output levels under imperfect information and behave as if firm 2’s cost equals the expected cost \( c_\lambda \equiv \lambda c_l + (1 - \lambda)c_h \).

Moving back, now consider the home country’s problem of tariff choice. Under tariff discrimination, the home country chooses its tariff schedule \((t_1, t_2)\) to maximize her expected welfare:

\[
Max_{t_1, t_2} E[W(t_1, t_2)] = E[CS(t_1, t_2) + TR(t_1, t_2) + \pi_0(t_1, t_2)]
\]

(4)

where the home country’s expected consumer surplus equals

\[
E[CS] = \lambda(u(X^l) - pX^l) + (1 - \lambda)(u(X^h) - pX^h)
\]

(5)

and its expected tariff revenue is

\[
E[TR] = t_1x_1 + \lambda t_2x_1^l + (1 - \lambda)t_2x_2^h
\]

(6)

and finally \(E(\pi_0(t_1, t_2))\) denotes the expected profit of the home firm.

For ease of notation, let us define

\[
x_2^\lambda \equiv \lambda x_2^l + (1 - \lambda)x_2^h
\]

(7)

and

\[
\frac{\partial X^\lambda}{\partial t_i} \equiv \lambda \frac{\partial X^l}{\partial t_i} X^l + (1 - \lambda) \frac{\partial X^h}{\partial t_i} X^h, \quad i \in \{1, 2\}
\]

(8)

Using these definitions, the first order conditions with respect to \(t_1\) and \(t_2\) are given by

\[
F(t_1, t_2, \lambda) \equiv \frac{\partial E(W)}{\partial t_1} = \frac{\partial E(\pi_0)}{\partial t_1} + x_1 + t_1 \frac{\partial x_1}{\partial t_1} + t_2 \frac{\partial x_2^\lambda}{\partial t_1} - p \frac{\partial X^\lambda}{\partial t_1} = 0
\]

(9)

\[
G(t_1, t_2, \lambda) \equiv \frac{\partial E(W)}{\partial t_2} = \frac{\partial E(\pi_0)}{\partial t_2} + t_1 \frac{\partial x_1}{\partial t_2} + t_2 \frac{\partial x_2^\lambda}{\partial t_2} + x_2^\lambda - p \frac{\partial X^\lambda}{\partial t_2} = 0
\]

(10)

Since marginal cost of production for each firm is constant, the expected profit of the home firm depends on the total protection \(t_1 + t_2\), not on how it is divided between the exporting firms (see Varian, 1992). Thus, we must have:

\[
\frac{\partial E(\pi_0(t_1, t_2))}{\partial t_1} = \frac{\partial E(\pi_0(t_1, t_2))}{\partial t_2}
\]

Subtracting (10) from (9) and noting that

\[
\frac{\partial X^i}{\partial t_1} = \frac{\partial X^i}{\partial t_2}
\]
for $i \in \{l, h\}$, one gets

$$x_1 - x_2 - t_i (\frac{\partial x_1}{\partial t_i} - \frac{\partial x_1}{\partial t_2}) + t_2 (\frac{\partial x_2}{\partial t_1} - \frac{\partial x_2}{\partial t_2}) = 0$$  \hspace{1cm} (11)

But from the first order conditions in (3) characterizing the product market equilibrium, we have

$$x_1 - x_2 = \frac{c - c_\lambda + (t_1 - t_2)}{p'}$$  \hspace{1cm} (12)

where $c_\lambda = \lambda c_l + (1 - \lambda)c_h$ is the expected cost of firm 2. Substituting (12) into (11) and rearranging gives the following relationship between the equilibrium tariffs $t_1^*$ and $t_2^*$.

$$\left(t_1^* - t_2^*\right) \left\{1 + \frac{(\frac{\partial x_1}{\partial t_1} - \frac{\partial x_1}{\partial t_2})p'}{p'}\right\} = c_\lambda - c$$  \hspace{1cm} (13)

which implies that $t_1^* > t_2^*$ iff $c_\lambda > c$. Therefore, as in the literature on tariff discrimination under complete information, we find that under tariff discrimination, the optimal tariff on country 1 ($t_1^*$) is higher than the tariff on country 2 ($t_2^*$) iff country 1 is expected to be more efficient than country 2. Even more interesting is the following result:

**Proposition 1:** Relative to the complete information case, the equilibrium degree of tariff dispersion ($t_1^* - t_2^*$) under tariff discrimination is lower under incomplete information.

The above result follows immediately from equation (13). Under incomplete information, tariff discrimination is proportional to $c_\lambda - c$ whereas under complete information tariff discrimination is proportional to the degree of technology dispersion between firms $c - c_l = c_h - c = a$. Since $c_\lambda - c = (1 - 2\lambda)a < a$, the importing country’s tariffs under incomplete information are closer together than under complete information.

Now consider the home country’s optimal MFN tariff. In this case, the home country imposes the same tariff $t$ on both exporters. Under MFN, the home country solves

$$\max_t E[W(t)] = E[CS(t) + TR(t) + \pi_0(t)]$$  \hspace{1cm} (14)
The first order condition for the optimal MFN tariff $t$ is

$$F(t, \lambda) = -p' \frac{\partial X^\lambda}{\partial t} + (p - c) \frac{\partial x_0}{\partial t} + x_1 + x_2^\lambda + t\left(\frac{\partial x_1}{\partial t} + \frac{\partial x_2^\lambda}{\partial t}\right) = 0$$

(15)

where

$$\frac{\partial X^\lambda}{\partial t} \equiv \lambda \frac{\partial X^l}{\partial t} - X^l + (1 - \lambda) \frac{\partial X^h}{\partial t} - X^h$$

and $x_2^\lambda$ is as defined before. The above condition defines the optimal MFN tariff $t^*$ as

$$t^* = \frac{-p' \frac{\partial X^\lambda}{\partial t} - (x_1 + x_2^\lambda) - (p - c) \frac{\partial x_0}{\partial t}}{\frac{\partial x_1}{\partial t} + \frac{\partial x_2^\lambda}{\partial t}}$$

(16)

Now, we can investigate how the optimal MFN tariff $t^*$ compares with the discriminatory tariffs $t_1$ and $t_2$. Note that when $t_j = t$ for $j \in \{1, 2\}$ we must have

$$\frac{\partial X^i}{\partial t} = 2 \frac{\partial X^i}{\partial t_j} \text{ for } i \in \{h, l\} \text{ and } j \in \{1, 2\}$$

(17)

Consider the first order condition under discrimination given by (9). Evaluating this at $t_1 = t_2 = t$ and using the above relationships in (17) yields

$$\left. \frac{\partial E(W)}{\partial t_1} \right|_{t_1 = t_2 = t} = x_1 + t\left(\frac{\partial x_1}{\partial t} + \frac{\partial x_2^\lambda}{\partial t}\right) - \left(\frac{p'}{2}\right)X^\lambda$$

Evaluating this equation at the optimal MFN tariff $t^*$ defined in (16) yields

$$\left. \frac{\partial E(W)}{\partial t_1} \right|_{t_1 = t_2 = t^*} = \frac{2x_1 - (x_1 + x_2^\lambda)}{2} > 0 \text{ iff } c_\lambda > c$$

Thus starting at the optimal MFN tariff $t^*$, the home country gains from increasing its tariff on country 1 iff country 1 is expected to be more efficient than country 2, as implied by $c < c_\lambda$. Therefore, we find that the optimal MFN tariff $t^*$ strictly lies between the discriminatory tariffs $t_1^*$ and $t_2^*$. For $c_\lambda > c$, we have $t_1^* > t^* > t_2^*$, whereas for $c_\lambda < c$ we have $t_2^* > t^* > t_1^*$. Thus, the existing result that the MFN tariff is bound by the two discriminatory tariffs (see Gatsios, 1990, Hwang and Mai, 1991, and Saggi, 2002) holds even under incomplete information.

What happens to the MFN tariff as the probability of facing a low cost exporter increases? Consider the first order condition $F(t, \lambda) = 0$ in (16) that describes the optimal MFN tariff. Total differentiation and solving for $\frac{\partial t^*}{\partial \lambda}$ yields

$$\frac{\partial t^*}{\partial \lambda} = -\frac{F_\lambda}{F_t} > 0$$
which follows since $F_t < 0$ by the second order condition and
\[
F_\lambda = -F_t + (x_1 + x_2^\lambda) > 0
\] (18)

Therefore, an increase in the probability that firm 2 is of low cost type increases the MFN tariff.

Now, consider the discrimination regime. From the equilibrium condition (13), one can see the effect of $\lambda$ on the degree of tariff dispersion $t_1^* - t_2^*$. When $\lambda = 1/2$, this dispersion is zero, since the expected cost of firm 2 is equal to the known cost $c$ of firm 1. For $\lambda \in [0, 1/2)$, i.e., firm 2 is expected to be the efficient exporter and higher values of $\lambda$ imply a higher expected technology dispersion so that the degree of tariff dispersion in favor of the inefficient firm increases. For $\lambda \in (1/2, 1]$, the same argument applies, but this time the tariff dispersion becomes higher in favor of firm 1, as it is firm 1 that is expected to be the inefficient exporter. Therefore, for $\lambda \neq 1/2$, an increase in $\lambda$ increases the degree of tariff dispersion between the two countries.

Consider now the effect of $\lambda$ on the level of equilibrium tariffs $t_1^*$ and $t_2^*$ under tariff discrimination. As $\lambda$ increases one expects that the optimal discriminatory tariff $t_1^*$ on country 1 should decrease (since it is more likely that she is the inefficient exporter) and the optimal discriminatory tariff $t_2^*$ on country 2 should increase. Let $F_\lambda(G_\lambda)$ denote the partial derivative with respect to $\lambda$, of the marginal increase in expected welfare of the home country with respect to $t_1(t_2)$. The following result confirms this intuition.

**Lemma 1:** Suppose $F_\lambda > 0$ and $G_\lambda < 0$. Then
\[
\frac{\partial t_1^*}{\partial \lambda} < 0 \text{ and } \frac{\partial t_2^*}{\partial \lambda} > 0
\]

Proof: Totally differentiating the equilibrium conditions (9) and (10) and using the implicit function theorem, one gets
\[
\text{sign}\left(\frac{\partial t_1^*}{\partial \lambda}\right) = \text{sign}(F_\lambda G_2 - F_2 G_\lambda)
\]
\[
\text{sign}\left(\frac{\partial t_2^*}{\partial \lambda}\right) = \text{sign}(F_1 G_\lambda - G_1 F_\lambda)
\]

Imposing $F_\lambda > 0$ and $G_\lambda < 0$ yields the desired result.
2.2 Welfare effects of MFN

In this section, we investigate the welfare effects of MFN and the specific role of incomplete information. In order to quantify welfare under the two different tariff regimes, we assume that $u(x)$ is quadratic, so that the demand curve for good $x$ is linear in home country:

$$p(X) = A - bX$$

where $X$ is the aggregate output.

We first report the equilibrium tariff rates under each regime under linear demand.

**Lemma 2**: The optimal discriminatory tariffs under linear demand are

$$t_1^* = \frac{A' + 3a(1 - 2\lambda)}{20} \quad \text{and} \quad t_2^* = t_1^* - \frac{a(1 - 2\lambda)}{2} \quad \text{where} \quad A' = 2(3A - 2c - c_0).$$

and the optimal MFN tariff is

$$t^* = \frac{t_1^* + t_2^*}{2}$$

We start our welfare comparison with the home country. One question of interest is whether the home country is better off under tariff discrimination or MFN when it has incomplete information about the costs of exporters. As in the complete information case, it turns out that the home country is better off under tariff discrimination relative to MFN:

**Proposition 2A**: Let $W_{MFN}$ denote the expected welfare of home country under MFN and $W_D$ denote her expected welfare under tariff discrimination. Then

$$W_D - W_{MFN} = \frac{a^2(1 - 2\lambda)^2}{8b} > 0$$

i.e., the home country is better off discriminating for any $\lambda \neq 1/2$.

Further note, that the welfare loss from adopting MFN for the importing country is increasing in the degree of cost dispersion between the two exporters (as measured by the parameter $a$). Next we investigate the implications of MFN for world welfare.

**Proposition 2B**: Let $WW_{MFN}$ denote the expected world welfare under MFN and $WW_D$ denote the expected world welfare under tariff discrimination. Then

$$WW_{MFN} - WW_D = \frac{a^2(1 - 2\lambda)^2}{4b} > 0$$

i.e. the world is always better off under MFN than under tariff discrimination for any $\lambda \neq 1/2$. Furthermore, the larger the cost dispersion between exporters ($a$), the larger the gains from MFN adoption.
The reason for this result is that MFN favors the exporter that is expected to be more efficient and thereby eliminates the harmful trade diversion introduced by tariff discrimination.

To investigate the role played by incomplete information in our model, we ask two further questions: Is the importing country’s incentive to discriminate (measured by the welfare loss due to adopting MFN) lower or higher under incomplete information? Similarly, are the gains from MFN (measured by the world welfare gain due to adopting MFN) lower or higher under incomplete information?

Define $\Delta W(\lambda) \equiv W_D(\lambda) - W_{MFN}(\lambda)$ as the loss in welfare suffered by the home country due to MFN. From Proposition 2A, we know that $\Delta W(\lambda)$ is positive for any $\lambda \neq 1/2$. Now define a similar welfare loss function for the full information case, corresponding to $\lambda = 1$ or $\lambda = 0$ as $\Delta W(full) \equiv W_D(full) - W_{MFN}(full)$.

Proposition 3A: The home country’s welfare loss due to adopting MFN is always smaller under incomplete information, i.e.,

$$\Delta W(\lambda) - \Delta W(full) = \frac{\lambda a^2 (\lambda - 1)}{2b} < 0.$$  

In other words, incomplete information decreases the home country’s incentive to practice tariff discrimination. The intuition for this result is simple: since the degree of tariff dispersion is lower under incomplete information, the adoption of MFN does not require the importing country to move too far away from its optimal choice.

Define $\Delta WW(\lambda) \equiv WW_{MFN}(\lambda) - WW_D(\lambda)$ as the gain in world welfare due to adopting MFN under incomplete information. From Proposition 2B, we know that $\Delta WW(\lambda)$ is positive for any $\lambda \neq 1/2$. Now define a similar welfare gain function for the full information case, corresponding to $\lambda = 1$ or $\lambda = 0$ as $\Delta WW(full) \equiv WW_{MFN}(full) - WW_D(full)$.

Proposition 3B: Relative to complete information, the gain in world welfare due to MFN adoption is smaller under incomplete information:

$$\Delta WW(full) - \Delta WW(\lambda) = \frac{\lambda(1 - \lambda)a^2}{b} > 0.$$  

The intuition for this result is that the incentives to discriminate are strongest under full information and MFN introduces a larger welfare gain precisely when

---

2While the cost of production of firm 2 depends upon $\lambda$ (so that aggregate output differs under the cases $\lambda = 0$ and 1), the relative welfare loss suffered by the importing country due to MFN adoption does not depend upon which of the two full information cases is considered.
incentives to discriminate are the strongest. Therefore, MFN contributes less to world welfare under incomplete information. Thus, MFN and the lack of information regarding an exporter’s cost are substitutes in terms of improving world welfare.

3 Conclusion

This paper has examined the effect of incomplete information on tariff discrimination and the welfare consequences of the adoption of an MFN clause that prohibits such discrimination. Our main result is that an importing country continues to prefer tariff discrimination to MFN even under incomplete information and such discrimination results in higher tariffs being imposed on the exporter that is expected to be more efficient. However, relative to the case of complete information, the tariff discrimination practiced by the importing country is milder in nature. Thus, both the lack of information and MFN favor the efficient exporter.

The above result has an important implication: since equilibrium tariff dispersion is muted due to incomplete information, the global welfare gains from MFN adoption are also lower in a world of incomplete information. In our model, information about costs is used by the importing country to introduce trade diversion in the world that is favorable for the inefficient exporter. Such trade diversion is harmful for the world and incomplete information ensures that less such diversion occurs thereby reducing the welfare gain from MFN adoption. It bears repeating that the welfare effect of MFN remains positive even under incomplete information; it is just lower in magnitude relative to complete information.

References


