The Role of MFN under Asymmetries in Environmental Standards

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Abstract

We critically examine the implications of the most favored nation (MFN) clause under asymmetric environmental standards. Using an oligopolistic intra-industry trade model, we show that tariff discrimination leads to an environmentally beneficial trade diversion and higher world welfare than MFN.

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1 Introduction

Recently, there has been growing public concern related to the degradation of the global commons (i.e. ozone depletion, loss of biological diversity and climate change). The shift from the local to the global scale has rendered environmental problems more visible and suggests a critical link between environmental and trade policies. While full cooperation yields the economically optimal outcome, an inequitable sharing of the burden of pollution abatement, incentives to free-ride, and difficulties in enforcement make cooperation among countries difficult.

Presently, environmental standards differ substantially across countries. Producers in countries with stricter environmental standards have worried about the impact of those standards on their competitiveness in world markets whereas governments and firms in countries with less strict standards have expressed concern about new barriers being erected against their exports.[1] As a result, the World Trade Organization (WTO) has been involved in the discussion of environmental policy and its impact on trade and welfare. At the heart of WTO is the principle of non-discrimination - embodied in the most-favored-nation (MFN) clause in Article I of the General Agreements on Tariffs and Trade (GATT) - under which WTO members are required to treat products from all other members equally. However, the economic case for non-discrimination from a pure trade policy perspective is hardly obvious (Caplin and Krishna, 1988, Horn and Mavroidis, 2001, Saggi and Yildiz, 2005).

In this paper, we examine the implications of the MFN principle as opposed to tariff discrimination when environmental standards are asymmetric across countries.[2] Under an oligopolistic intra-industry trade model, we address the following questions.[3] What is the pattern of tariffs under MFN and discrimination? Is MFN adoption necessarily desirable from an aggregate world welfare perspective? We show that when countries deviate from

[1] The linkage between environmental and trade policies has been examined by Conrad (1993), Barrett (1994), Kennedy (1994), Ulph (1996), and Engel (2004), among others.

[2] Article XX of the GATT includes important environmental-related provisions that override other obligations of the GATT, including potentially MFN. See the key measures in paragraphs (b) and (g).

[3] See Hwang and Mai (1991), Choi (1995) and Saggi (2004).

MFN and tariff discriminate, environmentally beneficial trade diversion occurs via punishing countries that are free riding in the supply of a global public good. In this way, a larger share of world production is undertaken by countries with stricter environmental standards and higher world welfare obtains under discrimination relative to MFN.

2 Model

We develop a simple oligopoly model of international trade between n countries (indexed by $i = 1...n$). Firms produce a joint product: a homogenous traded good x and pollution resulting from the production of x. The pollution generated is a transboundary public bad that affects all countries equally, regardless of the point of origin. Each country contains a single profit-maximizing firm and has a predetermined pollution abatement standard $\phi_i \epsilon [0, 1]$, such as a limit on CO_2 emissions or the extent of land-use restrictions in biodiversity-sensitive areas. Costs to firm i are $C(x_i, \phi_i) = \sigma \phi_i x_i$, where $x_i = \sum_{z=1}^{n} x_{iz}$ denotes the total output produced in country i and sold across all markets, and σ is the marginal cost of abatement.[4] Given the abatement standards, emissions by firm i are $x_i(1 - \phi_i)$. Note that when no abatement is undertaken, emissions are equal to output level while emissions are zero if abatement is maximal. Aggregate damages are then given by $\Psi = \omega \sum_{z=1}^{n} x_z(1 - \phi_z)$, where ω is the marginal benefit of abatement (or marginal damages).

We assume that inverse demand $p_i = \alpha - \sum_{z=1}^{n} x_{zi}$ is linear in each country, where x_{zi} denotes the output sold by firm z in country i, and firms compete in quantities (Cournot competition). In this case, firms make independent decisions regarding how much to sell in each market (i.e. markets are segmented).[5] Thus, it is sufficient to focus on only one country's market equilibrium. Country i's tariff schedule is a 1xn vector: $\mathbf{t}_i \equiv (t_{1i}, ..., t_{ni})$ where firm z faces a specific tariff t_{zi} when exporting to country i and $t_{ii} = 0$ for all i.

In order to critically examine the implications of MFN when environmental standards differ across countries, we consider a two-stage game under two tariff regimes: MFN and

[4] For simplicity, marginal cost of production and transport costs are assumed to be zero.

[5] As in Brander and Spencer (1985).

discrimination. In the first stage, given exogenous abatement standards and the tariff regime, countries simultaneously choose their tariff schedules. Then, firms compete in quantities.

3 MFN versus Tariff Discrimination

We obtain a subgame perfect Nash equilibrium. There are n first-order conditions for profit maximization for each firm in each market. Firm j's profits from exports to country i are given by

$$\Pi_{ji} = [p_i(x_i) - \sigma\phi_j - t_{ji}]x_{ji} \tag{1}$$

where $x_i = \sum_{z=1}^{n} x_{zi}$. Firm j's first-order condition yields

$$x_{ji} = \frac{\alpha - \sum_{z\neq j} x_{zi} - \sigma\phi_j - t_{ji}}{2} \tag{2}$$

Solution for the product market equilibrium leads to the following output levels:

$$x_{ii} = \frac{\alpha + \sum_{z\neq i}(t_{zi} + \sigma\phi_z) - n\sigma\phi_i}{n+1}, \; x_{ji} = \frac{\alpha + \sum_{z\neq j}\sigma\phi_z + \sum_{z\neq j,i} t_{zi} - n(\sigma\phi_j + t_{ji})}{n+1} \tag{3}$$

At the trade policy stage, countries simultaneously choose their tariff schedules to maximize their own welfare. Due to linear costs and market segmentation, strategic independence of tariffs obtains so that the own tariffs of country i do not effect its export profits $(\sum_{z\neq i} \pi_{iz}(\mathbf{t_{-i}}))$. Under tariff discrimination, country i solves:

$$\underset{\mathbf{t_i}}{Max}\; W_i(\mathbf{t_i}) \equiv CS_i(\mathbf{t_i}) + \pi_{ii}(\mathbf{t_i}) + TR_i(\mathbf{t_i}) - \Psi(\mathbf{t_i}, \mathbf{t}_{-i}) \tag{4}$$

where $CS_i = \frac{x_i^2(\mathbf{t_i})}{2}$ denotes consumer surplus in country i, $\pi_{ii}(\mathbf{t_i}) = x_{ii}^2(\mathbf{t_i})$ the profits of firm i in its own market, $TR_i(t_{ji},\, t_{ki}) = \sum_{z\neq i} t_{zi}x_{zi}$ country i's tariff revenue, and $\Psi(\mathbf{t_i}, \mathbf{t}_{-i})$ the environmental damage suffered by each country.

Solution of the welfare maximization problem in (4) yields the following optimal discriminatory tariffs

$$t_{ji}^* = \frac{1}{(n-1)}\left[\frac{\sum_{z\neq i}(\sigma+\omega)\phi_z - (n-1)(\sigma+\omega)\phi_j}{2} + \tau_i^*\right] \tag{5}$$

where τ_i^* represents total protection under tariff discrimination:

$$\tau_i^* = \frac{\Omega - \Theta}{n+7} \tag{6}$$

such that

$$\Omega = 3(n-1)\alpha + ((n-5) - 2(n+1)) \sum_{z \neq i} (\sigma + \omega)\phi_z$$

and

$$\Theta = (n-1)((n+1)(\omega + \omega\phi_i) + (n-2)\sigma\phi_i)$$

Asymmetric abatement standards across countries yield different mark-up levels for each exporter. This gives country i an incentive to discriminate across its exporters:

$$t_{ji}^* - t_{ki}^* = \frac{(\sigma + \omega)(\phi_k - \phi_j)}{2} \tag{7}$$

Proposition 1 *Under tariff discrimination, the following results hold: (i) country i's optimal tariff on country j is higher than its tariff on country k iff country j's abatement standard is lower than that of country k: $t_{ji}^* \geq t_{ki}^*$ iff $\phi_k \geq \phi_j$; (ii) The true cost ranking of countries is preserved: $\sigma\phi_k + t_{ki}^* \geq \sigma\phi_j + t_{ji}^*$ iff $\sigma \geq \omega$ while it is reversed: $\sigma\phi_k + t_{ki}^* \leq \sigma\phi_j + t_{ji}^*$ iff $\sigma \leq \omega$.*

The first part of the proposition implies that by being biased against (in favor of) the countries with low (high) abatement standards, discrimination causes environmentally beneficial trade diversion. In other words, tariff discrimination works as a punishment mechanism for the countries free riding in the supply of the global public good (those with less stringent environmental policy). Note that the trade diversion becomes larger as both the marginal benefit of abatement, ω, and the marginal cost of abatement, σ, get larger. The second part of the proposition immediately follows from equations in (5) and (6) and argues even a stronger result: when ω exceeds σ, the discrimination is so strong that the exporters with higher abatement standards gain competitive advantage over the ones with lower standards.

The problem under MFN differs from the problem in (4) in only one respect: country i imposes the same tariff t_i on all exporters and solves

$$\underset{t_i}{Max}\ W_i(t_i) \equiv CS_i(t_i) + \pi_{ii}(t_i) + TR_i - \Psi(t_i, t_{-i}) \tag{8}$$

Due to symmetric treatment under MFN, it is immediate that

$$t_i^M = \frac{\tau_i^M}{(n-1)} \tag{9}$$

where τ_i^M represents the total protection under MFN. It is proved by Saggi (2004) that under Cournot competition with constant marginal costs (as assumed here), total protection under discrimination τ_i^* does not change when it adopts MFN tariffs:

$$\tau_i^M = \tau_i^* \tag{10}$$

This implies that relative to discrimination, MFN adoption does not change the equilibrium price and total imports while it has distributional implications for its trading partners. Using the optimal tariffs in (5) and (9), we obtain

$$t_i^M - t_{ji}^* = \frac{(\sigma+\omega)(\sum_{z\neq i}\phi_z - (n-1)\phi_j)}{(n+1)} \tag{11}$$

Proposition 2 *Country i's discriminatory tariff is higher than its MFN tariff on country j's export iff country j's abatement standard is lower than the average abatement standard of all exporters to country i:*

$$t_i^M \leq t_{ji}^* \text{ iff } \phi_j \leq \overline{\phi_{\sim i}} = \frac{\sum_{z\neq i}\phi_z}{n-1}$$

As might be expected, countries always have unilateral incentives to discriminate since MFN constrains its choice set without conferring any benefit in return. The above proposition informs us that when a country deviates from Article I and discriminates, the trading partner with the highest abatement standard necessarily gains while the one with the lowest standard necessarily loses. The impacts on the other countries depend on the distribution of the abatement standards across countries.

3.1 World Welfare

Article I of the GATT requires each member country to adopt MFN on a multilateral basis rather than unilaterally. To this end, we consider two scenarios, one where all countries have to abide by Article I and another where they are free to discriminate. Given the fact that discrimination causes an environmentally beneficial trade diversion, is discrimination necessarily desirable from the perspective of aggregate world welfare? We define world welfare as the sum of individual countries' welfare. The comparison between world welfare under discrimination (WW^D) and MFN (WW^M) yields

$$WW^D - WW^M = \frac{(\sigma+\omega)(n\omega-\sigma)^{\frac{(n-2)}{2}}\left[(n-1)\sum_z \phi_z^2 - 2\sum_{z\neq r}\phi_z\phi_r\right]}{(n-1)} \tag{12}$$

Note that as long as $n \geq 3$, the term inside the square brackets is positive since it can be written as a sum of squares.

Proposition 3 *World welfare is higher under discrimination relative to MFN unless the marginal benefit of abatement (ω) is sufficiently low relative to marginal cost of abatement (σ):*[6]

$$WW^D \geq WW^M \text{ iff } \omega \geq \frac{\sigma}{n}$$

To see the intuition for this result, consider the situation where marginal benefit of abatement (ω) approaches zero. Then, the cost of abatement becomes pure production cost so that under discrimination each country imposes higher tariffs on low cost producers, thereby causing socially harmful trade diversion. MFN adoption eliminates this trade diversion and improves world welfare. On the other hand, when the marginal benefit of abatement exceeds the minimum threshold, a larger share of world production is undertaken by countries with more stringent environmental policy under discrimination than under MFN, leading to an improvement in world welfare.

[6] Interestingly, aside from the strategic effect of the abatement choice, Barrett (1997) obtains minimal abatement under full cooperation when $\omega < \frac{\sigma}{n}$. Since the abatement standards are exogenous here, our results converge.

Since abatement standards differ across countries, tariff discrimination generates asymmetric losses and benefits for adopting and recipient countries relative to MFN. Therefore, it is also worth asking which country's deviation from MFN benefits world welfare the most? We make the following comparison:

$$WW_{\tilde{i}}^{M} - WW_{\tilde{j}}^{M} = \frac{n(\sigma+\omega)(n\omega-\sigma)(\phi_i-\phi_j)(2\overline{\phi}-\phi_i-\phi_j)}{2(n-1)} \tag{13}$$

where $\overline{\phi} = \sum_{z=1}^{n} \frac{\phi_z}{n}$ is the average abatement standard and $WW_{\tilde{i}}^{M}$ ($WW_{\tilde{j}}^{M}$) denotes world welfare when country i (j) uses optimal discriminatory tariffs while all other countries impose MFN tariffs.

Proposition 4 *Suppose $\omega \geq \frac{\sigma}{n}$ holds. The deviation from Article I (MFN) by country i improves world welfare more than the deviation by country j iff $(\phi_i - \phi_j)(2\overline{\phi} - \phi_i - \phi_j) > 0$.*

The above proposition implies that, given that the other countries adopt MFN, tariff discrimination by the country with the average abatement standard (say, country a) benefits world welfare the most. To see this, suppose $\phi_i = \overline{\phi}$ and $\phi_i \neq \phi_j$. Then (13) becomes

$$WW_{\tilde{i}}^{M} - WW_{\tilde{j}}^{M} = \frac{n(\sigma+\omega)(n\omega-\sigma)(\overline{\phi}-\phi_j)^2}{2(n-1)} \geq 0 \text{ iff } \omega \geq \frac{\sigma}{n} \tag{14}$$

The intuition is as follows. By discriminating, only country a imposes higher (lower) tariffs on *all* exporters with abatement standards below (above) the average $\overline{\phi}$. Tariff discrimination by any other country is either harmful for some countries with relatively high standards (above the average) or beneficial for some countries with relatively low standards (below the average).

4 Conclusion

Based on the argument that asymmetries in the economic environment of countries are important determinants of the desirability of MFN, we examine the case where environmental standards differ across countries. Under MFN, countries with weak environmental standards

gain competitive advantage without being treated differently in export markets. By contrast, these countries face higher tariffs under discrimination that diminish or even reverse their cost advantage. As a result, environmentally beneficial trade diversion occurs, leading to a higher world welfare under discrimination relative to MFN.

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