Potential Pareto-improving Move towards Most Favored Nation Tariffs

By

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Abstract

We use a multi-country asymmetric oligopolistic framework for segmented markets to study the welfare effects of reducing tariff discriminations — which we call a move towards Most Favored Nation tariffs. Both unilateral and multilateral reforms are considered. We investigate this issue under different scenarios such as when initial tariffs are arbitrary and when they are optimal, and when there is unemployment and when there is not. Conditions under which such harmonizations are potentially Pareto-improving are derived and results compared across scenarios. We also analyze the effects on individual countries. Presence of unemployment makes a significant difference to qualitative results.

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1 Introduction

There is voluminous literature on the desirability of moving taxes toward uniformity. This literature has many strands depending on the type of taxes and the type of markets one considers. One strand considers the implications of a move towards uniformity of domestic taxes across goods. The origin of this literature dates back to Atkinson and Stiglitz (1976) who show that, when income tax is set optimally, differential commodity taxation is inefficient. Hatta (1977), in the context of a closed economy and without considering a tax revenue constraint, examines the welfare implications of moving consumption taxes towards uniformity, while Hatta (1986), re-examines the implications of the above tax reforms under a revenue constraint. The broad argument here is that non-uniformity in commodity taxation distorts consumption choices and therefore is inefficient.\footnote{Panagariya and Rodrik (1993) provide a political-economic argument for having uniform tariffs across goods: uniformity leads to free-riding by lobby groups and thus lower levels of lobbying.}


Uniformity of environmental taxes has also been analyzed. Fullerton et al. (2010) examined the welfare implications of uniformity of domestic environmental taxes across heterogeneous firms within an industry. Hatzipanayotou et al. (2011) take the case of uniform environmental taxes across sectors of production both in the absence and in the presence of binding revenue constraints.

This paper considers a different kind of uniformity or harmonization: one of bringing closer discriminatory tariffs imposed by a country on imports from different countries for
the same good. In other words, we analyze the phenomenon of ‘most favored nation’ (MFN) status in international economic relations. By according the MFN status to a trading partner, a country promises not to treat the trading partner less advantageously than any other country. By joining the World Trade Organization (WTO) a country agrees to accord MFN status to the other members of the WTO. There are, however, important exceptions such as preferential treatment of developing countries and of members of regional free trade areas and customs unions. We shall examine the welfare implication of a move towards the MFN principle following the approach and methodology adopted by the tax reform literature.

We consider a model of oligopolistic segmented markets in an arbitrary number of countries, with an arbitrary number of symmetric firms in each country, and possibly asymmetries in the efficiency levels of firms across the countries. Furthermore, we allow for possible unemployment in the countries. As we shall see later on, this possibility changes the qualitative nature of the results significantly. Given that the presence of unemployment is pervasive, the effect of trade reforms on unemployment do play an important role in the shaping of trade agreements and therefore this consideration is a significant one. The demand side of the model is rather general, enabling us to deviate from the most commonly considered case of linear demand functions.

We also allow for possible revenue constraints in the sense that a local public good in each country needs to be financed at the margin by the distortionary tariffs and by a tax on consumption. This assumption allows us to show that our results are robust to various cases ranging from economies that rely substantially on tariff revenues to cover government spending as well as economies where the share of revenue raised from trade taxes is negligible. In our benchmark model, each country applies arbitrary — possibly non-optimal and discriminatory — level of tariffs against imports from its trading partners.

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3Fruend (2000), Krishna (1998) and Ornelas (2007) are examples of the application of this type of framework to study preferential trade arrangements. Saggi (2004) applies a similar framework to study the welfare effects of the MFN clause.

4In a different context, Davidson, Martin and Matusz (1999) show that certain results derived under the assumption of full employment in traditional models may be significantly altered in the presence of unemployment.
We then pick any two of the tariffs in a country and examine the effect of an unilateral small move of both tariffs towards an weighted average of the two on the levels of welfare of that country and on global welfare. Having derived conditions for welfare improvements in the benchmark case, we then consider the special case in which the initial tariffs are at the non-cooperative optimal levels, as in Saggi (2004) for the case of full employment. We also examine the effect of multilateral reforms of the type discussed above on the welfare levels of individual countries and on aggregate welfare.\(^5\)

Our approach to the analysis of the effect of MFN on welfare is somewhat different from those usually found in the literature. In the literature, the MFN equilibrium is the case where there is no discrimination, i.e., tariffs on imports from all trading partners are equal (see, for example, Bagwell and Staiger, 1999; Saggi, 2004; Saggi and Yildiz (2005)). In contrast, we consider a small move towards uniformity as, for example, in the literature on commodity tax harmonization discussed above (see, for example, Keen, 1987).\(^6\) Our approach can be justified on a number of grounds and in reality we observe various forms of discrimination in treatment of countries for many reasons. First, the presence of preferential trading agreements brings in discrimination even among trade between WTO-member countries. Second, there are countries which are still not members of the WTO.\(^7\) In these cases, WTO members are not required to extend MFN status to these countries, and the non-WTO members may apply discretionary tariffs at their discretion.

Third, many developing countries continue to receive preferential (special and differential) treatments under WTO rules. This enables developed countries to grant developing countries unilateral preferential access to their markets, and also allows developing countries to

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\(^5\)In the preferential trade agreements literature, Raff (2001) investigates which countries would be chosen by an importing country on welfare grounds to be granted full preferential access to the importing country's market. He concludes that the least-efficient ones would be chosen given the external tariff on other (non-selected) countries. In this case, the question asks about the discrete deviations from the MFN rule under certain conditions.

\(^6\)Thus, we adopt a piecemeal approach to tariff reform. This approach is part of a rich literature in international economics. Anderson and Neary (2007) employ this approach to investigate the feasibility in achieving increases in market access and welfare-enhancement under piecemeal tariff reforms, while Diewert, Turunen-Red and Woodland (1989) discuss the conditions under which piecemeal tax and tariff reforms are Pareto-improving, among several other papers.

\(^7\)There are 43 countries that are members of the United Nations, but are not full members of the WTO.
exchange preferential access through partial scope trade agreements. Fourth, Article XXIV of the WTO, for example, allow for many special circumstances, and India and Pakistan have only recently granted each other MFN status. Thus, most WTO member countries have significant leeway in discriminating tariffs.

In fact, a recent paper by Fugazza and Nicita (2013) shows how the complex network of trade preferences among countries has been responsible for important and varying degrees of tariff discrimination. In this paper, they show that taking into account the direct effect of tariffs on a particular exporting country, as well as the relative preference margin granted to exporters, is paramount in explaining bilateral trade flows. Their dataset allows us to consider examples such as the case of Argentina, which is a member of different preferential trade agreements involving other developing countries. In the case of exports to Argentina, members of the Common Market of the Southern Cone (MERCOSUR) receive an average preferential margin 12 percentage points higher than the rest of the world, while Mexico, which has partial scope agreements with different MERCOSUR members, receives a preferential margin 7 percentage points higher than the rest of the world. On the other side of the spectrum, their dataset shows that the US faces an average preferential margin 3 percentage points lower than other countries exporting to Argentina.\textsuperscript{10,11}

Finally, WTO/GATT agreements are only commitments to ‘bound tariffs’, i.e., the country commits not to impose tariffs above a certain rate (see, for example, Bagwell and Staiger (2011)). But, in practice, more often than not, these bound tariffs are not binding. For

\textsuperscript{8}Article XXIV, for example, includes “Taking into account the exceptional circumstances arising out of the establishment of India and Pakistan as independent States and recognizing the fact that they have long constituted an economic unit, the contracting parties agree that the provisions of this Agreement shall not prevent the two countries from entering into special arrangements with respect to the trade between them, pending the establishment of their mutual trade relations on a definitive basis.”


\textsuperscript{10}These numbers correspond to the relative preferential margin (RPM) as detailed on page 10 of Fugazza and Nicita (2012). Notice that this measure of relative market access can only differ from zero if tariffs differ across countries at the product level (6-digit of the Harmonized System), which implies the presence of tariff discrimination. The average also depends on the import shares and on the bilateral import demand elasticities.

\textsuperscript{11}Foletti et al. (2012) show that tariff overhanging in Argentina was twenty-eight percentage points in 2008. This suggests that Argentina and other members of MERCOSUR, have significant policy space to implement tariff reforms as suggested by their discriminatory tariff schedule.
example, Foletti et al. (2011) show that the average tariff overhanging (bound minus the
applied MFN tariff) across countries is eleven percentage points, and it reaches more than
thirty-five percentage points across low income countries. This implies that most countries
have significant policy space to implement tariff reforms of the type considered here. For ex-
ample, if the reform involves raising tariffs against WTO members, that shall not be against
WTO rules as long as there is some tariff overhang.

The lay out of the paper is as follows. Section 2 sets up the basic framework and the tariff
reform rules. It also derives the basic welfare equation. Sections 3 and 4 then examines the
welfare effects of unilateral and multilateral tariff reforms, respectively. Finally, in section 5
some concluding remarks are made.

2 The Model

We consider an \( m \)-country oligopolistic framework where the market for the oligopolistic
good in each country is segmented. The model is a partial equilibrium, but, as is common in
the literature, one can provide a general equilibrium interpretation of it.\textsuperscript{12} The oligopolistic
good \( x \) is produced in country \( k \) by \( n_k \) firms. The total number of firms in the oligopolistic
industry is denoted by \( n \), i.e., \( n = \sum_{k=1}^{m} n_k \). The oligopolistic good is produced using
only labor according to a constant returns to scale production function, which implies that
oligopolistic firms face a constant marginal cost of production in terms of the numéraire (see
footnote 12). We assume that the oligopolistic firms within a country are symmetric, but
can be asymmetric across countries. The marginal cost of firms in country \( k \) is denoted \( c_k \).

We let \( x_{i,j} \) denote the quantity of good \( x \) produced by a firm located in country \( j \) and
sold in country \( i \). The total amount of good \( x \) originating in country \( j \) and sold in country
\( i \) is then described by \( n_j x_{i,j} \), and the total amount of good \( x \) sold in country \( i \) is denoted

\textsuperscript{12} For example, in the case of full employment one can assume that, at the background, there is a good
\( y \) that is produced in all countries under perfectly competitive conditions, using only labor as an input.
Labor is perfectly mobile between the two sectors. This good is freely traded and serves as the numéraire.
This implies that the wage rate will be pinned down by the competitive sector and the producers in the
oligopolistic sector take this wage rate as given.
by \( x_i = \sum_{k=1}^{m} n_k x_{i,k} \). We assume that government can raise revenues by using tariffs and by applying a consumption tax on the oligopolistic good. The notation used for tariffs follows a similar pattern of the notation used for consumption and production. Assuming that country \( i \) can apply discriminatory tariffs on other trading partner countries, we denote by \( t_{i,j} \) the tariff applied by country \( i \) on imports from country \( j \).\(^{13}\) Country \( i \)'s tariff vector is described by \( t'_i = (t_{i,1}, t_{i,2}, ..., t_{i,m}) \). The set of tariffs applied by the various countries in our model can be described in a matrix form by \( t=(t_1, t_2, ..., t_m) \).\(^{14}\) There is also consumption taxation, and we denote the consumption tax on the oligopolistic good in country \( i \) by \( \tau_i \).

Country \( i \) consumers’ preferences are described by an indirect utility function assumed to be of the form \( \tilde{W}_i(p_i + \tau_i, Z_i, G_i) = v(p_i + \tau_i) + Z_i + \rho_i G_i \) where \( p_i \) is the producer price of the oligopoly good in country \( i \), \( Z_i \) denotes lump-sum income and \( G_i \) the level of a local public good. The parameter \( \rho_i \) represents the marginal willingness to pay for the public good (MWP) in country \( i \). The lump-sum income consists of labor income and profits of firms in country \( i \). The level of public good will be assumed to be equal to the revenue raised by the government from tariffs and from the consumption tax, i.e.,

\[
G_i = \sum_k t_{i,k} n_k x_{i,k} (t_i) + \tau_i x_i. \tag{1}
\]

We shall take the function \( v(p_i + \tau_i) \) to be general so that the inverse demand function takes the general form \( p_i + \tau_i = f_i(x_i) \) with \( f'_i < 0 \). We assume the demand function to satisfy:

**Assumption 1** \( f'_i(X) + xf''_i(X) < 0 \) for any \( X \) and \( x \) satisfying \( X \geq x \geq 0 \), and for all \( i = 1, \cdots, m \).

This assumption corresponds to the ‘normal’ case in Seade (1980) and to strategic substitutes in Bulow, Geanakoplos and Klemperer (1985) and Dixit (1986).

\(^{13}\)Clearly, \( t_{i,i} = 0 \). If countries \( i \) and \( j \) are members of the Free Trade Area, then also \( t_{i,j} = 0 \).

\(^{14}\)Unless otherwise stated, all vectors are column vectors, and for a vector \( z \), the transpose of it is denoted by \( z' \).
Due to the assumptions of segmented markets and constant unit/marginal costs, the price in country $i$ is not affected by tariffs imposed by country $j$ ($j \neq i$). Thus, the reduced form of social welfare can be written as:

$$W_i(t) = n_i \pi_i(t) + \theta n_i c_i \sum x_{k,i} + \rho_i G_i + CS_i(t_i),$$

where $G_i$ is given by (1), and the first term represents profits in the oligopolistic sector,

$$\pi_i(t) = \sum_k \pi_{k,i} = \sum_k [p_k - c - t_{k,i}] x_{k,i}. \quad (3)$$

When $\theta = 0$, equation (2) gives the traditional welfare expression that is considered in the literature. Here implicitly, it is assumed that the economy is a full-employment one and employment income created in the oligopolistic sector is employment income foregone in the rest of the economy and hence it is not considered as a part of welfare. When $\theta = 1$, we allow for possible unemployment. Implicitly, we assume that there is another competitive sector which uses labor and a specific factor in production and a constant returns to scale technology. The oligopolistic sector uses only labor. With this assumption, when the wage rate is rigid, we shall have the case of classical unemployment, as considered by Brander and Spencer (1987) and Lahiri and Ono (1998). In this case the marginal costs in the oligopolistic sector will continue to be constant and changes in tariffs facing the oligopolistic sector will have no consequence for these costs. With unemployment, income generated in the oligopolistic sector is not income foregone in the competitive sector and hence it is included in the welfare expression.

The third and fourth terms capture the contribution from the public good provision to social welfare, while $CS_i (= v(p_i))$ represents the consumers’ surplus with $dCS_i = -x_i dp_i$ (due to Roy’s identity since the marginal utility of income is unity with our quasi-linear preferences).

It is well-known that an optimizing government will equate the MWP to the marginal cost of public funds (MCPF, defined as the welfare lost by raising an additional dollar of
When only lump sum taxes are available freely, MCPF is unity and therefore $\rho_i = 1$. When $\rho_i > 1$, a government that is able to deploy lump sum taxes will do so until any upper bound on such taxes bites (see, for example, Neary, 1994; Keen and Lahiri, 1993; Maggi and Rodriguez-Clare, 2000; and Gawande, Krishna and Olarreaga, 2007). It is assumed throughout that $\rho_i \geq 1$ (since it would otherwise be preferable to eliminate any public good provision in favor of a lump sum rebate to the consumer).

2.1 Production and Consumption Choices

In this section, we consider that firms make production choices taking as given the tariff matrix $t$. As markets are segmented in our model, we can simply describe the equilibrium outcomes in country $i$. We consider the case of Cournot oligopolistic competition, which implies that a firm producing the oligopolistic good in country $j$ solves the following problem with respect to country $i$'s market:

$$\max_{x_{i,j}} [p_i - c - t_{i,j}] x_{i,j},$$

taking as given the output of all other firms for that market. This optimization problem gives rise to the following first-order condition:

$$f'_i x_{i,j} + p_i = c_j + t_{i,j} \quad \text{for all } j.$$  \hspace{1cm} (4)

Equation (4) implies that

$$x_{i,j} - x_{i,k} = \frac{(t_{i,k} - t_{i,j}) + (c_k - c_j)}{(-f'_i)}$$  \hspace{1cm} (5)

Thus, a firm’s sales in country $i$ differs from its competitors’ sales according to the difference in the effective marginal costs of exports, i.e. tariffs plus marginal costs of production.

We now carry out a few comparative static exercises with respect to tariffs and these will be used for examining the welfare effects of tariff reforms. First of all, we have

$$dp_i = f'_i dx_i.$$  \hspace{1cm} (6)

\footnote{To save on notation, the fact that quantities and prices are a function of the tariffs, are implicit.}
Then, multiplying expression (4) by \( n_j \) and summing over countries, we are able to implicitly solve for \( x_i \) from:

\[
f_i'x_i + np_i = \sum_k n_k c_k + \sum_k n_k t_{i,k},
\]
and then, differentiate it, and use (6) to get:

\[
\Delta_i dx_i = \sum_k n_k dt_{i,k}
\]
where \( \Delta_i = (n + 1)f' + x_i f'' < 0 \) from assumption 1. An increase in overall protection in country \( i \) reduces total consumption in that country and increases price.

Also, totally differentiating equation (4), and using (6) and (8), we get:

\[
f_i' dx_{i,j} = dt_{i,j} - \frac{(f_i' + x_{i,j} f_i'') \sum_k n_k dt_{i,k}}{\Delta_i}.
\]
An increase in tariffs on country \( j \) reduces imports from it, but an increase in tariffs against its competitors increases imports from country \( j \).

Substituting the first-order condition (4) in the expression for profit (equation (3)), we can first express profits accrued by a firm located in country \( j \) for sales in country \( i \) as described by the following relationship:

\[
\pi_{i,j} = -f_i'(x_{i,j})^2,
\]
and then totally differentiate it to obtain:

\[
d\pi_{i,j} = -(x_{i,j})^2 f_i'' dx_i - 2f_i' x_{i,j} dx_{i,j}.
\]

We shall now use expressions (6) - (11) to examine the effects of tariff reform on welfare. But before that, we shall formally describe the type of reform we consider.
2.2 Description of Tariff Reform

We adopt a simple but also useful approach to describe a move towards non-discriminatory tariffs in country $i$. Our framework considers that tariff reform may involve any pair of tariffs employed by country $i$. In particular, it decreases marginally the higher of the two tariffs while it increases marginally the lower, keeping all other discriminatory tariffs, and a weighted average of these two tariffs, unchanged. Without loss of generality, we denote the benchmark (initial) higher tariff applied by country $i$ by $t_{i,w}$ and the lower tariff by $t_{i,l}$. In particular, the tariff reform under consideration maintains the following average between $t_{i,w}$ and $t_{i,l}$ constant:

$$A = \lambda t_{i,l} + (1 - \lambda) t_{i,w},$$

(12)

where the parameter $\lambda \in (0,1)$ and we shall consider different values for it below.

In this scenario, the tariff reform employed by country $i$ is summarized by the following formulae

$$dt_{i,l} = \delta (A - t_{i,l}) \quad \text{and} \quad dt_{i,w} = \delta (A - t_{i,w}),$$

(13)

where $\delta$ is a positive scalar.

It is clear that replacing the average tariff $A$ from (12) in (13) gives

$$dt_{i,l} = \delta (1 - \lambda) (t_{i,w} - t_{i,l}) \quad \text{and} \quad dt_{i,w} = -\delta \lambda (t_{i,w} - t_{i,l}),$$

(14)

which implies that $dt_{i,l} > 0$ and $dt_{i,w} < 0$ given that we assume that $t_{i,w} > t_{i,l}$. Similarly, we denote the marginal cost of the firms subject to the higher (lower) tariff in country $i$ by $c_w$ ($c_l$). Notice that $c_w$ may be greater or lower than $c_l$ since we consider both arbitrary and optimal initial values of tariffs.

2.3 Welfare Effects of Tariff Reform

In this subsection we shall develop the basic welfare equation for further examination in the subsequent sections. The effects of tariff reforms in one or more countries on the level of
welfare in country $i$ is obtained by totally differentiating expression (2). The general effects of a tariff reform in country $i$'s welfare is described by the following expression:

$$dW_i = -x_idp_i + \rho_i \sum_j n_{j,t_{i,j}}dx_{i,j} + \rho_i \sum_j n_j x_{i,j}dt_{i,j} + \rho_i d\pi_{i,i} + \theta n_i c_i dx_{i,i}$$

(15)

$$+ \sum_{j \neq i} n_i d\pi_{j,i} + \theta n_i c_i \sum_{j \neq i} dx_{j,i},$$

where Term 1 represents the effects of tariff reform in country $i$ on its own welfare while Term 2 describes the effects of tariff reform in countries other than $i$ on country $i$'s welfare. Notice that market segmentation implies that the effects of tariff reform in other countries only affect country $i$ by changing the sales, and the profits related to it, of firms based in country $i$ to other markets. We can use (6), (8), (9) and (11), to write (15) as:

$$dW_i = \frac{(2n_i x_{i,i} - x_i)f_i'}{\Delta_i} + n_i(x_{i,i})^2 f''_i \sum_j n_{j,dt_{i,j}} - \frac{\theta n_i c_i (f_i' + x_{i,i}f''_i) \sum_j n_j dt_{i,j}}{f_i' \Delta_i}$$

(16)

$$+ \frac{\rho_i}{f_i'} \sum_j n_{j,t_{i,j}} \left[ dt_{i,j} - \frac{(f_i' + x_{i,j}f''_j) \sum_k n_k dt_{i,k}}{\Delta_j} \right] + \rho_i \sum_j n_j x_{i,j} dt_{i,j} + \rho_i \tau_i \sum_j n_j dt_{i,j}$$

$$+ n_i \left[ \frac{1}{\Delta_j} \left( 2x_{j,i}f_j' + x_{j,i}^2 f''_j \right) \sum_k n_k dt_{j,k} \right] - n_i \sum_{j \neq i} 2x_{j,i} dt_{j,i}$$

$$+ \theta n_i c_i \sum_{j \neq i} \left[ \frac{dt_{j,i}}{f_j'} - \frac{(f_j' + x_{j,i}f''_j) \sum_k n_k dt_{j,k}}{f_j' \Delta_j} \right]$$

The first and second lines in expression (16) describe the elements present in Term 1 of expression (15), while the third and fourth lines represent the elements present in Term 2. More specifically, the elements described on the first line of the right-hand side of expression (16) represent the effects of tariff reform on the summation of consumers' surplus in country $i$, the effects on profits accrued by country $i$'s firms in the domestic market, plus the effect of tariff reform in country $i$ on its employment income. The second line describes the effects of tariff reform in country $i$ on its employment income. The second line describes the effects of

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\[16\] In this paper, we consider the effects of tariff harmonization and, therefore, we do not consider changes in the tax on consumption in expression (15), $d\tau_i = 0$. 

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tariff reform on revenue raised by the government in country $i$ while the tax on consumption is assumed to remain fixed. Similarly, the terms in the third line represent the effects of tariff reform in other countries on profits of firms located in country $i$, while the term in the fourth line represents the effects of tariff reform in other countries on country $i$'s employment income.

Having derived the basic welfare equation for tariff reform, we shall now consider a number of scenarios. In the first, we assume that the reform is unilateral, i.e., reform takes place only in country $i$ and not in other countries. We shall consider two subcases depending on the presence/absence of unemployment. These are taken up in the next section.

### 3 Unilateral Tariff Reform

In this Section, we shall consider two sub-scenarios in two sub-sections. In the first, we shall take that the initial tariffs are at arbitrary levels, and not necessarily at their optimal values. In the second sub-scenario the initial levels of the tariffs will be assumed to be at their non-cooperative optimal levels.

#### 3.1 Reform under an arbitrary initial position

In this section, we assume that the welfare effects of an unilateral tariff harmonization reform in country $i$ when the initial tariffs are set at arbitrary levels. This means that initial tariffs are not necessarily optimal from a social welfare point of view. Moreover, we assume that tariffs do not change in any country other than $i$. This implies that the terms shown in the third and fourth lines of expression (16) equal zero since tariffs in countries other than $i$ remain at their original levels.

Notice that further advances in expression (16) require a more detailed description of the tariff reform implemented in country $i$. This would allow us to describe the terms $dt_{i,j}$ in expression (16). As detailed above, we consider a tariff reform under which the government
in country $i$ decreases a particular tariff $t_{i,w}$ and increases another tariff $t_{i,l}$, where we assume that $t_{i,w} > t_{i,l}$. Expressions (14) require that we choose a particular value for parameter $\lambda$, which is used in determining the weighted average tariff that remains constant during the tariff harmonization reform. We choose a specific value of $\lambda$, the weight in (12)-(14), as $\lambda = n_l/(n_l + n_w)$. The choice of weight $\lambda$ is in line with expressions (8) and (9) that suggest that tariffs weighted by the number of firms are central in determining the equilibrium quantity, and, therefore, also important in determining the equilibrium price.\footnote{In the appendix, we derive the welfare effects of import-weighted unilateral tariff reforms as an alternative and show that the results are robust to this alternative specification.}

With this choice of weight $\lambda$, we can use expressions (14) to immediately obtain:

$$\sum_j n_j dt_{i,j} = n_l dt_{i,l} + n_w dt_{i,w} = n_l \delta (1 - \lambda) (t_{i,w} - t_{i,l}) - n_w \delta \lambda (t_{i,w} - t_{i,l}) = 0. \quad (17)$$

In this case, the term $\sum_j n_j dt_{i,j}$ represents the aggregate level of protection in country $i$. Equation (17) indicates that the tariff reform employing our choice of weight $\lambda$ keeps the level of protection in country $i$ constant. This also means that the equilibrium price, output of firms in country $i$ and total sales of the oligopolistic good do not change with the reform, i.e $dx_i = dx_{i,i} = dp_i = 0$.

Substituting (5) and (17) into (16) we obtain:

$$dW_i = -\rho_i \left[ \frac{\delta n_l n_w (t_{i,w} - t_{i,l})}{f'_i(n_l + n_w)} \right] \cdot 2 (t_{i,w} - t_{i,l}) + (c_w - c_l), \quad (18)$$

From (18), the following proposition follows.

**Proposition 1** Starting from arbitrary initial values of tariff rates, a unilateral tariff reform in the form of (14) in country $i$ will increase welfare in that country if and only if

$$t_{i,w} - t_{i,l} > \frac{(c_l - c_w)}{2}. \quad (19)$$
Moreover, the greater the marginal willingness to pay for the public good $\rho_i$ in country $i$, the greater the absolute change in welfare in that country. Moreover, the presence or absence of unemployment does not affect these results.

The intuition behind the above proposition can be explained as follows. The tariff reform described by expressions (12)-(14) keep the aggregate level of protection ($\sum n_k t_{i,k}$) in country $i$ constant. Thus, it neither affects the equilibrium price in country $i$ nor the profits of the firms based in this country as indicated by expression (11). The only aspect of country $i$’s welfare affected by the tariff reform is the tariff revenue term which increases if and only if equation (19) holds. Notice that this result is robust to the presence of a consumption tax and to various degrees to which the government relies on the consumption tax relatively to tariff revenues in financing the public good.

Three main points should be noted here. First, the size of the welfare effect for country $i$ of a tariff reform depends directly on parameter $\rho_i$ given that tariff revenues are used solely to pay for the public good. Second, since the reform does not have any effect on domestic output for the domestic market, it has no consequences for employment in the reforming country. Finally, a sufficient condition for welfare in country $i$ to increase is that $c_w > c_l$. This is because if $c_w > c_l$, the tariff that is reduced has a lower base than the one which is raised and therefore the reform raises tariff revenue unambiguously in this case. Formally,

**Corollary 1** Starting from arbitrary initial values of tariff rates, a sufficient condition for a unilateral tariff reform in the form of (14) in country $i$ to increase welfare in that country is $c_w > c_l$, and a necessary condition for it to reduce welfare there is $c_l > c_w$.

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18The effect of tariff reforms on tariff revenue depends on the changes in the tariff rate $dt_{i,j}$, given the tariff base $x_{i,j}$, and on the changes in the tariff base $dx_{i,j}$, given the tariff rate $t_{i,j}$. Since we change two tariffs, differences in the tariff bases of the two tariff rates becomes important when calculating the first effect. Changes in the tax bases depend only on the changes in the tax rate (see (9)), but changes in the tax rate affects via the difference between the tax bases which in turn depends on the effective marginal costs (that is, tariffs and marginals costs of production; see (5)). Therefore, the overall effect is that changes in the tariffs is multiplied by a factor of two.
Notice that corollary 1 suggests that a sufficient condition for welfare increase in country $i$ is to implement a reform that increases the tariff on the low-marginal cost firms while it decreases the tariff on high-marginal cost firms, $c_w > c_l$. In this case, reducing tariff discrimination would lead to a decrease in the overall efficiency of the oligopolistic industry through the promotion of inefficient firms from country $w$ relative to more efficiency firms from country $l$. This result suggests a possible tension between efficiency in the oligopolistic industry and welfare gains in country $i$.

We now turn to the effect of the unilateral reform in country $i$ on global welfare. If there is an increase in global welfare, we can say that the reform is potentially Pareto improving in the sense that, with appropriate lump-sum transfers, all countries can be made better off.

Note that as far as reforms in country $i$ are concerned, the world welfare changes can be derived from the following expression:

$$W_{WR,i}(t) = W_i(t) + \sum_{j \neq i} n_j \pi_{i,j}(t_i) + \theta \sum_{j \neq i} c_j n_j x_{i,j}, \quad (20)$$

which indicates that the world welfare effects of unilateral tariff reform in country $i$ can be derived by considering the welfare effects in country $i$, the effects on profits and on employment income related to the sales of firms located in other countries selling in this country. Totally differentiating expression (20) we obtain:

$$dW_{WR,i} = \rho_i dTR_i + \sum_{j \neq i} n_j d\pi_{i,j}(t_i) + \theta \sum_{j \neq i} n_j c_j dx_{i,j}$$

$$= \rho_i dTR_i - \sum_{j \neq i} \left(2 f'_i n_j x_{i,j} dx_{i,j} + n_j f''_i x_{i,j}^2 dx_i\right) + \theta \sum_{j \neq i} n_j c_j dx_{i,j}$$

$$= \rho_i dTR_i - 2 (x_{i,l} m_l dt_{i,l} + x_{i,w} m_w dt_{i,w}) + \frac{\theta n_w c_w dt_{i,w} + \theta n_l c_l dt_{i,l}}{f'_i}$$

$$= -\rho_i \left[ \frac{\delta n_l m_w (t_{i,w} - t_{i,l})}{f'_i (n_l + n_w)} \right] [2 (t_{i,w} - t_{i,l}) + (c_w - c_l)]$$

$$- \left[ \frac{\delta n_l m_w (t_{i,l} - t_{i,w})}{f'_i (n_l + n_w)} \right] [2 (t_{i,l} - t_{i,w}) + (2 - \theta) (c_l - c_w)], \quad (21)$$
where \(dTR_i\) represents the changes in tariff revenue collected by country \(i\) caused by a tariff reform.

Having derived a general expression for welfare change due to the reform, we shall consider the two cases of full employment and unemployment in turn.

### 3.1.1 The case of full employment

In this case, substituting \(\theta = 0\) in (21), we get

\[
dW_{WR,i} = -\frac{\delta n_l n_w (t_{i,w} - t_{i,l})}{f_i(n_l + n_w)} \left[ 2(\rho_i - 1)(t_{i,w} - t_{i,l}) + (\rho_i - 2)(c_w - c_l) \right]
\]  

(22)

From (22), the following proposition follows.

**Proposition 2** Consider a unilateral tariff reform in the form of (14) in country \(i\), starting from arbitrary initial values of tariff rates and in the presence of full employment. We have:

(i) When \(\rho_i = 1\), the reform will increase global welfare if and only if \(c_l > c_w\).

(ii) When \(\rho_i > 1\), the reform will increase world welfare if and only if

\[
t_{i,w} - t_{i,l} > \frac{(\rho_i - 2)(c_l - c_w)}{2(\rho_i - 1)},
\]

(23)

From part (ii) of proposition 2 the following corollary follows:

**Corollary 2** Consider a unilateral tariff reform in the form of (14) in country \(i\), starting from arbitrary initial values of tariff rates and in the presence of full employment. We have:

(i) When \(1 < \rho_i < 2\), a sufficient condition for the reform to increase global welfare is \(c_l > c_w\), and a necessary condition for the reform to reduce global welfare is \(c_w > c_l\).

(ii) When \(\rho_i > 2\), a sufficient condition for the reform to increase global welfare is \(c_w > c_l\), and a necessary condition for the reform to reduce global welfare is \(c_l > c_w\).
The above results can be explained as follows. From (21), we know that changes in welfare is a linear combination of changes in tariff revenue (which is the change in welfare for the country reforming its tariffs), changes in the profits of firms selling to the reforming-country market, and changes in employment income in countries selling to the reforming-country market. In this case, changes in tariff revenue has a larger weight than the latter two terms since \( \rho_i > 1 \). From corollary 1 we know that when \( c_w > c_l \) the reform increases tariff revenue. However, when \( c_l > c_w \), the reform increases the average efficiency in the industry by increasing the market share and profits of the more efficient firms. In this case, total profits of foreign firms increase with the reform. Therefore, when we put a very high weight on tariff revenue (\( \rho_i > 2 \)), a sufficient condition for the reform to be global welfare improving is \( c_w > c_l \), and when it is not very high (\( 1 < \rho_i < 2 \)), the profits of foreign firm become relatively more important than tariff revenue and \( c_l > c_w \) is a sufficient condition for the reform to be global welfare improving.\(^{19}\)

Finally, we examine what an increase in \( \rho_i \) does to the probability of global welfare being raised with the tariff reform, i.e., we ask if condition 23 in proposition 2(ii) is more likely to be satisfied when the value of \( \rho_i \) increases. Interestingly, we find that it will be the case when the reform increases the welfare of the reforming country (proposition 1). Formally,

**Corollary 3** Starting from arbitrary initial values of tariff rates and in the presence of full employment, an increase in the value of \( \rho_i \) is more likely to result in the unilateral tariff reform in the form of (14) being global welfare improving if and only if condition (19) is satisfied, i.e., \( t_{i,w} - t_{i,l} > (c_l - c_w) / 2 \). As the value of \( \rho_i \) increases, a sufficient condition for the probability of global welfare to improve with the reform is \( c_w > c_l \), and a necessary condition for it to decrease is \( c_l > c_w \).

\(^{19}\)That is, policy reforms in a country may become viable because of an increase in profits of foreign firms when \( \rho_i \) is relatively low, even though domestic welfare may decrease. In a different context but in similar vein, Facchini and Testa (2009) show that a common market may become politically viable if the rents of mobile factors increase with the market integration, reflecting, therefore, a possible tension between political viability and social welfare.
Bearse, Glomm and Janeba (2000) argue that tax collection technology is clearly inferior in developing economies relative to developed ones. Gawande, Krishna and Olarreaga (2007) conclude that many developing countries display very low appreciation for consumer surplus relative to tariff revenues and to producer surplus. In our model, these would translate into high values of parameter $\rho_i$. Corollary 3 in this respect tell us about the relative need for MFN tariffs from a global perspective.

3.1.2 The case of unemployment

Substituting $\theta = 1$ in (21), we get

$$dW_{WR,i} = -(\rho_i - 1) \left[ \frac{\delta n m_w (t_{i,w} - t_{i,l})}{f_i'(n_l + n_w)} \right] \cdot [2 (t_{i,w} - t_{i,l}) + (c_w - c_l)] .$$

(24)

First of all note that when $\rho_i = 1$, the reform has no effect on global welfare. When $\rho_i > 1$, comparing (24) with (18), we note that global welfare improves with the tariff reform if and only if the reform increases the welfare of the reforming country and that the magnitude of the welfare effect is lower in the presence of unemployment than under full employment. Like before the magnitude of welfare change increases with the marginal willingness to pay for the public good, $\rho_i$. Formally,

**Proposition 3** Starting from arbitrary initial values of tariff rates and in the presence of unemployment, a unilateral tariff reform in the form of (14) in country $i$ will have no effect on global welfare when $\rho_i = 1$, and when $\rho_i > 1$, it increase global welfare if and only if

$$t_{i,w} - t_{i,l} > \frac{(c_l - c_w)}{2} .$$

(25)

Moreover, the greater the marginal willingness to pay for the public good $\rho_i$ in country $i$, the greater the absolute change in global welfare. Furthermore, the magnitude of the effect is lower in absolute value in the presence of unemployment than under full employment.
Comparing proposition 3 with proposition 2, we note that the consideration of unemployment changes the qualitative nature of the results significantly. In particular, as long as \( \rho_i > 1 \), the magnitude of the marginal willingness to pay plays no role in determining the direction of welfare change in the presence of unemployment, a result strikingly different from the result obtained under full employment. Note that the considerations of efficiency and job creation have some conflicting elements in it: higher marginal costs reduces efficiency of production, but increases employment for a given level of output. This is the reason why the magnitude of the welfare effect is lower in the presence of unemployment than under full employment.

### 3.2 Tariff reform under optimal initial tariffs

In this subsection, we consider the special case in which the initial tariffs are at the non-cooperative optimal levels. Notice that both (18) and (21) giving the welfare effects of tariff reform, as well as (14) which describes the nature of the tariff reform, continue to apply. What we need to do is to derive expressions for optimal tariffs and check whether or not those tariffs satisfy the conditions of welfare improvements stated in Propositions 1 and 2.

Optimal tariffs applied by country \( i \) are chosen by setting \( \partial W_i / \partial t_{i,j} = 0 \) for all \( j \neq i = 1, 2, \cdots, m \), giving rise to:

\[
\frac{(2n_i x_{i,i} - x_i) f_i' + n_i (x_{i,i})^2 f_i''}{\Delta_i} - \frac{\rho_i}{f_i' \Delta_i} \left[ \sum_k n_k t_{i,k} (f_i' + x_{i,k} f_i'') \right] - \frac{\theta c_i n_i (f_i' + x_{i,i} f_i'')}{f_i' \Delta_i} + \frac{\rho_i \tau_i}{\Delta_i} + \frac{\rho_i (t_{i,j} + f_i' x_{i,j})}{f_i'} = 0. \tag{26}
\]

Notice that expressions (18) and (22) depend on the difference between the tariffs involved in the tariff reform, \( t_{i,w} - t_{i,l} \). We can subtract the first order conditions related to the choice of these two tariffs to obtain:

\[
t_{i,w} - t_{i,l} + f_i'(x_{i,w} - x_{i,l}) = 0 \tag{27}
\]

\(^{20}\)This expression can be obtained directly from expression (16). Note that the number of firms in country \( n_j \) affects all the terms proportionally and hence cancel out.
which, using equation (5) simplifies to:

$$t_{i,w} - t_{i,l} = \frac{c_l - c_w}{2},$$

(28)

which implies that a higher tariff is imposed on firms with lower marginal cost (see, Saggi (2004)). By putting more restrictions on imports from more efficient firms, the country can better protect its social welfare interests (profits and tariff revenue). What is interesting here is to note that the presence or absence of unemployment, as well as the level of the consumption tax, makes no difference to this result. This is because the employment effect and the effect on total sales of the two tariffs are the same in magnitude. Moreover, the differences in optimal initial tariffs do not depend on the choice of parameter $\lambda$, a fact is used in the appendix to explore the robustness of our results.

Since the initial tariffs are at the optimal levels, from the envelope property it immediately follows that the reform will have no effect on the welfare level of country $i$, i.e., $dW_i = 0$. As far the effect on global welfare is concerned, we consider the cases of full employment and unemployment in turn. Under full employment, it is easy to verify that optimal tariffs satisfying (28) also satisfy the condition of welfare improvement in Proposition 2 since $\rho_i \geq 1$.

In fact, from equation (22) we find:

$$dW_{WR,i} = -\frac{\delta n_l n_w (c_l - c_w)^2}{2 f_i'(n_l + n_w)} > 0.$$  

(29)

Formally,

**Proposition 4** Starting from non-cooperative optimal initial values of tariff rates and under full employment, a unilateral tariff reform in the form of (14) in country $i$ unambiguously increases global welfare.

From (28) we know that the country with more efficient firms faces a higher tariff from country $i$. This is due to the non-cooperative nature of optimal tariffs. For global efficiency,
more efficient firms should have a bigger market share than those at the Nash optimal levels. Since our reform reduces tariffs imposed on the more efficient country and increases that of the more inefficient one, it improves global efficiency and hence increases global welfare. Again, the degree to which an economy relies on tariff revenues or revenues raised using a consumption tax is immaterial to the general effects of tariff reforms.

In the analysis above we have taken the weight \( \lambda \) to be equal to \( n_l/(n_l + n_w) \). In the appendix, we have carried out the same analysis as in this sub-section when the weight is the ratio of imports from country \( l \) to total imports from countries \( l \) and \( w \). It is shown there that Proposition 4 continues to hold under this new value of \( \lambda \).

In the presence of unemployment, substituting (28) in (24), we find that \( dW_{WR,i} = 0 \) that is, the reform has no impact on global welfare. Formally,

**Proposition 5** Starting from non-cooperative optimal initial values of tariff rates and in the presence of unemployment, a unilateral tariff reform in the form of (14) in country \( i \) has no effect on global welfare.

Once again, the presence of unemployment makes a significant difference to the qualitative nature of the result. The effects of the reform on employment created by foreign firms exporting to country \( i \) in their respective countries cancel out the effects on their profits.

4 Multilateral Tariff Harmonization

In the previous section we consider the welfare effects of a tariff reform in country \( i \) and no reform in any other country. We shall now consider simultaneous reforms in all the countries. In other words, we consider multilateral reforms where all the countries reform their tariffs according to the rule given in equations (12)-(14). For expositional clarity and simplicity, we shall assume that (i) each country reduces its maximum tariff and increases the minimum,
(ii) the initial levels of the tariffs are at their non-cooperative optimal levels, and (iii) full employment prevails in each economy.

Since the highest and lowest tariffs in various countries can correspond to imports from different countries, we need to introduce new notations for subscripts. The highest and the lowest tariffs imposed by country $i$ are denoted by $t_{i,w(i)}$ and $t_{i,l(i)}$ respectively. Similarly, the notations $x_{i,w(i)}$, $x_{i,l(i)}$, $c_{w(i)}$, $c_{l(i)}$, $n_{w(i)}$ and $n_{l(i)}$ are defined. Using these notations, equations (5) and (14) are rewritten below:

\[
x_{i,l(i)} - x_{i,w(i)} = \frac{(t_{i,w(i)} - t_{i,l(i)}) + (c_{w(i)} - c_{l(i)})}{f'_i} \quad (30)
\]

\[
dt_{i,l(i)} = \delta (1 - \lambda_i) (t_{i,w(i)} - t_{i,l(i)}) \quad \text{and} \quad dt_{i,w(i)} = -\delta \lambda_i (t_{i,w(i)} - t_{i,l(i)}) \quad (31)
\]

In (31) we recognize that since the rank order of tariffs can be different across countries, the weight $\lambda$ can also vary from country to country.

Turning to world welfare and denoting it by $dW_{WR}$, and considering the same tariff reform as in (14), change in global welfare is computed as the sum of each country’s contribution to the change in world welfare as given by equation (29), i.e.,

\[
dW_{WR} = \sum_i dW_{WR,i} = -\sum_i \frac{\delta n_{l(i)} n_{w(i)} (c_{l(i)} - c_{w(i)})^2}{2f_i (n_{l(i)} + n_{w(i)})} > 0. \quad (32)
\]

The reason for this global welfare improvement is the same as discussed after proposition 4. In this case however, not all countries will gain, as we shall show now.

Equation (15) describes the welfare effects of tariff reform for country $i$. When the initial tariffs are at non-cooperative optimal levels as it is the case in this subsection, Term 1 disappears due to the envelope property. So, in a multilateral tariff reform a country is affected only by changes in the tariffs imposed by other countries, as captured by Term 2 in

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21The expression below is derived when $\lambda_i = n_{l(i)}/(n_{l(i)} + n_{l(i)})$. The same global welfare-improving results can be obtained when the weight is the ratio of imports from country $l$ to total imports from country $l$ and $w$, as in the Appendix.
This says that we can have three situations that a country may face and we shall now describe them one by one.

First, the firms located in country \( i \) may have the highest marginal costs among firms from all countries. This implies that under the tariff reform we consider here, these firms would face tariff increases in selling to other countries, and this will reduce the profits of these firms. Thus, welfare in country \( i \) necessarily decreases according to Term 2 in equation (15).

Second, firms located in country \( i \) may be the most efficient firms (lowest marginal costs) in the world. This implies that these firms will face lower tariffs selling in other countries’ markets raising welfare in country \( i \).

The last case corresponds to the situation where firms from a particular country \( i \) are neither the most nor the least efficient in the world. In this case, with tariff reform, tariffs employed on imports from country \( i \) do not change, \( dt_{j,i} = 0 \) for any country \( j \), and the welfare effect on country \( i \) is derived from equation (16) as follows:

\[
dW_i = n_i \sum_{j \neq i} \left[ \frac{1}{\Delta_j} \left( 2x_{j,i}f_j' + x_{j,i}f_j'' \right) \left( n_{l(j)}dt_{l(j)} + n_{w(j)}dt_{w(j)} \right) \right] 
\]

(33)

Notice that, according to equation (33), country \( i \) benefits from an increase in \( t_{j,l(j)} \) but loses from a decrease in \( t_{j,w(j)} \). Substituting the reform rule (14) in (33) we obtain:

\[
dW_i = \sum_{j \neq i} \left[ \frac{n_i}{\Delta_j} \left( 2x_{j,i}f_j' + x_{j,i}f_j'' \right) \left( t_{j,w(j)} - t_{j,l(j)} \right) \left( n_{l(j)} (1 - \lambda_j) - n_{w(j)} \lambda_j \right) \right] 
\]

(34)

From equation (34) we can derive two results. First, when the weights are given by \( \lambda_j = n_{l(j)}/(n_{l(j)} + n_{w(j)}) \), there will be no change in welfare for country \( i \) in this case, i.e., \( dW_i = 0 \). This is the case since the tariff reform based on the relative number of firms keeps the aggregate level of protection constant, which implies that equilibrium price and total sales in country \( j \) remain constant. Consequently, sales by countries not directly affected by changes in tariffs are left untouched, a fact also suggested by expressions (8) and (9).
Second, if the weights are as in the appendix, i.e., \( \lambda_j = \frac{n_l(j)x_{i,l(j)}}{(n_l(j)x_{j,l(j)} + n_w(j)x_{j,w(j)})} \) then equation (34) simplifies to:

\[
dW_i = \sum_{j \neq i} \left( -\frac{\delta n_l(j)n_w(j)n_i(c_{l(j)} - c_{w(j)})^2(2x_{j,i}f'_j + x^2_jf''_j)}{4\Delta_jf'_j(n_l(j)x_{j,l(j)} + n_w(j)x_{j,w(j)})} \right) > 0. \tag{35}
\]

In this case, we can conclude that \( dW_i > 0 \) since \( \Delta_j < 0 \), \( f'_j < 0 \) and \( f''_j(x_j) + f''_j(x_j)(x^2_{j,i}/2x_{j,i}) < 0 \) according to assumption 1 since \( x_j = \sum_k x_{j,k} > (x^2_{j,i}/2x_{j,i}) \). The above results are formally stated in the proposition below.

**Proposition 6** Starting from non-cooperative optimal initial values of tariffs rates and under full employment, a multilateral reform of tariffs as given by the rule (31) gives rise to the following:

1. The country with the most efficient firms gain,
2. The country with the least efficient firms lose,
3. If \( \lambda_j = \frac{n_l(j)}{(n_l(j) + n_w(j))} \), there is no change in welfare in all other countries,
4. If \( \lambda_j = \frac{n_l(j)x_{i,l(j)}}{(n_l(j)x_{j,l(j)} + n_w(j)x_{j,w(j)})} \), all other countries gain, and
5. If either \( \lambda_j = \frac{n_l(j)}{(n_l(j) + n_w(j))} \) or \( \lambda_j = \frac{n_l(j)x_{i,l(j)}}{(n_l(j)x_{j,l(j)} + n_w(j)x_{j,w(j)})} \), global welfare increases.

Notice that result 4 in proposition 6 applies because country \( i \)'s sales in country \( j \) are positively affected by a substantial increase in the tariff imposed on the most inefficient firms relative to the decrease in the tariff imposed on the least efficient firms. Notice that gains for country \( i \) in each market are not affected by changes taking place in other markets given market segmentation, and the presence or not of consumption taxes does not alter these results.
5 Conclusion

In practice there exists quite a bit of discrimination in tariff policies. In particular, countries apply different tariff rates on imports of the same good from different countries. This happens in spite of the agreed principle of Most Favored Nation (MFN) in international economic transactions and the MFN clause of the World Trade Organization (WTO). This is so since there are various exceptions included in the WTO charter, the non-inclusion of many important countries, and the non-binding nature of bound tariff commitments within WTO agreements.

Given the existence of such discrimination, in this paper we examine piecemeal tariff reforms that reduce the level of discrimination by moving two of the tariffs towards an weighted average of the two. We do so under an asymmetric oligopolistic framework in segmented markets for an arbitrary number of countries with different market structures (number of firms and marginal costs). We consider a general demand structure where the usually studied linear case is one of many possibilities. The model allows for possible revenue constraints that can be satisfied by the application of tariffs on imports and by consumption taxation, and also considers cases where unemployment is present.

First of all we consider unilateral reform of tariffs of the type described above in a country when the initial tariff rates are arbitrary and not necessarily optimal. We derive necessary and sufficient conditions for the reform to increase the welfare of the reforming country and also a necessary and sufficient condition for the global welfare to increase. This analysis enables us to consider the welfare effects of efficiency-enhancing tariff reforms in countries facing significant revenue constraints. In the case of arbitrary initial tariffs, the results suggest that efficiency-enhancing tariff reforms may be opposed by welfare-minded tariff-reforming governments. Moreover, the more important the revenue constraints the less likely an efficiency-enhancing tariff reform is sufficient to guarantee an increase in global welfare. This investigation seems to resonate well with the reality faced by many developing
countries.

We then characterize optimal non-cooperative tariffs and show that global welfare un-
ambiguously increases because of the reform in the presence of full employment. This result
seems robust to alternative ways in which tariff reform is implemented and to alternatives
forms of raising revenue to the government. However, this result does not seem to hold up
in the presence of unemployment. We can interpret the presence of unemployment as an
additional market failure. In the case of optimal initial tariffs, a tariff reform that reduces
discrimination across countries increases the aggregate profits of foreign firms by decreas-
ing tariffs on more efficient firms while increasing tariffs on less efficient firms. However,
if unemployment is present, this gain in efficiency is countered by a deterioration in the
unemployment level in other countries. In this second best scenario, tariff reform mitigates
one distortion (tariff discrimination) but it exacerbates another (unemployment).

We also consider multilateral reform of tariffs when the initial tariffs are optimal and
full employment prevails. In this case, we find that not all countries will gain from such
reforms; there will be some losers. In particular, while the country with most efficient firms
will gain, the country with the most inefficient firms will lose. The other countries will either
be unaffected or gain depending on the weights chosen to calculate the average target tariff.
Global welfare will increase unambiguously.

Thus, we find that a reduction of discrimination is very likely to be potentially Pareto
improving as long as unemployment is not important to reforming-countries, i.e., it will
increase the welfare of all countries in the presence of appropriate lump-sum transfers between
countries, and the direction of transfers ought to be from more advanced nations (the ones
with efficient firms) to less advanced or emerging nations (the ones with less efficient firms).
Appendix

In section 3.2, we have shown that, starting with non-cooperative optimal tariffs, a unilateral tariff reform in country \( i \) increases global welfare under full employment when the weight \( \lambda \) in the reform rule (12)-(14) is given by \( \lambda = n_l/(n_l + n_w) \). In this appendix we show that this result also goes through when \( \lambda = n_l x_{i,l}/(n_l x_{i,l} + n_w x_{i,w}) \).

Equation (21) can be expressed in the following way by replacing \( dx_{i,j} \) and \( dx_i \) with assistance of expressions (9) and (8):

\[
dW_{WR,i} = -\sum_{j \neq i} [2n_j x_{i,j} \left\{ dt_{i,j} - \frac{(f''_i x_{i,j} + f'_i) \sum_k n_k dt_{i,k}}{\Delta_i} \right\} + n_j f''_i x_{i,j}^2 \sum_k n_k dt_{i,k}], \quad (A.1)
\]

where we used the fact that the welfare level in country \( i \) is not affected due to the envelope property. Expression (A.1) can be simplified as

\[
dW_{WR,i} = \sum_{j \neq i} \left[ n_j x_{i,j} \frac{(f''_i x_{i,j} + 2f'_i) \sum_k n_k dt_{i,k}}{\Delta_i} \right] = \frac{1}{\Delta_i} \left[ 2f'_i \sum_{j \neq i} n_j x_{i,j} + f''_i \sum_{j \neq i} n_j x_{i,j}^2 \right] (n_l dt_{i,l} + n_w dt_{i,w}),
\]

where we used that \( \sum_{j \neq i} n_j x_{i,j} dt_{i,j} = 0 \) given that we assume an import-weighted average, \( n_l x_{i,l}/(n_l x_{i,l} + n_w x_{i,w}) \), as \( \lambda \).

Replacing \( dt_{i,l} \) and \( dt_{i,w} \) using (14), applying the weight \( \lambda = n_l x_{i,l}/(n_l x_{i,l} + n_w x_{i,w}) \), and using (28) to replace the difference between optimal tariffs \( t_{i,l} \) and \( t_{i,w} \), allows us to conclude after manipulations that:

\[
dW_{WR,i} = -\frac{n_l n_w \delta (c_l - c_w)^2}{4f'_i \Delta_i (n_l x_{i,l} + n_w x_{i,w})} \left[ 2f'_i \sum_{j \neq i} n_j x_{i,j} + f''_i \sum_{j \neq i} n_j x_{i,j}^2 \right], \quad (A.2)
\]

Note that \( x_i = \sum_j n_j x_{i,j} > \left( \sum_{j \neq i} n_j x_{i,j}^2 / (2 \sum_{j \neq i} n_j x_{i,j}) \right) \). Thus, using assumption 1, we can say that the term inside the square bracket in (A.2) is negative. Also since \( f'_i < 0 \) and \( \Delta_i < 0 \), from (A.2) we can conclude that \( dW_{WR,i} > 0 \).
References


