Economic Integration, Trade Diversion, and Welfare Change

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Abstract

This paper examines how the volume of trade diverted from a non-member country to a member country during the formation of a new free trade area may be related to the welfare of a member country. The relation is analyzed in the presence of two types of trade: inter-industry trade with perfect competition and intra-industry trade with oligopoly. We found that in the presence of inter-industry trade, a bigger trade volume diverted is generally associated with a smaller change in welfare while in the presence of intra-industry trade with oligopoly, the relation is not so straighforward. We did find that the result in Krishna (1998) that a bigger trade volume diverted implies a higher likelihood of an FTA may not be true.

1 Introduction

The welfare impacts of a new preferential trade agreement (PTA) such as a customs union (CU) or a free trade agreement/area (FTA) on the member countries and non-member countries has long been an interesting issue for economists and policy makers. In particular, they want to know how a country may be affected if it chooses to form a new FTA with other countries.

For some time, economists had held the position that anything can happen as an PTA represents a movement of a second-best equilibrium to another second-best equilibrium, while it is argued that the first-best position of the world is free trade by all countries.[1] Viner, in his pioneering work (Viner, 1950), suggested an approach to identifying welfare-improving PTAs and welfare-deteriorating PTAs. He argued that a trade creating PTA (one in which a member country imports more from a country where the cost of production is lower) is beneficial but that a trade diverting PTA (one in which a member country switches its import from a country with a lower cost of production to a country with a higher cost of production) is detrimental.

Viner's approach has been criticized. First, it had been argued that a trade diverting PTA may still be beneficial (Gehrels (1956-57), Lipsey (1957), and Wonnacott (1996)). Second, it had been realized that Viner's criteria for welfare improvement are difficult to test, as it could be costly to estimate the costs of production of different goods in different countries. Third, since Viner's analysis is based on a partial equilibrium framework, it is not clear how the analysis can be extended to a multi-good economy. In particular, it is not clear how the welfare may change if one finds trade creation for some goods but trade diversion for some goods.

Economists who tried to apply Viner's approach to examine the impacts of a PTA chose to focus on the change in the trade volumes to get hints on how welfare may change. For example, Yeats (1997) examines that a significant increase in the trade volume between member countries of MERCOSUR comes from trade diverted from more efficient non-member countries. Balassa (1996) finds that European Common Market is trade creating in the most of commodity categories while some commodity categories indicate the trade diverting effect. Krueger (1999) shows that NAFTA is trade creating, rather than trade diverting. Clausing (2001) tests CUSFTA and finds trade

[1] By the Second-best Theory, two second-best positions *in general* cannot be ranked in terms of the welfare of the world or the welfare of a country.

creation, but a little evidence of trade diversion. However, what is lacking in these studies is the relation between the changes in trade volumes and the changes in welfare levels.[2]

Recently, Krishna (1998) provides an examination of the volume of trade diverted and the profits of local firms in a member country.[3] Using a model similar to the Brander-Krugman model of intra-industry trade with oligopoly, he argues that a larger trade volume diverted from non-member country to a member country represents a bigger increase in the profits of local firms, and thus makes a FTA more attractive and likely. Krishna's result, however, seems to be incompatible with the general belief that a larger trade volume diverted implies a higher likelihood of a drop in welfare.

In this paper, we try to sort out the seemingly conflicting results about what a bigger trade diversion may mean to welfare. We provide a systematic analysis of the relation between changes in trade volume diverted and changes in welfare in order to determine whether an FTA may be supported by the government and local firms. We find out that such a relation depends crucially on the type of trade one is considering. If inter-industry trade with perfect competition is assumed, then a rise in the trade volume diverted will generally imply a drop in the change in the welfare that a member country will get. This seems to be compatible with Viner's instinct about trade diversion and to confirm the belief in some recent studies about the welfare implications of volume of trade diverted. If, however, one examines intra-industry trade in the presence of oligopoly, the relation between trade volume diverted and profit change is more complicated, and the relation cannot positive or negative. In particular, we find that Krishna's conclusion about a positive relation may not hold.

The rest of this paper is organized as follows. In Section 2, we introduce a framework that allows us to examine the relation between trade volume diverted and welfare change. In Section 3, the focus of the analysis is on intra-industry trade. To allow a comparison between our analysis and previous

[2]Kowalczyk (2000) had argued that if a good from a non-member country is complementary to a good exported from a member country, a non-member country may end up exporting more to a member country even after the FTA, and a member country may increase the volume of trade with a non-member country due to increased income after eliminating tariffs.

[3]Krishna (1998) follows the approach in Grossman and Helpman (1994, 1995) and assumes that the government of a member country put a big emphasis on the profits of local firms.

analysis, we follow Krishna's approach and use the profits of local firms as a criterion for the formation of an FTA. Section 4 concludes.

2 Inter-industry Trade: The Vinerian Analysis

We first examine the implication of trade diversion on welfare using Viner's approach. Consider a model of three countries labelled X, Y, and Z. Countries X and Y are forming a free trade area (FTA) so that goods can flow freely between them while both of them keep their initial tariffs on the goods imported from Z. Country Z is the non-member country, and its tariffs on the goods from countries X and Y are not affected by the new FTA. For simplicity, goods can flow between any two countries without transport costs.

Consider a competitive industry of a homogeneous product in country X. Denote its inverse import demand function by $P_x = A_x - M_x$, where P_x is the import price (including any possible tariff) and M_x is the import level.[4] The constant $A_x > 0$ is a measure of the size of the market in X for importers. The import demand function is illustrated by curve AB in Figure 1. The country can import the good from countries Y and Z at constant marginal costs equal to C_y and C_z, respectively, $C_z < C_y$.

Initially, country X imposes a specific tariff of t_x on the good imported from Y and Z. Thus the total cost of importing one unit of the good from countries Y and Z are $C_y + t_x$ and $C_z + t_x$, respectively, as shown in Figure 1, assuming that $C_y < C_z + t$. Thus country X chooses to import the good from Z, and the domestic price in X is $P_x = C_z + t_x$, and the corresponding import level is M_x^e.

Now, countries X and Y form an FTA. This means that the tariff on the good from Y is no longer subject to the tariff, but the good from Z is. Because $C_y < C_z + t$, country X will choose to import the good from Y, and the new import level is $M_x^g > M_x^e$. This is trade diversion. Viner seemed to regard this type of trade as detrimental to country X because it represents a switch of the import from a place where the marginal cost is lower to a place where the marginal cost is higher. However, as pointed out by Gehrels (1956, 1957) and Lipsey (1957), trade diversion may or may not be harmful

[4] In this paper, we allow the possibility of positive production of the good in country X.

to country X. What has not been analyzed is how the change in the welfare of X is related to the volume of trade diverted. This is what we now turn to.

The volume of trade diverted, D, from Z to Y for country X is M_x^e, which is the initial import level from Z, i.e., $D = M_x^e$. From country X's import demand function,

$$D = D(A_x, C_z, t) = A_x - C_z - t. \tag{1}$$

The dependence of the diverted trade on the exogenous variables can be obtained easily by differentiating both sides of (1) to give:

$$\mathrm{d}D = \mathrm{d}A_x - \mathrm{d}C_z - \mathrm{d}t. \tag{2}$$

The welfare of this industry of country X can be represented by the sum of consumers' surplus, producers' surplus, and the tariff revenue. As the market price drops from C_z+t to C_y, the corresponding change in net surplus is equal to area $(a + c)$ in Figure 1.[5] At the same time, the government of X loses the tariff revenue that it initially received. The tariff revenue is equal to area $(a + b)$ in Figure 1. As a result, the change in welfare of country X, W_x, is equal to area $(c - b)$ in Figure 1. The area c represents the regular gains from trade: the welfare improvement from an increase in trade, and the area b is the net loss in tariff revenue. Using Figure 1, the welfare improvement is equal to

$$\begin{aligned} W_x &= W_x(A_x, C_y, C_z, t) \\ &= (C_z + t - C_y)(A_x - C_z - t) + \frac{1}{2}(C_z + t - C_y)^2 - t(A_x - C_z - t) \\ &= \frac{1}{2}(C_y^2 - C_z^2) + \frac{1}{2}t^2 - A_x(C_y - C_z). \end{aligned} \tag{3}$$

The sign of the change in X's welfare, W_x, in equation (3) is ambiguous. It has been argued that there are cases in which it is positive, meaning that country X may still gain from a trade-diversion FTA.

The dependence of the change in welfare can be given by differentiating both sides of (3) to give:

$$\mathrm{d}W_x = (A_x - C_z)\mathrm{d}C_z - (A_x - C_z)\mathrm{d}C_y - (C_y - C_z)\mathrm{d}A_x + t\mathrm{d}t_x. \tag{4}$$

[5]Net surplus is the consumers' surplus less producers' surplus. The change in net surplus is equal to the change in consumers' surplus less the change in producers' surplus.

What we want to examine is how the change in welfare, W, is related the volume of trade diverted, D. Equations (1) and (3) show that both of them depend on several exogenous variables. We can derive the relation between them by allowing one of the exogenous variables to change.

(a) A Change in C_z

When only C_z can change while all other exogenous variables are kept constant, both D and W_x can be inverted to find how a change in W_x can be dependent on a change in D. More explicitly, assuming that $\mathrm{d}A_x = \mathrm{d}C_y = \mathrm{d}t = 0$, equations (2) and (4) can be combined to give

$$\mathrm{d}C_z = -\mathrm{d}D = \mathrm{d}W_x/(A_x - C_z),$$

which, after rearranging terms, gives

$$\left.\frac{\mathrm{d}W_x}{\mathrm{d}D}\right|_{C_z} = -(A_x - C_z) < 0. \tag{5}$$

Equation (5) implies that a rise in the volume of trade diverted as caused by a change in C_z hurts the welfare improvement that country X can experience from the new FTA. In other words, a bigger volume of trade diverted will diminish country X's willingness to form the FTA.

The relation between W_x and D is shown by curve DW in Figure 2. The slope of the curve is equal to $-(A_x - C_z)$. The vertical and horizontal intercepts can be obtained by making use of equation (1) and (3): When $D = 0$, the corresponding welfare change is $W_{x0} = (A_x - C_y)^2/2 > 0$ or when $W_x = 0$, the corresponding trade volume diverted is $D_0 = -t_x + \sqrt{(A_x - C_y)^2 + t_x^2} > 0$. In the present case, an FTA with a small diverted trade volume benefits country X.

Lemma 1 *A bigger volume of trade diverted from a more efficient non-member country to a member country lowers the welfare improvement that a country is able to get from a new FTA.*

The above lemma can be explained easily by using Figure 1. When C_z decreases, the initial volume of import from country Z is larger, meaning there is a bigger trade volume diverted. At the same time, the decrease in C_z diminishes the size of area c (because of a small increase in trade)

but enlarges the net loss in tariff revenue (because of a large pre-FTA trade tariff). We call this case the smaller-trade-diversion-the-better case.

(b) A Change in t

When A_x, C_z, and C_y are held constant, equations (1) and (3) can be combined together, after eliminating t, so that W_x can be expressed as a function of D. The derivative of this function can be obtained by combining equations (2) and (4) together after setting $\mathrm{d}A_x = \mathrm{d}C_z = \mathrm{d}C_y = 0$. We have

$$\left.\frac{\mathrm{d}W_x}{\mathrm{d}D}\right|_{t_x} = -t < 0, \tag{6}$$

which means that a rise in the diverted trade volume because of a smaller initial tariff diminishes the welfare improvement of country X. The relation between the diverted trade volume and the welfare improvement can be illustrated by a curve similar to curve WD in Figure 2. Thus we have

Lemma 2 *A bigger volume of trade diverted from a non-member country to a member country because of a small initial tariff lowers the welfare improvement that a country is able to get from a new FTA.*

This lemma can be explained in terms of Figure 1. If the initial tariff, t, is smaller, the initial import level from country Z will be bigger, meaning a bigger trade volume diverted. At the same time, area c is smaller but area b is bigger. Thus the welfare improvement country X gets from the new FTA is smaller. Note that this is another the-smaller-trade-diversion-the-better case.

(c) A Change in A_x

Suppose now that we treat A_x as a parameter while keeping C_z, C_y, and t constant. Like we did earlier, equations (1) and (3) can be combined together to eliminate A_x, thus giving the relation between trade diversion and welfare improvement. More specifically, equation (2) gives $\mathrm{d}D = \mathrm{d}A_x$, which can be substituted into (4) to give

$$\left.\frac{\mathrm{d}W_x}{\mathrm{d}D}\right|_{A_x} = -(C_y - C_z) < 0, \tag{7}$$

which implies that a rise in trade diversion because of a bigger size of the domestic market diminishes the welfare improvement of the FTA. This relation

can also be illustrated graphically by a curve similar to curve WD in Figure 2. Thus we have:

Lemma 3 *A bigger volume of trade diverted from a non-member country to a member country because of a bigger size of the local market lowers the welfare improvement that a country is able to get from a new FTA.*

This result can also be explained in terms of Figure 1. An increase in A_x is represented by an upward shift of curve AB. Since the marginal costs and the tariff rate do not change, area c remains the same as before, but area b becomes bigger. Thus the welfare improvement drops. This is another example of the-smaller-trade-diversion-the-better case.

(d) A Change in C_y

Note that the trade volume diverted is independent of C_y. From (4),

$$\frac{\partial W_x}{\partial C_y} = -(A_x - C_z) < 0. \tag{8}$$

Thus we have,

Lemma 4 *A decrease in a member country's marginal cost will not affect the volume of trade diversion but will improve the welfare of country X as a new FTA is formed.*

This lemma can also be explained in terms of Figure 1. A rise in C_y will not affect the volume of trade diversion, M_x^e, but will lower the size of area c but increase that of area b. In this case, which be called the trade-diversion-does-not-matter case, there is no direct relation between the trade diversion volume and the welfare improvement of country X.

The above results are summarized below:

Proposition 1 *An increase in the trade diversion volume due to a more efficient non-member country, a lower pre-FTA tariff, or a bigger local market represents a lower welfare improvement of a country from a new FTA. Trading with a more efficient member country will not affect the volume of trade diversion but will increase the welfare improvement of the country.*

3 Intra-industry Trade: Trade Diversion and Welfare Change

We now consider intra-industry trade. We adopt the model of Krishna (1998) and use it to examine the relation between trade diversion and welfare change.

3.1 The Model

Consider again three countries labeled X, Y, and Z, and a homogeneous product. In country i, i = X, Y, Z, there are n_i firms producing the homogeneous product and competing in a Cournot fashion. Assume for simplicity that all firms face the same marginal cost of c, which is independent of output level. The demand for the product by the consumers in country i is $P_i = A_i - Q_i$, where P_i is the market price and Q_i is the demand.

Before the formation of any free trade area, each country imposes the same specific tariff rate, t, on the product imported, independent of the country of origin. We assume that the demand is sufficiently large and the tariff sufficiently small so that there is intra-industry trade in the good among the countries. (Brander and Krugman, 1983). Denote the supply of the product by a firm in country i to the market in j by q_j^i, i, j = X, Y, Z. In equilibrium, $Q_j = \Sigma_i n_i q_j^i$. The profit of a representative firm in country i, π_i, consists of the profit from market j, π_i^j, i.e., $\pi_i = \Sigma_j \pi_i^j$, where

$$\pi_i^j = q_j^i \left[A_j - Q_j - (c+t) \right]. \tag{9}$$

The firm chooses the outputs, q_j^i, to maximize its profit, taking the tariff rate and the outputs of all other firms are given. The first-order conditions (assuming intra-industry trade) are:

$$A_x - q_x^i - \sum\nolimits_j n_j q_x^j - c - t = 0 \tag{10a}$$

$$A_y - q_y^i - \sum\nolimits_j n_j q_y^j - c - t = 0 \tag{10b}$$

$$A_z - q_z^i - \sum\nolimits_j n_j q_z^j - c - t = 0. \tag{10c}$$

Denote the total number of firms by $n = n_x + n_y + n_z$. Solving the first-order conditions (10), we get the Nash equilibrium supply by a firm in country i to country j:

$$q_j^i = \frac{A_j - c + \Sigma_k n_k t_j^k}{n+1} - t_j^i, \tag{11}$$

where $t_j^i = t$ if $i \neq j$ or $t_j^i = 0$ if $i = j$. The summation in (11) is over X, Y, and Z. For example, condition (11) gives country X's import from country Z:

$$q_x^z = \frac{A_x - c - t(1 + n_x)}{n + 1}. \tag{12}$$

From (9) and (11), we can get the profit received by a firm in country i from the market in country j :

$$\pi_i^j = \left[q_j^i\right]^2. \tag{13}$$

Condition (13) shows a monotonic positive relation between the profit of a firm in country i from a market and the output to that market. Condition (13) also gives the total profit received by a firm in country i:

$$\pi_i = \Sigma_j \pi_i^j = \Sigma_j [q_j^i]^2. \tag{14}$$

3.2 Formation of An FTA

Suppose now that countries X and Y form a free trade area (FTA), removing the tariff on the good imported from each other while maintaining the tariff on the good from Z. Note that this case can be analyzed by applying the above analysis by noting that the FTA is an integrated economy with the number of identical firms given by $n_x + n_y$. Let us use a subscript "xy" before a variable to represent it in the presence of the FTA; for example, ${}_{xy}q_x^z$ is the export of a firm in country Z to country X after the formation of the FTA. Applying (12), the Nash equilibrium FTA-volume of country X's import of the good from country Z is

$${}_{xy}q_x^z = \frac{A_x - c - t(1 + n_x + n_y)}{n + 1}. \tag{15}$$

Condition (14) can be applied to find the resulting profit of a firm in country X after the formation of the FTA:

$${}_{xy}\pi_x = \Sigma_j [{}_{xy}q_j^x]^2. \tag{16}$$

We now compare the pre-FTA equilibrium with the post-FTA equilibrium. In particular, we want to see whether the FTA will likely to be accepted by country X. We assume a political-economic approach similar to the one in Grossman and Helpman (1995) and Krishna (1998), so that the

decision of whether an FTA is chosen is based solely on whether the profits of local firms increase. We will examine the relations between the volume of trade diverted and the local firms' profits.

We say that for country X trade is diverted from country Z to country Y if there is a drop in the volume of import from country Z, or if $q_x^z > {}_{xy}q_x^z$.[6] In this case, we define for country X the volume of trade diverted (VTD) from country Z, D, by

$$\begin{aligned} D &= D(n_x, n_y, n_z, t) = n_x \left[q_x^z - {}_{xy}q_x^z \right] \\ &= t \left(\frac{n_y n_z}{n+1} \right). \end{aligned} \tag{17}$$

The derivatives of the VTD from Z can be obtained from (17):

$$\frac{\partial D}{\partial t} = \frac{n_y n_z}{n+1} > 0 \tag{18a}$$

$$\frac{\partial D}{\partial n_x} = -\frac{t n_y n_z}{(n+1)^2} < 0 \tag{18b}$$

$$\frac{\partial D}{\partial n_y} = \frac{t n_z (1 + n_x + n_z)}{(n+1)^2} > 0 \tag{18c}$$

$$\frac{\partial D}{\partial n_z} = \frac{t n_y (1 + n_x + n_y)}{(n+1)^2} > 0. \tag{18d}$$

The intuition for the signs of the derivatives in (18) is simple. If the initial tariff rate is higher, it means a greater drop in the tariff on the good from country Y. Thus a higher initial tariff rate, or a larger number of firms in country Y or Z will result in a bigger impact on trade and thus a bigger volume of trade diverted. A larger number of firms in country X will have a smaller impact, however, because it will tend to diminish the impact of the FTA.

As explained, we use the change of a firm in country X to determine whether the FTA will be accepted by the country. Subtract condition (14)

[6] For the purpose of this paper, we do not examine whether the volume of import from country Y will increase by the amount of volume of trade diverted.

from (16), we get the change in the profit of a firm in X:

$$\begin{aligned}\Pi_x &= \Pi_x(A_x, A_y, n_x, n_y, n_z, t, c) \equiv {}_{xy}\pi_x - \pi_x \\ &= \left[\left({}_{xy}q_x^x\right)^2 + \left({}_{xy}q_y^x\right)^2 + \left({}_{xy}q_z^x\right)^2\right] - \left[\left(q_x^x\right)^2 + \left(q_y^x\right)^2 + \left(q_z^x\right)^2\right] \\ &= \frac{t\Phi}{(n+1)^2}. \end{aligned} \tag{19}$$

where $\Phi = 2(A_y - c)(1 + n_y + n_z) + t(n_z)^2 - t(1 + n_y)^2 - 2(A_x - c)n_y - tn_y^2 - 2tn_y n_z$. Condition (19) can be used to derive how these exogenous variables may affect the change in profit. First, we get the effects of a change in the size of the markets:

$$\frac{\partial \Pi_x}{\partial A_x} = -\frac{2tn_y}{(n+1)^2} < 0 \tag{20a}$$

$$\frac{\partial \Pi_x}{\partial A_y} = \frac{2tn_y(1 + n_y + n_z)}{(n+1)^2} > 0. \tag{20b}$$

Conditions (20) imply that a smaller local demand or a bigger demand in country Y will allow country X to gain more from the FTA. This result is not surprising as a bigger market in a member country will allow the local firms to export more while a bigger local market will attract more competition from the firms in a member country.

We then turn to the effects of the number of firms in each of the countries.

$$\frac{\partial \Pi_x}{\partial n_x} = -\frac{2t\Phi}{(n+1)^3} \tag{21a}$$

$$\frac{\partial \Pi_x}{\partial n_y} = \frac{-2t[(A_x - A_y) + t(1 + 2n_y + n_z)]}{(n+1)^2} - \frac{2t\Phi}{(n+1)^3} \tag{21b}$$

$$\frac{\partial \Pi_x}{\partial n_z} = \frac{2t[(A_y - c) + t(n_z - n_y)]}{(n+1)^2} - \frac{2t\Phi}{(n+1)^3}. \tag{21c}$$

Note that for the purpose of our analysis, we assume that $\Pi_x > 0$, i.e., country X is willing to form an FTA with country Y. This implies that $\Phi > 0$, and that by (21a) $\partial \Pi_x / \partial n_x < 0$. For (21b), if it is further assumed that

$$A_x \geq A_y, \tag{22}$$

then $\partial\Pi_x/\partial n_y < 0$. For (21c), $\partial\Pi_x/\partial n_z < 0$ if and only if

$$\Pi_x > \frac{t[(A_y - c) + t(n_z - n_y)]}{(n+1)}. \tag{23}$$

A sufficient condition for $\partial\Pi_x/\partial n_z < 0$ is that $(A_y - c) + t(n_z - n_y)$ is sufficiently small.

We now examine the impacts of a change in t or c.

$$\frac{\partial\Pi_x}{\partial t} = \frac{2\Phi - 2(A_y - c)(1 + n_y + n_z)}{(n+1)^2} \tag{24a}$$

$$\frac{\partial\Pi_x}{\partial c} = -\frac{2(t + tn_z)}{(n+1)^2} < 0. \tag{24b}$$

The effect of a higher initial tariff rate t on the change in the profit of a firm in country X is complicated: If the initial tariff rate is larger, both countries X and Y will experience a substantial drop in the tariff rate. For firms in country X, it is good because it will be easily to invade into the market in country Y, but it is also bad because it will be easier for firms in country Y to invade into the local market. In general, the net effect in ambiguous. Condition (24a) can be rearranged to show that if

$$\Pi_x > \frac{t^2[(1+n)^2 + n_y^2 + 2n_y n_z - n_z^2]}{(n+1)^2}, \tag{25}$$

then $\partial\Pi_x/\partial t > 0$. On the other hand, condition (24b) means that if the marginal cost of all firms is lower, the gain in the profit of each firm in country X will be higher.

The above results are summarized by the following proposition:

Proposition 2 *If the firms in country X would support an FTA with country Y, each of them will get a bigger profit improvement if*

1. *the size of country X's market A_x is smaller; or*
2. *the size of country Y's market A_y is larger; or*
3. *the number of firms in country X n_x is smaller; or*
4. *the number of firms in country Y n_y is smaller, if condition (22) is satisfied*;

5. *the number of firms in country Z n_z is smaller, if condition (23) is satisfied; or*

6. *the initial tariff rate t is higher, if condition (25) is satisfied; or*

7. *the common marginal cost c is lower.*

3.3 Volume of Trade Diverted and Profit Change

Conditions (17) and (19) show that for country X the volume of trade diverted from country Z to country Y, D, and the change in the profit of each firm in country X, Π_x, are dependent on some exogenous variables. A change in some of exogenous variables could change D and Π_x simultaneously. We now examine how D and Π_x may change. The analysis in the previous section shows that the D-Π_x relationship depends on which exogenous variable is changing. A general theory can be provided as follows. Suppose that an exogenous variable v changes and that it may affect both Π_x and D. Thus the D-Π_x relations can be given by

$$\left.\frac{\mathrm{d}\Pi_x}{\mathrm{d}D}\right|_v = \frac{\partial\Pi_x/\partial v}{\partial D/\partial v}. \tag{26}$$

Condition (26) immediately gives the following lemma:

Lemma 5 *$d\Pi_x/dD|_v < 0$ if and only if sign($\partial\Pi_x/\partial v$) $\neq$ sign($\partial D/\partial v$).*

We now make use of the lemma to see how trade volume diverted and the change in firm profit may be related to each other. We can consider the following cases:

(a) *The Smaller-Trade-Diversion-the-Better Case*

We note that an increase in the number of firms in Y or Z will enlarge the trade volume diverted, D, but will lower the profit improvement each firm in X will experience, under the conditions stated in Proposition 2. This means that

$$\left.\frac{\mathrm{d}\Pi_x}{\mathrm{d}D}\right|_v = \frac{\partial\Pi_x/\partial v}{\partial D/\partial v} < 0, \tag{27}$$

where $v = n_y$ or n_z. In these cases, a bigger volume of trade diverted from country Z to country Y is not good in terms of the profit of the firms in country X.

(b) *The Larger-Trade-Diversion-the-Better Case*

If there is a decrease in the number of firms in country X or a larger initial tariff rate, both the trade volume diverted and the profit improvement experienced by each firm in country X will go up. Thus we have

$$\left.\frac{\mathrm{d}\Pi_x}{\mathrm{d}D}\right|_u = \frac{\partial\Pi_x/\partial u}{\partial D/\partial u} > 0, \tag{28}$$

where $u = n_x$ or t. In these cases, a bigger volume of trade diverted from country Z to country Y represents a bigger profit improvement experienced by each firm in country X.

(c) *The Trade-Diversion-Does-Not-Matter Case*

If, however, there is a decrease in A_x or c, or there is an increase in A_y, then each firm in X will experience a bigger profit improvement but the volume of trade diverted will not be affected. This means that there is no direct relation between trade diversion volume and the profit improvement of the firms in country X.

In the present case with intra-industry trade, we can identify three types of relations between trade volume diverted and profit improvement. In the case of inter-industry trade, we find only the smaller-trade-diversion-the-better case and the trade-diversion-does-not-matter case, but not the large-trade-diversion-the-better case.

The direct relation between the trade diversion volume and profit improvement was probably first pointed out by Krishna (1998). He argued that a country facing a non-member country with more firms producing the product is more likely to form an FTA because of a bigger profit improvement for local firms. Our results are quite different from his. First, we note that with inter-industry trade, profit improvement is likely negatively related to the welfare improvement. Second, with intra-industry trade, an increase in the trade diversion volume may indicate an increase, a decrease, or no change in the trade diversion increase, depending on the factor that causes a change in the trade diversion volume in the first place. Third, even if we consider only the case in which there is a change in the number of firms in the non-member country Z, we note that the relations between the trade diversion volume and the profit improvement is in general ambiguous, and is negative if condition (23) is satisfied.

4 Concluding Remarks

In this paper, we examined the relation between the change in trade volume diverted and the change in welfare (or profits of local firms) using two different types of trade models: inter-industry trade in the presence of perfect competition and intra-industry trade with oligopoly. We argued that the relation depends on the type of trade considered. We showed that if trade is of the inter-industry trade type, a rise in the trade volume diverted in general is related to a smaller change in welfare. An interesting result is that if the trade volume diverted is small the welfare change could be positive. This means that a trade diversion can be welfare improving if the volume of trade diverted is small. If intra-industry trade with oligopoly is considered, then the relation between trade volume diverted and profit change is not so straightforward. We did find that Krishna's conclusion about a positive relation may not hold.

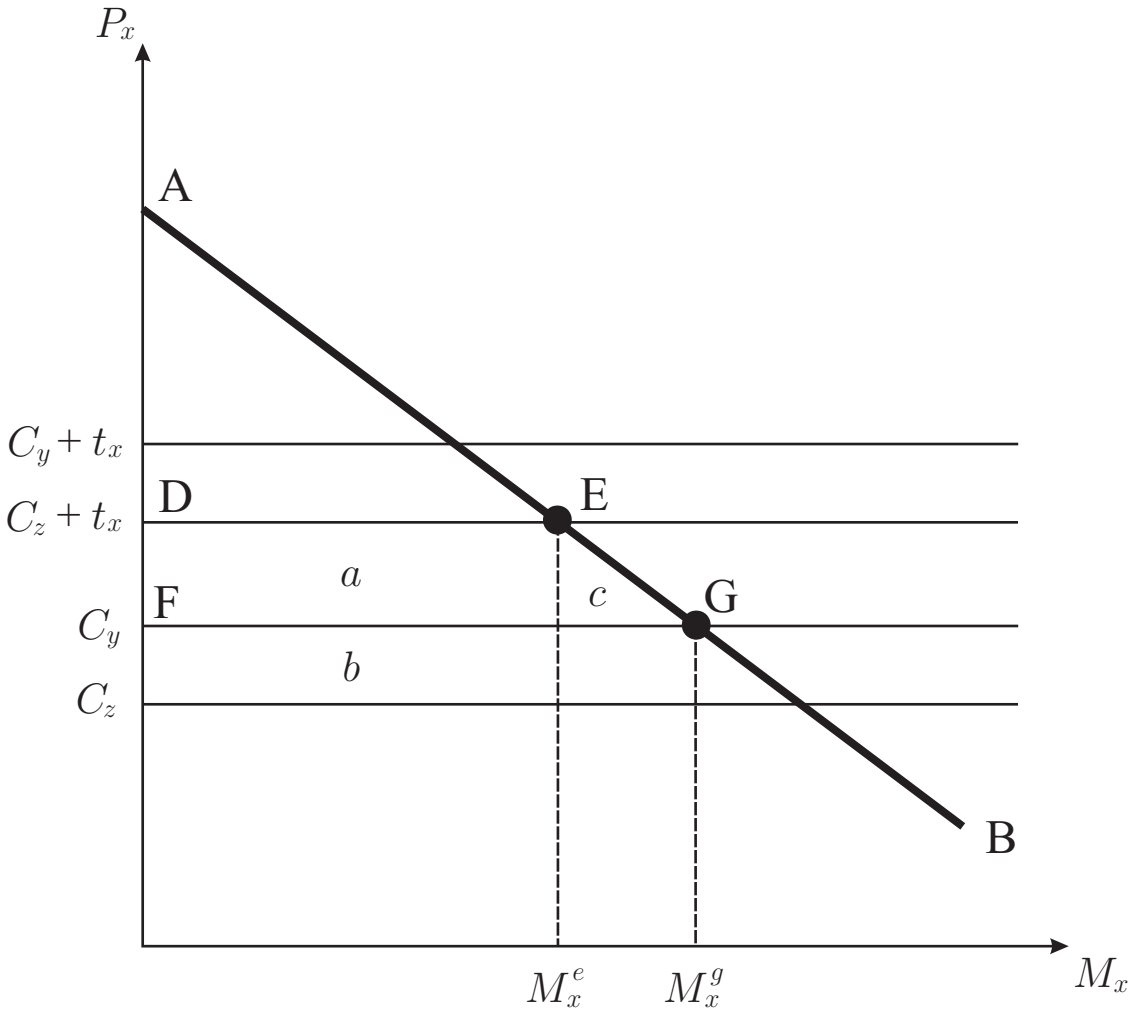

Figure 1: Equilibrium Prices

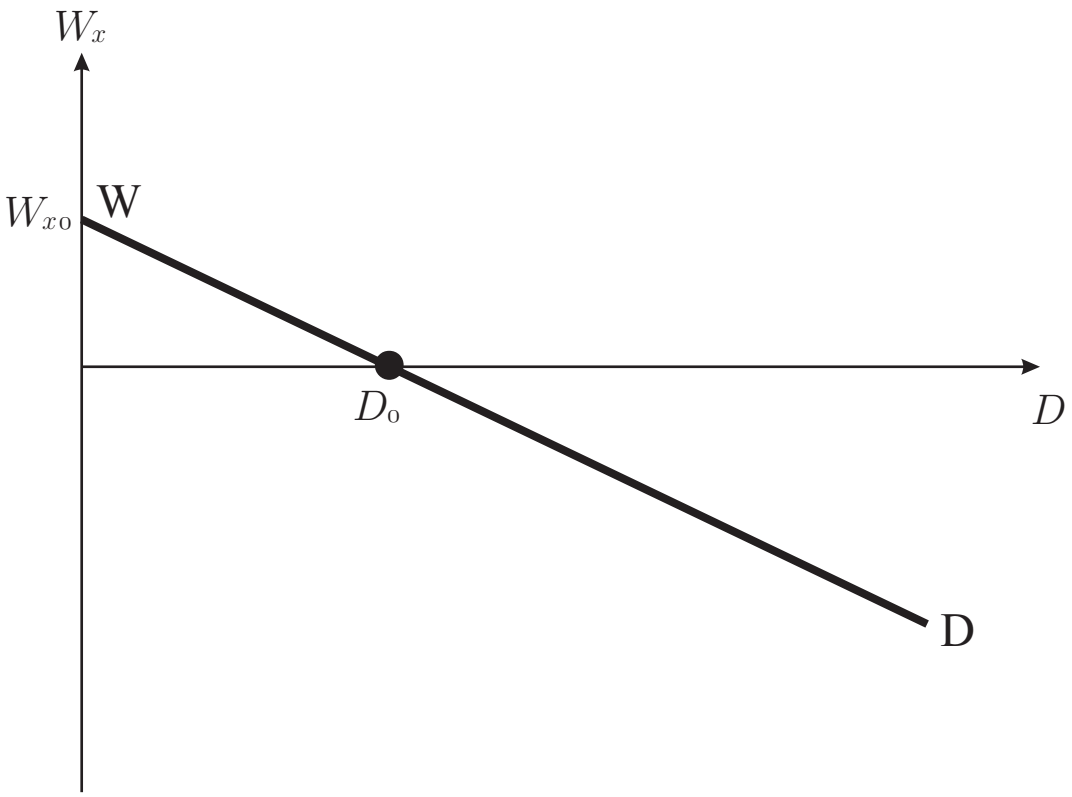

Figure 2: The Smaller-Trade-Diversion-the-Better Case

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