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ENLARGEMENT DECISIONS OF REGIONAL TRADING BLOCS WITH ASYMMETRIC MEMBERS

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ABSTRACT

This paper analyzes the conditions under which an existing bilateral free trade area (FTA) prefers to expand in size and when it prefers consolidation through customs union (CU) formation when the existing members of the FTA are asymmetric, both with respect to production technology and domestic market sizes. The analytical framework employs a standard oligopolistic strategic trade model in a three-country world. In presence of technology asymmetry, there will exist a clash of interest between the FTA members while the non-member will always prefer to join the bloc. Global free trade can be sustained as a subgame perfect Nash equilibrium only for lower degrees of production inefficiency while for higher degrees of production inefficiency a CU between the initial members can be sustained in the presence of some side payments. Given market size asymmetry, both the initial FTA members will offer accession to the non-member country. However, the non-member country will accept the offer of accession only if the market size of the smaller initial member is larger than a critical value.

Key Words: Consolidation, Expansion, Regional Trading Blocs.

JEL Classifications: C72, F12, F15

1. Introduction

The world trading system has witnessed an unprecedented proliferation of regional trading blocs (RTBs) over the last three decades[1]. This increased number of agreements consists of both new agreements (like the free trade area between China and Georgia that came into force on 1st January, 2018) and enlargement of existing RTBs (like the accession of the Kyrgyz Republic to the Eurasian Economic Union on 12th August, 2015). Enlargement of existing RTBs can occur in three possible ways. First type of enlargement is characterised only by increase in the number of members of the RTB (expansion). The accession of Seychelles to the Southern African Development Community on 25th May, 2015 is a recent example of the first type of enlargement. The second type of enlargement is characterised by deeper degree of economic cooperation among the existing members (consolidation). For example, the Gulf Cooperation Council has deepened economic cooperation among the member states since its establishment in 1981. The third type of enlargement consists of both expansion and deepening simultaneously (like the accession of the east European countries in the European Union). Enlargement decisions of RTBs and the ensuing dynamic nature of their structure has remained a major topic of debate. At the onset we briefly discuss the various existing perspectives on this issue.

The existing theoretical literature on the equilibrium structure of a RTB has mixed predictions. Kemp and Wan (1976) argues that global free trade (GFT) can be attainable through an appropriate adjustment of external tariffs. Kennan and Riezman (1990) show that a free trade area (FTA) improves global resource allocations compared to unilaterally optimal Nash equilibrium (NE) tariffs. Yi (2000) establishes that formation of a FTA is a Pareto improvement in itself. However, GFT does not qualify as a stable equilibrium due to free-riding problems. Yi (1996) finds that, given open regionalism, a grand custom union (CU)

[1] Out of 306 agreements reported to the WTO (WTO RTA Database) as on 20th June, 2018, only 23 agreements were in force before 1990.

is the unique pure-strategy Nash equilibrium outcome[2]. Park and Park (2008) find that a CU with minimum common external tariff (CET) is the best option not only for the members but for the rest of the world (ROW) as well. Empirical evidences on the welfare implications of enlargement of RTBs have yielded mixed results as well (see for example Gil *et al* 2008; Lee *et al* 2008 and Egger and Larch 2008).

Another set of literature analyzes the trade-off between the choices of expansion vis-à-vis consolidation in the context of international unions. Gilligan (2004) shows that there exists a "broader-deeper trade-off" if the members opt for an "identical" policy. Alesina *et al* (2005) argue that the trade-off between size and scope of international unions determine the optimal size of the unions – higher degree of policy centralization leads to smaller union size and vice-versa. Hausken *et al* (2006) find that expansion is preferred by the union members if lower degree of policy harmonization is required in the process of integration. Berglof *et al* (2008) infer that the degree of integration is determined by the effort of the "weakest" or least efficient member under the assumption of unanimity.

Ghosh (2016) connects both these streams and analyzes the choice of an existing RTB regarding inclusion of non-members vis-à-vis deeper integration among existing members in an asymmetric (both with respect to technology and domestic market sizes) world. The author finds that CU formation between symmetric initial members will be sustained as the subgame perfect Nash equilibrium (SPNE) given technology asymmetry. The equilibrium outcome given market size asymmetry depends on the market size of the bigger non-member country.

We argue that the issue of expansion or consolidation of an existing FTA may itself depend on asymmetries within the initial member countries themselves. Ghosh (2016), however, assumes that the members of the initial FTA are symmetric in terms of either technology

[2] Open regionalism does not require existing members of a RTB to give consent to the offer of accession to a new member. The situation when such consent is required from all the existing members, we call that unanimous regionalism. In practice, open regionalism is hardly followed.

or market size. This paper tries to analyze the decision of an existing bilateral FTA regarding expansion vis-à-vis consolidation (transformation into CU) when the members countries of the initial FTA are themselves asymmetric, in terms of both technology and domestic market sizes. We consider a three country world economy with a homogeneous good produced under monopolistic market conditions with linear inverse demand and cost functions. Possibility of trade in the identical good arises due to 'reciprocal dumping' motives of firms *a la* Brander (1981), Brander and Krugman (1983). We analyze the role of cross-country asymmetries in influencing the decision of an initial two-country RTB regarding further economic integration between them (consolidation) vis-à-vis offering accession to a non-member country in the RTB (expansion).

We find that there will be a clash of interest between the initial member countries given technology asymmetry between them. The non-member country will always prefer GFT. GFT can be sustained as a SPNE only for lower degrees of production inefficiency. For higher degrees of production inefficiency a CU between the initial members can be sustained in the presence of some side payments. In presence of market size asymmetry between the initial member countries, we establish that both the initial members will offer accession to the non-member country. However, the non-member country will accept the offer of accession only if the market size of the smaller initial member is larger than a critical value.

The rest of the paper is organized as follows. Section 2 describes the model. Section 3 analyzes the benchmark case under technology asymmetry. Section 4 provides the analyses for market size asymmetry. Section 5 concludes the paper followed by appendices.

2. The Model[3]

We consider a world consisting of three countries and denote the countries as 1, 2, and 3 (one can treat Country-3 as the ROW). Each

[3] This section draws from Ghosh (2016).

country has a single firm that produces a homogeneous good locally and supplies in its own country-market as well as in other country-markets[4]. Hence, total supply of the good in each market-i consists of domestic firm's supply and foreign firms' supplies (or, imports). We consider a linear inverse demand function[5] for the i^{th} market –

$$P_i = a_i - \sum_{j=1}^{3} X_{ji} \quad \forall \; i,j = 1,2,3. \tag{1}$$

where, X_{ji} is the supply of firm j in country-i market , P_i is the domestic price level in the i^{th} country and the intercept term a_i gives us a measure of the market size.

The markets are segmented by the assumption of constant marginal costs and cost functions are linear such that –

$$C_i = c_i X_i = c_i \sum_{j=1}^{3} X_{ij} \quad \forall \; i,j = 1,2,3. \tag{2}$$

Each national government protects the import competing firm by imposing a national welfare maximizing specific tariff t_i on its imports from the other two countries[6]. Given the linear cost function and specific tariffs, the profit functions of the national firms can be written as –

$$\pi_i = \left(\sum_{j=1}^{3} P_j X_{ij} - c_i \sum_{j=1}^{3} X_{ij} - \sum_{k=1}^{3} t_k X_{ik}\right) \quad \forall \quad i,j,k = 1,2,3; \quad i \neq k \tag{3}$$

The firms are assumed to be Cournot players – they choose their output levels to maximize profits given the output choices of the rival firms. Welfare function for the i^{th} country consists of the profit of the i^{th} firm (π_i), the surplus accruing to the consumers of the i^{th} country (CS_i) and the total tariff revenue generated by the i^{th} country's imposition of specific tariffs on its imports (TR_i) –

$$W_i = \pi_i + CS_i + TR_i \quad \forall \quad i = 1,2,3. \tag{4}$$

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[4] This theoretical framework revolves around the role of intra-industry trade (IIT). IIT has not only been a major part of trade among developed nations, it plays a major role in their trading patterns for developing economies as well. [see Brulhart (2009), Menon (1996), Khalifa (1996), Hurley (2003), Ahlstrom and Stalros (2005), Hu and Ma (1999) and Gaulier et al. (2012) for the importance of IIT in trade for emerging and developing nations].

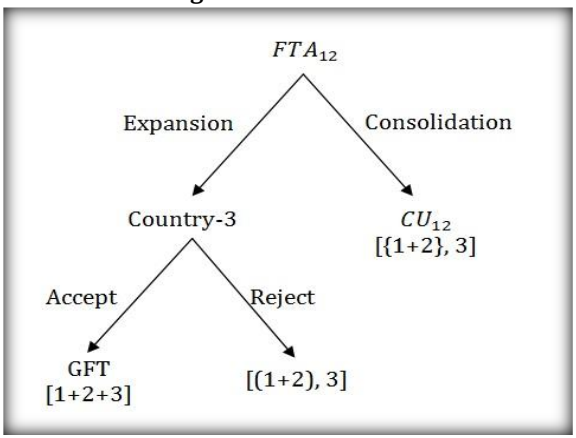
[5] We assume that demand functions in different markets are different only with respect to maximum willingness-to-pay.

[6] The national governments behave in a Cournot fashion over tariff.

We consider a two-stage game. In the first stage the national governments choose optimum tariffs on each other's imports. In the second stage the firms choose their output levels (both domestic sales and exports). We solve for the SPNE of the game.

One major deviation embedded in this three-country framework, compared to Ghosh (2016), is that here we consider expansion and consolidation as two separate and mutually exclusive alternatives. Simultaneous expansion possibilities are not feasible as expansion of the initial FTA is analogous to GFT in this three-country framework. The game tree in Figure 1 will illustrate the expansion possibilities faced by the initial FTA. We denote the world-system under FTA_{12} as [(1+2), 3] while that under CU_{12} as [{1+2}, 3]. Similarly, under GFT the world system has been denoted as [1+2+3].

Figure 1: Game Tree



3. Technology Asymmetry

To begin with we consider the situation where the initial FTA members differ from each other in terms of cross-country production technology but all are symmetric in terms of market size. We further assume that Country-1 has an inefficient production technology vis-à-vis the other two countries. In particular we consider –

$$a_1 = a_2 = a_3 = a \quad (5a)$$
$$c_1 > c_2 = c_3 = c \quad (5b)$$

The optimal tariff levels[7] set by the member countries under FTA_{12} and CU_{12} turn out respectively to be –

$$\tilde{t}_1 = \frac{1}{21}(3a - c_1 - 2c) \quad (6a)$$
$$\tilde{t}_2 = \frac{1}{21}(3a + 7c_1 - 10c) \quad (6b)$$
$$\tilde{t}_{12}^{CU} = \frac{5}{19}(a + c_1 - 2c) \quad (6c)$$

whereas, the optimal tariff set by the non-member country is –

$$\tilde{t}_3 = \frac{1}{10}(3a - c_1 - 2c) \quad (6d)$$

3.1. Second-stage Decision

We start with analyzing whether the efficient non-member country (Country-3) will accept the offer of accession to FTA extended to it by the existing members of the FTA or not. That is, we consider the left hand of the game tree given in Figure 1. If Country-3 accepts the offer, we will have GFT. Hence, we need to compare Country-3's welfare levels under GFT (W_3^*) and that under the FTA_{12} regime ($\widetilde{W}_3$).

If we expand the welfare function of Country- 3 under the alternative tariff regimes, it is readily verifiable that[8] –

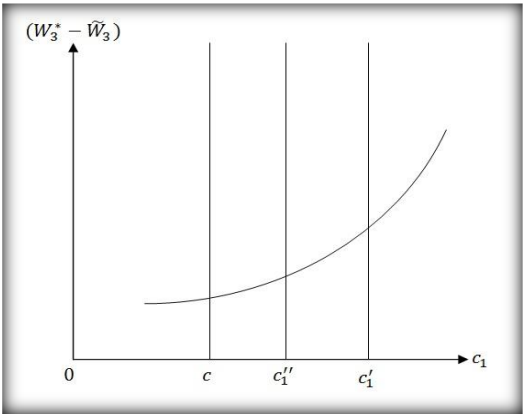
$$W_3^* = \frac{3}{16}(a + c_1 - 2c)^2 + \frac{1}{32}(3a - c_1 - 2c)^2 \quad (7a)$$
$$\widetilde{W}_3 = \frac{1}{49}(a + 2c_1 - 3c)^2 + \frac{1}{49}(a - c)^2 + \frac{1}{25}(2a + c_1 - 3c)^2 + \frac{1}{25}(3a - c_1 - 2c)(2a - c_1 - 2c) \quad (7b)$$

It is apparent that whether national welfare of Country-3 is higher under GFT or not depends, among others, on the magnitude of technology asymmetry of the countries ($c_1 - c$). One convenient way to look at this is to vary the level of c_1 keeping the value of c at some positive level. However, given a particular value of c, the maximum value that c_1 can assume is c_1', where, $c_1' = \frac{1}{8}(3a + 5c)$ is the level of

[7] See appendix A1.
[8] See appendix A2.

marginal cost of production for which $\tilde{X}_{11} = 0$ and $c_1^{''} = \frac{1}{3}(a + 2c)$ is the level of marginal cost of production for which $X_{11}^{*} = 0$. Further, we have $c_1^{'} - c_1^{''} = 0.042(a - c) > 0$. That is, we capture the variations in the degree of technology asymmetry by varying c_1 over the range (c, c_1). As shown in appendix A3, this relationship is monotonically increasing over this relevant range and Country-3 will accept the offer of accession. This is illustrated in Figure 2.

Figure 2: Welfare Ranking for the Non-member Country



Hence, the welfare gain for Country-3 increases with an increase in cost of production as faced by the inefficient member Country-1 (c_1). Country-3 will gain by accepting the offer made by the existing FTA members.

Lemma 1: The efficient non-member country will accept the offer of joining an existing FTA made by the member countries.

Decomposition of welfare change explains the result.

$$\left(W_3^* - \tilde{W}_3\right) = (\pi_3^* - \tilde{\pi}_3) + \left(CS_3^* - \widetilde{CS}_3\right) - \widetilde{TR}_3 \qquad (8)$$

Calculations reveal that under optimal tariff levels $\tilde{t}_i$ $(i = 1,2,3)$, as Country-3 accepts the offer of joining the existing FTA, its firm-profit increases, the tariff revenue disappears but the consumer surplus

increases. Such results are quite obvious as Country-3 under GFT gains from its production efficiency and consequently its firm-profit increases. Similarly, in absence of any import tariff, the consumption distortions disappear and the consumers benefit from lower price of imports. Hence, Country-3 decides in favour of joining the existing FTA.

3.2. First-stage Decision of the Inefficient Member

Now we expand the welfare function of Country-1 (the inefficient member country) under FTA (W_1^*) and CU$_{12}$ (W_1^{CU}). Given the price and output solutions under the alternative regimes, as shown in appendix A4, it is readily verifiable that –

$$W_1^* = \frac{3}{16}(a - c_1 + 2c)^2 + \frac{1}{32}(3a - c_1 - 2c)^2 \quad (9a)$$

$$W_1^{CU} = \frac{2}{361}(6a - 13c_1 + 7c)^2 + \frac{1}{100}(a - 7c_1 + 6c)^2 + \frac{1}{722}(13a - 6c_1 - 7c)^2 + \frac{5}{361}(a + c_1 - 2c)^2 \quad (9b)$$

The difference in welfare levels of Country-1 under GFT and that under CU$_{12}$ turns out to be –

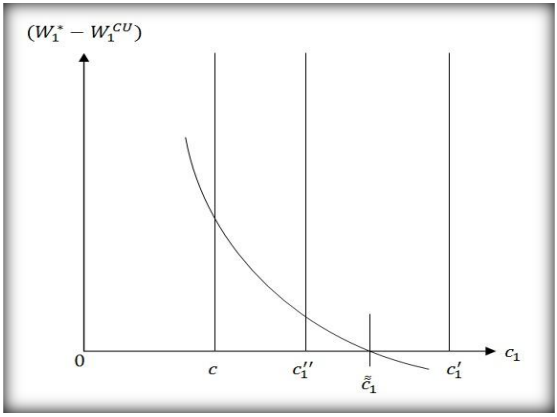
$$W_1^* - W_1^{CU} = 0.011a^2 - 0.12ac_1 + 0.097ac + 0.23c_1^2 - 0.337cc_1 + 0.12c^2 \quad (10)$$

To evaluate whether welfare of Country-1 is higher under GFT or not, vary the level of c_1 keeping the value of c at some positive level as done in section 3.1. Given a particular value of c, the maximum value of c_1 can be c_1' where $c_1' = \frac{1}{13}(6a + 7c)$ is the level of marginal cost of production for which $X_{11}^{CU} = 0$ whereas, $c_1'' = \frac{1}{3}(a + 2c)$ is the level of marginal cost of production for which $X_{11}^* = 0$ and we have $c_1' - c_1'' = 0.128(a - c) > 0$.

As shown in appendix A5, this relationship between the choice Country-1 (between GFT and CU) and the degree of technology asymmetry is decreasing monotonically over the relevant range as specified above. Moreover, such choice of Country-1 regarding the tariff regime depends on a critical level of efficiency in production technology and it will prefer forming a CU over GFT if it is

significantly inefficient in the sense that $c_1 > \tilde{\tilde{c}}_1$ where, $\tilde{\tilde{c}}_1 = (0.399a + 0.601c)$. This is illustrated in Figure 3 below.

Figure 3: Welfare Ranking for the Inefficient Member Country



Thus, the more inefficient Country-1 is, the more beneficial it will be for it to opt for CU rather than GFT. Now, the absolute welfare gain from GFT for Country-1 is positive for $c_1 \in (c, \tilde{\tilde{c}}_1)$. However, for any $c_1 > \tilde{\tilde{c}}_1$ it will opt for CU$_{12}$ over GFT.

Lemma 2: The inefficient member country will prefer GFT only for lower degrees of production inefficiency in the sense that $c_1 \in (c, \tilde{\tilde{c}}_1)$.

3.3. First-stage Decision of the Efficient Member

Now we expand the welfare function of Country-2 (the efficient member country) under the alternative regimes of GFT (W_2^*) and CU$_{12}$ (W_2^{CU}). The welfare levels are calculated to be –

$$W_2^* = \frac{3}{16}(a + c_1 - 2c)^2 + \frac{1}{32}(3a - c_1 - 2c)^2 \quad (11a)$$

$$W_2^{CU} = \frac{1}{100}(a + 3c_1 - 4c)^2 + \frac{1}{722}(13a - 6c_1 - 7c)^2 + \frac{79}{361}(a + c_1 - 2c)^2 \quad (11b)$$

The difference in welfare levels of Country-1 GFT and CU_{12} turns out to be –

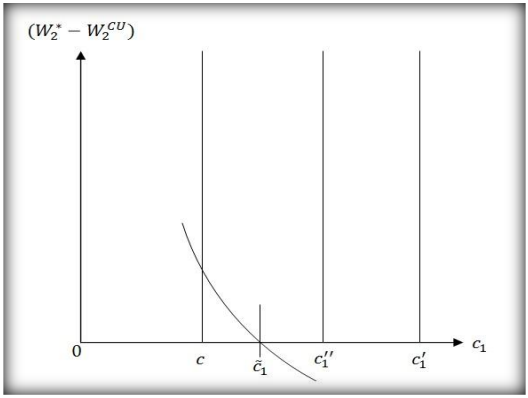
$$W_2^* - W_2^{CU} = 0.006a^2 - 0.094ac_1 + 0.082ac - 0.14c_1^2 + 0.334cc_1 - 0.228c^2 \quad (12)$$

As worked out for the inefficient member country, we can work out the effect of the magnitude of technology asymmetry (c_1) on the welfare rankings for the efficient member country as well. We vary the level of c_1 keeping the value of c at some positive level.

However, given a particular value of c, c_1 can at most be $c_1^{'}$. Now, $c_1^{'} = \frac{1}{13}(6a + 7c)$ is the level of marginal cost of production for which $X_{11}^{CU} = 0$; whereas, $c_1^{''} = \frac{1}{3}(a + 2c)$ is the level of marginal cost of production for which $X_{11}^{*} = 0$ and we have $c_1^{'} - c_1^{''} = 0.128(a - c) > 0$.

As shown in appendix A6 such relation is monotonically decreasing and the efficient member Country-2 will opt for CU over GFT if the inefficient member Country-1 is more inefficient than a critical limit given by $\tilde{c}_1 = (0.057a + 0.943c)$. This is illustrated in Figure 4.

Figure 4: Welfare Ranking for the Efficient Member Country



Hence, the more inefficient Country-1 is, the more beneficial for the efficient member Country-2 to opt for CU rather than GFT. The

absolute welfare gain for Country-2 from GFT is positive for $c_1 \in (c, \tilde{c}_1)$. However, for any $c_1 > \tilde{c}_1$ it will opt for CU_{12} over GFT.

Lemma 3: The efficient member country will prefer global free trade only for lower degrees of production inefficiency of the inefficient member country in the sense that $c_1 \in (c, \tilde{c}_1)$.

3.4. Subgame Perfect Expansion of FTA_{12}

Before proceeding to solve for the SPNE of the enlargement game, we will compare the critical levels of c_1 for which the member countries opt for CU over GFT. The critical levels of c_1 for which the efficient and inefficient member countries opt for CU_{12} over GFT are $\tilde{c}_1$ and $\tilde{\tilde{c}}_1$ respectively and we have –

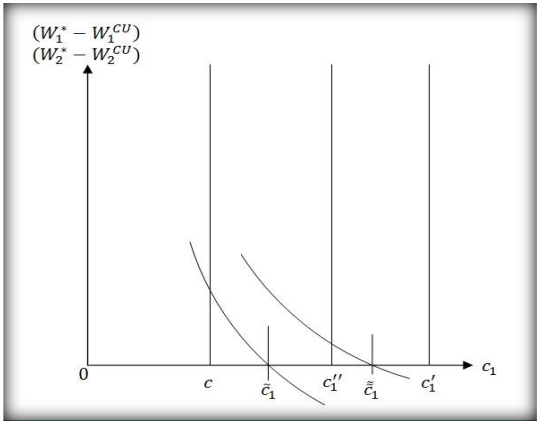
$$\tilde{\tilde{c}}_1 - \tilde{c}_1 = \{(0.399a + 0.601c) - (0.057a + 0.943c)\} = 0.342(a - c) > 0 \quad (13)$$

Both the member countries will opt for GFT and offer accession to the non-member Country-3 for all $c_1 \in (c, \tilde{c}_1)$ and both of the member countries will opt for CU_{12} given any $c_1 > \tilde{\tilde{c}}_1$. However, there exists some conflict of interest in the range $(\tilde{c}_1, \tilde{\tilde{c}}_1)$. Relevant calculations show that the joint welfare of the member countries is higher under CU_{12} than under FTA_{12} regime for $c_1 = \tilde{c}_1$. Hence, the efficient member (Country-2) can enforce a CU by making some side payments to the inefficient partner (Country-1). We have illustrated this in Figure 5 below.

Proposition 1: ***If there exists a FTA between two dissimilar countries with one inefficient member and there exists an efficient non-member country, then GFT will be the SPNE outcome only if the inefficient member country is less inefficient in the sense that $c_1 \leq (0.057a + 0.943c)$. If the critical value is exceeded then CU_{12} can be sustained as the SPNE outcome with the efficient member country making some side payment to its inefficient partner.***

Proof: From Lemma 1 it is evident that the non-member Country-3 accepts the offer of accession to the FTA. Lemma 2 and Lemma 3 together state that given such optimal choice of the non-member country, it is optimal for the member states to offer it accession to the FTA if $c_1 \leq (0.057a + 0.943c)$.

Figure 5: Critical Inefficiency Levels and Welfare Rankings for the Member Countries



4. Market Size Asymmetry

In this section we consider the situation where the initial FTA members differ from each other in terms of domestic market sizes but all are symmetric in terms of production technology. Country-1 has a smaller market size vis-à-vis the other two countries. In particular we assume –

$$a_1 < a_2 = a_3 = a \tag{14a}$$

$$c_1 = c_2 = c_3 = c \tag{14b}$$

Given the above assumptions the optimal tariff levels set by the member countries under FTA$_{12}$ and CU$_{12}$ are respectively –

$$\tilde{\tilde{t}}_1 = \frac{1}{7}(a_1 - c) \tag{15a}$$

$$\tilde{\tilde{t}}_2 = \frac{1}{7}(a - c) \tag{15b}$$

$$\tilde{\tilde{t}}_{12}^{CU} = \frac{5}{38}(a + a_1 - 2c) \tag{15c}$$

whereas, the optimal rate set by the non-member country is –

$$\tilde{\tilde{t}}_3 = \frac{3}{10}(a - c) \tag{15d}$$

4.1. Second-stage Decision

We start with the decision of the non-member country (Country-3). We analyze whether it will accept the offer of accession to FTA extended to it by the existing members of the FTA or not. If it accepts the offer of accession to the existing FTA, we will have GFT. Hence, we compare Country-3's welfare levels under GFT ($\widetilde{W}_3^*$) and FTA ($\widetilde{\widetilde{W}}_3$). The welfare levels of Country-3 under FTA$_{12}$ and GFT turn out to be –

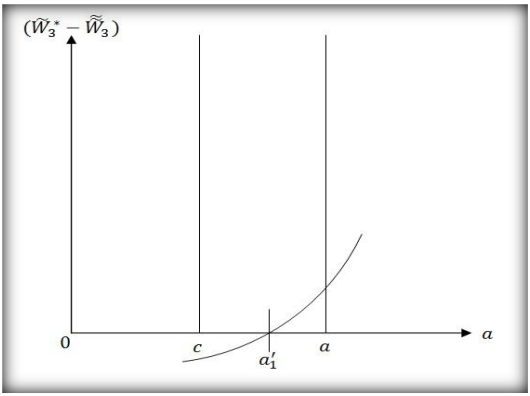
$$\widetilde{W}_3^* = \frac{1}{16}(a_1 - c)^2 + \frac{13}{32}(a - c)^2 \tag{16a}$$

$$\widetilde{\widetilde{W}}_3 = \frac{1}{49}(a_1 - c)^2 + \frac{103}{245}(a - c)^2 \tag{16b}$$

Whether national welfare of Country-3 is higher under GFT or not depends, among others, on the magnitude of market size asymmetry of the countries $(a - a_1)$. We follow exactly the same approach as in section 3.1 for this. We vary the level of a_1 keeping the value of a at some positive level and thus capture the variations in the degree of market size asymmetry by varying a_1 in the range (c, a) where a denotes the market size of the other two countries and the lowest possible value which a_1 can take is c. Otherwise, the market will not exist in the sense that there will be no price at which buyers will buy a non-negative quantity under autarky. Now, as shown in appendix A7, such relationship $(\widetilde{W}_3^* - \widetilde{\widetilde{W}}_3)$ is monotonically increasing in a_1 over the range (c, a) and Country-3 will accept the offer of accession to the FTA only if the smaller member country has a considerable market size in the sense that $a_1 > a_1^{'}$ where $a_1^{'} = (0.58a + 0.42c)$. This is illustrated in Figure 6 below.

The non-member Country-3 will accept the offer accession to the FTA only if the market size of the smaller member country a_1 is greater than a critical limit $a_1^{'} = (0.58a + 0.42c)$. However, if $a_1 < a_1^{'}$ then the non-member Country-3 will reject the offer of accession to the FTA.

Figure 6: Welfare Ranking for the Non-member Country



Lemma 4: If the market size of the smaller member country is big enough in the sense that $a_1 > (0.58a + 0.42c)$, then the non-member country will accept the offer of accession to the existing country made by the member countries.

4.2. First-stage Decision of the Smaller Member

If we expand the welfare function of Country-1 (the member country with smaller market size) under GFT ($\widetilde{W}_1^*$) and CU_{12} regime ($\widetilde{W}_1^{CU}$), it is readily verifiable that –

$$\widetilde{W}_1^* = \frac{11}{32}(a_1 - c)^2 + \frac{1}{8}(a - c)^2 \tag{17a}$$

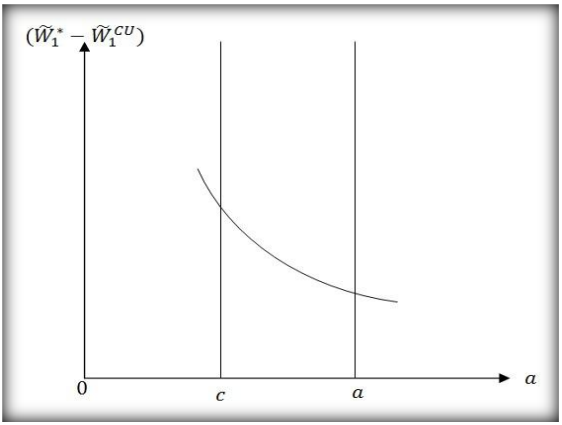
$$\begin{aligned}\widetilde{W}_1^{CU} = {} & \frac{1}{23104}(43a_1 + 5a - 48c)(43a_1 + 5a - 54c) \\ & + \frac{1}{23104}(5a_1 + 43a - 48c)(5a_1 + 43a - 54c) + \\ & \frac{1}{100}(a - c)^2 + \frac{1}{46208}(103a_1 - 5a - 98c)^2 + \\ & \frac{5}{5776}(a_1 + a - 2c)(23a_1 - 15a - 8c)\end{aligned} \tag{17b}$$

The difference in welfare levels of Country-1 under GFT and CU_{12} turns out to be –

$$\begin{aligned}\left(\widetilde{W}_1^* - \widetilde{W}_1^{CU}\right) = {} & 0.013a_1^2 + 0.008a_1c + 0.013c^2 + 0.046a^2 - \\ & 0.058ac - 0.022aa_1\end{aligned} \tag{18}$$

From (18) it is evident that the sign of the welfare ranking is ambiguous. Hence, whether the welfare level is higher under GFT or not, depends on the magnitude of market size asymmetry of the countries $(a - a_1)$. Similar to section 4.1, we vary a_1 in the range (c, a) where a denotes the market size of the other two countries and c is the lowest possible value which a_1 can take. As worked out in appendix A8, the relationship is monotonically decreasing over the relevant range (c, a) and Country-1 will find GFT more profitable. This is illustrated in Figure 7.

Figure 7: Welfare Ranking for the Member Country with Smaller Market Size



Hence, the bigger the market size of Country-1 is, the lower will be its gain from GFT. However, the absolute gain from GFT is positive in the range (c, a). As a result, it will opt for GFT.

Lemma 5: The member country with smaller market size will opt for GFT and will offer accession to the non-member country.

4.3. First-stage Decision of the Bigger Member

Expanding the welfare function of Country-2 (the member country with bigger market size) under GFT ($\widetilde{W}_2^*$) and CU$_{12}$ regime ($\widetilde{W}_2^{CU}$) we have

$$\widetilde{W}_2^* = \frac{1}{16}(a_1 - c)^2 + \frac{13}{32}(a - c)^2 \quad (19a)$$

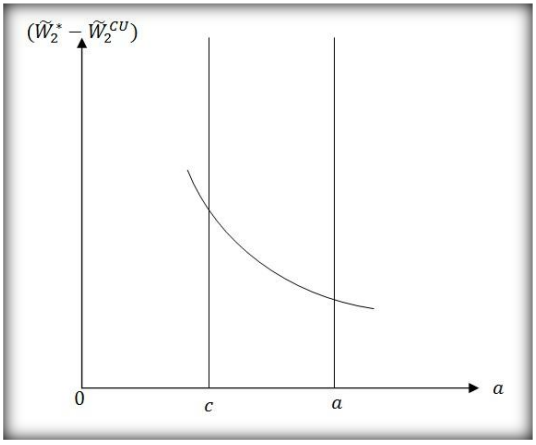
$$\widetilde{W}_2^{CU} = \frac{1}{23104}(43a_1 + 5a - 48c)(43a_1 + 5a - 54c) + \frac{1}{23104}(5a_1 + 43a - 48c)(5a_1 + 43a - 54c) + \frac{1}{100}(a - c)^2 + \frac{1}{46208}(103a_1 - 5a - 98c)^2 + \frac{5}{5776}(a_1 + a - 2c)(23a_1 - 15a - 8c) \quad (19b)$$

The difference in welfare levels of Country-2 turns out to be –

$$\left(\widetilde{W}_2^* - \widetilde{W}_2^{CU}\right) = -0.006a_1^2 + 0.046a_1c + 0.013c^2 + 0.065a^2 - 0.097a - 0.022aa_1 \quad (20)$$

The relationship given by (20) is monotonically decreasing in the relevant range (c, a)[9] and, like the smaller member, the bigger Country-2 will also prefer offering accession to the bigger non-member Country-3 and hence, implement GFT. This is illustrated in Figure 8.

Figure 8: Welfare Ranking for the Member Country with Bigger Market Size



Hence, the bigger the market size of Country-1, the lower will be Country-2's gain from GFT. However, the absolute gain from GFT over

[9] See appendix A9.

that under CU_{12} regime is positive in the range (c, a). As a result it will opt for GFT and offer accession to non-member Country-3.

Lemma 6: The member country with bigger market size will opt for GFT and will offer accession to the non-member country.

4.4. Subgame Perfect Expansion of FTA_{12}

The non-member country will accept the offer made by the existing members of the FTA given the market size of the smaller member country is big enough in the sense that $a_1 > (0.58a + 0.42c)$. The member countries will opt for expansion of the FTA. Hence, if $a_1 > (0.58a + 0.42c)$, there will be GFT.

Proposition 2: ***If there exists a FTA between two dissimilar countries with one smaller member and there exists a non-member country, then GFT will be the SPNE outcome if the smaller member country is large enough in the sense that $a_1 > (0.58a + \mathbf{0.42c})$.***

Proof: Lemma 4 states that the non-member country will accept the offer of accession to the existing FTA made by the member countries given the market size of the smaller member country is big enough in the sense that $a_1 > (0.58a + 0.42c)$. Lemma 5 and Lemma 6 together state that the member countries will opt for GFT and they will offer accession to the non-member country.

5. Conclusion

RTBs do not remain static over time. All the major RTBs in the world have enlarged over time. Such enlargement consists of both expansion and consolidation. This paper analyzes the conditions under which an existing bilateral FTA prefers an expansion and when it prefers consolidation through CU formation when the existing members of the

FTA are asymmetric, both with respect to production technology and domestic market sizes.

If there exists an inefficient initial member country (technology asymmetry), there will exist a clash of interest between the members while the non-member will always prefer to join the bloc. We find that GFT can be sustained as a SPNE only for lower degrees of production inefficiency while for higher degrees of production inefficiency a CU between the initial members can be sustained in the presence of some side payments. This result brings out the nuances of unanimous regionalism where the decision of the exiting members of a bloc is paramount regarding the future structure and composition of the RTB.

Given there exists a smaller initial member country (market size asymmetry), both the initial members will offer accession to the non-member country. However, the non-member country will accept the offer of accession only if the market size of the smaller initial member is larger than a critical value. This result somewhat represents the case of open regionalism as the decision of the non-member country becomes pivotal regarding the enlargement possibilities of the RTB.

The model can be enriched further if modeled in a four-country world economy and hence, allow for simultaneous expansion and consolidation. In a four-country world two more things can be looked at. First, it would be interesting to see which non-member country the existing members would offer accession to. Second, for the non-member countries, the possibility of forming a separate bloc rather than joining an existing one can be analyzed. Hence, the existing framework can be extended so as to incorporate the possibility of formation of multiple trade blocs simultaneously.

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Appendices

A1. Optimal Tariff Levels

Under FTA$_{12}$ the welfare functions of Country-1 is given to be

$$\begin{aligned}\widetilde{W}_1 = \tfrac{1}{16}[&(a + c_1 + 2c + \tilde{t}_1)(a - 3c_1 + 2c + \tilde{t}_1)\\ &+(a + c_1 + 2c + \tilde{t}_2)(a - 3c_1 + 2c + \tilde{t}_2)\\ &+(a + c_1 + 2c + 2\tilde{t}_3)(a - 3c_1 + 2c - 2\tilde{t}_3)\\ &-\frac{1}{4}(3a - 9c_1 + 6c + \tilde{t}_1 + \tilde{t}_2 - 2\tilde{t}_3)c\\ &-\frac{1}{4}(a - 3c_1 + 2c - 2\tilde{t}_3)\tilde{t}_3\\ &+\tfrac{1}{32}(3a - c_1 - 2c - \tilde{t}_1)^2 + \tfrac{1}{4}(a + c_1 - 2c - 3\tilde{t}_1)\tilde{t}_1 \qquad (21)\end{aligned}$$

Maximizing $\widetilde{W}_1$ given by (21) with respect to $\tilde{t}_1$ yields the optimal tariff as

$$\tilde{t}_1 = \tfrac{1}{21}(3a - c_1 - 2c)$$

Similarly we get the optimal tariffs for countries 2 and 3 as given in (6b) and (6d). Under CU$_{12}$ the welfare functions for countries 1 and 2 are maximized jointly to yield the CET $\tilde{t}_{12}^{CU}$ as given in (6c).

A.2. Welfare Levels of Country-3 under FTA$_{12}$ and Global Free Trade Regimes

Under global free trade we have the profit level for the non-member Country-3 to be

$$\pi_3^* = \tfrac{3}{16}(a + c_1 - 2c)^2$$

and the consumer surplus for Country-3 under GFT turns out to be

$$CS_3^* = \tfrac{1}{32}(3a - c_1 - 2c)^2$$

Under free trade regime there is no tariffe revenue generated. Hence, given global free trade regime and the set of assumptions regarding cross-country technology and market size, the welfare level for Country-3 can be written as

$$W_3^* = \pi_3^* + CS_3^* = \tfrac{3}{16}(a + c_1 - 2c)^2 + \tfrac{1}{32}(3a - c_1 - 2c)^2 \qquad (22)$$

Now, under the same set of assumptions regarding cross-country technology and market size but under FTA$_{12}$ regime, the profit level for Country-3 is

$$\tilde{\pi}_3 = \frac{1}{49}(a + 2c_1 - 3c)^2 + \frac{1}{49}(a - c)^2 + \frac{1}{25}(2a + c_1 - 3c)^2$$

The consumer surplus is $\widetilde{CS}_3 = \frac{1}{50}(3a - c_1 - 2c)^2$

Tariff revenue accruing to Country3 is $\widetilde{TR}_3 = \frac{1}{50}(3a - c_1 - 2c)(a - 2c_1 + c)$

Hence, given FTA$_{12}$ regime the welfare level of Country- 3 is given by

$$\widetilde{W}_3 = \frac{1}{49}(a + 2c_1 - 3c)^2 + \frac{1}{49}(a - c)^2 + \frac{1}{25}(2a + c_1 - 3c)^2 + \frac{1}{25}(3a - c_1 - 2c)(a - 2c_1 + c) \quad (23)$$

A.3. Decision of the Non-member Country-3

The following properties of functions are readily verifiable.

$W_3^* - \widetilde{W}_3 = 0.028(a - c)^2 > 0$ for $c_1 = c$

$W_3^* - \widetilde{W}_3 = 0.101(a - c)^2 > 0$ for $c_1 = c_1''$

$W_3^* - \widetilde{W}_3 = 0.11(a - c)^2 > 0$ for $c_1 = c_1'$

Moreover, the function $(W_3^* - \widetilde{W}_3)$ is monotonically increasing at an increasing rate over the range (c, c_1).

$$\frac{\delta}{\delta c_1}\left(W_3^* - \widetilde{W}_3\right) = 0.206(a - c) + 0.074(c_1 - c) > 0$$

$$\frac{\delta^2}{\delta c_1^2}\left(W_3^* - \widetilde{W}_3\right) = 0.074 > 0$$

Thus, using all these properties, we arrive at,

$$\left(W_3^* - \widetilde{W}_3\right) > 0 \quad \forall \quad c_1 \in (c, c_1')$$

A.4. Welfare Levels of Country-1 under CU$_{12}$ and GFT Regimes

Under GFT there is no tariffe revenue generated. Hence, given GFT and the set of assumptions regarding cross-country technology and market size, the welfare level for Country-1 turns out to be

$$W_1^* = \frac{3}{16}(a - 3c_1 + 2c)^2 + \frac{1}{32}(3a - c_1 - 2c)^2 \quad (24)$$

Now, under the same set of assumptions regarding cross-country technology and market size but under CU_{12} regime, the profit level for Country-1 turns out to be

$$W_1^{CU} = \frac{2}{361}(6a - 13c_1 + 7c)^2 + \frac{1}{100}(a - 7c_1 + 6c)^2 + \frac{1}{722}(13a - 6c_1 - 7c)^2 + \frac{5}{361}(a + c_1 - 2c)^2 \quad (25)$$

A.5. Decision of Country-1

Now, the following properties of the function $(W_1^* - W_1^{CU})$ are readily verifiable.

$W_1^* - W_1^{CU} = 0.011(a - c)^2 > 0$ for $c_1 = c$

$W_1^* - W_1^{CU} = 0.004(a - c)^2 > 0$ for $c_1 = c_1^{''}$

$W_1^* - W_1^{CU} = -0.003(a - c)^2 > 0$ for $c_1 = c_1^{'}$

Moreover, the function $(W_1^* - W_1^{CU})$ is monotonically decreasing at an increasing rate over the range (c, c_1).

$$\frac{\delta}{\delta c_1}(W_1^* - W_1^{CU}) = -[0.12(a - c_1) + 0.34(c - c_1) < 0$$

$$\frac{\delta^2}{\delta c_1^2}(W_1^* - W_1^{CU}) = 0.4575 > 0$$

Thus, using all these properties, we arrive at,

$$(W_1^* - W_1^{CU}) > 0 \quad \forall \quad c_1 \in (c, \tilde{\tilde{c}}_1)$$

where, $\tilde{\tilde{c}}_1 = (0.399a + 0.601c)$.

However, $(W_1^* - W_1^{CU}) < 0 \quad \forall \quad c_1 > \tilde{\tilde{c}}_1$.

A.6. Welfare Levels and Choice of Country-2 given CU_{12} and GFT Regimes

Under global free trade for the inefficient member Country-2 we have the profit level to be

$$\pi_2^* = \frac{3}{16}(a + c_1 - 2c)^2$$

and the consumer surplus for Country-2 under GFT turns out to be

$$CS_2^* = \frac{1}{32}(3a - c_1 - 2c)^2$$

Under GFT there is no tariff revenue generated. Hence, given GFT and the set of assumptions regarding cross-country technology and market size, the welfare level for Country-2 turns out to be

$$W_2^* = \frac{3}{16}(a + c_1 - 2c)^2 + \frac{1}{32}(3a - c_1 - 2c)^2 \quad (26)$$

Now, under the same set of assumptions regarding cross-country technology and market size but under CU_{12} regime, the profit level for Country-2 turns out to be

$$\pi_2^{CU} = \frac{72}{361}(a + c_1 - 2c)^2 + \frac{1}{100}(a + 3c_1 - 4c)^2$$

The consumer surplus turns out to be $CU_2^{CU} = \frac{1}{722}(13a - 6c_1 - 7c)^2$ and the tariff revenue accruing to Country-2 is $TR_2^{CU} = \frac{5}{361}(a + c_1 - 2c)2$

Hence, given FTA_{12} regime the welfare level of Country-2 is given by

$$W_2^{CU} = \frac{79}{361}(a + c_1 - 2c)^2 + \frac{1}{100}(a + 3c_1 - 4c)^2 + \frac{1}{722}(13a - 6c1 - 7c)2 \quad (27)$$

Now, the following properties of function $(W_2^* - W_2^{CU})$ are readily verifiable.

$(W_2^* - W_2^{CU}) = 0.006(a - c)^2 > 0$ for $c_1 = c$

$(W_2^* - W_2^{CU}) = -0.041(a - c)^2 < 0$ for $c_1 = c_1''$

$(W_2^* - W_2^{CU}) = -0.067(a - c)^2 < 0$ for $c_1 = c_1'$

Moreover, the function $(W_2^* - W_2^{CU})$ is monotonically decreasing at an increasing rate over the range (c, c_1).

$$\frac{\delta}{\delta c_1}(W_2^* - W_2^{CU}) = -[0.09(a - c) + 0.28(c_1 - c) < 0$$

$$\frac{\delta^2}{\delta c_1^2}(W_2^* - W_2^{CU}) = -0.28 < 0$$

Thus, using all these properties, we arrive at,

$$(W_2^* - W_2^{CU}) > 0 \quad \forall \quad c_1 \in (c, \tilde{c_1})$$

where, $\tilde{c_1} = (0.057a + 0.943c)$.

However, $(W_2^* - W_2^{CU}) < 0 \quad \forall \quad c_1 > \tilde{c_1}$.

A.7. Decision of the Bigger Non-member

From (16a) and (16b) we have

$$\widetilde{W}_3^* = \frac{1}{16}(a_1 - c)^2 + \frac{13}{32}(a - c)^2$$

$$\widetilde{\widetilde{W}}_3 = \frac{1}{49}(a_1 - c)^2 + \frac{103}{245}(a - c)^2$$

Now, it is immediate that

$\widetilde{W}_3^* - \widetilde{\widetilde{W}}_3 = 0.028(a - c)^2 > 0$ for $a_1 = a$

$\widetilde{W}_3^* - \widetilde{\widetilde{W}}_3 = -0.014(a - c)^2 < 0$ for $a_1 = c$

Moreover, the function $(\widetilde{W}_3^* - \widetilde{\widetilde{W}}_3)$ is monotonically increasing at an increasing rate over the range (c, a).

$$\frac{\delta}{\delta a_1}\left(\widetilde{W}_3^* - \widetilde{\widetilde{W}}_3\right) = 0.0842(a_1 - c) > 0$$

$$\frac{\delta^2}{\delta a_1^2}\left(\widetilde{W}_3^* - \widetilde{\widetilde{W}}_3\right) = 0.0842 > 0$$

Thus, using all these properties, we arrive at,

$$\widetilde{W}_3^* > \widetilde{\widetilde{W}}_3 \quad \forall \quad a_1 \in (a_1^{'}, a)$$

where $a_1^{'} = (0.58a + 0.42c)$.

A.8. Choice of the Smaller Member Country

From (18) we have

$$\left(\widetilde{W}_1^* - \widetilde{W}_1^{CU}\right) = 0.013a_1^2 + 0.008a_1c + 0.013c^2 + 0.046a^2 - 0.058ac - 0.022aa_1$$

For $a_1 = a$ we have

$$\left(\widetilde{W}_1^* - \widetilde{W}_1^{CU}\right) = 0.038a^2 - 0.05ac + 0.013c^2 > 0 \text{ if } a > c$$

For $a_1 = c$ we have

$$\left(\widetilde{W}_1^* - \widetilde{W}_1^{CU}\right) = 0.046a^2 - 0.08ac + 0.034c^2 > 0 \text{ if } a > c$$

Moreover, the function $(\widetilde{W}_1^* - \widetilde{W}_1^{CU})$ is monotonically decreasing at an increasing rate over the range (c, a).

$$\frac{\delta}{\delta a_1}\left(\widetilde{W}_1^* - \widetilde{W}_1^{CU}\right) = \frac{1}{23104}(607a_1 - 505a + 186c) > 0$$

given the condition $a > (1.21a_1 + 0.34c)$

$$\frac{\delta^2}{\delta a_1^2}\left(\widetilde{W}_1^* - \widetilde{W}_1^{CU}\right) = \frac{607}{23104} > 0$$

A.9. Choice of the Bigger Member Country

From (20) we have

$$\left(\widetilde{W}_2^* - \widetilde{W}_2^{CU}\right) = -0.006a_1^2 + 0.046a_1c + 0.013c^2 + 0.065a^2 - 0.097ac - 0.022aa_1$$

For $a_1 = a$ we have

$$\left(\widetilde{W}_2^* - \widetilde{W}_2^{CU}\right) = 0.037a^2 - 0.05ac + 0.013c^2 > 0 \text{ if } a > c$$

For $a_1 = c$ we have

$$\left(\widetilde{W}_2^* - \widetilde{W}_2^{CU}\right) = 0.065a^2 - 0.118ac + 0.053c^2 > 0 \text{ if } a > c$$

Relevant calculations reveal that the difference in welfare levels $\left(\widetilde{W}_2^* - \widetilde{W}_2^{CU}\right)$ is bigger when a_1 assumes the value c than when a_1 assumes the value a.

The function $(\widetilde{W}_2^* - \widetilde{W}_2^{CU})$ is monotonically decreasing at an decreasing rate over the range (c, a).

$$\frac{\delta}{\delta a_1}\left(\widetilde{W}_2^* - \widetilde{W}_2^{CU}\right) = -(0.0123a_1 + 0.0218a - 0.0466c) < 0$$

given the condition $c < (0.264a_1 + 0.468a)$

$$\frac{\delta^2}{\delta a_1^2}\left(\widetilde{W}_1^* - \widetilde{W}_1^{CU}\right) = -0.0123 < 0$$

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