A Strategic and Welfare Theoretic Analysis of Free Trade Areas

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Abstract: We utilize a three-country trade model to determine how the formation of a free trade area (FTA) between welfare-maximizing countries affects equilibrium tariffs and welfare of members and nonmembers. Our analysis reveals that, at constant nonmember tariffs, the liberalization of internal trade by symmetric members induces them to *reduce* their individually optimal external tariff below the Kemp-Wan (1976) tariff level thereby causing the outside country's terms of trade to improve and its welfare to rise. For this reason, FTA members find the complete elimination of internal tariffs unappealing. We also extend the analysis to allow the nonmember country to behave strategically. Our work clarifies that, upon the formation of the FTA, the outside country behaves more aggressively in its tariff policy while FTA members do not. As a consequence, the nonmember country benefits from integration even more; in contrast, FTA members benefit only if the relative size of the FTA is sufficiently large.

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1. Introduction

A World Trade Organization (2000) report on preferential trade agreements identified 172 trade accords in force as of June 2000, with an additional 68 agreements under negotiation. Free trade areas (FTAs) accounted for 148 of the agreements in force and 67 of the agreements under negotiation. Yet, despite the overwhelming predominance of FTAs in practice, the literature on preferential trade arrangements has tended to focus primarily on the analysis of customs unions.[1]

This paper takes a step toward redressing this imbalance in attention by providing new insights on the strategic aspects and welfare effects of FTAs. We use a simple three-country general equilibrium trade model to analyze how the formation of an FTA between two countries affects the tariff and welfare levels of all countries. Since the recent literature examines the effects of preferential trade arrangements under a variety of assumptions regarding the setting of inter-bloc tariffs and the structure of regional agreements, it is useful to place our analysis in this literature by highlighting two of our assumptions. First, we assume that external tariffs rates are endogenously determined with countries choosing these rates independently to maximize national welfare in a single-period, non-cooperative, tariff-setting game.[2] Second, we consider situations in which two (exogenously chosen) countries of equal size form an FTA. The fact that two of the three countries considered form an FTA means that the agreement expands the size of the member countries relative to the rest of the world (ROW). This enables us to identify the strategic effects of tariff cuts within the FTA and obtain sharp predictions on how the relative size of the member countries is likely to affect the costs and benefits of forming an FTA. The assumption of symmetric FTA members is adopted for tractability and because it places

[1] The theoretical literature on regional trade agreements is now fifty years old. Beginning with Viner (1950), Meade (1955), Lipsey (1970), and continuing with the modern contributions by Riezman (1979), Kennan and Riezman (1990), Krugman (1991), Bond and Syropoulos (1996a), Syropoulos (1999) and others, this literature has primarily focused on customs unions.

[2] A number of authors have examined this question under alternative assumptions regarding both the objective functions of policymakers and the nature of the tariff-setting game between them. For example, Bagwell and Staiger (1997) and Bond and Syropoulos (1996b) assume that inter-bloc tariffs are the outcome of a repeated game between the trading blocs. Richardson (1993) examines the case in which the objective function of the bloc members attaches a positive weight to special interests.

the size of the FTA relative to the rest of the world (ROW) at center stage while abstracting from internal distributional issues within the FTA.[3]

In evaluating the effects of FTAs one of the theoretical difficulties is that tariff changes are discrete. Typically, in such settings, one is concerned with how pre- and post-integration Nash tariff equilibria compare. However, because this comparison involves discrete changes in tariffs, the use of traditional calculus methodology is quite difficult. We overcome this difficulty by decomposing the entire change into two separate steps. We first solve for the relationship between trade liberalization within the FTA and the FTA members' optimal external tariffs which are identical due to symmetry. We then solve for the relationship between the external tariffs of the FTA members and the nonmember. This decomposition is appealing because it allows us to capture the empirically relevant point that trade liberalization within FTAs (e.g., NAFTA) often takes place gradually with internal free trade being attained only after periods of ten or more years. We can thus analyze how tariffs and welfare vary along the transition path of internal liberalization. A further benefit of this two stage approach is that it allows to us to compare the welfare effect of internal liberalization both in the absence and the presence of optimal tariff adjustments by ROW. The former case is relevant for illustrating the welfare effects of trade liberalization when ROW cannot raise its tariff against the FTA members, as may be the case if ROW is constrained by multilateral trade obligations.

We now highlight several of the key results of our analysis. The first concerns the impact of internal trade liberalization on the external tariff of the individual members, assuming that ROW tariffs remain constant. A useful benchmark for this analysis is the Kemp-Wan tariff adjustment, which is a reduction in the external tariff of the FTA that would leave ROW's terms of trade unaffected by the reduction in internal tariffs. We show that, in response to internal trade liberalization, individual members have an incentive to reduce their

[3] The importance of the relative size of a trading bloc has been extensively examined for the case of customs unions, but is relatively unexplored in the case of FTAs. Kennan and Riezman (1990) numerically studied the role of country size in regional trading arrangements. Krugman (1991) divided the world into an equal number of customs unions to explore the effects of simultaneously expanding the (absolute) size of all CUs. The role of relative versus absolute size in many country models of CUs is emphasized by Bond and Syropoulos (1996a). Kose and Riezman (2000) present some additional numerical results for CUs and FTAs.

external tariffs by an amount that exceeds the Kemp-Wan tariff reduction.[4] This result is key to our welfare analysis. Several researchers have established a result similar to ours, namely that internal liberalization in the context of a preferential trade arrangement (PTA) results in a decline in the PTA's optimal external tariff. Bagwell and Staiger (1998) call this "tariff complementarity." Ours is stronger in that it establishes that the fall in the external tariff is so large that it improves ROW's terms of trade and hence makes it better off (at constant ROW tariffs).[5]

We then use this result to show, first, that in the post-integration Nash equilibrium the external tariff of FTA members falls below its level in the pre-integration Nash equilibrium and, second, that ROW's optimal tariff rises above its pre-integration level. Interestingly, these tariff adjustments cause ROW's terms of trade to improve and, as we will see, imply that the formation of the FTA benefits ROW.

The aforementioned findings also provide fresh insights on the differences between FTAs and CUs. As emphasized by Kennan and Riezman (1990), a key difference between these forms of integration is that CU members coordinate their external tariff policies and thus internalize the terms of trade externalities they generate for each other. More generally, though, the formation of a CU creates two opposing effects on the external tariff: a *coordination effect* that causes this tariff to rise and a *complementarity effect* that causes it to fall.[6] Our clarifies that the absence of the coordination effect in FTAs means that the external tariff of members will always

[4] Our definition of the Kemp-Wan tariff adjustment is based on the well-known result of Kemp and Wan (1976) that there exists an external tariff structure that leaves ROW unaffected by the formation of a customs union. Similarly, in the symmetric trade model we consider, there exists an external tariff of the FTA members that leaves ROW unaffected by regional integration.

[5] Syropoulos (1999) and Bond et al. (2001) also show the presence of tariff complementarity in a trade model similar to the one considered here but with the PTA being a customs union. Bagwell and Staiger (1998) examine a partial equilibrium trade model with identical countries and linear demand functions and find that tariff complementarity holds for both FTAs and CUs. Freund (2000) obtains a similar result in a model with imperfectly competitive firms. Richardson (1995) also establishes that internal liberalization may result in a reduction in external tariffs in an FTA with and without rules of origin. This occurs because member countries reduce their external tariffs below those in the partner country to capture tariff revenues on imports that will ultimately be sold in the partner country's market. Our analysis differs in that we assume the presence of rules of origin capable of preventing such tariff revenue competition.

[6] Whether external tariffs rise or fall upon the formation of a CU depends, among other things, on inter-country differences in endowments (see, for example, Syropoulos (1999)).

be lower in an FTA than in a CU equilibrium. A second implication of this lack of coordination of external policies is that the optimal internal tariff for an FTA is positive. Intuitively, this is so because an increase of the internal tariff in the neighborhood of free internal trade raises welfare of FTA members by causing them to behave more aggressively in the external tariff policies.

The above findings unveil the presence of conflicting welfare effects of FTA formation on member states. The removal of internal tariffs expands internal trade and thus tends to improve member country welfare. However, the FTA terms of trade deteriorate because of the resulting changes in inter-bloc tariffs: the external tariff of the FTA members falls below its Kemp-Wan level and ROW becomes relatively more aggressive in the post-integration equilibrium. It then follows that the relative size of the FTA ought to play an important role in determining whether FTA members benefit from the agreement.

A relatively large FTA is more likely to benefit its members for two reasons. First, internal trade constitutes a relatively larger fraction of total trade for a large FTA, which implies that the beneficial trade volume effects are likely to be relatively larger. Second, a large FTA suffers less from adverse changes in ROW's external tariff because in this case ROW's market power is less pronounced. We show that there exists a sufficiently large (threshold) FTA size such that FTA members gain from internal liberalization, and provide simulation results to illustrate how large an FTA has to be for these gains to materialize. Our analysis reveals that, if ROW's tariff remains fixed at its pre-integration level, the formation of the FTA benefits its members and the optimal degree of internal liberalization is quite large. This threshold size is generally small but it can be large when ROW retaliates -- especially when the elasticity of substitution in consumption is small and the degree of inter-country differences in comparative advantage large.[7]

Lastly, our work sheds light on the question of whether FTAs are"building blocks" or "stumbling blocks"

[7] Kose and Riezman (2000) simulate a three-good version of our model but with identically sized countries and find that the formation of an FTA raises welfare of both members and nonmembers when trade patterns are similar to the ones considered here. Our results indicate that the latter result is a general property of FTAs in this type of model, but that the former result hinges on the assumption that all countries are of equal size.

to global free trade (Bhagwati, 1992). Levy (1997) finds that, in the Heckscher-Ohlin model, bilateral free trade agreements do not block global free trade. Our analysis indicates that FTAs can undermine multilateral trade liberalization in neoclassical settings if countries exploit their market power in world trade with the use of (non-prohibitive) external tariffs. This possibility arises here because either ROW or FTA members may favor the FTA equilibrium over global free trade.

In the next section, we present the formal trade model and derive analytic results on the effects of integration on tariffs and welfare under the assumption that ROW's tariff remains fixed. In Section 3, we extend the analysis to examine the effects of allowing ROW to adjust its tariff optimally. In Section 4, we offer some concluding remarks. The proofs to propositions and algebraic details can be found in the Appendix.

2. The Model and Analysis

In this section, we present our basic trade model and define equilibrium between the FTA and ROW for an arbitrary degree of internal integration for the FTA. We then solve for the equilibrium of the model in the case where the FTA members are symmetric, and characterize the effects of eliminating internal trade barriers on the inter-bloc tariffs and welfare of all parties.

2.1 *The Trade Model*

We examine an endowment model in which there are *N* regions and *N* goods.[8] Regions have Cobb-Douglas preferences represented by the utility function $u^i = \prod_{j=1}^{N} c_j^i$, where c_j^i is consumption of good *j* in region *i*. Region *i* has an endowment of $1+\alpha$ units of good *i* and 1 unit of good $j \neq i$, where $\alpha > 0$, so region *i* has a comparative advantage in good *i*. We assume that these *N* regions are divided into three countries, with β_i denoting the fraction of the regions contained in country *i*. This symmetric configuration of endowments and preferences ensures that country *i* has comparative advantage in all of the goods $j \in N_i$, where N_i is the set of indices of all

[8] Our model is a variant of the model used by Bond and Syropoulos (1996a).

regions contained in country i. Choosing good 1 as the numeraire, this model has a free trade equilibrium in which the prices of all goods equal unity and country i exports $(1-\beta_i)\alpha$ units of good $j \in N_i$. Since the volume of trade is increasing in parameter α for all countries, in this model α serves as a measure of the degree of comparative advantage.

Let τ_k^i and q_k respectively denote country i's tariff (plus unity) on its imports of good k and the world price of the same product. The domestic price of good k in country i will be $p_k^i = \tau_k^i q_k$. We will assume that (i) there are no export taxes, and (ii) country i imposes the same ad valorem tariffs on all goods imported from country j.[9] Assumption (ii) together with our assumption of symmetric preferences ensure that, if goods k and l are exported by some country j, $c_k^i/c_l^i = q_l/q_k$ for every importing country i. Since world endowments of the two goods are equal, this can be consistent with world market equilibrium only if $q_k = q_l$ and $c_j^i = c_k^i$.[10] Since the relative prices of all goods from a given country are constant, we can treat goods exported by country j as a Hicksian composite commodity j and define $C_j^i = \sum_{k \in N_j} c_k^i$ to be country i's consumption of good j originating in country j. It can be shown that the direct utility function in country i associated with these composite commodities is a monotonic transformation of the following function:[11]

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[9] It is shown in Bond and Syropoulos (1996a) that the assumed symmetry in endowments and preferences renders identical the optimal tariffs on all goods from a particular country. Therefore, this assumption is without loss of generality when tariffs are set optimally. When tariffs are not set optimally, as in the case of internal tariff cuts in an FTA considered below, the symmetry of regions with in a country makes the equal tariff assumption seem a natural one.

[10] Consider two goods j and k associated with the same country. The market-clearing condition for good j requires $\sum_{i=1}^{N} c_j^i = x(N+\alpha)$. With Cobb Douglas preferences, consumer optimization implies $c_j^i p_j^i = c_k^i p_k^i$ for each region i. Our assumption of equal tariff rates for goods from the same bloc then yields $c_k^i = c_j^i q_j/q_k$, so the market-clearing condition for good k can be written as $\sum_i c_k^i = (q_j/q_k)(\sum_i c_j^i) = x(N+\alpha)$, which requires $q_j = q_k$.

[11] Letting p_j^i denote the common price of goods coming from country j into country i and Y^i consumer income in a region in country i, the budget constraint requires that $\sum_{j=1}^{j=3} (p_j^i \sum_{k \in N_j} c_k^i) = Y^i$. The indirect utility function is $v^i(p_1^i, p_2^i p_3^i, Y^i) = (Y^i/N)^N \Pi_{j=1}^{j=3} (p_j^i)^{-\beta_j N}$. The corresponding direct utility function can then be obtained by solving $\tilde{U}^i(C_1^i, C_2^i, C_3^i) = \min v^i(p_1^i, p_2^i, p_3^i, Y^i)$ subject to $\sum_{j=1}^{j=3} p_j^i C_j^i = Y^i$. Equation (1) is obtained by a monotonic transformation of this direct utility function, $U = \tilde{U}^{1/N}$.

(1) $$U^i = \prod_{j=1}^{j=3} \left(\frac{C_j^i}{\beta_j} \right)^{\beta_j}, \qquad i = 1,2,3$$

The country size parameters β_j appear in the utility function in the composite commodity formulation because the number of goods in which a country has comparative advantage is proportional to its size. Consumer optimization then implies that $(p_j^i C_j^i)/(p_k^i C_k^i) = (\beta_j/\beta_k)$ for $i, j \neq k = 1,2,3$, so the relative budget shares (evaluated at domestic prices) are equal to relative country size.

Aggregating the endowments of the individual regions within a country, country *i* will have an endowment of $\beta_i \beta_j N^2$ of good $j \neq i$ and $\beta_i(\beta_i + \alpha)N^2$ of good *i*. It is direct to show that the equilibrium prices in this model are homogeneous of degree 0 in *N* so we can simplify the following discussion by choosing *N*=1.[12] The budget constraint requires expenditure at world prices to equal the value of the country's income, Y^i, also evaluated at world prices; that is,

(2) $$\sum_{j=1}^{j=3} q_j C_j^i = Y^i \equiv \beta_i \left(\alpha q_i + \sum_{j=1}^{j=3} \beta_j q_j \right), \qquad i = 1,2,3.$$

The necessary conditions for consumer optimization yield the following demand functions:

(3a) $$C_j^i = s_j^i (Y^i/q_j) \qquad i, j = 1,2,3$$

where

(3b) $$s_j^i \equiv \frac{\beta_j q_j (p_j^i)^{-1}}{\sum_{k=1}^{k=3} \beta_k q_k (p_k^i)^{-1}} = \frac{\beta_j/\tau_j^i}{\sum_{k=1}^{k=3} (\beta_k/\tau_k^i)}, \qquad i, j = 1,2,3.$$

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[12] This is simply another way of scaling world supply. We begin with $\beta_i(\beta_i + \alpha)N^2$ of good *i* and $\beta_i \beta_j N^2$ of good $j \neq i$. Suppose instead we started with $x(1+\alpha)$ units of good *i* and *x* units of good $j \neq i$. This would yield the same equilibrium prices, because prices of homogeneous of degree 0 in *x* for the same reason they are homogeneous of degree 0 in *N*. The supply of the composite commodity would then be $x\beta_i \beta_j N^2$ and $x\beta_i(\beta_i + \alpha)N^2$. The normalization of setting *N* = 1 would then be the same as choosing $x = 1/N^2$.

Denote with $\boldsymbol{T}^i$ the vector of tariffs imposed by country i. Utilizing (3) and the hitherto described endowment structure, the excess demand function of good i in country i is $M_i^i(q_2, q_3, \boldsymbol{T}^i) = C_i^i - \beta_i(\beta_i + \alpha)$ whereas the excess demand of good j in country i is $M_j^i(q_2, q_3, \boldsymbol{T}^i) = C_j^i - \beta_i\beta_j$. The market clearing prices will be the values of q_2 and q_3 that solve

$$(4) \qquad \sum_{i=1}^{i=3} M_j^i(q_2, q_3, \boldsymbol{T}^i) = 0, \qquad j = 2, 3.$$

Under the symmetry conditions on tariffs we impose below, this equilibrium can be shown to be unique (see Bond and Syropoulos (1996a) for details), so we can write the associated world relative prices, $q_i(\boldsymbol{T})$, as functions of tariffs, where $\boldsymbol{T} \equiv (\boldsymbol{T}^1, \boldsymbol{T}^2, \boldsymbol{T}^3)$ is the vector of tariffs in the world economy.

Let $V^i(q_2, q_3, \boldsymbol{T}^i)$ denote the indirect utility function of country i obtained by substituting (3) into (1). We can substitute the equilibrium price relations into the indirect utility functions to obtain the preferences of country i, $W^i(\boldsymbol{T}) = V^i(q_2(\boldsymbol{T}), q_3(\boldsymbol{T}), \boldsymbol{T}^i)$, over all tariff rates.

2.2 *Equilibrium with an FTA*

Our next objective is to utilize the trade model to analyze the effect of the formation of an FTA on the welfare of members and ROW. The FTA members set their tariffs on imports from ROW independently. Both the FTA members and ROW adjust their tariffs so as to maximize national welfare. Henceforth, we assume that it is countries 1 and 2 that form an FTA; therefore, country 3 is ROW.

One of the difficulties in deriving analytic results on the formation of FTAs is that this process involves discrete reductions in the tariff levels, $\{\tau_2^1, \tau_1^2\}$, on internal trade. We overcome this problem by introducing the concept of a conditional FTA equilibrium:

Conditional FTA Equilibrium: A tariff vector $\{\tau_3^1, \tau_3^2, \tau_1^3, \tau_2^3\}$ is an FTA equilibrium, conditional on internal tariffs $\{\tau_2^1, \tau_1^2\}$, if the external tariffs of FTA members satisfy

(5a) $$\frac{\partial W^1(\boldsymbol{T})}{\partial \tau_3^1} = 0, \qquad \frac{\partial W^2(\boldsymbol{T})}{\partial \tau_3^2} = 0$$

and the tariffs of the nonmember country (ROW) satisfy

(5b) $$\frac{\partial W^3(\boldsymbol{T})}{\partial \tau_j^3} = 0 \qquad \text{for } j = 1, 2.$$

Thus, according to this definition, the pre-integration Nash equilibrium is a particular conditional FTA equilibrium in which the internal tariffs also satisfy the conditions $\partial W^1(\boldsymbol{T})/\partial \tau_2^1 = \partial W^2(\boldsymbol{T})/\partial \tau_1^2 = 0$. The effects of the formation of an FTA can be derived by first establishing the existence of equilibrium for a conditional FTA. The effects of changing internal tariffs from their initial Nash equilibrium levels all the way to zero can then be determined with the use of comparative statics analysis. In addition to tractability, the concept of a conditional FTA generates two additional benefits. First, we can investigate how welfare changes along the adjustment path. In practice, FTA members do not eliminate their internal trade barriers immediately; usually, they reduce these barriers gradually. Second, we can examine whether it is optimal for the FTA members to completely eliminate their internal tariffs, or whether they would prefer partial elimination.

It is now convenient to change our notation slightly and let a star "*" identify ROW variables. (For example, τ_j^* (j =1,2) will denote ROW's tariff on its imports of good j from country j.) We now make the following additional assumption:

Symmetry of Partner Countries: Suppose the FTA members are of equal size (i.e., $\beta_1 = \beta_2$). Then we can restrict the analysis to solutions to (5) which satisfy the following symmetry conditions for tariffs:

(C1) $$t \equiv \tau_2^1 = \tau_1^2$$

(C2) $$\tau \equiv \tau_3^1 = \tau_3^2$$

(C3) $\tau^* \equiv \tau_1^* = \tau_2^*$.

It should be noted that the symmetry conditions on tariffs are introduced to simplify the exposition.[13] Bond and Syropoulos (1996a) establish the existence of a pre-integration Nash equilibrium in which (C1), (C2) and (C3) are satisfied, so it is natural to focus on a path to internally free trade along which (C1) is satisfied. With $\beta_1 = \beta_2$ our analysis of the conditional FTA equilibrium is simplified to solving for tariffs $\tau^*(t)$ and $\tau(t) \equiv \tau_3^1(t) = \tau_3^2(t)$ that satisfy (5a) and (5b).

2.3 *Kemp-Wan Tariff Adjustments*

The Kemp-Wan adjustment is defined as the change in the external tariff of the FTA members that leaves welfare of ROW unaffected by a change in the internal tariff. The Kemp-Wan tariff adjustment is normally associated with the theory of customs unions, where union members have a common external tariff (CET). However, by symmetry, the FTA members will end up choosing the same level of external tariff here as well. The Kemp-Wan adjustment provides a useful benchmark for our welfare analysis because (it can be shown that) trade liberalization within the FTA improves the terms of trade of ROW, at given ROW tariffs, iff the external tariffs of FTA members are reduced by more than the Kemp-Wan adjustment.

The following result establishes that adjustments in tariffs of FTA members result in a terms of trade improvement for ROW iff they reduce Ψ, where

(6) $$\Psi \equiv \frac{\tau(1 + t^{-1})}{2}.$$

[13] Symmetry is a useful simplification because it allows us to analyze the behavior of a representative FTA member and tariff interactions can be reduced to those between two (as opposed to three) policymakers in the pre- and post-integration Nash equilibria. It can be shown that, given (C1) and (C3), the best-response external tariffs of the FTA members that solve (5a) will satisfy (C2). Similarly, if (C1) and (C2) are satisfied, the best-response tariffs of ROW will satisfy (C3). Therefore, if internal tariffs satisfy (C1), an equilibrium in which (C2) and (C3) are satisfied will continue to be an equilibrium in the absence of these restrictions.

Lemma 1, which is proven in the Appendix, is established using (3) and (4).

Lemma 1: If (C1), (C2) and (C3) hold, then

(a) $q_2 = 1$

(b) $q_3 = q(\Psi(\tau, t), \tau^*)$, where $-1 < \dfrac{\partial q}{\partial \Psi} \dfrac{\Psi}{q} < 0$ and $0 < \dfrac{\partial q}{\partial \tau^*} \dfrac{\tau^*}{q} < 1.$

The terms of trade of the FTA relative to ROW are improved by an increase in the external tariff, τ, of the FTA, and are worsened by an increase in the internal tariff, t. These results follow from the fact that, at given world prices, an increase in the external (internal) tariff results in substitution toward (away from) exports of the member partner. Our assumptions of symmetry in endowments and preferences eliminate the possibility of a Metzler or Lerner paradox regarding the effect of tariff changes. We can then invert (6) and define the ***Kemp-Wan tariff adjustment*** as follows:

(7) $$\tau = \kappa(\Psi, t) \qquad \text{where} \qquad \frac{\partial \kappa / \partial t}{\kappa / t} = \frac{1}{1 + t}.$$

Under a Kemp-Wan adjustment, a reciprocal and symmetric cut in the FTA members' internal tariffs must be met by a less than proportionate reduction in their external tariffs for the world price, q_3, to remain at its initial level. By Lemma 1, ROW's terms of trade improve iff internal trade liberalization is accompanied by an external tariff change that exceeds the Kemp-Wan adjustment. Lemma 1 also shows that ROW can improve its terms of trade by raising its tariff, τ^*.

The effect of changes in t and τ on welfare of FTA members can be illustrated with the help of Fig. 1 and the results of Lemma 1. The Ψ_N schedule reflects a Kemp-Wan tariff adjustment path, as defined by (7), staring from the initial Nash tariff equilibrium, *N*. The Ψ_G schedule depicts Kemp-Wan tariff adjustment path associated with a lower value of Ψ, which by Lemma 1 reflects a higher initial value of q_3 (and hence worse terms of trade for the FTA members). The Ψ loci also represent ROW indifference curves in (t, τ) space because the terms of trade and trade volume for ROW remain constant along each Ψ.

Under our symmetry assumptions, welfare of a representative FTA member can be obtained by substituting the demand functions (3) and equilibrium relations from Lemma 1 into (1). Normalizing welfare to be that of a representative region within a country, which has income Y^i/β_i from (2), we obtain

$$(8) \qquad \tilde{W}^1(\tau, t, \tau^*) = W^1(\tau, \tau, t, t, \tau^*, \tau^*) = \frac{2^{\beta}\left[\alpha + \beta + \beta^* q(\Psi, \tau^*)\right]\Psi^{\beta} q(\Psi, \tau^*)^{\beta - 1}\left[t/(1+t)^2\right]^{\beta/2}}{\beta^* + \beta\Psi}$$

where $\beta = 2\beta_1$ is the relative size of the FTA and $\beta^* = 1 - \beta$ is the relative size of ROW. With this normalization, the free trade welfare is $W^i_{FT} = 1 + \alpha$.

Totally differentiating (8) with respect to t and Ψ and using the comparative statics results from Lemma 1 yields

$$(9) \qquad \frac{d\tilde{W}^1}{\tilde{W}^1} = \beta\left[\left(\frac{\beta^*}{\beta^* + \beta\Psi}\right)\left(\frac{\varepsilon^* - 1}{\varepsilon + \varepsilon^* - 1}\right)\left(\frac{\varepsilon^*}{\varepsilon^* - 1} - \Psi\right)\hat{\Psi} - \frac{1}{2}\left(\frac{t - 1}{t + 1}\right)\hat{t}\right]$$

where $\varepsilon > 1$ $(\varepsilon^* > 1)$ is the price elasticity of the FTA (ROW) import demand function and a hat (^) over variables denotes percentage change. The second term in (9) shows that at a given Ψ, a reduction in t will raise welfare in the FTA iff t >1. Thus, holding the external terms of trade of the FTA constant, internal tariff adjustments in the direction of free trade must raise welfare of FTA members. This is due to the favorable trade volume effect that results from this (reciprocal) tariff reduction at given terms of trade. In Fig. 1, this is shown by the fact that welfare of the FTA members is decreasing in t along a constant Ψ locus for t > 1, and that the constant Ψ locus is tangent to a member iso-welfare contour at t =1.

The first term in (9) shows that welfare of the FTA will be increasing in Ψ iff $\Psi < \varepsilon^*/(\varepsilon^* - 1)$. Note that the welfare of the member countries is maximized by choosing a common external tariff that satisfies

$\Psi = \varepsilon^*/(\varepsilon^* - 1)$, which corresponds to the familiar optimal tariff formula when internal tariffs are zero, (t = 1.) This is the external tariff that would be chosen if the member countries formed a customs union and chose the external tariff to maximize joint welfare (as discussed in Bond et al (2001)), and is illustrated by the Ψ_{CU} locus in Fig. 1. On this locus, member country iso-welfare contours will be vertical. Further, member country welfare will be increasing (decreasing) in Ψ for values below (above) Ψ_{CU}.[14] However, since member countries do not coordinate in their choice of external tariffs in an FTA, they do not take into account the favorable terms of trade effects of increases in their external tariff on the partner country. Specifically, since $\partial\tilde{W}^1/\partial\tau = \partial W^1/\partial\tau_3^1 + \partial W^1/\partial\tau_3^2$, a favorable terms of trade spillover between member countries (i.e., $\partial W^1/\partial\tau_3^2 > 0$) will mean that the member iso-welfare contour will be positively sloped at the conditional FTA equilibrium where $\partial W^1/\partial\tau_3^1 = 0$. We now turn to a characterization of the external tariffs chosen in the conditional FTA equilibria.

2.4 *Best-Response Tariff for the Representative FTA Member*

The best-response function for the FTA members will be the optimal choice of tariffs $\{\tau_3^1, \tau_3^2\}$ that satisfies (5a) given $\tau_2^1 = \tau_1^2 = t$ and $\tau_1^3 = \tau_2^3 = \tau^*$.[15] As a result of our symmetry assumptions, the best-response external tariff of an FTA member will be the value of τ that satisfies

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[14] Using the result for ε^* derived in the proof of Lemma 1 in the Appendix, the value of Ψ that maximizes member welfare satisfies $\Psi = (\alpha+\beta^*)q(\Psi, \tau^*)/\beta^*\tau^*$. It then follows from Lemma 1b that for $\Psi < \Psi_{CU}$ ($\Psi > \Psi_{CU}$) , welfare of the FTA members will be increasing (decreasing) in τ.

[15] The type of an FTA we consider here is one with (previously established) rules of origin. In other words, we abstract from the possibility of transshipment and the potential problems that may arise with respect to the sustainability of external tariffs when rules of origin are present. In addition, we abstract from the possible competition for tariff revenues that may arise between FTA policymakers when producers attempt to capitalize on arbitrage opportunities across national borders due to differential external tariffs. See Richardson (1995) for an argument establishing how such competition for tariff revenues may induce both FTA members to dismantle their external tariffs as they adhere to internally free trade. As will become clear later on, we could easily modify the analysis to consider this possibility. It is useful to keep in mind though that the FTA we consider here will provide an upper bound to the external tariffs FTA members can sustain.

$$(10) \qquad \frac{\partial W^1(\tau, \tau, t, t, \tau^*, \tau^*)}{\partial \tau_3^1} = 0.$$

If (10) holds, the symmetry assumptions ensure that $\partial W^2/\partial \tau_3^2 = 0$ when evaluated at the same tariff vector.

In our derivation of the properties of the best-response function, we will limit attention to values of $t < t_E(\tau^*)$, where $t_E(\tau^*)$ satisfies $\partial W^1(\tau, \tau, t, t, \tau^*, \tau^*)/\partial \tau_2^1 = 0$ when evaluated at τ satisfying (10). Since the purpose of the formation of the FTA is to achieve mutual gains among members through reciprocal tariff reductions, we can limit attention to internal tariffs that are less than the values that would be optimal for a country acting unilaterally. Our first result establishes the properties of the FTA external tariff rates.

Proposition 1: (*Tariffs*) Assume (C1), (C3), and suppose ROW tariffs remain fixed at a non-prohibitive level τ^*. Then there will exist an aggregate best-response function, $\varphi(\tau^*, t)$, for the FTA with the following properties:

(a) $\partial \varphi(\tau^*, t)/\partial \tau^* < 0$

(b) (*Tariff Complementarity*) $\partial \varphi(\tau^*, t)/\partial t > 0$

(c) If $t_2 < t_1$ and $\tau_1 = \varphi(\tau^*, t_1)$, then $\varphi(\tau^*, t_2) < \kappa(\Psi(\tau_1, t_1), t_2)$.

Part (a) of Proposition 1 shows that τ and τ^* are strategic substitutes. Higher ROW tariffs induce the FTA members to lower their external tariffs. Part (b) establishes tariff complementarity between internal and external tariffs for the FTA, so that reductions in internal tariffs will reduce the external tariff of the member countries. Part (c) strengthens this result by showing that the external tariff falls below the Kemp-Wan tariff. Thus, complete internal liberalization by the FTA induces its members to reduce their external tariff so much that their external terms of trade deteriorate. These results are illustrated in Fig. 1. The *NG* locus indicates the path of best response external tariffs of the FTA members as the internal tariff falls from t_N to 1. This line lies below the Kemp-Wan schedule, *NK*, by part (c) of Proposition 1, so point *G* represents a worsening of the FTA terms of trade relative to point *N*.[16]

We next consider the welfare effects of an FTA. Proposition 1 can be used to derive the impact of internal liberalization of an FTA on welfare for a given level of the ROW tariff, τ^*.

Proposition 2: (*Welfare for a given* τ^*) Assume (C1), (C3), and suppose ROW's tariff remains fixed at a non-prohibitive level τ^* while FTA countries 1 and 2 set their external tariffs optimally.

(a) Internal trade liberalization within the FTA raises ROW welfare, and may either raise or lower welfare of the FTA members.

(b) There exists an internal tariff $t_S > 1$ that leaves every FTA member better off as compared to internal free trade, i.e., $W^1(\varphi(\tau^*, t_S), t_S, \tau^*) > W^1(\varphi(\tau^*, t=1), t=1, \tau^*)$.

The fact that ROW gains follows immediately from Proposition (1c), which indicates that ROW terms of trade improve with internal liberalization. The effect of tariff reduction on member welfare consists of two effects, which can be illustrated with the help of Fig. 1 and the welfare decomposition for FTA members in (9). The first effect is the trade volume effect which is favorable to the FTA members. To see this consider the effect of complete elimination of internal trade barriers starting from the Nash equilibrium (point *N*). If the external tariff were adjusted so as to hold world prices constant, the elimination of internal trade barriers would involve a movement along the Ψ_N locus from point *N* to point *K* in Fig. 1, which must be welfare-improving for FTA members. The second effect is the terms of trade effect resulting from the external tariff adjustment, illustrated by the movement from *K* to *G*, which must be welfare-reducing for FTA members. The overall effect on member welfare of the movement from *N* to *G* appears to be ambiguous for FTA members countries, but raises ROW

[16] In contrast, it is shown in Syropoulos (1999) and Bond et al. (2001) that members of a CU adopt a more aggressive stance externally so that their common external tariff exceeds the Kemp-Wan tariff that is associated with the initial Nash equilibrium (illustrated by the *N'H* locus in Fig. 1). Members of a CU choose higher tariffs because they internalize the effects of one member's tariff on the welfare of other members. As a consequence, the CU improves its terms of trade as compared to the Nash equilibrium.

welfare. It is interesting to note that this decomposition of a favorable trade volume effect and unfavorable terms of trade effect also applies to partial reductions of internal tariffs. We will revisit these points later when we will allow ROW to behave strategically.

Part (b) of Proposition 2 illustrates that welfare of FTA members can be improved if they *stop short* of totally dismantling their (symmetric) internal trade barriers. This can be shown by using the fact that an iso-welfare contour of an FTA member is tangent to an iso-Ψ contour at t = 1, as noted in the discussion above. Therefore, an increase in t and τ that raises Ψ will raise welfare of an FTA member if the external tariff is below the welfare-maximizing tariff at *H*. This is illustrated by the movement in the direction of point *N* along *GN* in Fig. 1, with the welfare of each FTA member rising throughout the interval *GS*. The desirability of stopping short of completely eliminating internal barriers results from the fact that FTA members do not take into account the impact of their external tariff on the welfare of other members, so that FTA members set external tariffs that are lower than the ones that maximize member welfare. Due to the complementarity between internal and external tariffs identified in Proposition 1, the internal tariff provides an indirect means of coordinating their external tariff policies.[17]

The size of the FTA members relative to ROW play an important role in determining the relative importance of the terms of trade and trade volume effects, and hence the response of member welfare to trade liberalization. For very large blocs, the internal liberalization effect will dominate and the FTA will be welfare-improving. This can be seen by noting that, in the limiting case in which $\beta \to 1$, trade with ROW becomes insignificant -- the terms of trade effect disappears and only the benefits to trade liberalization matter. This limiting case is equivalent to the gains from tariff reduction in a two-country world, so welfare of members rises monotonically as the internal tariff t is reduced (i.e., $t_S \to 1$ as $\beta \to 1$ in part (b)). For small blocs, on the other

[17] As compared to the case of customs unions, this finding resembles the one due Ethier and Horn (1984) who showed that internal free trade is not optimal for a small customs union with positive common external tariffs, but differs from the one due to Bond et al. (2001) who proved that internal free trade is optimal when the common external tariff maximizes union welfare.

hand, the benefits of internal liberalization approach zero as $\beta \to 0$ because internal trade becomes an insignificant share of total trade. However, terms of trade effects also disappear as $\beta \to 0$ because the impact of changes in Ψ on world prices goes to zero. (It can be shown, for example, that $\lim_{\beta \to 0} (dW^1/dt)(W^1/t) = 0$).

2.5 *Optimal Policies in ROW*

We next turn to an examination of how ROW's optimal tariff responds to changes in the FTA internal tariff, t. The tariff reaction function for ROW is derived by finding the value of τ^* that satisfies (5b) for given FTA tariffs. Using our symmetry assumptions and the results of Lemma 1, the excess demand functions of the FTA members can be expressed as $M_j^1(\Psi, q_3)$ for i=1,2 and j=1,2,3. The optimal tariff of ROW will thus be a function of Ψ, so its best-response function can be expressed as $\varphi^*(\tau, t) = f(\Psi(\tau, t))$. We can establish the following properties for this function:

Proposition 3: Assume (C1), (C2), and suppose the tariffs of FTA members 1 and 2 are below their prohibitive levels. Then, ROW will have a best-response tariff, $\varphi^*(\tau, t) = f(\Psi(\tau, t))$, such that $f'(\Psi(\cdot)) < 0$. Therefore,

(a) $\partial\varphi^*(\tau, t)/\partial\tau < 0$

(b) $\partial\varphi^*(\tau, t)/\partial t > 0$.

Part (a) of Proposition 3 says that ROW responds to an increase in the FTA external tariff τ by lowering its own external tariff τ^*. In other words, the external tariff of the FTA is a strategic *substitute* for ROW's tariff. The intuition for this result can be seen by first considering Lemma 1 which shows that q_2 is independent of ROW's tariff policy. Thus, one can think of this as a two-good model in which ROW imports a composite commodity from the FTA. An increase in the FTA's external tariff reduces the import demand of the FTA, which raises the price elasticity of demand for ROW exports and thus diminishes ROW's monopoly power in trade. This induces ROW to charge a lower tariff on its trade with the FTA. An increase in the FTA's internal trade barriers will have the opposite effect on ROW's optimal tariff (part (b) of Proposition 3). Increasing internal trade barriers raises the demand for ROW exports and reduces the elasticity of demand. This, of course, induces ROW to raise its tariff. Hence, the internal tariff of the FTA is a strategic *complement* for ROW's tariff.

These results identify another reason as to why FTA members find the complete removal of internal tariffs unappealing. Internal trade liberalization, by inducing FTA members to behave less aggressively externally, on balance enhances ROW's monopoly power in trade and thus exacerbates the inability of FTA members to internalize their (external) tariff externality. In other words, as internal tariffs approach zero, the additional benefits of liberalization get smaller, but the terms of trade losses due to lower FTA external tariffs *and* higher ROW tariffs do not. We are now in a position to determine equilibrium.

3. Equilibrium Tariffs and Welfare

Proposition 2 derived the welfare effects of internal liberalization for the FTA under the assumption that ROW tariffs do not change. Now that we have derived the properties of the reaction functions of the FTA members and ROW, we can obtain results on the equilibrium tariffs between ROW and the FTA when ROW reacts optimally to the liberalization of trade within the FTA. These results on tariffs will then be used to study how internal trade liberalization affects welfare of FTA members and ROW.

3.1 *Inter-Bloc Tariff Adjustments*

Starting from the three-country (pre-integration) Nash equilibrium, where the initial tariffs are denoted $\{\tau_N, \tau_N^*, t_N\}$, we consider the effects of eliminating internal barriers in the context of Fig. 2 whose axes are the external tariff of a representative FTA member and of ROW. The pre-integration Nash equilibrium is captured by point *N*, the intersection of ROW's best-response function (dashed-line curve) and the best-response function of the representative FTA member (not shown). These functions are drawn for a given t, and in this case we set t at t_N.

It follows from Propositions 1 and 3 that the elimination of internal barriers will cause a leftward shift in both best-response functions. In order to compare the magnitude of these shifts, we can compare these best-responses to the situation that would arise if the FTA external tariff adjusted in a Kemp-Wan fashion relative to the pre-integration equilibrium instead; that is, if $\tau = \kappa(\Psi_N, t=1)$ where $\Psi_N \equiv \Psi(\tau_N, t_N)$. Proposition 3 showed that ROW's best-response is a function of Ψ alone, so ROW's best-response tariff is $\varphi^*(\kappa(\Psi_N, t=1), t=1) = \tau_N^*$, as illustrated by point *K* in Fig. 2. Furthermore, Proposition 1(a) established that $\varphi(\tau_N^*, t=1) < \kappa(\Psi_N, t=1)$; therefore, the FTA members' best-response tariff must lie to the left of point *K*. Since the best-response functions of both parties are downward sloping and intersect uniquely when t = 1, the conditional FTA equilibrium tariff pair at internal free trade, i.e., $\{\tau_F, \tau_F^*\}$, must be at a point like *F* in Fig.2 where $\tau_F < \kappa(\Psi_N, t=1) < \tau_N$ and $\tau_F^* > \tau_N^*$.

The above discussion focused on the case in which the initial equilibrium was the pre-integration Nash equilibrium. Interestingly, however, the same argument can be made starting from any conditional Nash equilibrium with $t \in (1, t_N]$. This yields the following result:

Proposition 4: *(Tariffs)* Suppose an FTA has an internal tariff of $t_1 \in (1, t_N]$. Let $\tau_1 = \varphi(\tau_1^*, t_1)$ and $\tau_1^* = \varphi^*(\tau_1, t_1)$ denote a conditional FTA tariff equilibrium. If the FTA members completely eliminate their internal tariff, the tariffs $\{\tau_F, \tau_F^*\}$ in the resulting Nash equilibrium will satisfy

(a) $\tau_F < \kappa(\Psi(\tau_1, t_1), t=1) < \tau_1$

(b) $\tau_F^* > \tau_1^*$.

Part (a) shows that along a path of internal tariff reductions to free internal trade, the external tariff of the FTA members will always be above the level chosen when t =1. This means that for FTA members the Kemp-Wan external tariff is lower than the initial equilibrium and, furthermore, the optimal external tariff is even lower than the Kemp-Wan level at the full-integration equilibrium. Part (b) shows that ROW responds by charging a higher tariff. Thus, FTA formation results in lower tariffs for members and higher tariffs for ROW.

3.2 *Welfare Effects of Complete Liberalization*

What do the changes in external tariffs identified in Proposition 4 mean for welfare of ROW and FTA members? Combining Propositions 3 and 4, we may answer this question as follows:

Proposition 5: *(Welfare)* Suppose we have a conditional equilibrium $\{\tau_1, \tau_1^*\}$ for $t_1 \in (1, t_N]$. An FTA between symmetric countries that completely eliminates internal trade barriers *always* benefits ROW. The FTA will benefit its members if their combined size is sufficiently large relative to ROW. However, small FTAs may be welfare-reducing for its members. Specifically,

(a) $W^*(\tau_F, t\!=\!1, \tau_F^*) > W^*(\tau_1, t_1, \tau_1^*)$

(b) There exists a $\bar{\beta} \in (0,1)$ such that $W^i(\tau_F, t\!=\!1, \tau_F^*) > W^i(\tau_1, t_1, \tau_1^*)$ for $\beta > \bar{\beta}$.

To see why ROW welfare must rise, consider the effect of a reduction in the internal tariff from $t = t_N$ to $t = 1$, as shown in Fig. 2. ROW welfare at point *K* will be equal to that at the initial point *N* by the definition of the Kemp-Wan tariff reduction. ROW welfare at point *F* must exceed that at point *K*, however, because ROW welfare is decreasing in τ along its best-response function. Thus, the movement from *N* to *F* must raise ROW welfare. For an FTA member, Proposition 2(a) showed that the movement from *N* to *G* had an ambiguous effect on welfare. The movement from *G* to *F* is welfare-reducing for FTA members because the welfare of the typical member is decreasing in τ^* along its reaction function. The overall effect on welfare for the FTA member is ambiguous. However, it is clear that when ROW tariffs adjust optimally in response to FTA liberalization it becomes more likely that FTA members will lose from this form of regional integration.

Part (b) says that, if the FTA members are large enough they will benefit from the formation of the FTA. The intuition for this result is that, for FTA members whose combined size relative to ROW is sufficiently large, the benefits from internal liberalization are large while the welfare losses due to terms of trade deterioration with ROW are small. One can also see this result by considering the limiting case in which the FTA members become arbitrarily large by letting $\beta \to 1$. The welfare level of FTA members with internal free trade will approach the level with global free trade level, because the tariff-distorted trade with ROW is an insignificant fraction of world trade. In contrast, prior to internally free trade, member welfare will approach the level in the Nash equilibrium of a two (symmetric) country tariff-setting game, which is lower than the free trade level. Since the respective payoffs are continuous in the FTA's size, β, the FTA payoff with internal free trade must be higher than the Nash equilibrium payoff for β sufficiently close to 1. In contrast, when the FTA is small, the gains from internal liberalization are also small because of the small volume of internal trade. However, the welfare loss from deteriorating terms of trade with ROW will be large because of the large volume of trade with the outside country.

Fig. 3 provides some further insights about the role of relative FTA size, as suggested in Proposition 5b. The reported calculations suppose $\alpha = 2$ and the payoffs are normalized so that the free trade welfare level of the representative region in a country equals 100.[18] The solid lines show the welfare of the FTA members (W_N^1) and ROW (W_N^*) in the pre-integration Nash equilibrium as a function of the relative size of the FTA. For β below the value given by point *B*, the market power of ROW is sufficiently large that its welfare in the pre-integration Nash equilibrium exceeds the free trade level.[19] The dotted-line curves show the welfare level of FTA members (W_F^1) and ROW (W_F^*) in the FTA equilibrium with complete internal liberalization. As

[18] The payoffs are transformed by multiplying the utility of each country by $100/(1+\alpha)$. It is easy to verify then that under globally free trade, we would have $W^i = 100$ for the representative region in country *i* (=1,2,3).

[19] These possibilities arise for extreme size configurations thereby confirming the idea that sufficiently large countries are likely to win tariffs wars, as pointed out in Kennan and Riezman (1988) and Syropoulos (forthcoming).

indicated by Proposition 5(a), ROW gains from the formation of the FTA for all values of β, with the percentage gains being largest when the FTA is relatively large. For FTA members, the critical value $\bar{\beta}$ identified in Proposition 5(b) is about 0.3. The simulations suggest a stronger result than the one in Proposition 5, since they show that there is a relative size $\bar{\beta}$ such that FTA members benefit from formation of the FTA iff $\beta > \bar{\beta}$.

An interesting feature of Fig. 3 is that the formation of the FTA enlarges the set of relative sizes under which a global free trade equilibrium becomes undesirable. Specifically, for sizes associated with the range of points *B* and *F*, global free trade is preferred by all countries over the pre-integration Nash equilibrium, and thus feasible. The formation of the FTA reduces this of sizes to those that are associated with interval *CD*, as the FTA members (ROW) now prefer(s) the FTA regime over global free trade for all size configurations along segment *DF* (*AC*). This clearly suggests that while, in the short-run, FTAs may be welfare-improving in the Pareto sense, they may end up being "stumbling blocks" (Bhagwati, 1992) to the attainment of global free trade in the longer run.[20] Lastly, it should be noted that FTA welfare does not rise monotonically with FTA size either in the pre-integration equilibrium or in the FTA equilibrium. Using techniques similar to those in Bond and Syropoulos (1996a), it can be shown that W_F^1 approaches the free trade welfare level from above as $\beta \to 1$. A similar point is valid for ROW welfare as $\beta \to 0$.

With the help of the analysis in Bond et al. (2001), we can contrast the aforementioned results with those obtained in the customs union case. It can be shown that, if a CU forms, the optimal common external tariff will be related to the internal tariff t as shown by schedule *N'H* (Fig. 1) and that this schedule will not lie below the Kemp-Wan path through point *H'* (not drawn). Pulling the above observations together, it can also be shown that, even if ROW were allowed to behave optimally, the common external tariff of the CU would be *larger* than the Kemp-Wan tariff that would keep the world price at the pre-integration level. This implies that

[20] In independent but related work, Ornelas (2001) obtained a similar result in the context of a reciprocal dumping model in which policymakers also have (domestic) distributional concerns.

the formation of an unconstrained CU benefits its members and hurts ROW (Syropoulos, 1999).

3.3 *Determining the Critical Size for Welfare Improvement with an FTA*

The analytic results in Proposition 5 suggest an important role for the size of FTA members in determining the benefits of FTA formation. For policy purposes, it would be useful to have an idea of what factors determine how large an FTA has to be to ensure that its members benefit from complete liberalization of internal trade. In addition, it would also be useful to know whether partial internal liberalization can be beneficial for FTAs whose size falls below the critical value. In this section we provide some additional simulations to address each of these issues.

Table 1 illustrates how $\bar{\beta}$ varies with two parameters: the degree of comparative advantage (α) and the elasticity of substitution in consumption (σ). The latter parameter was restricted to $\sigma = 1$ in the formal analysis to derive analytical results, but here we allow it to vary to highlight the sensitivity of our findings to this assumption. The results reported in Table 1 indicate that $\bar{\beta}$ is increasing in α and decreasing in σ. Therefore, small FTAs are most vulnerable to adverse effects of internal liberalization when the degree of comparative advantage is large and the elasticity of substitution between products is low. In Bond and Syropoulos (1996a) it was shown that trading blocs will set higher external tariffs when α is high and σ is low, because the elasticities of the offer curves are lowest in this case. This suggests that the losses of the small trading blocs are largely due to the exercise of market power by ROW in adjusting its external tariff.

TABLE 1

Values of $\bar{\beta}$ for alternative parameter values

α	σ				
	1	2	5	10	20
1	.212	.137	.087	.071	.062
2	.283	.184	.114	.091	.079

5	.341	.225	.135	.105	.090
10	.359	.240	.138	.107	.092

Figs. 4a and 4b can be used to see how the welfare of FTA members is affected along the path of internal trade liberalization. We consider two cases: a high elasticity of substitution ($\sigma = 5$ in Fig. 4a) and a low elasticity of substitution ($\sigma = 1$ in Fig. 4b). For both cases we choose a value of $\beta = .1 < \bar{\beta}$ for which an FTA with complete internal liberalization is welfare reducing. We choose this value to show that partial liberalization can be beneficial in cases where complete liberalization is not. The dotted-line curves in Figs. 4a and 4b illustrate how welfare varies with the internal tariff under the assumption that ROW's tariff remains fixed at its pre-integration level. They show, as Proposition 2 states, that starting from internal free trade, an FTA can increase its welfare by increasing the internal tariff rate. In fact, the welfare of FTA members is maximized at some $t > 1$ (as in Proposition 2b), although the benefit from stopping short of complete internal liberalization is relatively small. The dotted-line curves in Figs. 4a and 4b also show that, starting from the pre-integration Nash equilibrium, if ROW were constrained not to raise its external tariff, the formation of an FTA would be beneficial even when the aggregate size of the FTA is small.[21]

The solid-line curves in Fig. 4a and 4b illustrate the effect of internal liberalization on welfare in each case when ROW's tariff is set optimally. Since $\beta = .1 < \bar{\beta}$, we know that an FTA with complete internal liberalization leads to lower welfare than Nash equilibrium. However, Fig. 4a shows that when the elasticity of substitution is high, partial liberalization can be welfare-improving. Also, note that the welfare maximum occurs at a significantly higher value of the internal tariff, t, than when ROW's tariff is held constant. On the other hand, when the elasticity of substitution is low, all degrees of internal liberalization are welfare-reducing for the FTA.

[21] The validity of this observation appears to remain intact under a wide range of parameter values. In fact, our simulations failed to identify parameter values under which FTA welfare falls below its pre-integration level when ROW does not behave strategically.

4. Concluding Remarks

Our results indicate that the formation of an FTA improves the terms of trade and welfare of nonmember countries because it creates an incentive for members to reduce their external tariffs. However, for member states, there are two opposing effects. In equilibrium, their terms of trade vis-a-vis ROW deteriorate and this is welfare-reducing. At the same time, the liberalization of internal trade causes intra-union trade to expand and this is welfare-improving. We have shown that, as long as member countries are sufficiently large, the latter effect will dominate and the formation of an FTA will benefit both members.

These results contrast with the case of a CU, which will have a smaller external tariff reduction (or an increase in external tariffs) as a result of regional integration. This occurs because CU members jointly choose the external tariff to maximize union welfare, and thus solve the (positive) tariff externality that exists whenever two countries import the same good from ROW.[22]

Our results are contingent on the assumptions that the structure of FTAs is exogenously given and that direct trade liberalization between the FTA members and ROW is not possible. Yet, our analysis is relevant for the analysis of endogenous coalition formation and has interesting implications for whether FTAs are "stepping stones" or "stumbling blocks" to the attainment of global free trade. As we have seen, an FTA may be welfare-improving in the Pareto sense relative to no cooperation at all. Still, these welfare gains may very well undermine global free trade because, depending on the relative size of trading blocs, they may render this regime less attractive to FTA members or ROW. Future work could consider in finer detail how the formation

[22] With the objective function that we consider, a CU would always be preferable to an FTA for symmetric member countries because of its more favorable market power effects. Thus, this model does not provide a positive theory of FTA formation. However, it does provide insights about how international distributional effects are likely to differ between FTAs and CUs. It also suggests that FTAs are more favorable from a world welfare perspective since tariff setting is relative less aggressive and outside countries are not harmed. Further, it points out that Article XXIV of the GATT (the Article that constrains PTA members not to raise external tariffs beyond pre-integration levels) is irrelevant for FTAs while it may be binding for CUs (Syropoulos, 1999); and, since under an FTA, it is ROW that behaves more aggressively in the post-integration equilibrium, the analysis brings to the fore the notion that GATT rules that prevent ROW from raising its tariffs may be as important as Article XXIV. In practice, an important reason of why countries prefer an FTA over a CU is that they enjoy greater flexibility in conducting their trade policy vis-a-vis ROW.

of an FTA might affect the appeal of multilateral trade liberalization, paying special attention to incentive constraints and intra-union asymmetries in relative size.[23]

Our analysis also abstracted from special interest politics and how political economy motives might affect tariff-setting incentives. One can adapt our approach to analyzing such problems by reformulating the objective functions of the individual countries.

[23] In a previous version of this paper (Bond et al. (2000)), we numerically explored the effects of intra-union asymmetries in size and found that, in the absence of compensatory transfers, small countries favor the formation of an FTA with large partners while the latter may not. This differs from McLaren's (1997) finding that the anticipation of a trade agreement (with side payments) between two countries may leave the "small" partner worse off, as compared to non-cooperation. The key reason for this difference in results is that McLaren allows private agents in the small country to undertake irreversible investments under the prospect of free trade thereby amplifying the country's dependence on trade and eroding its (strategic) bargaining position in future negotiations.

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Appendix

Proof of Lemma 1: The fact that $q_2 = 1$ is an equilibrium can be seen by substituting the symmetry assumptions into (3) and (4). The uniqueness result from Bond and Syropoulos (1996a) ensures that this is the only equilibrium. If the symmetry assumptions are substituted into (3), the excess demand functions for good 3 by FTA members can be written as $M_3^i/N^2 = \beta\beta^*(\alpha+\beta-\beta\Psi q)/[2q(\beta^*+\beta\Psi)]$ for i =1,2 and the excess demand for FTA goods by ROW as $M^*/N^2 = \beta(1-\beta)\left[(\alpha+\beta^*)q-\beta^*\tau^*\right]/(\beta+\beta^*\tau^*)$. The price elasticities of these demands are $\varepsilon \equiv -(\partial M_3^i/\partial q)/(M_3^i/q) = (\alpha+\beta)/(\alpha+\beta-\beta\Psi q) > 1$ and $\varepsilon^* = (\alpha+\beta^*)q/\left[(\alpha+\beta^*)q-\beta^*\tau^*\right] > 1$, respectively. Moreover, letting $\gamma \equiv -(\partial M_3^i/\partial\Psi)(M_3^i/\Psi) = \Psi\beta(\alpha+\beta+\beta^* q)/\left((\beta\Psi+\beta^*)(\alpha+\beta-\beta\Psi q)\right) > 0$ and $\gamma^* \equiv -\left(\partial M^*/\partial\tau^*\right)\left(\tau^*/M^*\right) = \beta^*\tau^*\left[q(\alpha+\beta^*)+\beta\right]/\left[(\beta+\beta^*\tau^*)[(\alpha+\beta^*)q-\beta^*\tau^*]\right] > 0$, we have $\varepsilon > \gamma$ and $\varepsilon^* > \gamma^*$. Now, using the budget constraint, the market-clearing condition for good 3 can be written as $2qM_3^1 = M^*$. Totally differentiating this expression and using the definitions above yields the comparative statics results of Lemma 1(b): $-1 < \hat{q}/\hat{\Psi} = -\gamma/(\varepsilon+\varepsilon^*-1) < 0$ and $0 < \hat{q}/\hat{\tau}^* = \gamma^*/(\varepsilon+\varepsilon^*-1) < 1$. ||

Proof of Proposition 1: To establish existence and the postulated properties of the FTA's aggregate reaction function $\varphi(\tau^*, t)$ it is convenient to work with variables Ψ and t (instead of τ and t). Going back to country 1's welfare decomposition in (9), attribute the changes in world prices q_2 and q_3 to a change in the external tariff τ_3^1. These price changes can be derived by utilizing the definitions of the import demand functions (which follow from equations (2) and (3)) in the balanced trade condition (4), and imposing conditions (C1)-(C3) after differentiating (4) appropriately. Doing so leads to equation (10) which describes country 1's first-order condition (FOC) for welfare maximization and defines $\varphi(\tau^*, t)$ implicitly. After some cumbersome algebra, it can be shown that $\partial W^1(\cdot)/\partial\tau_3^i = 0$ with symmetry is equivalent to the requirement that

$$\text{(A.1)} \qquad \Psi = \Omega(\Psi, t, \tau^*) \equiv q(\Psi, \tau^*)\left[\frac{\mu(\Psi, t, \tau^*)}{\lambda(\Psi, t, \tau^*)}\right]$$

where

(A.2) $$q(\cdot) = \left[\frac{\alpha+\beta}{\beta^*+\beta\Psi} + \frac{\beta^*\tau^*}{\beta+\beta^*\tau^*}\right]\left[\frac{\beta\Psi}{\beta^*+\beta\Psi} + \frac{\alpha+\beta^*}{\beta+\beta^*\tau^*}\right]^{-1}$$

(A.3) $$\mu(\cdot) = (1+\alpha)\left[\frac{\beta\Psi}{2(\beta^*+\beta\Psi)} + \frac{\alpha+\beta^*}{\beta+\beta^*\tau^*}\right](t+1) - \left[\frac{\alpha(\alpha+\beta^*)\beta\Psi}{2(\beta^*+\beta\Psi)(\beta+\beta^*\tau^*)}\right](t-1)$$

(A.4) $$\lambda(\cdot) = (1+\alpha)\left[\frac{\alpha+\beta}{\beta^*+\beta\Psi} + \frac{2\beta^*\tau^*}{\beta+\beta^*\tau^*}\right] + \left[\frac{\alpha+\beta}{2(\beta^*+\beta\Psi)} + \frac{\beta^*\tau^*}{\beta+\beta^*\tau^*} + \frac{\alpha(\beta^*)^2\tau^*}{2(\beta^*+\beta\Psi)(\beta+\beta^*\tau^*)}\right](t-1)$$

The $q(\Psi,\tau^*)$ function in (A.2) describes the world price for good 3 (ROW' exportable) that clears world markets. It is useful to keep in mind that, by symmetry, $q_1 = q_2 = 1$ and that differentiation of $q(\Psi,\tau^*)$ gives the properties described in Lemma 1.

We now note the following points: First, it can be easily verified that $\Omega(0,t,\tau^*) > 0$ for any given t and τ^* that do not eliminate internal and external trade flows. Second, $\Omega_\Psi < 0$, as shown below. Thus, for given t and τ^*, there exists a value for Ψ that solves (A.1). To illustrate this point consider Fig. A.1 which depicts $\Omega(\Psi,t,\tau^*)$ and Ψ (the solid-line curves) as functions of Ψ. The properties of $\Omega(\Psi,t,\tau^*)$ ensure that it will intersect the Ψ schedule uniquely, as shown by point *A*.

To establish that $\Omega_\Psi < 0$, we differentiate (A.1) with respect to Ψ logarithmically to find

$$\frac{\Psi\Omega_\Psi}{\Omega} = \frac{\Psi q_\Psi}{q} + \frac{\Psi\mu_\Psi}{\mu} - \frac{\Psi\lambda_\Psi}{\lambda}$$

Differentiating (A.2) with respect to Ψ allows us to rewrite the above expression as

$$\frac{\Psi\Omega_\Psi}{\Omega} = \left\{-\frac{\beta^*\beta\Psi}{(\beta^*+\beta\Psi)^2}\left[\frac{\beta\Psi}{\beta^*+\beta\Psi} + \frac{\alpha+\beta^*}{\beta+\beta^*\tau^*}\right]^{-1} + \frac{\Psi\mu_\Psi}{\mu}\right\} + \left\{-\frac{\beta\Psi(\alpha+\beta)}{(\beta^*+\beta\Psi)^2}\left[\frac{\alpha+\beta}{\beta^*+\beta\Psi} + \frac{\beta^*\tau^*}{\beta+\beta^*\tau^*}\right]^{-1} - \frac{\Psi\lambda_\Psi}{\lambda}\right\}$$

It is now easy to check by differentiating (A.3) and (A.4) that both expressions in the curly brackets are negative.

Part (a): To prove this part it is sufficient to show that $\Omega_{\tau^*} < 0$. Following a procedure similar to the one described above it is direct but tedious to check by differentiating (A.1) and (A.2)-(A.4) appropriately that indeed

$$\frac{\tau^*\Omega_{\tau^*}}{\Omega} = \frac{\tau^* q_{\tau^*}}{q} + \frac{\tau^*\mu_{\tau^*}}{\mu} - \frac{\tau^*\lambda_{\tau^*}}{\lambda} < 0.$$

In terms of Fig. A.1, an increase in τ^* causes the $\Omega(\cdot)$ schedule to shift downward. This is shown by the dashed-line schedule which intersects Ψ at the new point *B*. Since the increase in τ^* causes Ψ to fall while t remains fixed, by (6), it will be the case that the best-response tariff τ falls thereby establishing part (a).

Parts (b) and (c): Logarithmic differentiation of $\Omega(\Psi, t, \tau^*)$ in (A.1) with respect to t gives

$$\frac{t\Omega_t}{\Omega} = \frac{t\mu_t}{\mu} - \frac{t\lambda_t}{\lambda} = \frac{t\alpha(1+\alpha)}{\mu\lambda}\left[\frac{(\alpha+\beta)\beta\Psi}{2(\beta^*+\beta\Psi)^2} + \frac{(\alpha+\beta^*)\beta^*\tau^*}{(\beta+\beta^*\tau^*)^2}\right] +$$

$$\frac{t\alpha(1+\alpha)}{\mu\lambda}\left[\frac{(\alpha+\beta)(\alpha+\beta^*)(2\beta^*+\beta\Psi) + (\beta\Psi)(\beta^*\tau^*)(\beta^*+2\beta\Psi)}{2(\beta^*+\beta\Psi)^2(\beta+\beta^*\tau^*)}\right] > 0$$

In the context of Fig. A.1, the above implies that a reduction in the internal tariff t causes the $\Omega(\cdot)$ curve to shift downward, as shown by the dashed-line curve that intersects the Ψ curve at point *B*. Since this implies that Ψ falls, by the definition of Ψ in (6), the best-response external tariff τ falls below its Kemp-Wan level thereby establishing parts (b) and (c). ||

Proof of Proposition 2: Proposition 2 follows immediately from the welfare decomposition in (9) and the results of Proposition 1, as discussed in the text. ||

Proof of Proposition 3: According to the optimal tariff formula $\tau^* = \varepsilon/(\varepsilon - 1)$. Substituting into this result for ε as derived in the proof of lemma 1, we obtain the best response function for ROW to be $\tau^* = (\alpha+\beta)/(\beta\Psi q)$, where $q = q(\Psi, \tau^*)$ by Lemma 1. It follows from Lemma 1 that the elasticity of q with respect to τ^* is contained in (0,1), so ROW will have a unique optimal tariff that is decreasing in Ψ. Proposition 3 then follows from this result and the properties of Ψ. ||

Proof of Proposition 5: *Derivation of Results for an Arbitrarily Large FTA*

The case of an arbitrarily large FTA is considered by taking the limit as $\beta \to 1$. Using the elasticity formulas derived in Lemma 1, we obtain $\lim_{\beta \to 1} \varepsilon^* = 1$, $\lim_{\beta \to 1} \varepsilon = (1+\alpha)/\alpha$ and $\lim_{\beta \to 1} q = 1/\Psi$. The external tariff imposed by the FTA members in this case can be obtained by solving (A.1)-(A.4) and using $\beta \to 1$, which yields an optimal external tariff of FTA members of

$$\lim_{\beta \to 1} \tau = \frac{2t(1+3\alpha+3\alpha^2+t+3\alpha t+\alpha^2 t)}{(1+\alpha)(1+t)(1+\alpha+t)} .$$

In contrast, the optimal external tariff for a customs union is the solution to $\Psi_{CU} = \varepsilon^*/(\varepsilon^* - 1)$, which yields $\lim_{\beta \to 1} \tau = \infty$. The optimal tariff of ROW is $\lim_{\beta \to 1} \tau^* = 1+\alpha$. Note that, in this model, small countries maintain some market power in the limit because they are the sole exporters of the goods in which they have a comparative advantage.

Substituting these results in (8) yields $\lim_{\beta \to 1} W^1 = 2(1+\alpha)t^{1/2}/(1+t)$. As the FTA becomes arbitrarily large, the payoff to the FTA is maximized at t =1 where it achieves the free trade level. Terms of trade have an insignificant effect on welfare of the FTA as $\beta \to 1$ because the volume of trade becomes insignificant. In the pre-integration Nash equilibrium, $\lim_{\beta \to 1} t = (1+2\alpha)^{1/2}$, which is the optimal tariff in a two-country trade war. Thus, in the limit, internal trade liberalization is unambiguously beneficial because it raises welfare from the Nash equilibrium level to the free trade level. ||

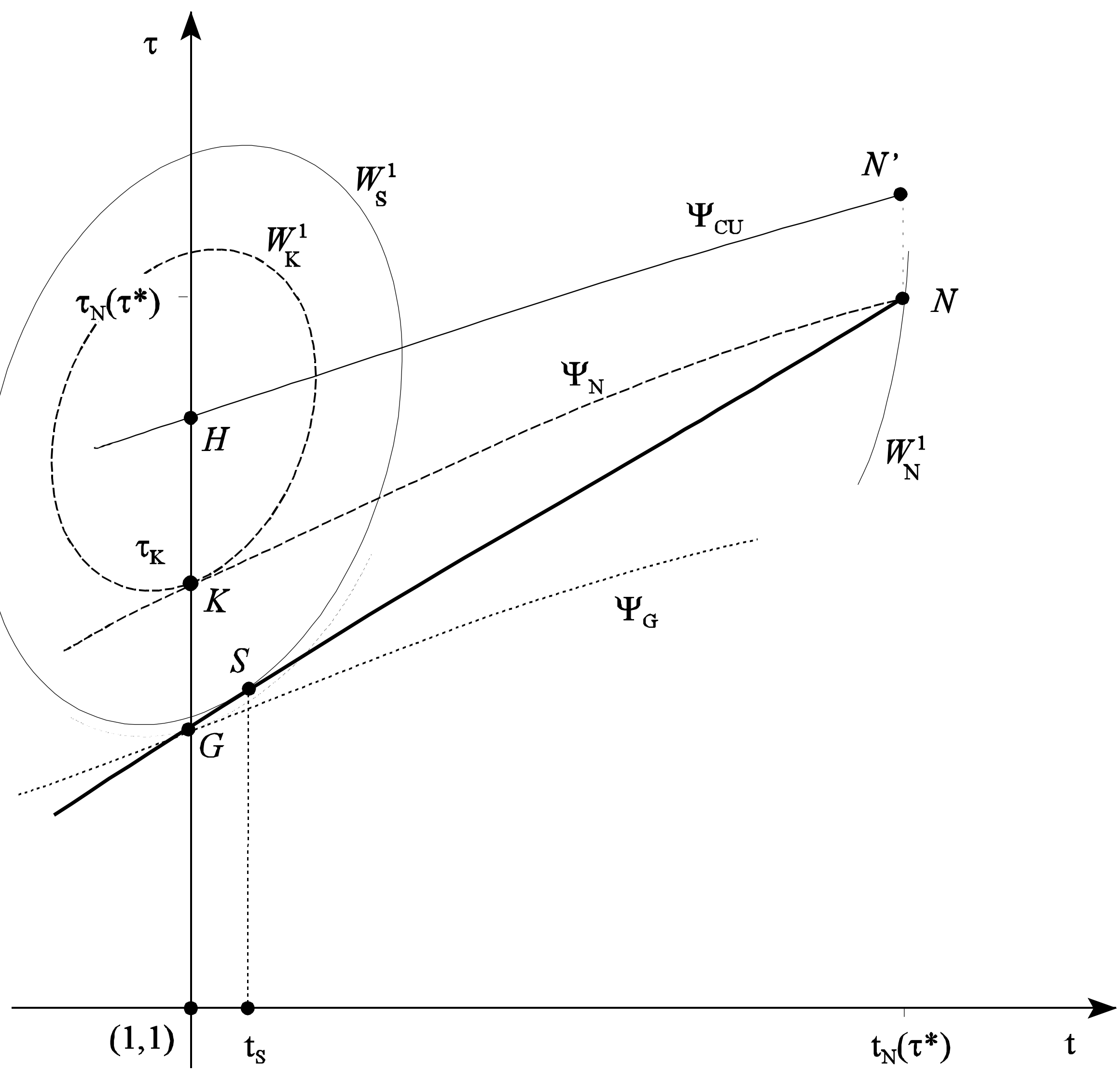

τ
W_S^1
N'
Ψ_{CU}
W_K^1
$\tau_N(\tau^*)$
N
Ψ_N
H
W_N^1
τ_K
K
Ψ_G
S
G
(1,1)
t_S
$t_N(\tau^*)$
t

Figure 1

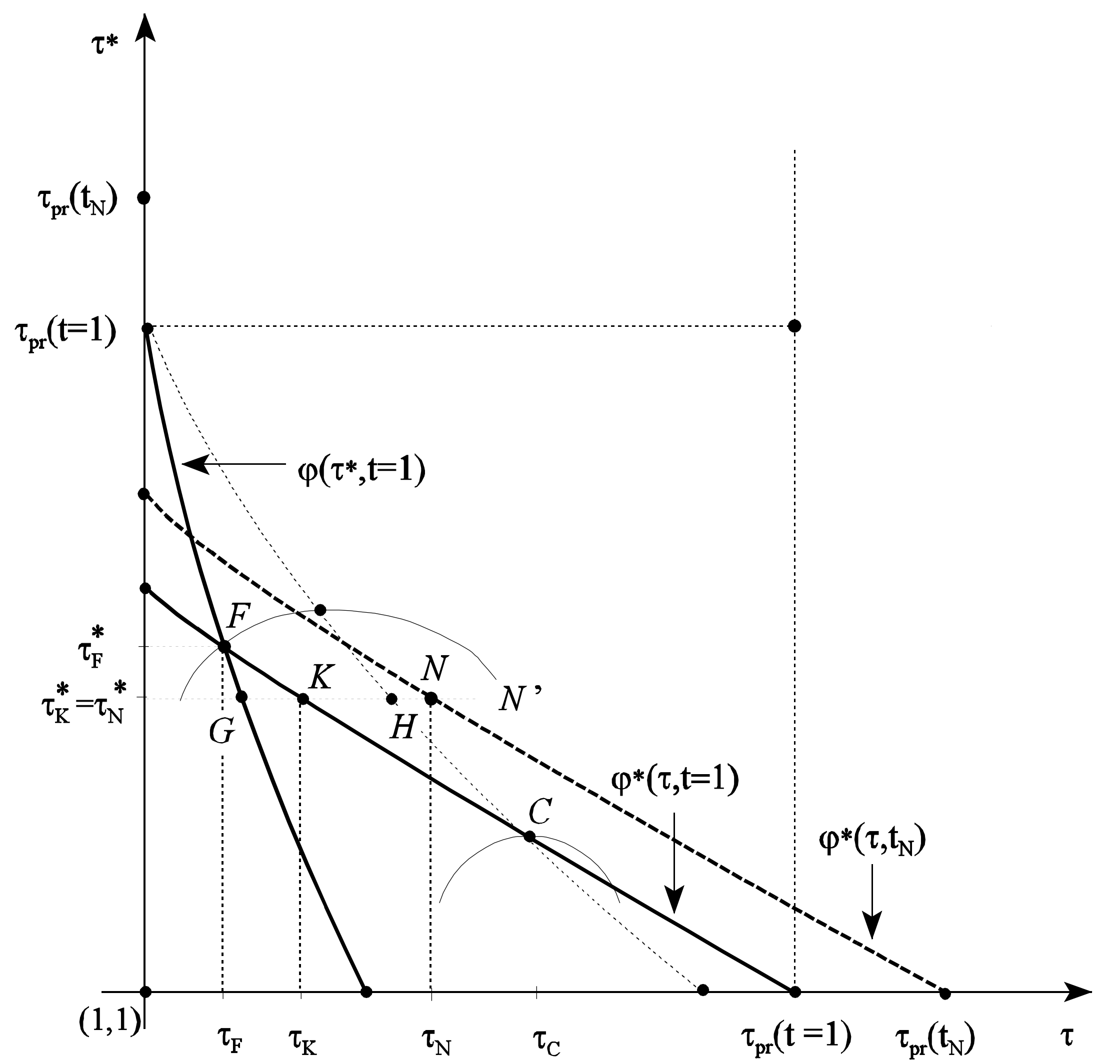

τ*
τpr(tN)
τpr(t=1)
φ(τ*,t=1)
F
τ*F
K
N
τ*K=τ*N
N'
G
H
φ*(τ,t=1)
C
φ*(τ,tN)
(1,1)
τF
τK
τN
τC
τpr(t =1)
τpr(tN)
τ

Figure 2

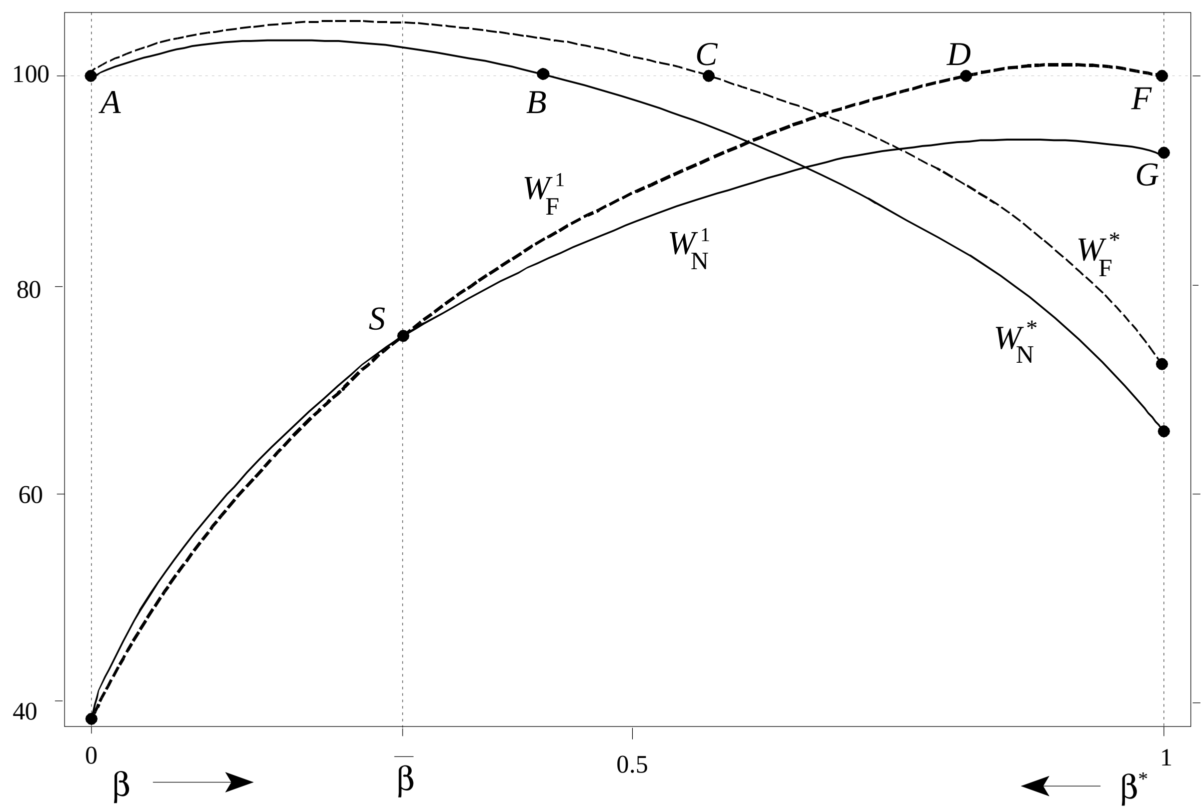


Figure 3

$\beta = 0.1,\ \alpha = 2,\ \sigma = 5.$

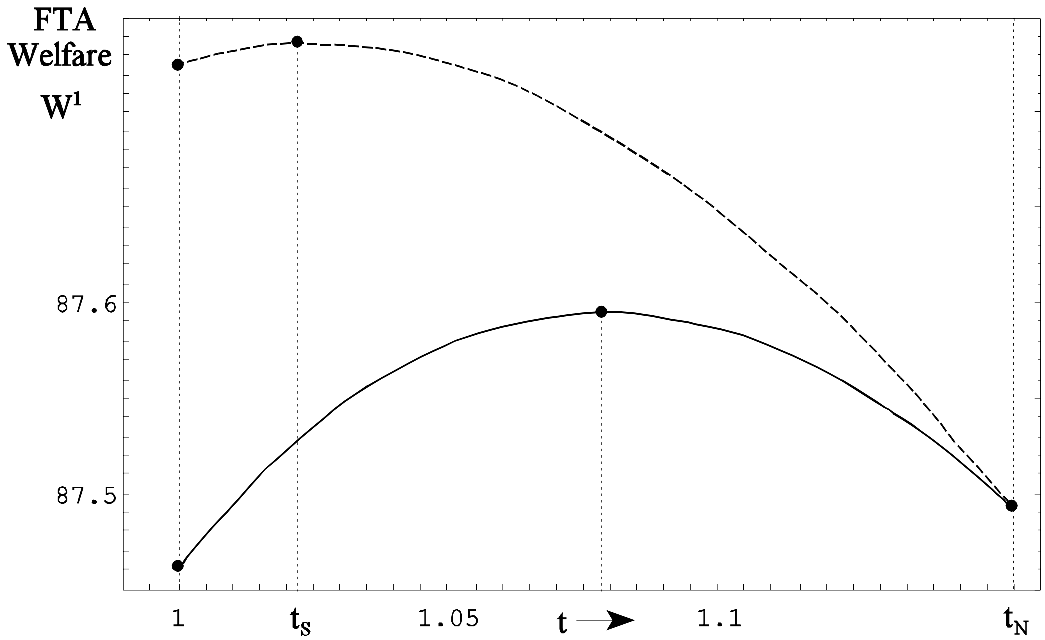
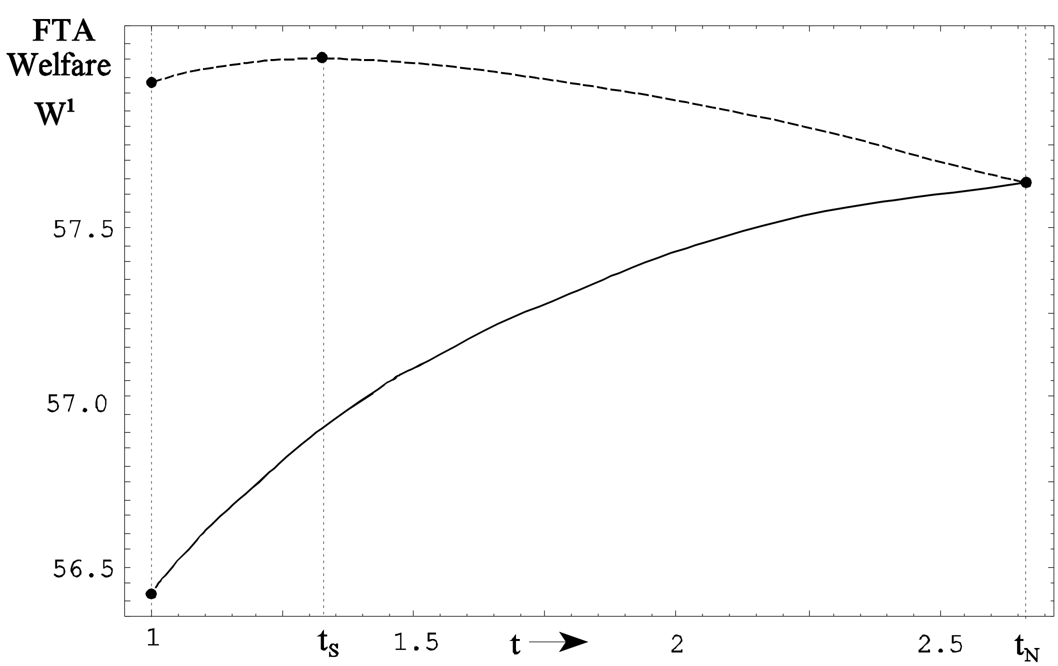


Figure 4a



$\beta = 0.1,\ \alpha = 2,\ \sigma = 1.$

Figure 4b

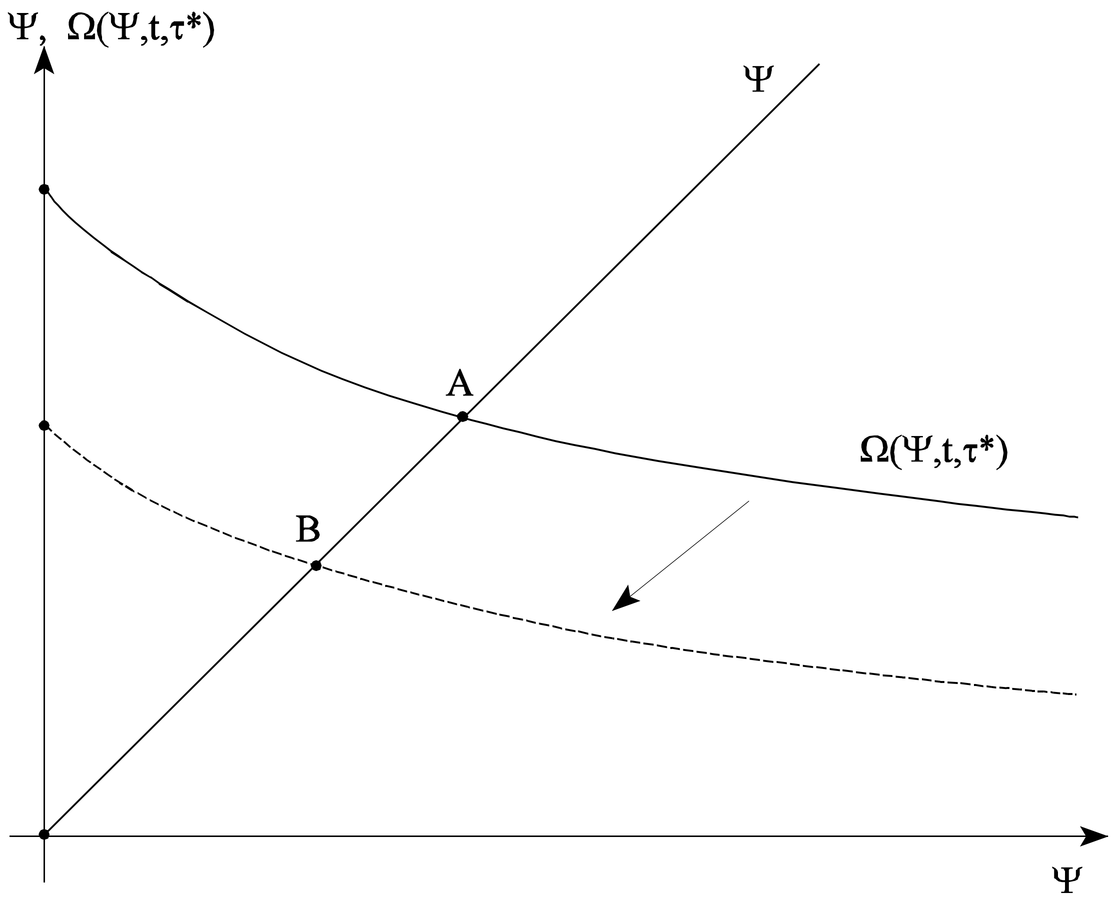


Figure A.1