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Understanding the Welfare Implications of Preferential Trade Agreements

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Abstract:

This paper examines various implications of Preferential Trade Agreements (PTAs), namely Customs Unions (CUs) and Free Trade Areas (FTAs), in the context of a multi-country general equilibrium model based on comparative advantage considerations. We calibrate the model to represent countries with symmetric endowments, and compare the impact of those agreements with free trade and a non-cooperative Nash equilibria. Utilizing aggregate and disaggregate welfare change measures, we quantify the welfare effects of trade arrangements. In particular, we develop a numerical approximation procedure to decompose the welfare changes into two components associated with the variations in terms of trade and volume of trade. The results of our analysis indicate that FTAs are better than CUs on welfare grounds for the world as a whole since both member and nonmember economies enjoy welfare benefits in an FTA. Further, we show that, for certain endowment distributions, upon formation of an FTA, nonmember economies get larger welfare benefits than member economies do. Nonetheless, member economies have larger welfare gains in CUs than in FTAS. Our welfare decompositions suggest that a significant fraction of the welfare changes in both member and nonmember countries is explained by the volume of trade effect for both types of PTAS. This implies that, having free access to larger markets, along with greater market power are both important aspects of PTAS. Comparison across endowment distributions indicates that as countries become more divergent in their endowments, the volume of trade effect gets more pronounced for CUs as well as for FTAS. The absence of policy coordination between the members of FTAs decreases the market power of the member economies and induces welfare losses that are associated with the terms of trade effect. However, the ten-ns of trade effect results in significant welfare gains for the members of CUs since they jointly determine their tariff rates.

Keywords:. , General Equilibrium, Trading Blocs, Free Trade Agreements, Customs Unions, Tariffs, Welfare.

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Non-Technical Summary:

In this study we construct a very simple model to study various implications of two types of preferential trade agreements, free trade associations and customs unions. In this model countries have symmetric endowments and identical preferences. Using simulation techniques we calculate consumption allocations, tariffs, prices, and trade volumes that result from the various trade arrangements. We compare the implications of customs unions and free trade associations with those of free trade and an initial equilibrium for which we use a Nash equilibrium in tariffs.

Our study revels several regularities and differences across preferential trade agreements: first, in a free trade association equilibrium, the nonmember country charges higher tariffs on imports than the member countries of the agreement do. In contrast, the member countries charge higher tariffs on imports than the nonunion country does in a customs union equilibrium. Second, while formation of a free trade association does not lead to an increase in the tariff rates of member countries, it induces higher tariff rates in the nonmember economy. Strikingly, when countries have sufficiently uneven endowments, i.e. when they have seemingly more market power in their export goods, the member countries reduce their tariff rates in a customs union equilibrium. Third, upon the formation of a customs union, the terms of trade of the members improves at the expense of nonmembers. In contrast, a nonmember economy in a free trade association equilibrium enjoys a terms of trade improvement, since member economies do not coordinate their tariff policies. Fourth, the formation of free trade associations leads to more trade in both member and nonmember economies than the formation of customs unions.

After studying the impact of preferential trade agreements on model variables, we analyze the welfare implications of different types of preferential trade agreement. Our results suggest that free trade associations are better than customs unions on welfare grounds for the world as a whole. Also, member economies have larger welfare gains in customs unions than in free trade associations. Further, we show that, for certain endowment distributions, upon formation of a free trade association, nonmember economies get larger welfare benefits than member economies do.

Our welfare decompositions indicate that a significant fraction of the welfare gains in both member and nonmember countries is explained by the volume of trade effect for both types of preferential trade agreements. This result suggests that having free market access is a major benefit of participating in a preferential trade agreement. The terms of trade effect generates relatively large welfare gains in the member economies of customs unions since the members jointly determine their tariff rates. The absence of policy coordination between the members of free trade associations decreases their market power and this produces welfare losses that are also associated with the terms of trade effect.

1. Introduction

The world trading system has been going through many changes in recent years. Among the many one notably important change is that attention has shifted away from the multilateralism of the WTO (formerly GATT) towards preferential trade agreements. In particular, the number of preferential trade agreements has nearly doubled in the last four years. Most of these agreements are Free Trade Areas rather than Customs Unions.[1] These developments as well as the ongoing intense debate about their contribution to the multilateral trading system have put various implications of preferential trade agreements in the forefront of research in international trade.[2]

Surprisingly, to date there has been no study providing a comprehensive, general equilibrium examination of the similarities and differences across different types of preferential trade agreements (PTAs), namely Free Trade Areas (FTAs) and Customs Unions (CUs).[3] In this paper, our objective is to fill this gap by systematically analyzing the various implications of these agreements in a general equilibrium setting. In particular, we examine the following questions: first, what are the effects of different types of preferential trade agreements on welfare, tariffs, prices, and the volume of trade? In the context of this broad question, our main goal is to understand the welfare implications of PTAs for member and nonmember economies as well as for the world, while providing further insight into the impact of these agreements on the macroeconomic variables such as tariffs, prices, and the trade volume. Second, what are the contributions of the variations in the terms of trade and volume of trade to the welfare changes associated with different types of PTAs?

To deal with these questions we construct a highly stylized multi-country general equilibrium model in which tariffs are endogenously determined. Our model is a pure-exchange economy in which trading patterns are determined by comparative advantage considerations. This feature of the model simplifies the analysis allowing us to employ numerical methods to find equilibrium allocations. We calibrate this model for artificial economies in which countries are symmetric in their endowments. Countries can sign preferential trade agreements, such as CUs and FTAs, with each other. In addition, they can establish free trade (FT), or they can behave non-cooperatively by charging optimal tariffs on the imports from other countries, i.e. Nash equilibrium. We simulate the model and find consumption

[1] See Sampson (1996) for more information about the recent increase in the number of preferential trade arrangements. The WTO (1995) reports that "most notifications made to GATT have involved free trade areas, and the number of customs union agreements is small."

[2] See Riezman (1997) for an extensive discussion of the question whether or not the new spate of preferential trade agreements are a help or hindrance in the goal of attaining free international trade. See also Perroni and Whalley (1996), Baldwin and Venables (1995), and Ethier (1996).

[3] Perroni and Whalley (1994, 1996) provide several results associated with CUs and FTAs using a general equilibrium model calibrated to represent major trading regions in the world. Bagwell and Staiger (1993a, 1993b) study the interactions between the formation of FTAs and CUs and multilateral trade liberalization, but their focus is on the behavior of tariff rates during this process.

allocations, prices, terms of trade, and volume of trade for member and nonmember economies and for every trading regime. We contrast the implications of CUs and FTAs with those of FT and Nash equilibrium.

We utilize two complementary welfare change measures to examine welfare effects of PTAs. The first calculates the aggregate consumption change in member and nonmember economies which occurs with the formation of trade agreements. We then examine a measure which decomposes the welfare effects into two components: the variation in aggregate income induced by the movements in terms of trade and the change in aggregate income caused by the change in volume of trade. The second measure provides useful intuition about different sources of welfare effects by isolating the important forces affecting aggregate welfare changes: the terms of trade effect explains the changes in the market power and the volume of trade effect accounts for the impact of free market access on the aggregate welfare.

Our paper is part of a rapidly growing research program which investigates a variety of issues related to preferential trade agreements. Inspired by the seminal work of Viner (1950), this literature has mostly focused on trade creation and trade diversion effects arising from trade agreements. Krugman (1991a) examines these two effects in the context of a monopolistically competitive model and shows that formation of CUs can potentially lead to higher external tariffs and can consequently result in lower world welfare. This result is interpreted as implying that recent PTAs constitute a potential threat to the multilateral trading system, since they increase the possibility of a global trade conflict. A number of studies, following Krugman, analyze the impact of the simultaneous formation of CUs on tariffs and welfare by relaxing a variety of his assumptions, such as absence of transportation costs, size of trading blocs etc.[4]

Although a significant fraction of recent PTAs have taken the form of FTAs, the massive body of the literature sparked by Krugman's study has largely ignored FTAs, and exclusively focused on the issues pertaining to CUs. In a recent paper, Krueger (1995) raises this issue, and investigates the differences between FTAs and CUs. Utilizing the Vinearian terminology, she finds that trade-creating CUs are superior to the FTAs on welfare grounds. Her results suggest that an FTA results in more trade diversion than a CU does, since sustainability of FTAs requires a variety of rules of origin requirements. This result is in sharp contrast with the "traditional" argument advanced by Shibata (1967) who claims that FTAs result in larger welfare gains than CUs.[5]

[4] See Krugman (1991b), Deardorff and Stern (1994), Sinclair and Vines (1995), Syropoulos (1995), Bond and Syropoulos (1996), Frankel, Stein, and Wei (1996), Haveman (1996), Bhagwati and Panagariya (1996), and Stein and Spilimbergo (1996).

[5] Pomfret (1996) also challenges Krueger's analysis and claims that the rules of origin requirements, while they could be detrimental to the welfare of member and nonmember countries, are unable to justify Krueger's conclusion. Joshi and Shivakumar (1997) consider a model involving a symmetric Cournot oligopoly and find that FTAs result in higher world welfare than CUs do.

While our analysis provides some important insights into these discussions our approach to the problems posed above differs in some key ways from others in this literature. First, we construct a fully specified general equilibrium model which requires only the specification of fundamental endowment parameters. We are able to analyze the strategic interactions between member and nonmember economies since tariffs are endogenously determined in our model. Second, FTAs and CUs are easily examined in our framework and the differences and similarities across different types of PTAs are documented. Third, our simple model economy with the symmetric endowment structure isolates the impact of rules of origin requirements associated with FTAs from the other fundamental considerations which shape the policies of member and nonmember economies upon the formation of PTAs. Hence, our model asks the same questions as Krueger, namely are CUs preferred to FTAs, but focuses on how strategic interactions, rather than rules of origin requirements, affect welfare.

In particular, we consider terms of trade and volume of trade effects, and develop a numerical approximation method to decompose the aggregate welfare effects into those two components. In this regard, our analysis constitutes a major departure from the literature that was fostered with the extensive use of the Vinerian trade creation trade diversion terminology.[6] While this taxonomy has enlarged our understanding of different effects of trade arrangements, and proven to be useful for simple descriptive arguments, a number of researchers have advanced concerns about the relative merits of it.[7] For example, the trade creation trade diversion terminology does not provide unambiguous results about the welfare implications of trade agreements. Further, it ignores the effects associated with the initial tariff levels, and how the PTA's themselves influence tariff levels and terms of trade. While accounting for the changes in tariffs and terms of trade, our welfare decomposition also separates the market power and market access forces. The former force is associated with the terms of trade effect, and the latter one is described by the volume of trade effect.

We first document the regularities associated with the effects of PTAs on tariffs, prices, and the volume of trade: our findings suggest that formation of CUs might not result in higher tariff rates and FTAs induce lower protective barriers. These two results challenge the "conventional" notion that simultaneous

[6] To the best of our knowledge, our study is the first one which numerically implements this type of welfare decomposition.

[7] Hamilton and Whalley (1985) note that *"… the usual focus in the customs union literature on trade creation and trade diversion effects not only neglects the important issue of the initial level of partner protection, but also neglects the potential for a joint terms of trade improvement through common external protection."* Harrison, Rutherford, and Wooton (1993) discuss the shortcomings of this terminology noting that *"…this method is, at best, unreliable and could give little clue as to the overall welfare effect on the country."* Srinavasan, Whalley, and Wooton (1993) note that *"much of the literature measuring the effects of regional integration agreements on trade and welfare uses a classical Vinearian trade creation/trade diversion framework which … is not well suited to the study and quantification of more recent regional integration."* Kowalyczyk (1996) provides a critical analysis of the literature and illustrates the potential problems which might arise with the "misuse" of it. He concludes that *"the Viner's terminology has severed customs union theory from the theory of multilateral tariff reform."*

formation of trade agreements can result in higher protective barriers which constitute a potential threat to the multilateral trading system. Regarding prices, our findings indicate that in a CU equilibrium, the terms of trade of the members improves at the expense of nonmembers. In contrast, a nonmember economy in an FTA equilibrium enjoys a terms of trade improvement, since the member economies do not coordinate their tariff policies. Surprisingly, the consumers in the member countries pay lower prices for imports than those in the nonmember economy in an FTA because the member economies of FTAs charge lower tariff rates than the nonmember does. The study of trade volume reveals an interesting regularity: the formation of FTAs leads to more trade in both member and nonmember economies than the CUs.

Unlike Krueger, we find that FTAs are better than CUs on welfare grounds for the world as a whole. While both member and nonmember economies enjoy welfare gains in an FTA, only the member economies gain and the nonmembers lose in a CU. The total welfare gain of the union members exceeds the loss of nonmember economy, and the formation of a CU results in an increase in the world welfare over Nash equilibrium. Our results also suggest that member economies have larger welfare gains in CUs than in FTAs. Further, we show that, for certain endowment distributions, upon formation of an FTA, nonmember economies get larger welfare benefits than member economies do.

Our welfare decompositions suggest that a significant fraction of the welfare gains in both member and nonmember countries is explained by the volume of trade effect for both types of PTAs. This result implies that for welfare considerations having free access to larger markets is quite important relative to having more market power. The terms of trade effect accounts for much of the welfare gain of member economies of CUs since the members jointly determine their tariff rates. The absence of policy coordination between the members of FTAs induces welfare losses which are also associated with the terms of trade effect.

The organization of the paper is as follows: in section 2, we present the model. Next, welfare gain calculations are explained in the following section. In section 4, we examine the implications of trade agreements and discuss the results. We conclude with a brief summary of our findings and suggestions for future research.

2. The Model

We construct a general equilibrium model of a representative world economy.[8] Our model is sufficiently comprehensive to incorporate an arbitrary number of countries. We assume that transaction

[8] A number of researchers have recently used this setup to analyze different issues: see Kennan and Riezman (1990), Syropoulos (1995), Haveman (1996), Kose and Riezman (1997), and Riezman (1997). Our study extends the research program initiated by Kennan and Riezman in several dimensions: first, unlike Kennan and Riezman who provide some examples only, we provide a comprehensive examination across different types of PTAs. Second, we focus on the welfare implications of trade

costs associated with international trade are equal to zero, and transfer payments between countries are not allowed.

Countries set tariffs optimally and can choose to not be part of any trade agreement and charge the optimal tariff, or they could decide to join a coalition with other countries. They could be part of an FTA, a CU or can mutually agree on establishing FT. In the FTA member countries agree to free trade between themselves, but are allowed to set their external tariffs independently. A CU is an FTA with the additional provision that the external tariff is set jointly by the members. A CU (or FTA) of all countries is, of course, Free Trade.[9]

2.1 The Environment

Consider a world of n countries. In each country, the agents derive utility by consuming m different goods. Each country is endowed with a fixed amount of each commodity. Let y_j^i be country i's endowment of good j. Assume that each country consists of individuals with identical Cobb-Douglas preferences. Then the utility function of a representative agent is the same as the aggregate and given by

$$U^i = \sum_{j=1}^{m} b_j^i \ln x_j^i \tag{1}$$

where U^i is the utility of country i, and b_j^i is the weight country i puts on commodity j $(\sum_{j=1}^{m} b_j^i = 1,\ i = 1,\ldots,n)$. x_j^i denotes the aggregate consumption of good j in country i. This preference formulation results in a linear expenditure system which allows us to employ numerical methods to solve the model. Further, with this structure we do not have to specify elasticities, and can state our results in terms of fundamental endowment parameters.

The net imports in each good, z_j^i, is defined to be $z_j^i = x_j^i - y_j^i$. As we have already stated above, countries charge optimal tariffs (export taxes or subsidies) on imports (exports). We call these tariffs or subsidies "tariffs" in the succeeding discussion. Denote the tariff charged by country i on imports of good j

arrangements, and sources of welfare effects associated with different types of PTAs. Third, we do not limit our analysis with only one trade pattern and consider the alternatives.

[9] We do not consider the equilibria which are consistent with Article XXIV and Kemp-Wan adjustment. See Syropoulos (1995) for an extensive discussion of those equilibria. While the assumption that the ex-post tariff rates should be consistent with the Article XXIV is a seemingly plausible one, the World Trade Organization (1995) reports that only six out of sixty-nine trade agreements are found to be in "full" conformity with the Article.

by t_j^i. If the world price for good j is p_j, then the domestic price of good j in country i is $q_j^i = (1+t_j^i)\, p_j$.

Given that each country consists of identical individuals, aggregate demand is obtained from maximizing the utility subject to the budget constraint

$$(2) \qquad \sum_{j=1}^{m} p_j(1+t_j^i)x_j^i = I^i = \sum_{j=1}^{m} p_j(1+t_j^i)y_j^i + p_j t_j^i z_j^i \quad i = 1,2,...,n,\ j = 1,2,...,m.$$

where I^i is income of country i and consists of income from the endowment plus tariff revenue which is rebated to consumers lump-sum.

2.2. The Equilibrium

The aggregate expenditure in each country must equal the value of its endowment at the equilibrium. Since we do not allow trade deficits or surpluses, the balance of payments constraint of each country i is given by

$$(3) \qquad W^i = \sum_{j=1}^{m} p_j x_j^i = \sum_{j=1}^{m} p_j y_j^i \qquad i = 1,2,\ldots,n.$$

W^i is the aggregate expenditure of country i. In addition to this constraint, the world demand for each good, should be equal to world supply, Y^i:

$$(4) \qquad \sum_{i=1}^{n} x_j^i = \sum_{i=1}^{n} y_j^i = Y^i \qquad j = 1,2,\ldots,m.$$

2.3. The Numerical Solution Method

. The logarithmic utility results in a linear expenditure system, in which agents allocates a fixed fraction of their income on each good. The first order conditions of the maximization problem lead to the following demand functions,

$$(5) \qquad x_j^i = \frac{b_j^i I^i}{(1+t_j^i)\, p_j}, \qquad i = 1,2,\ldots,n, \qquad j = 1,2,\ldots,m.$$

Denote expenditure of country i on good j with W_j^i. It is easy to show that expenditure is allocated across goods in proportion to b_j^i and t_j^i. Hence, $W_j^i = a_j^i W^i$ where a_j^i is a function of b_j^i and t_j^i. The world supply of each good is normalized to one unit. This implies that the world price of each good is equal to aggregate world expenditure on that good

$$\sum_{i=1}^{n} W_i^j = p_j, \qquad j = 1,2,\ldots,m. \tag{6}$$

Using equations (1), (5), and (6), we derive an analytical expression for utility of each country as a function of tariffs, for any given preference and endowment distribution. We employ a recursive numerical solution method to find an approximate solution for equilibrium allocations, prices, and tariffs since we cannot obtain a closed form solution for each equilibria.[10] The intuition of our solution method is straightforward: for a given endowment matrix, we can compute the equilibrium with optimal tariffs. Thus, when a country considers changing its tariff it has to make this calculation for any proposed tariff change. Once a country changes its tariff we have to re-compute optimal tariffs for the other countries. This continues until no country wants to alter its tariff rates, in other words, no country can increase its utility by changing its tariffs.

Operationally, FTAs and CUs put constraints on the feasible tariff matrix. For an FTA, tariffs between the member countries are set to zero, and external tariffs are set independently. Alternatively, one might consider a more general case in which we let the CUs or FTAs have tariffs between the member countries. We require that free trade be practiced between the members when a PTA is signed. This means to compute the equilibrium, the appropriate tariffs are constrained to be zero. Computing customs unions equilibria is a bit more complicated: one can think of a CU as an FTA with the added feature that the external tariff is set jointly. There are two important issues about the tariff determination problem. First, if the two FTA members exercise different tariff rates, then this results in trade deflection and different tariff rates cannot be sustained. Second, in general, there is a conflict of interest between the member countries as to what the external tariff should be in a CU. We calibrate our model in a way that so we can rule out both problems. Specifically, we consider countries with symmetric endowments, and this removes the possibility of emergence of those problems.[11]

[10] See Kennan and Riezman (1990) for details of our solution method.

2.4. Calibration

In order to utilize the solution algorithm, we should specify the number of countries, the number of goods and endowment of each country. We assume that m=n=3 and b_j^i=1/3 for all i,j=1,2,3. Any variation in cross country preferences or preferences across commodities can be replicated by a suitable adjustment of endowments. As we have already stated above we assume that the world supply of each good, Y^i, is one unit. Each country i has an endowment of $y_i^i = s$ units of good i and $y_j^i = 0.5(1-s)$ units of good j ($j \neq i$). s, which is between zero and one, denotes the degree of symmetry (or similarity) between countries. This endowment structure implies that countries are identical up to a relabelling of the goods. As s increases, the countries become more dissimilar, and their market power in their export goods increases. Depending on s, two symmetric trade patterns can occur at any equilibrium: when s<1/3, each country exports two goods ($z_i^j < 0, i \neq j$), imports the other ($z_i^i > 0$), and charges taxes ($t_i^j < 0, i \neq j$) on its exports. When s>1/3, each country exports one good ($z_i^i < 0$), imports the other two ($z_i^j > 0, i \neq j$), and charges tariffs on its imports ($t_i^j > 0, i \neq j$). When s=a=1/3, there is no trade, since countries have identical preferences and endowments.

We let s vary from 0.1 to 0.9. This changes the distribution of endowments across countries. For each s, we compute equilibrium allocations in Nash, CU, FTA, and FT equilibria. In CU and FTA equilibria, two countries establish a free trade agreement and leave the third one out. Since we limit our analysis with trade agreements between the symmetric economies, we do not have to model the choice of coalition partners.

3. Measuring Welfare Changes

In this section, we first describe an aggregate welfare change measure which is the compensating variation in consumption. Then, we explain how we decompose the welfare effect for each country into the changes associated with variations in volume of trade and terms of trade.

3.1. The Aggregate Welfare Change Measure

We use the measure of Compensating Variation in Consumption to evaluate the aggregate welfare changes associated with trade agreements.[12] The compensating variation in consumption is the fraction δ by

[11] Richardson (1993) discusses the first issue, and shows that even if rules of origin are strictly enforced it still may not be possible to sustain different tariff rates. Gatsios and Karp (1991) addresses the issue of conflict of interest between the members of the CUs.

[12] This measure is slightly different than the Equivalent Income Variation measure which looks at the change in income at constant prices. The measure of Compensating Variation in Consumption is widely used in macroeconomics and finance

which the consumption allocations should be decreased in a free trade equilibrium, which can be an FTA, CU, or FT, to keep the representative agent with the same utility as the one in the Nash equilibrium. So, the welfare change, δ, is calculated as

$$U^N(x_1, x_2, x_3) = U^F((1-d)x_1, (1-d)x_2, (1-d)x_3) \tag{7}$$

U^N: *utility under a Nash equilibrium*

U^F: *utility under a preferential trade equilibrium (FTA, CU , or FT)*

Unlike some other welfare measures, such as utility level of the representative consumer, our welfare change measure provides a transparent interpretation of welfare effects of trade agreements, since welfare changes are measured in consumption units. For example, it is possible to assess the percentage change in consumption with the establishment of a PTA.

We also examine the implications of preferential trade agreements on the world welfare. Since the countries are ex-ante identical up to a relabelling of the goods in their endowments in our model, they weigh equally in our world welfare measure. The world welfare change, d^w, is calculated using the same procedure above and given by the following formula

$$\sum_{i=1}^{3} U_i^N(x_1^i, x_2^i, x_3^i) = \sum_{i=1}^{3} U_i^F((1-d^w)x_1^i, (1-d^w)x_2^i, (1-d^w)x_3^i) \tag{8}$$

i: country i , $i=1,2,3$

3.2. The Disaggregate Welfare Change Measure

In order to provide an intuitive basis for our results and to further examine the potential sources of the welfare effects of preferential trade agreements, we decompose the welfare changes into two components which are associated with the variations in the terms of trade and volume of trade of each

literature to evaluate the costs of business cycles and of the lack of international consumption risk sharing. See Lucas (1987), Cole and Obstfeld (1991) for the use of this measure in different contexts. Kose and Riezman (1997) and Riezman (1997) utilize this measure to evaluate the welfare implications of different types of PTAs. See Perroni and Whalley (1994) for the use of Equivalent Income Variation, and Frankel, Stein, and Wei (1996) for the use of utility of the representative agent as the welfare measure.

country. Our measure, which we call it the disaggregate welfare change measure, was first carefully worked out by Kowalyzck (1996).[13]

In the previous section, we focused on the aggregate welfare change which is measured in terms of percentage changes in consumption. Now, we measure the welfare effects by the variations in aggregate income. Consider country i which involves in a preferential trade arrangement with another country in our model. We denote the aggregate income of country i by I^i. Let q^i be the m-element column vector of domestic prices, i.e. tariff inclusive prices, of country i. z^i is a row vector with m elements listing country i's net imports, i.e. the difference between imports and exports. We can rewrite (2) in terms of country i's net imports, and use the first order conditions of the optimization problem to get

$$dI^i = q^i dz^i \tag{9}$$

It is possible to rewrite the equation (3) to get the balanced trade condition, $pz^i = 0$, where p is an m-element column vector of world prices, i.e. tariff exclusive prices. Now, totally differentiating this equation and subtracting (9) from it yields the following formula

$$dI^i = \underbrace{-z^i dp}_{tot} + \underbrace{(q^i - p)\, dz^i}_{vot} \tag{10}$$

In this expression, the first term is the terms of trade (tot) effect which is the inner product of the vectors of net imports and changes in world prices. The second component denotes the volume of trade (vot) effect which is the inner product of the tariff wedge and the change in net imports. In our framework, the tariff rates are ad valorem, $q^i = (1 + t^i)\, p$, where $(1 + t^i)$ is an nxn diagonal matrix with 0's on its diagonal.

The above welfare measure disaggregates welfare changes for infinitesimal changes in tariffs. However, in our analysis tariffs change discretely when countries move from one equilibrium to another. In

[13] There were some earlier studies suggesting this type of disaggregate welfare change calculation, but Kowalczyk was the first one who convincingly argued that this type of welfare taxonomy is superior to the traditional trade creation and trade diversion terminology. See Bond (1990) for the derivation of this measure. See Gunter (1989), Baldwin and Venables (1995), and Winters (1997) for surveys on different types of welfare decompositions.

order to adapt this measure for our purposes, we develop a numerical approximation method which allows us to use (10) to decompose the overall welfare effects associated with discrete changes in tariffs.[14]

To do this we first define a transition path and divide the total change in tariffs into smaller discrete steps. Accordingly, countries go through N steps in which they reduce their tariff rates proportionally. We then calculate (N-2) intermediate equilibria on the transition path which leads countries from the initial equilibrium to the final one. Let $k \quad (1 \le k \le N)$ index the equilibrium on the transition path. The initial equilibrium, which is the Nash equilibrium is denoted by k=1, and the final equilibrium, (FTA, CU, or FT), corresponds to k=N. In each step, the countries charge tariff rates which are between the initial and final tariff rates. Next, we solve the model for each intermediate set of tariff rates, and find respective vectors of prices, exports, and imports. Knowing these variables, we calculate the disaggregate welfare gains for each equilibrium along the transition path. The terms of trade effect is approximated with $-z_i(k)\Delta p(k)$, and the volume of trade effect is found by $[q^i(k) - p(k)]\Delta z^i(k)$ for equilibrium k. Then, we sum the changes in welfare over each equilibrium on the transition path. The terms of trade effect for country i is found by

$$tot^i = \sum_{k=1}^{N-1} -z^i(k)\,\Delta p(k) \tag{11}$$

and similarly the volume of trade effect is

$$vot^i = \sum_{k=1}^{N-1} [q^i(k) - p(k)]\Delta z^i(k) \tag{12}$$

The summation of (11) and (12) produces an approximation to the overall welfare change of country i due to a PTA. We then compare this estimated measure of welfare change with the actual welfare change which we have computed directly. So each value of N gives us a welfare decompostion that can be compared to actual welfare. As N increases, the accuracy of our approximation gets better. By increasing N one can get the welfare decomposition as close as desired to the actual welfare level.

Through simulations we find that for our problem N=4 gets us "sufficiently" accurate answers.[15] For example, consider the transition path from the Nash equilibrium to the FTA equilibrium in our model.

[14] See Harrison, Rutherford, and Wooton (1993) for a similar welfare decomposition. They suggest the use of the same numerical approximation method, but their welfare change measure is different than ours. In particular, their measure decomposes the effects into two parts associated with changes in domestic prices and changes in tariff revenue.

We know allocations in the initial and final equilibria. Since countries reach the final equilibrium in 4 steps, each member country (the nonmember country) reduces (increases) its tariffs by 25 percent in the first step. In the second step, the tariff rate charged by each member country (the nonmember country) is 50 percent lower (higher) than that in the Nash equilibrium. In the third step, the tariff rate is decreased by 75 percent by the members, and is increased by 75 percent by the nonmember. Finally, countries charge the tariff rates corresponding to the FTA equilibrium. We compute the terms of trade and volume of trade effect for each adjacent intermediate equilibria, and then sum each term across all of the tariff rates. This provides the decomposition of the welfare gains due to a move from the Nash to the FTA equilibrium.[16]

4. Understanding Trade Agreements

In this section, we first present the results of our simulations which provide several interesting regularities about the effects of PTAs on tariffs, prices, and the trade volume of member and nonmember countries. We, then, examine the welfare implications of FTAs and CUs, and comment on the current debate about the relative merits of preferential trade agreements. The last section analyzes the welfare effects of trade agreements employing the terms of trade and volume of trade terminology. While presenting the results for both types of trade patterns, for brevity, we discuss only those associated with the trade pattern in which each country exports one good and imports the other two, i.e. s is greater than a.

4.1. Tariffs, prices, and trade volume

Figure 1 presents the equilibrium tariff rates charged by member and nonmember countries in different types of PTAs. As one would expect, the larger the disparity in endowments, the larger is the equilibrium tariff rate. An increase in s can be interpreted as an increase in the monopoly power of the countries in world trade, since it indicates that each country has a larger share of the world supply of its export good. This induces a rise in equilibrium tariff rates as s rises.

Figures 1a and 1b reveal a major difference between CUs and FTAs. In an FTA equilibrium, the nonmember country charges higher tariffs on imports than the member countries of the agreement do. In contrast, the member countries charge higher tariffs on imports than the nonunion country does in a CU equilibrium. This regularity can be explained with the externality-internalizing effect which was first

[15] We check the robustness of our results to the number of intermediate equilibria. For the values greater than 4, there were some small changes in the magnitudes of gains (or losses), but these were not significant enough to have an impact on our results.

[16] We also compare the aggregate welfare gains with the disaggregated ones, and verify the consistency of the two measures for each equilibria. There are an infinite number of paths from the initial to the final equilibrium. Harrison, Rutherford, and Wooton (1993) explain the path independence issue for a similar welfare decomposition. They show that the disaggregated welfare change does not depend on the transition path. We use the same transition path for every equilibrium, so the dependence of welfare effects to transition path is not a problem here.

advanced by Kennan and Riezman (1990): in a CU there is internal free trade (as in the FTA), and in addition, the union members jointly set a common tariff on imports of goods from the nonunion country. This generates a tariff externality whenever two countries import the same good, because a tariff imposed by one country lowers the price paid by both. In a CU, unlike in an FTA, the members internalize the tariff externality by setting their tariffs jointly.

In figures 1c and 1d, we compare the pre-agreement tariff rates with the post-agreement ones. While formation of an FTA does not lead to an increase in the tariff rates of member countries, it induces higher tariff rates in the nonmember economy. Strikingly, when countries have sufficiently uneven endowments, i.e. when they have seemingly more market power in their export good, the member countries reduce their tariff rates in a CU equilibrium. In particular, when s is greater than 0.81, the members of the customs union set a lower tariff rate than that they charge independently in a Nash equilibrium. In a recent paper, Syropoulos (1995) convincingly argues that, since the internal free trade among CU members causes an increase in the price elasticities of demand for the exports of all countries, the market power of union members and non-union members decrease, and they both reduce their tariff rates. Combined with our earlier explanation about externality-internalizing effect, which increases the tariff rate, Syropoulos' argument on the "trade-liberalizing" effect explains the decrease in the tariff rates of member countries. When s is greater than 0.81, the trade liberalizing effect outweighs the externality internalizing force, and drives the tariff rates down in a CU. When s is less than 0.81, the externality internalizing force becomes more pronounced and induces an increase in the common tariff rate practiced by the union members.

We can explain the fall in the tariff rates charged by the members of an FTA with the help of trade liberalizing effect. In an FTA, there is no externality internalizing force, and the only present effect is the trade liberalizing force which provides an incentive to member countries to decrease their tariff rates upon the formation of the FTA. Unlike in an FTA, in a CU agreement, nonmember economies reduce their tariff rates to exploit the gains associated with the increase in trade volume.

We further examine the change in tariff rates to assess the magnitude of these two opposing forces. Figures 1e and 1f present the percentage changes in equilibrium tariff rates moving from Nash equilibrium to CU and FTA equilibria. As s rises, i.e. as each country gets a larger fraction of the world supply of its export good, the trade liberalizing effect becomes more pronounced relative to the externality internalizing effect. For example, when s is 0.4, formation of a CU leads to a 42 percent increase in the tariff rates of the member countries. The increase in the tariff rates falls to 1.3 percent when s is 0.8. In an FTA equilibrium, the impact of the trade liberalizing force becomes more evident as s rises: when s increases from 0.4 to 0.8, the decrease in the equilibrium tariff rate of the member countries rises from 53 percent to 73 percent.

These results challenge the notion that simultaneous formation of trade agreements must result in higher protective barriers which constitute a potential threat to the multilateral trading system. Krugman (1991a) shows that CUs can potentially increase external tariffs due to the non-cooperative behavior of large economic units.[17] He considers a model in which each country produces a single good that is differentiable from the other goods produced by other countries. He limits his analysis with CUs which are formed by symmetrically endowed countries.

Krugman's findings increased the fears that simultaneous formation of PTAs can cause higher protective barriers, and lead to a global trade conflict. Our results paint a more optimistic picture: first, the formation of a CU can, indeed, lead to *lower*, not *higher*, tariff rates even within the context of a model with symmetrically endowed countries that set tariffs optimally. The complete specialization assumption, that drives Krugman's model, amplifies the externality-internalizing effect and, not surprisingly, results in higher tariffs. On the other hand, our model, in which trade is driven by the differences in endowment distributions, illuminates the interaction between the tariff increasing and tariff decreasing forces, i.e. the externality-internalizing and trade-liberalizing effects, and shows that a CU arrangement between countries with sufficiently diverse endowments lowers protective barriers. Second, and more importantly, our findings suggest that understanding of preferential trade agreements and the new wave of regionalism requires a much broader examination of different types of trading arrangements including FTAs along with CUs. For example, our results indicate that the formation of FTAs lead to lower tariff rates. In a recent study, the World Trade Organization (1995) reports that most of the regional trade agreements take the form of FTAs, and the number of CUs is small.[18] Considering that a number of recent trade agreements are FTAs, any analysis, which solely concentrates on the CUs, unnecessarily exaggerates the magnitude of the threat produced by these agreements and ignores the important differences, which have major implications on several relevant variables, between different forms of PTAs.[19]

Figure 2 provides information on the behavior of different price measures. It is evident that as countries become more powerful in their export markets, i.e. as s rises, the prices of their export goods

[17] In particular, he notes that *"indeed, we may expect as a general presumption that a customs union, being a larger unit with more market power than any of its constituent members, will have an optimal external tariff that is higher than the preunion tariff rates of the member nations."*

[18] See World Trade Organization (1995, p. 27).

[19] A number of studies challenge the Krugman's result: Bond and Syropoulos (1996) extend Krugman's work, and show that, for relatively low elasticity of substitution and low degree of comparative advantage, formation of CUs can lead to lower tariff rates. Syropoulos (1995) studies the same setup here, and concludes that CUs can result in lower protective barriers. Sinclair and Vines (1995) find that when countries are sufficiently similar in endowments, formation of CUs lowers tariffs. Moreover, they consider FTAs and find that when trade agreements take the form of FTAs, they do not result in higher tariff rates. Perroni and Whalley (1994) simulate a computable general equilibrium model calibrated to represent different trading regions in the world. They find that FTAs between large and small countries can result in lower tariff rates. Our study shows that both CUs and FTAs can result in lower protective barriers. Our results are also different from the ones of Sinclair and Vines since we find that CUs produce lower protective barriers when the countries have sufficiently dissimilar, not similar, endowments.

increase. Figures 2a and 2b show the impact of policy coordination on the terms of trade of member and nonmember economies. In figure 2b, upon the formation of the union, the terms of trade of the members improves at the expense of nonmembers. In contrast, a nonmember economy in an FTA equilibrium (figure 2a) enjoys a terms of trade improvement, since member economies do not coordinate their tariff policies. As figures 2c and 2d indicate, consumers in the member countries of CUs and FTAs pay lower prices (tariff inclusive prices) for imported goods than those in nonmember economies. It is interesting to observe that even though the terms of trade of FTA members get worse, the consumers in the member countries still pay lower prices for imports than those in the nonmember economy (figure 2c). This can be explained with a regularity we documented above: FTAs lead to higher (lower) tariffs in nonmember (member) countries. Figures 2e and 2f contrast domestic price levels (tariff inclusive prices) in Nash equilibrium with those in FTA and CU equilibria. As figure 2e indicates, for member countries the domestic prices of imported goods in Nash equilibrium are higher than those in CU and FTA equilibria.

Figure 3 presents the effects of trade agreements on the trade volume of the member and nonmember countries. We measure a country's trade volume with the ratio of its exports to its GDP. From figures 3a and 3b, it is clear that a member country of a PTA has a larger trade volume than the nonmember economy does. The gap between the trading volumes of member and nonmember economies becomes more pronuounced as the disparity in endowments increases. Figures 3c and 3d show that the formation of FTAs leads to more trade in both member and nonmember economies than the formation of CUs. As it can be seen in Figure 3e, FT (Nash) equilibrium results in the largest (smallest) trade volume. Inspection of figure 3f reveals that there is more trade between a member country and the nonmember country in an FTA equilibrium than a CU.

4.2. Aggregate Welfare Effects

We first analyze the effects of PTAs on the allocation of resources using the aggregate welfare measure described in section 3.1. We present the results of our simulations in figure 4. As endowments of countries become more dissimilar, they get larger welfare gains through establishing PTAs. This regularity is an expected one considering that each country consumes all three goods, and as the endowments of countries get more divergent, international trade becomes more important. Figure 4a discloses an interesting feature of FTAs: when s is less than 0.68, member countries get larger welfare gains than the nonmember does. Surprisingly, as the disparity in endowments gets larger, in particular when s is greater than 0.68, the nonmember country gets larger welfare gains than the members of the FTA do. In the previous section, we find that formation of an FTA results in higher tariff rates in nonmember countries than in member economies. In addition, we also document that the terms of trade of the nonmember country

improves at the expense of the members. The trade liberalizing force induces the FTA members to decrease their tariff rates, and the absence of policy coordination prevents them manipulating the terms of trade in their favor. Hence, the nonmember country is able to get large welfare benefits for certain endowment distributions, and in some cases, these gains are larger than those of the members.

Unlike FTAs, CUs are harmful to nonmember countries as it is shown in figure 4b. In a CU, the nonmember country always loses, and the members always gain. The comparison of the size of welfare gains associated with different types of PTAs provides further insight about the effects of these agreements on members and nonmembers: for example, consider the world economy when s is equal to 0.8. Upon formation of a CU, member economies increase their consumption by 8.4 percent, and the nonmember country suffers from an almost 12 percent fall in its consumption. When an FTA is established, member countries enjoy more than 5 percent rise in their consumption while the nonmember increases its consumption by almost 7 percent.

Figures 4c and 4d show that CUs (FTAs) are better than FTAs (CUs) for member (nonmember) countries on welfare grounds. Interestingly enough though, formation of a CU does not necessarily improve members' welfare over FT. If each country's endowment of its export good is greater than 0.67, then member economies are better off at an FT than at a CU. This result is seemingly contradictory to the notion that formation of CUs helps to generate larger economic units which can, because of their size, manipulate the terms of trade in their favor, and have larger welfare gains than the ones they can get at FT. However, s is being small is equivalent to the CU's being large in our framework. In other words, as countries become more dissimilar, the formation of a CU does not necessarily increase the welfare of the members, since the nonmember economy gets larger market power over its export good, and the trade liberalizing force outweighs the externality internalizing force and leads to lower tariff rates in the member countries.

Considering the recent debate about the welfare implications of PTAs, we can now answer the question of that "are CUs stumbling blocks or stepping stones to the attainment of global free trade?" Our results indicate that for certain endowment distributions (when $s<0.69$), CUs pose a threat to the multilateral trading system since the member countries can get larger welfare gains at CU than at FT. Therefore, if we rule out transfer payments from the nonmember economies to the member ones, CUs can be considered as stumbling blocks.[20] However, when countries are sufficiently dissimilar, or when they have more market power in their export markets, then CUs do not necessarily constitute a danger to the

[20] Kowalczyk and Sjostrom (1994) analyze a model of customs unions in which side payments are permitted. Their results indicate that the use of transfer payments can facilitate the attainment of free trade.

multilateral trading system, and in fact they can serve as a stepping stone to the attainment of global free trade.[21]

We established that while CUs benefit member countries, they hurt nonmember economies. As far as FTAs are concerned both member and nonmember countries get welfare gains. We now turn our attention to the effects of PTAs on world welfare. Figure 4f presents the results of world welfare calculations. As expected FT is the best outcome for the world as a whole. FTAs are always better than the CUs since while both the member and nonmember economies gain in an FTA, only members gain at the expense of the nonmember country in a CU. The total welfare gain of the members exceeds the loss of nonmember economy in a CU, and the world welfare increases over Nash equilibrium.

Our results also shed light on an important policy debate which has recently gained momentum: "are FTAs better than CUs?" Krueger (1995), using Vinerian trade creation trade diversion terminology, argues that CUs are better than FTAs from the viewpoint of welfare economics. Krueger assumes that after the formation a CU, member economies levy a tariff rate which is the average of their pre-agreement tariffs, and the formation of an FTA does not result in any change in tariff rates, i.e. the member economies maintain their pre-agreement tariffs. Krueger's analysis focuses on the rules of origin requirements which are exercised by the members of FTAs to prevent trade deflection from the low-tariff country to the high-tariff country when two FTA members charge different tariff rates. These requirements induce more trade diversion in FTAs than in CUs, and Krueger's results favor CUs over FTAs.

Our analysis is different than Krueger's: first, we rule out rules of origin problems by employing a symmetric endowment distribution. The rules of origin considerations bias the Krueger's conclusion against FTAs. While abstracting from the rules of origin requirements, our framework emphasizes the strategic interactions between the members and nonmembers to differentiate CUs from FTAs. Second, since tariffs are endogenously determined in our model, we do not impose any *a priori* assumptions about the pre- and post-agreement tariff rates. The tariffs coming out of the general equilibrium model used here do not justify the assumptions about the tariff rates made by Krueger. Third, while Krueger's study considers only the world welfare, we examine the welfare implications of PTAs for the member and nonmember economies as well as for the world.

[21] To see this, consider the following experiment: starting at Nash equilibrium, all the countries cooperatively and uniformly reduce their tariff rates. If they reduce their tariff rates by 75 percent, this results in 8.7 percent consumption gain in all countries. As we have already noted above, member economies increase their consumption by 8.4 percent upon the formation of a CU. In other words, 75 percent multilateral uniform tariff reduction results in larger welfare gains for all economies including the potential members of a CU. This simple experiment shows that through multilateral tariff reduction, countries can get larger welfare gains than they can get through establishing CUs. This result implies that formation of CUs can be a first step to the realization of multilateral free trade. We also examine the welfare gains associated with 25 percent and 50 percent multilateral tariff reductions. The results of our simulations are presented in figure 4f.

In contrast to Krueger's conclusion, our findings show that FTAs are better than CUs on welfare grounds for the world as a whole. Nonetheless, our study suggests that member economies have larger welfare gains in CUs than in FTAs. While both member and nonmember economies enjoy welfare gains in an FTA, only the member economies gain and the nonmembers lose in a CU. Further, we show that, for certain endowment distributions, upon formation of an FTA, nonmember economies get larger welfare benefits than member economies do.[22]

4.3. Decomposition of the Welfare Effects

We explore the different sources of welfare effects associated with preferential trade arrangements in this section.[23] The literature on preferential trade agreements has mainly focused on the welfare effects arising from trade creation and trade diversion. While this terminology has expanded our understanding of trade agreements, it has been criticized by several researchers because of the following reasons: first, it is very hard to interpret the total welfare effects pertaining to trade creation and diversion, in fact, most of the time the total welfare effects are ambiguous. Second, while explaining the changes in the trade patterns and trade volumes, each term is actually an aggregate welfare measure and does not provide information about the disaggregated welfare effects. Third, the trade creation trade diversion terminology requires the imposition of a number of *ad-hoc* assumptions which do not take into account the level of initial tariff rates and the strategic interactions between the members and nonmembers.[24]

Considering these problems, we employ a different welfare decomposition measure and determine the relative contribution of the terms of trade and volume of trade effects to the welfare changes. These two effects provide further intuitive insight into the welfare changes. For example, the volume of trade effect is associated with the welfare changes arising from the fact that countries are able to freely access into each others' markets through PTAs . Similarly, the terms of trade effect is an useful instrument in understanding the welfare changes pertaining to the variations in market power because formation of trade arrangements generates bigger economic units with larger market power in their export markets. We present the results of

[22] Krueger's result, that is CUs are better than FTAs on welfare grounds, is in sharp contrast with the argument advanced by Shibata (1967). Shibata, also employing Vinerian arguments, finds that *"this type of economic union (FTA) will most likely increase welfare both in the participating countries and in the rest of world… This can be interpreted to mean that the formation of this type of economic union is an ideal first step toward universal free trade."* It is important to note that while Krueger's analysis examines harmful effects of trade deflection between the members of the FTA, Shibata assumes that trade deflection removes the possibility of trade diversion. While we do not use Vinerian arguments, our findings, somewhat surprisingly, lend support to Shibata's conjecture on the benefits of FTAs.

[23] The FT equilibrium results in only volume of trade effects, since we consider symmetric endowment distributions. Therefore we constrain our welfare decompositions with FTAs and CUs.

[24] See Hamilton and Whalley (1985), Harrison, Rutherford, and Wooton (1993), Srinavasan, Whalley, and Wooton (1993), and Kowalyczyk (1996).

our calculations in table 1. In some cases formation of a PTA yields welfare losses and we report the decompositions corresponding to those cases in gray shaded columns.

We first investigate the disaggregated welfare changes associated with FTAs. Columns 2 to 5 show that, when two countries establish an FTA, i.e. when they move from a Nash equilibrium to an FTA equilibrium, a significant fraction of the welfare gains in both member and nonmember countries is explained by the volume of trade effect. Consider the economy with s equals 0.5: in the nonmember country, the terms of trade effect explains approximately 39 percent of the welfare gain, and the volume of trade effect accounts for the remaining 61 percent. In section 4.1, we document that, upon the formation of the FTA, the nonmember economy enjoys a terms of trade improvement, whereas the members face a decline in their terms of trade. We can clearly see the implication of this regularity on the disaggregated changes of the welfare of member economies. While the volume of trade effect explains roughly 112 percent of the aggregate welfare gain, 12 percent welfare loss is attributed to the terms of trade effect. The terms of trade effect is an indicator of the changes in market power. Since FTAs do not increase the market power of the member economies, they face welfare losses resulting from the fall in their terms of trade.

Our results suggest that the volume of trade effect explains a larger fraction of the welfare changes in member economies of FTAs than it does in the nonmember country. This result has also an intuitive interpretation: a member country has a larger trade volume than the nonmember economy does in an FTA. Further, as s increases, the gains associated with volume of trade effect becomes more pronounced. When s rises from 0.5 to 0.8, the volume of trade effect increases to 71 (122) percent from 61 (112) percent in the nonmember country (member economy). As s rises, countries control more of the world supply of their export goods. This increases the fraction of the welfare gains resulting from the free market access since international trade becomes more important for the members as well as the nonmember.

We next examine the decomposition of the welfare effects due to the formation of CUs. In columns 6 to 9, the results corresponding to CUs are presented. CUs result in welfare loss in nonmember economies in our model. As in FTAs, the volume of trade effect accounts for a larger fraction of the welfare change in both union and nonunion countries in CUs. This indicates that, for welfare considerations, having free market access is quite important even if countries can coordinate their tariff policies and gain terms of trade improvements.

Surprisingly, the change associated with the terms of trade effect is smaller in a CU member than the nonmember. This becomes more evident when each country has more market power in its export market. For example, when s is equal to 0.8, the terms of trade effect explains more than 26 percent of the welfare loss in the nonmember economy while only 13 percent of the welfare gain is attributable to the terms of trade effect in a member economy. This observation, combined with the fact that the size of the

welfare loss associated with the terms of trade effect in nonmember economies is larger than the size of the welfare gains from the same effect in member economies, provides further insight about the impact of policy coordination on the welfare of the member and nonmember economies in CUs. In particular, we learn that while the policy coordination by member economies does not make a significant contribution to the welfare gain of members, it is responsible for a significant fraction of the welfare loss in the nonmember economy.

Table 1 also suggests that the decomposition of welfare changes yields similar results for the nonmember economy in both CU and FTA equilibria. For the member economies, the terms of trade effect gets more pronounced in a CU equilibrium than an FTA, since CUs allow the member countries effectively use their expanded market power. On the other hand, welfare benefits arising from the free market access are larger than those associated with the increased market power for both CU and FTA members. Comparison across endowment distributions indicates that as countries become more dissimilar, i.e. as s rises, the fraction of total welfare change explained by the volume of trade effect gets larger, since international trade, for each country, becomes more important.

5. Concluding Comments

We construct a general equilibrium model to study various implications of different types of PTAs, namely FTAs and CUs. We calibrate this model to represent countries with symmetric endowments and through simulations we calculate consumption allocations, tariffs, prices, and trade volumes associated with trade arrangements. We compare the implications of CUs and FTAs with those of free trade and Nash equilibrium.

We analyze the welfare effects of PTAs employing aggregate and disaggregate welfare change measures. While our aggregate welfare change measure calculates the aggregate consumption change in member and nonmember economies, the disaggregate measure determines the relative contribution of the terms of trade and volume of trade effects to the welfare changes associated with trade agreements.

Our study revels several regularities and differences across PTAs: first, in an FTA equilibrium, the nonmember country charges higher tariffs on imports than the member countries of the agreement do. In contrast, the member countries charge higher tariffs on imports than the nonunion country does in a CU equilibrium. Second, while formation of an FTA does not lead to an increase in the tariff rates of member countries, it induces higher tariff rates in the nonmember economy. Strikingly, when countries have sufficiently uneven endowments, i.e. when they have seemingly more market power in their export goods, the member countries reduce their tariff rates in a CU equilibrium. Third, upon the formation of a CU, the terms of trade of the members improves at the expense of nonmembers. In contrast, a nonmember economy

in an FTA equilibrium enjoys a terms of trade improvement, since member economies do not coordinate their tariff policies. Fourth, the formation of FTAs leads to more trade in both member and nonmember economies than the formation of CUs.

After studying the impact of PTAs on model variables, we analyze the welfare implications of different types of PTAs: first, our results suggest that FTAs are better than CUs on welfare grounds for the world as a whole. Second, member economies have larger welfare gains in CUs than in FTAs. Further, we show that, for certain endowment distributions, upon formation of an FTA, nonmember economies get larger welfare benefits than member economies do.

Our welfare decompositions indicate that a significant fraction of the welfare gains in both member and nonmember countries is explained by the volume of trade effect for both types of PTAs. This result emphasizes the importance of having free market access as a result of joining into a PTA. The terms of trade effect generates relatively large welfare gains in the member economies of CUs since the members jointly determine their tariff rates. The absence of policy coordination between the members of FTAs decreases their market power and this produces welfare losses which are also associated with the terms of trade effect.

Considering the recent increase in the number of PTAs, it is crucial to provide a solid understanding of the different implications of these arrangements. We plan to extend our study by introducing asymmetries in endowments and by allowing dynamic strategic interactions between the member and nonmember economies. Our numeric welfare decomposition method provides an interesting, and a more useful, alternative to the traditional trade creation trade diversion taxonomy. Using this numerical decomposition method to explore the effects of PTAs in richer settings is also a promising research avenue which can greatly enhance our understanding of PTAs.

References:

Bagwell, K., and R. W. Staiger, 1993a, Multilateral tariff cooperation during the formation of regional free trade areas, NBER Working paper No: 4363

Bagwell, K., and R. W. Staiger, 1993b, Multilateral tariff cooperation during the formation of customs unions, NBER Working paper No: 4543

Baldwin, R., and A. J. Venables, 1995, Regional Economic Integration, in Handbook of International Economics Vol. III in G. N. Grossman and K. Rogoff (eds.), North Holland.

Bhagwati, J. and A. Panagariya, 1996, Preferential trading areas and multilateralism: strangers, friends or foes?, in Free Trade Areas or Free Trade? The Economics of Preferential Trading Agreements in J. Bhagwati and A. Panagariya (eds.), AEI press, forthcoming.

Bond, E., 1990, The optimal tariff structure in higher dimensions, International Economic Review, 31,1, 103-116.

Bond, E., and C. Syropoulos, 1996, The size of trading blocs: Market power and world welfare effects, Journal of International Economics, 40, 1/2, 411-437.

Cole, H.L., and M. Obstfeld, 1991, Commodity trade and International risk sharing: How much do Financial Markets Matter?, Journal of Monetary Economics 28,3-24.

Deardorff, A. V., and R. M. Stern, 1994, Multilateral trade negotiations and preferential trading arrangements, in A. V. Deardorff and R. M. Stern (eds.), Analytical and Negotiating Issues in the Global Trading System, University of Michigan Press, 27-94.

De Melo, J., A. Panagariya, and D. Rodrik, 1993, The new regionalism: a country perspective, in J. De Melo and A. Panagariya eds., New dimensions in regional integration, Cambridge University Press.

Ethier, F., 1996, Regionalism in a multilateral world, mimeo, University of Pennsylvania.

Frankel, J. A., E. Stein, and S. J. Wei, 1996, Regional trading agreements: natural or super-natural?, American Economic Review 86, 52-56.

Gatsios, K., and L. Karp, 1991, Delegation games in customs unions, Review of Economic Studies 58, 391-397.

Gunter, F. R., 1989, Customs union theory: retrospect and prospect, in D. Greenaway, T. Hyclak, and R. J. Thorton eds., Economic aspects of regional trading arrangements, Harwester Wheatsheaf.

Hamilton, B., and J. Whalley, 1985, Geographically discriminatory trade arrangements, The Review of Economics and Statistics, 446-455.

Harrison, G.W., T. F. Rutherford, and I. Wooton, 1993, An alternative welfare decomposition for customs unions, Canadian Journal of Economics 26, 961-968.

Haveman, J., 1996, Some welfare effects of sequential customs union formation, Canadian Journal of Economics 29, 941-958.

Joshi, S., and R. Shivakumar, 1997, Endogenous trading blocs: customs unions versus free trade areas, mimeo, The George Washington University

Kemp, M., and H. Y. Wan, 1976, An elementary proposition concerning the formation of customs unions, Journal of International Economics 6, 95-97.

Kennan, J., and R. Riezman, 1988, Do big countries win tariff wars?, International Economic Review 29, 81-85.

Kennan, J., and R. Riezman, 1990, Optimal tariff equilibria with customs unions, Canadian Journal of Economics 90, 70-83.

Kose, M. A., and R. Riezman, 1997, Small countries and regionalism, mimeo, University of Iowa.

Kowalczyk, C. and T. Sjostrom, 1994, Bringing GATT into the core, Economica, 61, 301-317.

Kowalczyk, C, 1996, Welfare and customs unions, mimeo, Tufts University.

Krueger, A. O., 1995, Free trade agreements versus customs unions, NBER Working Paper No:5084

Krugman, P., 1991a, Is bilateralism bad?, in E. Helpman and A. Razin, eds., International Trade and Trade Policy, Cambridge, MIT Press

Krugman, P., 1991b, The move toward free trade zones, in Policy Implications of Trade and Currency Zones. A symposium sponsored by the Federal Reserve Bank of Kansas City.

Lucas, R.E., 1987, Models of Business Cycles, Oxford, Blackwell

Perroni, C. and J. Whalley, 1994, The new regionalism: trade liberalization or insurance?, NBER WP#4626

Perroni, C. and J. Whalley, 1996, How severe is global retaliation risk under increasing regionalism?, American Economic Review 86, 57-61.

Pomfret, R., 1996, Are free trade areas better than customs unions?, Working Paper, University of Adelaide.

Richardson, M., 1993, Endogenous protection and trade diversion, Journal of International Economics 34, 309-324.

Riezman, R., 1997, Can bilateral trade agreements help induce free trade?, Working Paper No: 97-01, University of Iowa.

Sampson, G. P., 1996, Compatibility of regional and multilateral trading arrangements: reforming the WTO process, American Economic Review 86, 88-82.

Shibata, H., 1967, The theory of economic unions: a comparative analysis of customs unions, free trade areas, and tax unions, in C. S. Shoup (ed.) Fiscal Harmonization in Common Markets, vol. 1, Theory, Columbia University Press, 145-264.

Sinclair, P., and D. Vines, 1995, Bigger trade blocs need not entail more protection, Discussion Paper No: 95-32, The University of Birmingham.

Spilimbergo, A., and E. Stein, 1996, The welfare implications of trading blocs among countries with different endowments, Inter-American Development Bank, Working Paper Series No: 323.

Srinivasan, T. N., J. Whalley, and I. Wooton, 1993, Measuring the effects of regionalism on trade and welfare, in Regional integration and the global trading system in K. Anderson and R. Blackhurst (eds.), Harvester Wheatsheaf.

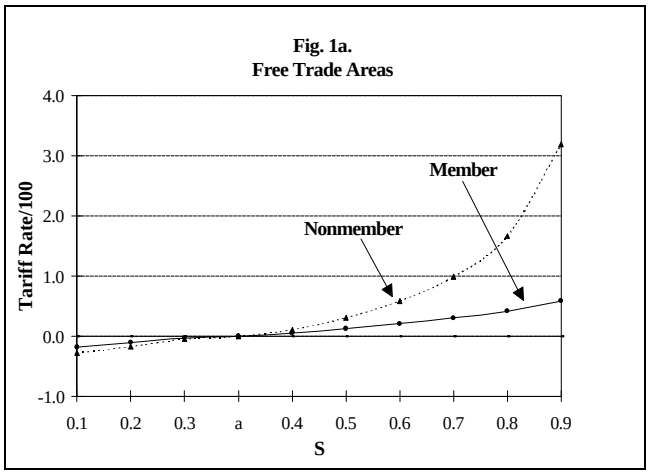
Syropoulos, C., 1995, Customs unions and comparative advantage, mimeo, Pennsylvania State University.

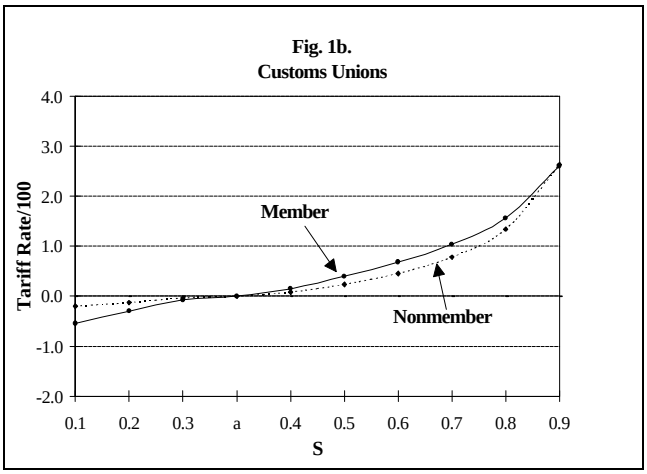
Viner, J., 1950, The customs union issue, Carnegie Endowment for International Peace.

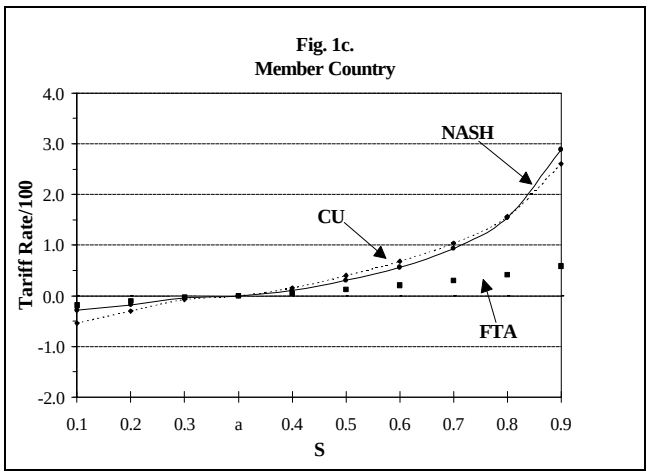
Winters, L. A., 1997, Regionalism and the rest of the world, Review of International Economics, forthcoming.

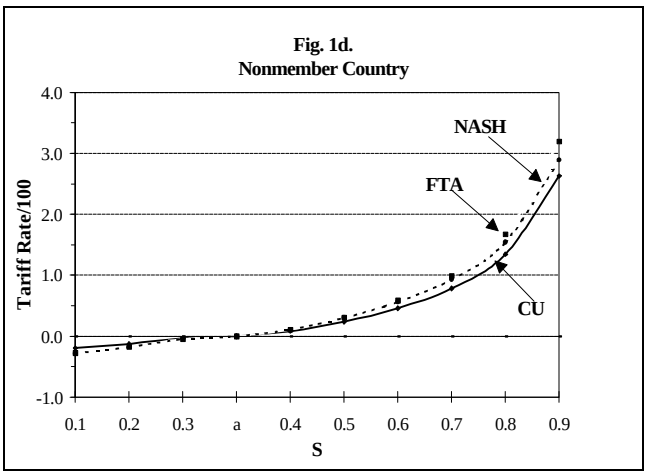
Figure 1: Tariff Rates

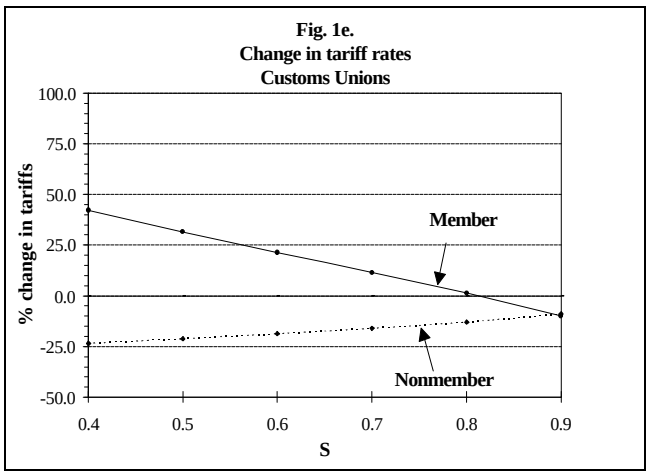
World Trade Organization, 1995, Regionalism and the world trading system, WTO, Geneva.

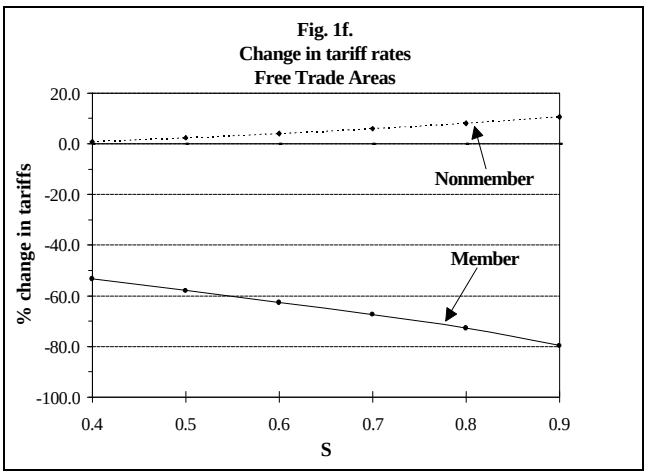






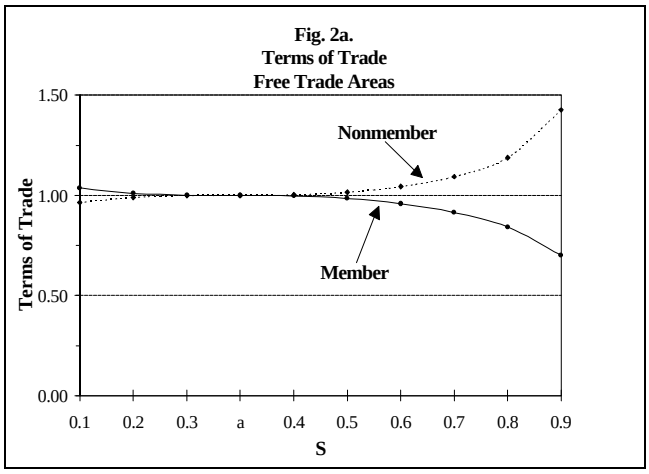


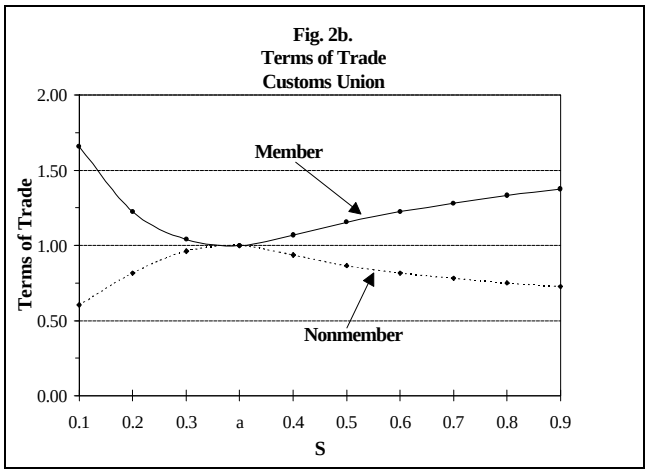


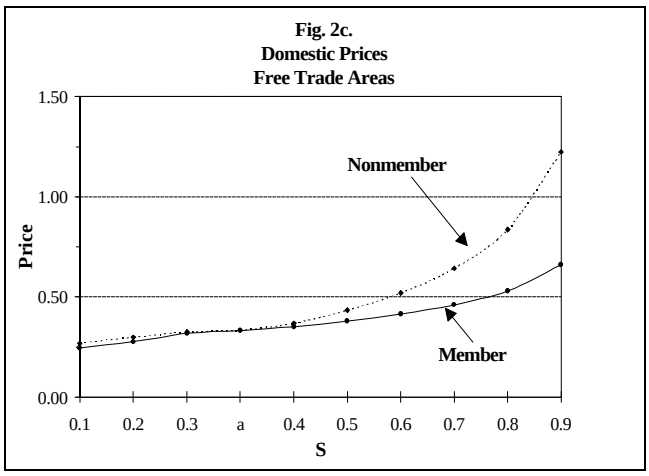


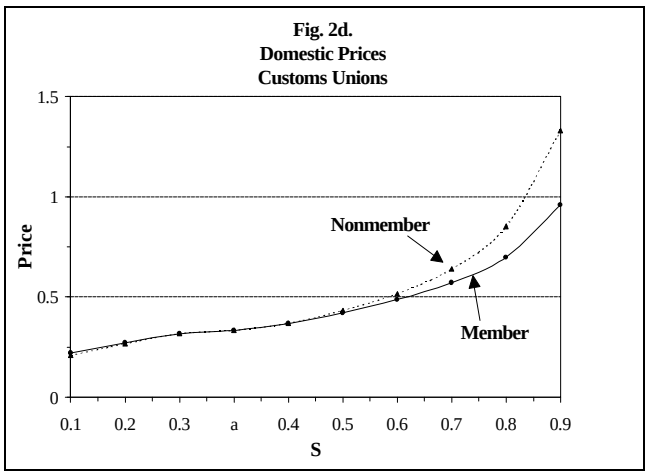
In figures e and f, percentage changes in tariff rates when countries move from NE to CU and FTA are presented. See section 4.1 for details.

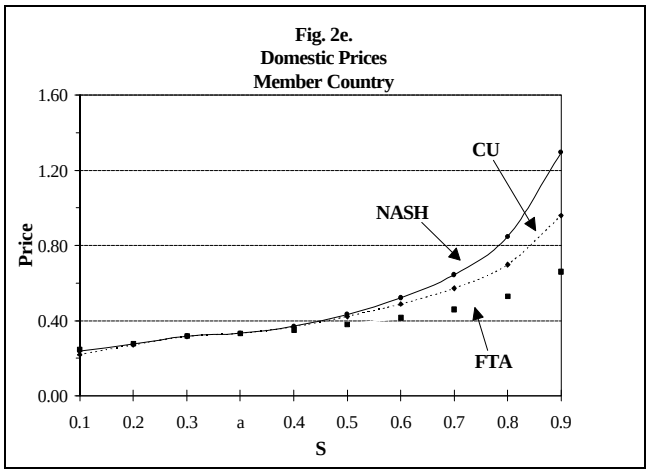
Figure 2: Prices

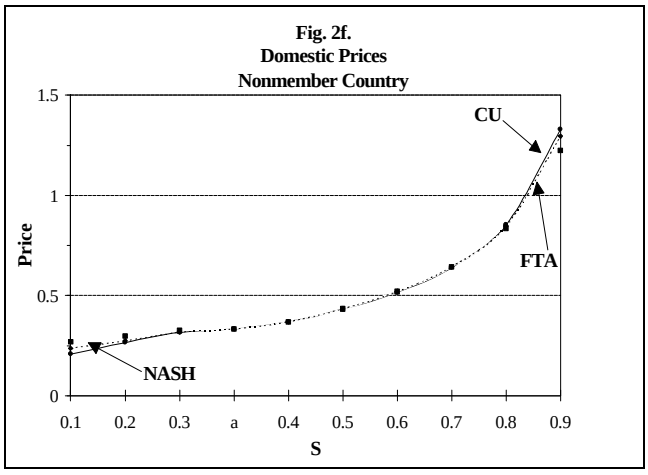






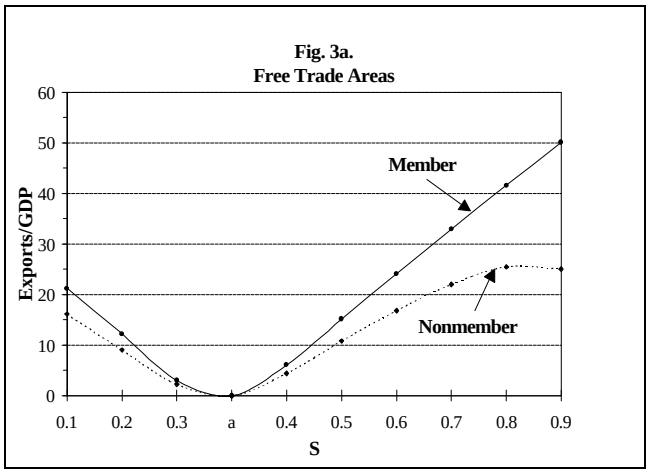


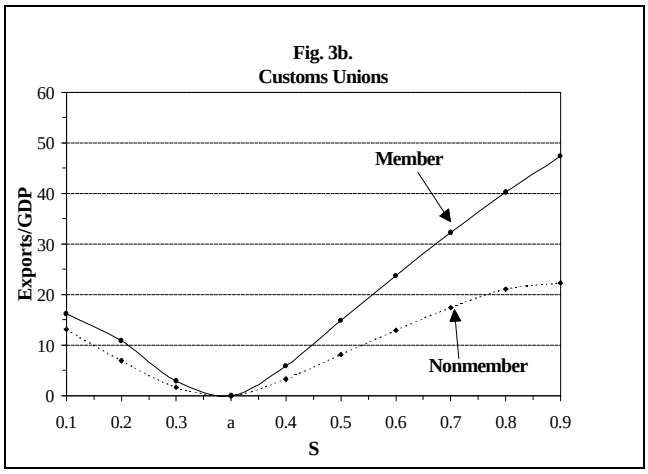


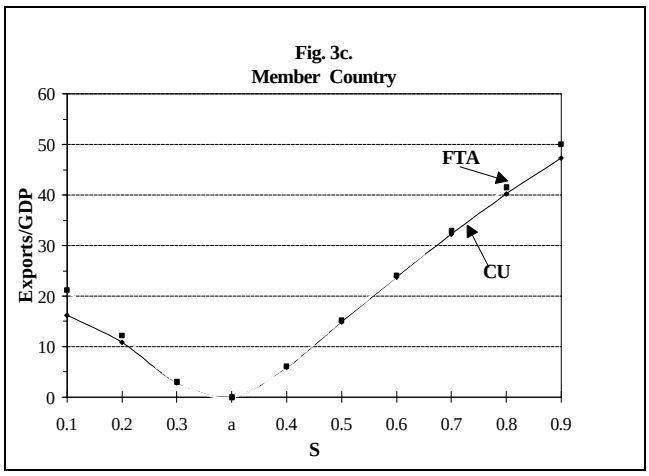


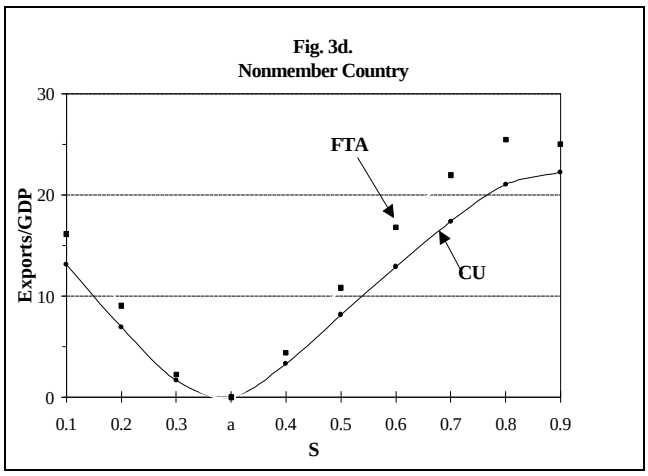
The terms of trade refers to the ratio of the price of export good to the price of import good. Domestic prices refer to the prices of imported goods. See section 4.1 for details.

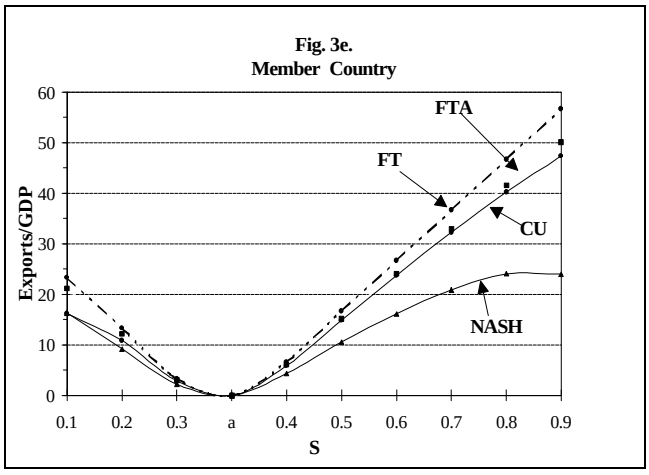
Figure 3: Trade Volume

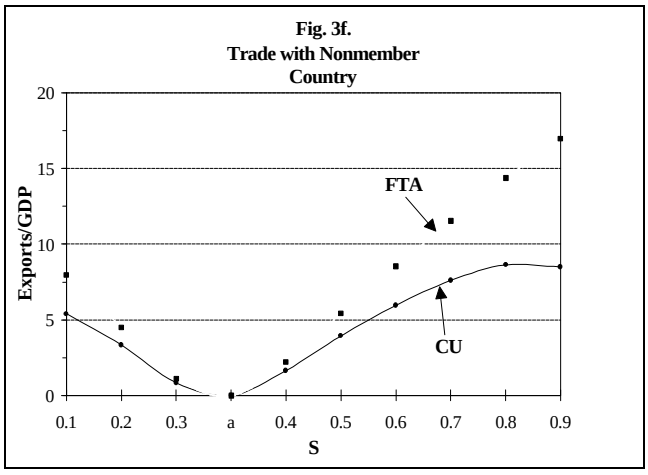






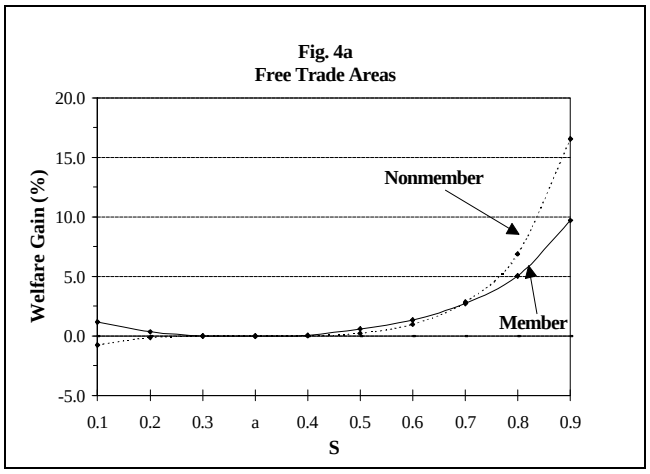


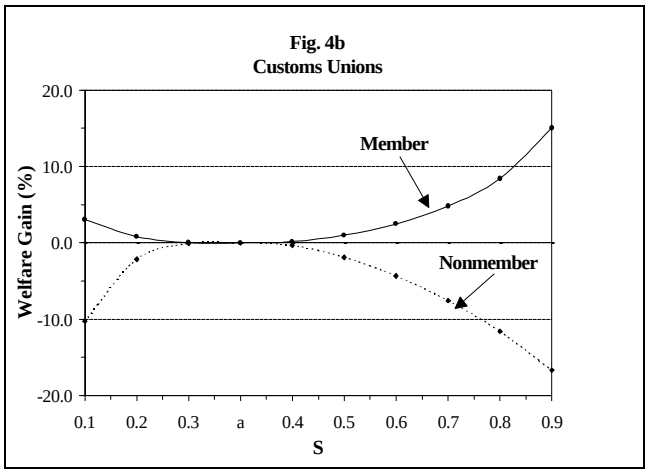


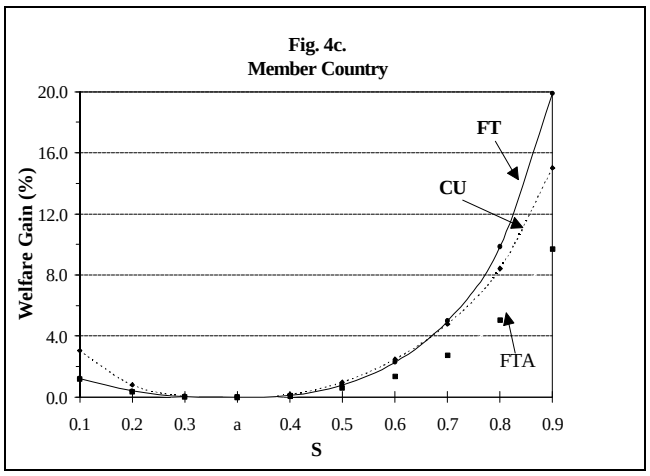


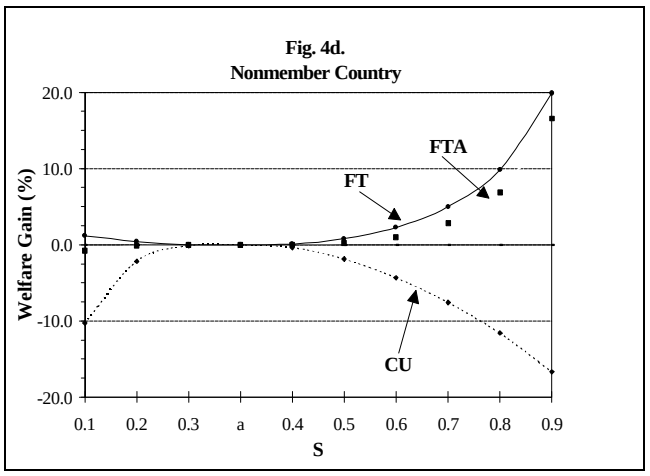
See section 4.1 for details.

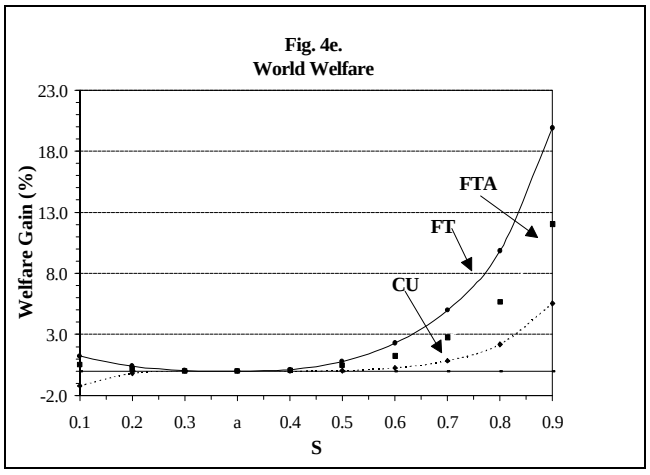
Figure 4: Welfare Changes

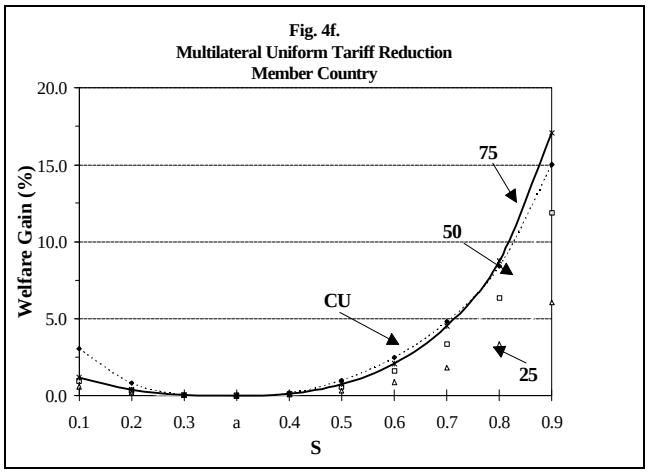












These figures refer to aggregate welfare changes described in section 4.2. See footnote 20 for an explanation of figure 4f.

Table 1
Welfare Change Decomposition
(in percent)

	FTA				CU			
	Nonmember		Member		Nonmember		Member	
S	TOT[1]	VOT[2]	TOT	VOT	TOT	VOT	TOT	VOT
0.1	49.352	50.648	19.025	80.975	50.785	49.215	53.894	46.106
0.2	47.245	52.755	10.577	89.423	47.079	52.921	48.334	51.666
0.3	44.275	55.725	2.695	97.305	43.992	56.008	42.653	57.347
0.4	43.462	56.538	-4.223	104.223	43.140	56.860	38.041	61.959
0.5	39.417	60.583	-11.581	111.581	38.480	61.520	30.840	69.160
0.6	36.428	63.572	-16.872	116.872	34.447	65.553	26.594	73.406
0.7	32.720	67.280	-21.409	121.409	31.174	68.826	19.338	80.662
0.8	28.692	71.308	-22.400	122.400	26.884	73.116	12.871	87.129
0.9	22.553	77.447	-20.384	120.384	21.189	78.811	6.558	93.442

[1] Percentage fraction of the welfare gain attributable to changes in terms of trade.
[2] Percentage fraction of the welfare gain attributable to changes in volume of trade.
The numbers in the gray shaded columns correspond to decomposition of welfare losses. See section 4.3 for details.