

WORKING PAPERS IN ECONOMICS

**A Theory of Exclusive
Trading Blocs**

by

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Abstract

Over the last decade the world trading system has seen a proliferation in regional trade agreements and a spate of requests for membership of the European Community. The purpose of this paper is to analyse the formation of trade blocs and what leads to their expansion. In the context of a general equilibrium model featuring imperfect competition, we show that both firms and consumers in new member countries unambiguously gain through trade bloc membership. For firms in existing trade bloc member countries however, the change in equilibrium operating profits initially increases with trade bloc size and then decreases as the bloc expands. Hence there exists an *optimal* trade bloc size for firms in existing member countries; the size at which the change in operating profits following the admission of a new member equals zero. Clearly trade bloc consumers prefer uninhibited expansion of the bloc, which places firms and consumers in conflict over the ideal size of the bloc. To overcome this opposition we consider ways in which existing firms might be compensated by those who gain from the enlargement. Where compensation is possible, the formation of a trading bloc combined with a system of lump-sum transfers might be considered a movement in the direction of free trade.

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1. INTRODUCTION¹

In recent years, trading relationships in the world economy have become increasingly regional in their focus. The European Community has grown in membership and moves to take in Eastern European members; the North American Free Trade Agreement may expand to include Latin American countries; and in the Asian Pacific, the APEC countries have committed to liberalising tariffs by early next century. The recent formation and enlargement of regional trade groupings has made the two fundamental questions of coalition formation, "Who does what with whom? (and) How does the formation or expansion of coalitions effect the welfare of individual countries, member nations and the global trading community?" (Kowalczyk (1990, 1)), as pressing as ever.

The inextricable link between these two questions is well established. In the case of customs unions or trade blocs, "who does what with whom" involves a group of countries agreeing to internal free trade while adopting common tariffs on trade with non-member countries. In terms of a customs union's impact on world welfare, Kemp and Wan (1976) have shown that a customs union can leave every country, whether a member of the union or not, no worse off than before while making some member countries better off. Where the union sets its common tariffs equal to the difference between the pre-union world prices and the post-union internal market clearing prices, the pre-union pattern of trade (and welfare) of non-member countries is preserved. As a result, there is no diversion of trade arising from the union's formation, only the creation of trade. Member countries who gain compensate, via a system of lump-sum transfers, member countries who lose in the union's formation. A customs union thereby has the potential to propel the world towards free trade, since in each enlargement, no country loses and some member countries actually gain.

As noted by Bergsten (1991, 53), "Regional trading arrangements are clearly going to happen." This paper's contribution is the development of a theory of trade bloc formation,

¹I acknowledge with gratitude the useful comments of Ross Milbourne, Donald Wright and Murray Kemp.

enlargement, and size that is based solely on the economic gains of trade bloc membership to consumers and firms. Trade bloc formation is explained in this paper by the unambiguous gains to firms and consumers in founding member countries. The unambiguous gains from trade bloc entry lure countries to enter the bloc which results in growth of the bloc. This growth then generates gains to existing member countries. However, disagreement between firms and consumers over what is the *ideal* size of the bloc occurs because the operating profits of existing trade bloc firms at first increase with trade bloc expansion but then decrease. The size at which the change in operating profits is zero (the slope of the profit function) occurs at a membership size smaller than worldwide membership. Given trade bloc consumers prefer uninhibited expansion, disagreement arises between firms and consumers over the preferred size of the bloc.

Using the Pareto criterion, we consider whether trade bloc expansion could occur via the winners from trade bloc enlargement compensating the losers in the form of lump-sum transfers, as envisaged by Kemp and Wan (1976). We find that firms from the new entrant country are the only group who can unambiguously compensate existing trade bloc firms. While making these compensatory payments permits entry, it is not the best strategy for non-trade bloc firms since they do better through their country forming or entering an alternate bloc whose membership is less than the optimal size.

The paper is organised as follows: Section two discusses some of the existing literature on trade bloc size. Section three develops a simple model of a trade bloc that was first conceived by Baldwin (1993) and adapted from Krugman's (1991a) framework which was used to analyse issues in economic geography. In this section we show that there are unambiguous gains for firms and consumers in countries which partake in the bloc's formation and for those who subsequently enter. We also outline the effect of membership expansion on firms and consumers in existing member countries. In section four we consider the possibility of the winners from trade bloc enlargement compensating the losers from enlargement. Section five offers some concluding comments.

2. THE LITERATURE ON TRADE BLOC SIZE

According to early work on customs unions by Viner (1950), the formation of a trade bloc gives rise to trade creation and trade diversion. Trade diversion entails a shift in the location of production from the least-cost source of supply outside the bloc to a high-cost source inside the bloc. Trade creation involves a shift in the location of production from a high-cost source within a member country to a low-cost source in another member country. The consolidation or fragmentation of trade blocs results in trade diversion and trade creation, with the effect on world welfare equalling the net of trade diversion and trade creation.

Krugman (1991b) suggests the relationship between world welfare and the number of blocs is U shaped because the consolidation of blocs generates a greater amount of trade diversion than trade creation, except in movements to fewer than three blocs. This relationship between welfare and trade bloc size implies that, as the number of blocs approaches three, free trade becomes relatively more attractive than a world of trading blocs. The U shape relationship can be attributed to the assumption that every country produces a differentiated product, which is an imperfect substitute for any other country's product. Given trade arises from the demand for each country's unique good, every increase in the symmetric size of blocs diverts more trade than it creates, since the number of countries (goods) outside the bloc is greater than the number inside, except in movements to fewer than three blocs. This finding is independent of blocs setting tariffs optimally, which serves only to reinforce trade diversion arising from enlargements.

Where trade between blocs is due to comparative advantage, blocs may set lower optimal external tariffs as they expand in size, thereby raising world welfare (Sinclair and Vines (1995)). Once some of the strong symmetry assumptions are relaxed, for example by introducing a distribution of factor endowments amongst countries, the monotonicity of global welfare as the number of blocs changes disappears (Srinivasan (1993)).

The literature that has emerged on trading blocs has taken trade bloc size to be determined exogenously in strategic tariffs setting models (Krugman (1991a,b)), or moving towards global membership along the lines of Kemp and Wan (McMillan (1993), Kowalczyk and Sjoström (1994)). In a companion paper, Cumberworth and Milbourne (1996) show the optimal trade bloc size to be less than global membership. Their analysis combines an economic framework based on Krugman (1991a) and a political economy setting adapted from Helpman and Grossman (1996) to determine the optimal size of the bloc. In the present paper, we employ a similar economic framework but include transport costs, and apply the Pareto criterion to determine trade bloc size, introducing a system of lump-sum transfers between the winners from enlargement and those who lose.

In a model in which external tariffs are held constant, Bond and Syropoulos (1993) show that blocs will have an incentive to increase their size relative to other blocs. Their work suggests there is an optimal trade bloc size for consumers, but do not solve for this size. Starting from any symmetric Nash equilibrium in which blocs impose optimal tariffs, Bond and Syropoulos show member welfare can be increased by expanding the relative size of the bloc. A relative expansion of the bloc improves the bloc's terms-of-trade due to greater consumption of trade bloc goods. Member country welfare increases provided the bloc sets tariffs below the optimal level while the tariffs of remaining blocs are held constant. Where the terms of trade effect offsets negative effects arising from trade diversion at constant terms of trade, there is an incentive for blocs to expand to the size that maximises the welfare of member countries, potentially raising their welfare above the free trade level.

Further work on trade blocs by Baldwin (1993) considers why countries appear eager to liberalise tariffs regionally but are reluctant to do so multilaterally. Baldwin shows that regional trade liberalisation, in the form of EC expansion, makes non-membership increasingly costly for firms outside the bloc, thus generating requests for membership among some non-member countries. Baldwin assumes that the supply of EC membership is

perfectly elastic and that governments maximise an objective function which comprises aggregate consumer welfare, the interests of firm owners and those opposed to entry.

In Baldwin's framework, when the economic gains from membership exceed the political resistance to entry, countries apply for membership. In the absence of political opposition to entry, which varies across economically symmetric countries, membership would expand uninhibited. In contrast to Baldwin's conclusion, this paper illustrates that trade bloc firms oppose the continual enlargement of the trade bloc on *economic* grounds, since expansion of the bloc above a certain size reduces their economic rents. The opposition of trade bloc firms to continued expansion conflicts with the desire of consumers for uninhibited expansion, and gives rise to a theory of trade bloc *size* which is smaller than world wide membership.

3. THE GAINS FROM MEMBERSHIP OF A TRADE BLOC

3.1 The Model

We start with a world comprising g countries, h of whom decide to form a trade bloc (TB), leaving $g-h$ remaining as non-trade bloc (NTB) countries. Initially countries impose a *common* tariff on imports from other countries, and we assume countries are bound by an agreement not to increase tariffs against other countries. Each country comprises two sectors, the first sector produces a number of differentiated products with each firm's production subject to internal economies of scale. The second sector produces a *homogeneous good under constant returns to scale*. For exposition, the first sector is referred to as manufacturing and the second sector as agriculture. Competition in the manufacturing sector takes the form of Dixit-Stiglitz (1977) monopolistic competition with firms having some degree of market power depending on elasticity of substitution between varieties. The number of firms is determined exogenously, thereby preventing freedom of entry from driving profits to zero, and making the framework one of differentiated product oligopoly.

Within each country there are K manufacturing firms and, with a world population of g countries, there is a total of gK manufactured goods. Production technology is identical across all firms, and individuals in each country have the same preferences over goods. Firms producing the agricultural good employ only labour in production, and one unit of labour produces one unit of the agricultural good. The price of the agricultural good therefore equates with the wage rate. We assume free trade in agriculture; that the agricultural good is produced in each country; and that every country either imports or exports the good. These assumptions ensure the agricultural good carries the world price in every country. By normalising the price of the agricultural good, it carries a domestic and world price of one. Finally, by assuming complete mobility of labour between sectors within each country, the wage rate is one in both sectors and all countries.

Each country comprises a population of firm owners (K), where $k=1, \dots, K$, and L labourers where $l=1, \dots, L$. The preferences of firm owners and labourers are, respectively,

$$\begin{aligned} U^k &= C_A \\ U^l &= C_A^{1-\lambda} C_M^\lambda ; \quad C_M = \left[\sum_{i=1}^{gk} c_i^{(\sigma-1)/\sigma} \right]^{\sigma/(\sigma-1)} \\ \sigma &> 1, \quad 0 < \lambda < 1 \end{aligned} \quad [1]$$

where C_A denotes the agricultural good, and C_M is a subutility function of manufactured goods. To simplify calculation of the general equilibrium demand patterns, there is only one firm owner per firm and firm owners consume only agricultures.² Given labourers have Cobb-Douglas preferences, we draw on the well known result that the proportion of income a labourer spends on the agricultural good is $1-\lambda$, and on manufactures is λ . Labourers' preferences over manufactured goods take the form of a constant elasticity of substitution utility function C_M , where σ is the elasticity of substitution between any two varieties of

² Were the firm owner to consume some of the manufactures her firm produces, profit maximising behaviour by the firm would not be consistent with the firm owner's utility maximisation.

manufactured goods. Given labourers consume both manufactured goods and the agricultural good, we refer to them as *consumers*.

A typical consumers' utility maximisation involves solving the problem backwards, beginning with the second stage of maximising

$$C_M = \left[\sum_{i=1}^{gK} c_i^{(\sigma-1)/\sigma} \right]^{\sigma/(\sigma-1)} \quad \text{subject to} \quad \lambda = \sum_{i=1}^{gK} p_i c_i$$

which yields a demand function for a typical manufactured good, good j , of the form

$$c_j = \left[\frac{p_j}{P} \right]^{-\sigma} \lambda, \quad \text{where} \quad P = \left[\sum_{i=1}^{gK} (p_i)^{1-\sigma} \right]^{-\frac{1}{\sigma}} \quad [2]$$

In [2], P represents a price index made up of gK manufactured goods' prices, and p_j denotes the price of manufactured good j . Solving the first stage of the consumer's maximisation problem, the consumer chooses an expenditure allocation which maximises overall welfare subject to the overall budget constraint. This choice yields a demand function for a typical agricultural good of the form $C_A = 1 - \lambda$ as the price of the agricultural good and wage are one. With regard to firm owners, a typical firm owner's demand for the agricultural good is $C_A = \Pi$, where Π denotes the profits of a manufacturing firm, all of which are spent on agricultures. Aggregate domestic demand for a typical manufactured good is Lc_j , given the assumption that the population of labourers in each country is L . Aggregate demand for the agricultural good is $K\Pi + (1-\lambda)L$, since each country has a population of K firm owners.

To model intra-bloc trade and non-intra-bloc trade, we introduce trade costs for manufactured goods shipped between any two countries. Trade costs consist of both transportation costs and tariffs, the latter depending on the trading status of countries. Trade costs take the form of Samuelson's iceberg costs, where shipping the good between any two

countries melts a fraction of the shipment. Hence for one unit of the good to arrive in a foreign market, more than one unit must originally have been shipped. Trade between two member countries requires $\mu > 1$ units of the good to be shipped in order for one unit to arrive. Intra-bloc trade costs do not equal one since transport costs are present in intra-bloc trade. Non-intra-bloc trade requires $\tau > 1$ units of the good to be shipped in order for one unit to arrive. There are no trade costs for domestic sales. The essence of trade-bloc membership is the difference in trade costs for intra-bloc trade of $\tau > \mu$. Tariff revenue received by the government is assumed to be spent on some public good which does not impact consumers' optimising decisions.

Firm owners produce manufactured goods under increasing returns to scale in which there are decreasing average costs and a constant marginal cost. All firms incur a fixed cost of production in terms of labour equal to α , which can be thought of as the cost of producing a different variety. The labour input requirement for a typical variety j is $l_j = \alpha + \beta q_j$, where $\alpha, \beta > 0$ and q_j is the output of variety j . The total cost of producing variety j therefore takes the form $TC_j = \alpha + \beta q_j$, since the wage rate is one. Increasing returns to scale is captured in the form of a decreasing average cost function; $AC_j = \frac{\alpha}{q_j} + \beta$.

In producing a variety of manufacture, the typical manufacturing firm j maximises profits on three different types of markets; a home market, non-trade bloc (NTB) export markets and trade bloc (TB) export markets. Profits on each market are defined as

$$\Pi^j = p_j(q_j)q_j - \beta tq_j - \alpha \quad [3]$$

where t , which denotes the trade costs of shipping one unit of the good, depends on the designated market. With the three types of markets, domestic, NTB and TB, the operating profits earned in each market are a function of the trade costs of the particular market. Differentiating with respect to q_j and setting the wage rate equal to one and then re-

arranging yields $p_j(1 - \frac{1}{\varepsilon_p}) = \beta t$, where ε_p is the price elasticity of demand faced by the manufacturing firm producing variety j . We assume that when firm j contemplates varying its output, it does so on the supposition that other firms do not change their outputs.

Following Helpman and Krugman (1985), the price elasticity of demand is defined as

$$\varepsilon_p = \sigma + (1 - \sigma) \frac{p_j^{1-\sigma}}{\sum_{i=1}^{gK} (p_i)^{1-\sigma}} \quad [4]$$

where i is a variety of the set of gK manufactured goods. Where the number of varieties of manufactured goods (gK) is large, we assume that firms disregard the second component of the elasticity term, taking σ to be the elasticity of demand it faces.³ Making use of the constant elasticity of demand facing firm j , the first order condition to the firm's profit maximisation problem in each market can then be written as

$$p_j(1 - \frac{1}{\sigma}) = \beta \quad \text{for home sales} \quad [5]$$

$$p_j(1 - \frac{1}{\sigma}) = \beta\tau \quad \text{for NTB sales} \quad [6]$$

$$p_j(1 - \frac{1}{\sigma}) = \beta\mu \quad \text{for TB sales where } j \text{ resides in a TB country} \quad [7]$$

The assumption of segmented markets in conjunction with a constant marginal cost of production allows the separation of the first order conditions for each of the three markets. Where firm j resides in a NTB member country, the first order condition for sales to NTB markets and TB markets are identical, given by [6]. For analytical convenience, we measure manufactured goods in units such that the unit input coefficient "beta" equals $\frac{\sigma - 1}{\sigma}$. The

³ The σ approximation is precise only where the set of potential varieties is a continuum and the set of available varieties is of a non-zero measure.

optimising firm therefore charges a unit price for domestic sales, a price of μ for intra-bloc sales and a price of τ for NTB sales as in Baldwin (1993). Note that the firm receives the same "free on board" price of one for all sales *regardless* of their destination, except that the number of sales on each type of market varies with the firm's competitiveness. Operating profits, which are profits gross of fixed costs, for firm j , are

$$\Pi^j = \sum_{m=1}^g [(p_{jm} - \beta t_m) q_{jm}]$$

where m is an index for market type. Given firm j faces an isoelastic demand curve, and making use of first-order conditions [5]-[7], firm j 's operating profits can be rewritten as

$$\Pi^j = \sum_{m=1}^g \left[\frac{p_{jm} q_{jm}}{\sigma} \right] \quad [8]$$

To consider what impact the formation of TBs might have on the process of multilateral trade liberalisation, we begin by considering a world without TBs. This situation is referred to as a zero TB world. In total, each firm sells on $g-1$ foreign markets and one domestic market, with the demand in each type of market given by substituting the relevant price into (2). Consumers in a TB country buy K domestic goods at price $p=1$ and K goods from each of the $g-1$ countries at price $p=\tau$. It follows from (2) that the price index in a world without blocs is

$$P_{non} = [K(1 + (g-1)\tau^{1-\sigma})]^{-\frac{1}{\sigma}} \quad [9]$$

Operating profits of a typical firm, Π_{0tb}^j , are the sum of operating profits earned on the home market and on $g-1$ foreign NTB markets;

$$\Pi_{0tb}^j = \left[\frac{1}{P_{non}} \right]^{-\sigma} \lambda L \left(\frac{1}{\sigma} \right) + \left[\frac{\tau}{P_{non}} \right]^{-\sigma} \lambda L \tau \left(\frac{1}{\sigma} \right) (g-1) \quad [10]$$

Making use of the definition of the NTB price index P_{non} , [10] can be reduced to

$$\Pi_{0tb}^j = \frac{\lambda L}{\sigma K} \quad [11]$$

Expression [11] is a function of the manufactures expenditure share in each country λ ; the elasticity of substitution between any two varieties of manufactures σ ; the number of firms in each country K ; and the population of consumers in each country L . In [11], a firm's equilibrium operating profits do not depend on the manufactures price index because firms are identical, facing a common price index on both home and foreign markets of P_{non} .

We now consider the initial welfare of firm owners and consumers in a typical country in a world before the formation of a TB. A typical TB firm owner receives profits of Π_{0tb} as her income, and spends these profits on the agricultural product. Her initial consumption of agriculture is $C_A = \Pi_{0tb}$ and substituting this consumption into the utility function gives $V_{0tb}^k = \Pi_{0tb}$. A consumer in country j consumes K domestic manufactures, and K manufactures from each of the $g-1$ countries. Her consumption of domestic and foreign manufactures is $\left[\frac{1}{P_{non}} \right]^{-\sigma} \lambda K$, and $\left[\frac{\tau}{P_{non}} \right]^{-\sigma} \lambda (g-1) K$ respectively. Substituting manufactures consumption into the subutility function, simplifying, and then substituting into [1] together with the agriculture consumption yields the indirect utility

$$V_{0tb}^l = (1 - \lambda)^{1-\lambda} (\lambda P_{non}^{-\sigma/(\sigma-1)})^\lambda \quad [12]$$

3.2 The Effect of Trade Bloc Membership on a Founding Member Country

Suppose a group of countries decide to form a TB by removing all tariffs on intra-bloc trade, how then does trade bloc membership effect the profits of firms and the welfare of consumers in a founding member country? With the formation of a trading bloc of h initial members, the population of non-member countries falls to $g-h$. Consumers in a founding member country face a new manufactures price index P_{tb} comprising K home manufactures priced at one, K imported manufactures from each of the $g-h$ NTB countries priced at τ , and

K imported manufactures from each of the original $h-1$ TB member countries priced at μ . Note that P_{tb} is smaller than P_{non} by $K(h-1)(\mu^{1-\sigma} - \tau^{1-\sigma})$. It follows from (2) that the price index in TB member countries is

$$P_{tb} = [K(1 + (g-h)\tau^{1-\sigma} + (h-1)\mu^{1-\sigma})]^{-\frac{1}{\sigma}} \quad [13]$$

Following the TB's formation, a typical firm in member country sells on its home market, $g-h$ NTB markets and $h-1$ TB markets, since country j itself is a member country. Operating profits for a typical firm, firm j , in a founding member country, are

$$\Pi_{tb}^j(h) = \left[\frac{1}{P_{tb}}\right]^\sigma \lambda L \left(\frac{1}{\sigma}\right) + \left[\frac{\tau}{P_{non}}\right]^\sigma \lambda L \tau \left(\frac{1}{\sigma}\right) (g-h) + \left[\frac{\mu}{P_{tb}}\right]^\sigma \lambda L \mu \left(\frac{1}{\sigma}\right) (h-1) \quad [14]$$

The difference in equilibrium operating profits for firm j between being in a founding TB member country and being in a world without TBs is therefore

$$\Pi_{tb}^j(h) - \Pi_{0tb}^j = \frac{\lambda L}{\sigma} (P_{tb}^\sigma - P_{non}^\sigma) + (h-1) \frac{\lambda L}{\sigma} (P_{tb}^\sigma \mu^{1-\sigma} - P_{non}^\sigma \tau^{1-\sigma}) \quad [15]$$

The first term in [15] represents the change in operating profits earned on firm j 's home market. The term is negative since P_{tb} is smaller than P_{non} . Following the bloc's formation, firm j is less competitive on its home market relative to TB firms which now sell at the intra-bloc price on j 's domestic market. We denote the decline in competitiveness and profits of the new member firm on its home market as the *home market* effect. The effect entails intra-bloc trade diversion, since the domestic sales of firms in the new member country are diverted to firms in existing trade bloc member countries.

The second term in [15] represents the difference in profits firm j earns on $(h-1)$ TB markets following the bloc's formation. The improvement in firm j 's competitiveness on trade bloc markets relative to TB firms and NTB firms leads to higher profits, and thus this term is

positive. We denote the increase in competitiveness and profits of the new member firm on the markets of TB member countries as the *trade bloc market* effect. Both intra-bloc and extra-bloc trade diversion occur in this effect, since the sales of firms in existing member countries and non-member countries are diverted to firms in the new member country.

The entry into the bloc involves a decrease in the relative competitiveness of new member firms on their home market and an increase in relative competitiveness on TB markets. The counterpart of the decrease in home market sales of new member firms is the increase in sales of existing trade bloc firms. In other words, what is the home market effect to the new member firm is the trade bloc market effect to existing member firms. Similarly, increased trade bloc market sales of new member firms due to the trade bloc market effect is the equal of the decrease in domestic market sales of existing trade bloc firms and trade bloc market sales of non-member firms.

There is no difference in profits earned on the $(g-h)$ NTB markets so these two terms drop out. After considerable manipulation, [15] can be simplified to

$$\Pi_{tb}^j(h) - \Pi_{0tb}^j = \frac{\lambda L (g-h) \tau^{1-\sigma} K (h-1) (\mu^{1-\sigma} - \tau^{1-\sigma})}{\sigma P_{non}^{-\sigma} P_{tb}^{-\sigma}} \quad [16]$$

Where the number of founding member countries is smaller than the number of countries in the world, expression [16] is clearly positive, implying the increase in sales of firm j on each of the $(h-1)$ TB markets is greater than the loss in domestic sales of firm j to each of the $(h-1)K$ existing TB firms. A typical firm in a founding member country therefore earns a higher level of operating profits in equilibrium and has an incentive to lobby its government for TB membership. Due to the symmetry of firms, every non-member firm would gain through TB membership and lobby for their country to obtain TB membership.

Focusing on consumer welfare, a typical consumer in a founding member country consumes K home manufactures, K manufactures from each of the $(g-h)$ NTB countries, and K manufactures from each of the $(h-1)$ TB countries. Following the formation of the bloc and the removal on the tariff on trade between member countries, consumption of domestic manufactures is $[\frac{1}{P_{tb}}]^{-\sigma} \lambda K$, consumption of TB manufactures is $[\frac{\mu}{P_{tb}}]^{-\sigma} \lambda K(h-1)$ and consumption of NTB manufactures is $[\frac{\tau}{P_{tb}}]^{-\sigma} \lambda K(g-h)$. Substituting these consumption levels into the subutility function and simplifying yields $C_M^{tb} = \lambda P_{tb}^{-\sigma/(\sigma-1)}$. The fall in the price of TB manufactures has no effect on the consumer's agriculture consumption in a founding member country because the positive income effect perfectly offsets the negative substitution effect; a property of the consumer's Cobb-Douglas preferences. Substituting the consumption levels of manufactures and agriculture into the utility function yields a typical consumer's utility in a TB member country;

$$V_{tb}^l(h) = (1-\lambda)^{1-\lambda} (\lambda P_{tb}^{-\sigma/(\sigma-1)})^\lambda \quad [17]$$

Since the manufactures price index in member countries P_{tb} is smaller than P_{non} , the utility of consumers in TB countries is greater than that of consumers in NTB countries. This increase in TB consumer welfare occurs because the consumer in the new member country now purchases $(h-1)K$ TB manufactures at a price of μ , formerly purchased at price of τ .

Summarising, a country's participation in the formation of a trade bloc clearly makes both firms and consumers better off. Consequently, firm owners and consumers both desire trade-bloc membership, making a world without TBs inherently unstable. The unambiguous gains to firms and consumers therefore leads to the formation of trade blocs. Whether blocs subsequently grow in size depends on the effects of TB expansion on existing TB member firms and consumers, which we now discuss.

3.3 The Effect on Trade Bloc Expansion on Existing Trade Bloc Member Countries

Before accepting any new members into bloc h , an existing firm in the bloc, firm j , earned operating profits given by [14]. Following the entry of a new member into bloc h , a typical firm sells to one less NTB market and one more TB market, so that operating profits are

$$\Pi_{tb}^j(h+1) = [\frac{1}{P_{tb+1}}]^{-\sigma} \lambda L (\frac{1}{\sigma}) + [\frac{\tau}{P_{non}}]^{-\sigma} \lambda L \tau (\frac{1}{\sigma}) (g-h-1) + [\frac{\mu}{P_{tb+1}}]^{-\sigma} \lambda L \mu (\frac{1}{\sigma}) h$$

The difference in equilibrium operating profits following the entry of a new member is then

$$\Pi_{tb}^j(h+1) - \Pi_{tb}^j(h) = \frac{\lambda L}{\sigma} [P_{tb+1}^\sigma - P_{tb}^\sigma] + \frac{\lambda L}{\sigma} [P_{tb+1}^\sigma \mu^{1-\sigma} - P_{non}^\sigma \tau^{1-\sigma}] + (h-1) \mu^{1-\sigma} \frac{\lambda L}{\sigma} [P_{tb+1}^\sigma - P_{tb}^\sigma] \quad [18]$$

The first term in [18] represents the difference in profits earned on the home market attributable to the admission of a new member and is negative. The *home market* effect involves a reduction in firm j 's home market competitiveness relative to firms in the new member country who now sell at the intra-bloc price μ . The second term in [18] represents the increase in profits on the new TB member's market. The increased competitiveness of an existing TB firm relative to both firms in the new member country and firms in non-member countries on this new TB market generates higher profits for firm j . The third term in [18] represents the difference in profits earned on the existing $h-1$ TB members' markets. The term is negative since firm j is less competitive on these TB markets relative to firms in the new member country. There is no change in profits earned on the $g-h-1$ NTB markets and therefore, the difference in profits drops out in [18].

Following some simplification, expression [18] can be re-written as

$$\Pi_{tb}^j(h+1) - \Pi_{tb}^j(h) = \lambda L k \tau^{1-\sigma} (\mu^{1-\sigma} - \tau^{1-\sigma}) \left[\frac{P_{non}^{-\sigma} - h P_{tb}^{-\sigma}}{\sigma P_{tb+1}^{-\sigma} P_{tb}^{-\sigma} P_{non}^{-\sigma}} \right] \quad [19]$$

where f is the number of NTB countries, equal to $g-h$. Expression [19] is unambiguously positive where the following necessary and sufficient condition holds

$$fP_{non}^{-\sigma} > hP_{tb}^{-\sigma} \quad [20]$$

Given $P_{non} > P_{tb}$, [20] implies a necessary but not sufficient condition that the number of countries (firms) outside the bloc must be greater than the number of TB countries (firms) inside the bloc for profit increases on the new entrants' markets to outweigh the fall in profits on home and existing TB markets. In the case where there is more than one trading bloc, f represents the number of countries who non-members of trade bloc h but are potentially members of other blocs.

The incentive for bloc creation is dependent on firms in founding member countries earning higher operating profits upon formation. Substituting $h=1$ into [20] gives the change in profits when the TB increases in size from one (each country is a TB of size one) to two. We obtain $(f-1)P_{non}^{1-\sigma} > 0$, showing that firms in founding member countries earn higher profits following trade bloc formation. To see the effect on the equilibrium operating profits of continual expansion of the bloc, we take the derivative of [14] with respect to trade bloc size;

$$\Pi'_{TB}(h) = \frac{L\lambda}{\sigma} \left[\frac{\mu^{1-\sigma}}{P_{tb}^{-\sigma}} - \frac{[1+(h-1)\mu^{1-\sigma}]k(\mu^{1-\sigma} - \tau^{1-\sigma})}{P_{tb}^{-2\sigma}} - \frac{\tau^{1-\sigma}}{P_{non}^{-\sigma}} \right] \quad [21]$$

In (21), the first term in the large brackets denotes the increase in profits earned on the new TB member's market; the second term denotes the combined reduction in profits on the home market and $(h-1)$ TB markets, where manufactures are priced at one and μ on the domestic and TB markets, respectively. The last term denotes the loss of profits from selling to one less NTB market. The sign of [21] is ambiguous, implying there exists a range of TB sizes for which operating profits are increasing and decreasing.

Intuitively, the TB will stop short of expanding to allow every country to enter, since the competitive advantage firms inside the bloc have on TB markets and their domestic market relative to NTB firms would be eliminated. But why would TB expansion stop short at a size smaller than the number of non-member countries still outside the bloc? When TB membership expands, a typical firm in an existing member country acquires a competitive advantage on the new member country market over firms in non-member countries who continue to sell at the non-intra-bloc price. Yet the existing TB firm loses some of its home market competitive advantage and all of its competitive advantage on existing TB markets relative to the new K TB firms. A prerequisite for the enlargement to *potentially* raise a TB firm's profits is that the number of firms the TB firm continues to hold a competitive advantage over be greater than the number of firms it no longer holds a competitive advantage following the enlargement.

To solve for the bloc's size at which the change in the operating profits of a TB firm is zero, we set (21) equal to zero and rearrange to obtain

$$h^* = \frac{[1+(g-1)\tau^{1-\sigma}][1+(g-1)\mu^{1-\sigma}]^{\frac{1}{2}} - (1+g\tau^{1-\sigma} - \mu^{1-\sigma})}{\mu^{1-\sigma} - \tau^{1-\sigma}} \quad [22]$$

The trade bloc size h^* represents the size that maximises the operating profits of existing TB firms, denoted by $\Pi_{TB}(h^*)$. It is therefore the optimal size of the bloc for existing TB firms, resulting in opposition to any enlargement of the bloc beyond this size. Note that h^* depends only on the exogenous parameters of the model, and in particular, does not depend on j , the number of non-member countries of TB h . The reason for this property is that the entry of a new member country in no way effects the sales of existing TB firms on non-member countries' markets (some or all of whom are possible members of other blocs). Firms in the new member country, along with those in existing member countries, continue to sell on the markets of non-member countries at a price of τ .

Given the optimal size of a TB, can we determine the number of TBs the world will divide into? By substituting $f = g - h$ into the left-hand side of [20] and making use of the definition of P_{tb} , the condition for existing TB firm profits to increase following enlargement can be expressed as

$$(g - 2h)P_{non}^{-\sigma} > hk(h - 1)(\mu^{1-\sigma} - \tau^{1-\sigma}) \quad [20']$$

which implies the number of countries (firms) inside the TB must be smaller than one-half the total number of countries (firms) in the world. In light of [20'], which is a necessary but not sufficient condition for existing TB firm profits to increase through a TB enlargement, the optimal size of the TB is less than one-half the population of countries in the world. Therefore, at a minimum, the world must comprise three trade blocs.

Why will the number of trade blocs in the world be at least three? We know that trade blocs are identical in every aspect, and therefore h^* represents the optimal size for every trade bloc. The first bloc to form will have a membership size of less than one-half the world population of countries, as will the second. Those countries which do not enter either the first or second bloc will therefore enter or form a third bloc, resulting in a world comprising at least three blocs. Yet the third or final bloc to form may be smaller than the optimal size, since the total number of countries divided by the optimal size may not yield a whole number.

Turning to the effect of TB expansion on existing member countries consumers, the consumption of agricultures of a typical firm owner following enlargement is now $C_A = \Pi_{tb}(h + 1)$ where $\Pi_{tb}(h + 1)$ denotes the new level of operating profits. Substituting agricultures consumption into the utility function gives their new utility level $V_{tb}^k(h + 1) = \Pi_{tb}(h + 1)$ which is greater than their initial utility where $h < h^*$. Following an

enlargement of the TB, a consumer's manufactures consumption rises to $\lambda P_{tb+1}^{-\sigma/(\sigma-1)}$, with a consumer's utility increasing to

$$V_{tb}^l(h + 1) = (1 - \lambda)^{1-\lambda} (\lambda P_{tb+1}^{-\sigma/(\sigma-1)})^\lambda \quad [23]$$

Comparing [17] with [23] reveals that the typical consumer in an existing member country is better off following the entry of a new member country, since P_{tb+1} is smaller than P_{tb} .

Summarising, the effect of TB enlargement on firm owners and consumers in existing member countries clearly improves the welfare of consumers, while it is uncertain whether firm owners' welfare increases. Consumers as a group will therefore support TB enlargement, however, firm owners will only support trade bloc expansion where profits increase post-enlargement.

4. THE EFFECT OF COMPENSATION ON TRADE BLOC SIZE

In section 3.2 we showed that a world *without* trade blocs was unstable. Firms and consumers have a uniform incentive to form or enter a trading bloc. Once inside a bloc, firms increase their competitiveness on trade bloc markets relative to NTB and TB firms, and TB consumers purchase manufactures from member countries at cheaper prices. When the first bloc to form reaches h^* , the size at which the profits of existing TB firms decline with further increases in membership, existing TB firms want expansion to cease. Consumers and firms in countries outside the bloc however, want expansion to continue to include them as do TB consumers.

In order that Pareto improvements from forming customs unions should be possible, the classical theory of the gains from trade requires potential losers to receive compensating lump-sum transfers. Applying the compensation criterion used in welfare economics, we consider whether trade bloc sizes exist larger than h^* are *potential* Pareto improvements. This approach involves the winners from enlargement making compensating lump-sum

transfers to the losers from enlargement. Where the compensation of losers is possible, TB sizes greater than h^* will represent a potential Pareto improvement on h^* , since trade bloc firms are no worse off and firms in new member countries are better off. We confine our discussion to considering *potential* lump-sum transfers once inside the bloc, examining whether an increase in trade bloc size would be an improvement in terms of allocative efficiency. We examine the following three possibilities:

(i) TB consumers compensate existing TB firms

(ii) NTB consumers compensate existing TB firms

(iii) NTB firms compensate existing TB firms

(i) The first case we consider involves consumers within TB countries making lumps sum transfers to existing TB firms. These transfers compensate for the reduction in profits that an expansion of the bloc beyond h^* brings. The question then arises how large these payments could potentially be? The maximum monetary amount TB consumers would be willing to give up is the difference in expenditure which yields the new utility $U_{ib}(h^* + 1)$ and the original utility $U_{ib}(h^*)$ at constant relative prices, or the compensating gain $CG_{ib(h^*) \rightarrow ib(h^* + 1)}$. This amount would return them to their pre-enlargement welfare level.

The compensating gain is defined as

$$CG_{ib(h^*) \rightarrow ib(h^* + 1)} = E[P_{ib^* + 1}, U_{ib}(h^* + 1)] - E[P_{ib^*}, U_{ib}(h^*)]$$

where E denotes the expenditure function. Substituting in the functional forms for expenditure, simplifying further by replacing utility with the indirect utility function (expressions [23] and [17]), and cancelling terms yields

$$CG_{ib(h^*) \rightarrow ib(h^* + 1)} = 1 - \left(\frac{P_{ib^* + 1}}{P_{ib^*}} \right)^{\sigma\lambda/(\sigma-1)} \quad [24]$$

In (24) the term inside the large brackets is less than one (since $P_{ib^* + 1} < P_{ib^*}$), implying the difference in expenditure between achieving the post-enlargement utility ($U_{ib}(h^* + 1)$) and the pre-enlargement utility ($U_{ib}(h^*)$) is positive. Since TB consumers purchase K additional manufactures at the intra-bloc price following enlargement, a positive compensating gain would be expected. For consumers in existing member countries to make potential lump-sum transfers to TB firms, the compensation gains of Lh^* consumers must exceed the reduction in TB firm profits following enlargement, which is the condition

$$h^* L \left[1 - \left(\frac{P_{ib^* + 1}}{P_{ib^*}} \right)^{\sigma\lambda/(\sigma-1)} \right] > -h^* K \cdot L\lambda K\tau^{1-\sigma} (\mu^{1-\sigma} - \tau^{1-\sigma}) \left[\frac{jP_{non}^{-\sigma} - h^* P_{ib^*}^{-\sigma}}{\sigma P_{ib^* + 1}^{-\sigma} P_{ib^*}^{-\sigma} P_{non}^{-\sigma}} \right] \quad [25]$$

The right-hand side of (25) represents the (negative) change in profits due to an increase in trade bloc size from h^* to $h^* + 1$ [$\Pi_{ib}(h^* + 1) - \Pi_{ib}(h^*)$], premultiplied by $-h^* K$. The right-hand side of (25) is positive since h^* is the trade bloc size where the change in operating profits is zero, which implies enlargements beyond this size decrease profits. Whether (25) holds is ambiguous. Since there are $h^* L$ TB consumers who will potentially give up their compensating gains from enlargement, we can divide through by $h^* L$, which implies one TB consumer must compensate K TB firms. Each of these TB firms sells to g markets (comprised of a single consumer following the division by $h^* L$). As the bloc expands, the left-hand side of (25) decreases in size because the term $\left(\frac{P_{ib^* + 1}}{P_{ib^*}} \right)^{\sigma\lambda/(\sigma-1)}$ is increasing in h , while the right-hand side can be shown to be increasing in trade bloc size.⁴ As h increases, the compensating gains from expansion are smaller while the reduction in firm profits are larger. Hence the likelihood of the condition being met decreases as the bloc expands. Where the condition does not hold at size h^* , it certainly will not hold at larger sizes.

⁴ Dividing [25] through by $h^* L$, the derivative of the right-hand side of [25] with respect to h can be shown to be $-K \frac{\partial \Pi_{ib}(h^* + 1)}{\partial h}$, which is unambiguously greater than zero.

(ii) Suppose NTB consumers in a country seeking membership organise with the aim of compensating existing TB firms. What is the maximum monetary amount NTB consumers would be willing to offer as compensation for the reduction in existing TB firm profits? The maximum monetary amount TB consumers would be willing to give up is the difference in expenditure which yields the new utility $U_{tb}(h^* + 1)$ and the original utility U_{non} at constant relative prices, or the compensating gain $CG_{non \rightarrow tb(h^* + 1)}$. This amount would return them to their earlier NTB member welfare level. The compensating gain is

$$CG_{non \rightarrow tb(h^* + 1)} = E[P_{tb^* + 1}^* U_{tb}(h^* + 1)] - E[P_{tb^* + 1}^*, U_{non}]$$

By substituting in the functional forms for the expenditures, replacing utility with the indirect utility functions (expressions [23] and [12]), and simplifying yields

$$CG_{non \rightarrow tb(h^* + 1)} = 1 - \left(\frac{P_{tb^* + 1}^*}{P_{non}} \right)^{\sigma\lambda/(\sigma-1)} \quad [26]$$

In [26], the term inside the large brackets is less than one (since $P_{tb^* + 1}^* < P_{non}$), implying the difference in expenditure between achieving utility $U_{tb}(h^* + 1)$ and utility U_{non} is positive. Since new TB consumers purchase Kh^* manufactures at the intra-bloc price following their entry, a positive compensating gain would be expected.

For new member country consumers to potentially compensate existing TB firms, the compensating gains from TB membership must exceed the reduction in profits TB firms incur upon enlargement, which is the condition

$$L \left[1 - \left(\frac{P_{tb^* + 1}^*}{P_{non}} \right)^{\sigma\lambda/(\sigma-1)} \right] > -h^* K \cdot L\lambda K \tau^{1-\sigma} (\mu^{1-\sigma} - \tau^{1-\sigma}) \left[\frac{jP_{non}^{-\sigma} - h^* P_{tb^*}^{-\sigma}}{\sigma P_{tb^* + 1}^{-\sigma} P_{tb^*}^{-\sigma} P_{non}^{-\sigma}} \right] \quad [27]$$

Whether (27) holds is ambiguous. By cancelling an L on both sides, the left-hand side is reduced to less than one implying that one consumer must compensate h^* TB firms for the reduction in profits on g markets where each market comprises a single consumer. Observe that as trade bloc size increases, the term $\left(\frac{P_{tb^* + 1}^*}{P_{non}} \right)^{\sigma\lambda/(\sigma-1)}$ decreases since the difference between the new TB price index and the NTB index increases. The compensating gain, the left-hand side of [27], is therefore increasing in h . The right-hand side of [27] is also increasing in h , so that the reduction in profits becomes larger as the bloc expands.⁵ Where the condition holds at size h^* , the likelihood that NTB consumers would potentially compensate existing firms as the bloc expands cannot be determined, since it depends on which side of (27) is increasing at a greater rate.

In view of the first two cases, it seems plausible that consumers from member or non-member countries could potentially compensate existing TB firms. A system of lump-sum transfers would therefore enable trade bloc size to increase beyond h^* . The third possibility however, whereby TB firms are potentially compensated by NTB firms, undermines the possibility of TB or NTB consumers compensating TB firms.

(iii) Once inside the bloc, firms in the new TB member country earn higher operating profits given by $\Pi_{tb}(h^* + 1) - \Pi_{non}(h)$. We consider the possibility of firms in the new member country compensating existing TB firms from this increase in profits. For lump-sum transfers to make member country firms no worse off following enlargement, the operating profits of existing h^*K TB firms plus the compensation from K new TB firms must be as large as the profits earned prior to the increase in membership, which is the condition

⁵ The Derivative of the right-hand side of [27] with respect to h can be shown to be $-K[\Pi_{tb}(h^* + 1) - \Pi_{tb}(h^*)] - hK \frac{\partial \Pi_{tb}(h^* + 1)}{\partial h}$ which is unambiguously greater than zero since $\Pi_{tb}(h^* + 1) - \Pi_{tb}(h^*) < 0$ and $\frac{\partial \Pi_{tb}(h^* + 1)}{\partial h} < 0$.

$$h^* K \Pi_{tb}(h^* + 1) + K [\Pi_{tb}(h^* + 1) - \Pi_{non}(h^*)] \geq h^* K \Pi_{tb}(h^*) \quad [28]$$

Re-arranging and dividing through by K in (28) produces

$$\Pi_{tb}(h^* + 1) - \Pi_{non}(h^*) > h^* [\Pi_{tb}(h^*) - \Pi_{tb}(h^* + 1)] \quad [29]$$

where the operating profits of a non-member country firm are defined as

$$\Pi_{non}(h) = \left[\frac{1}{P_{non}} \right]^\sigma \lambda L \left(\frac{1}{\sigma} \right) + \left[\frac{\tau}{P_{non}} \right]^\sigma \lambda L \tau \left(\frac{1}{\sigma} \right) (g - h - 1) + \left[\frac{\tau}{P_{tb}} \right]^\sigma \lambda L \tau \left(\frac{1}{\sigma} \right) h$$

After considerable manipulation, [29] can be simplified to

$$(g - h^* - 1)(P_{tb}^{-\sigma} + P_{non}^{-\sigma}) > 0 \quad [30]$$

Expression [30] suggests the new member country firm can make the required compensating lump-sum transfers to existing TB firms and still earn higher profits than when in a non-member country. For all positive values of h smaller than $g-1$, [30] holds with strict equality. The last enlargement of the bloc makes existing TB firms and firms in the last country to enter no better off than before. The compensatory payments required to make existing member country firms no worse off completely exhaust the increase in profits of the firms in the last country to enter the bloc. Since at each enlargement of the bloc, except for the final enlargement, existing and new TB firms are better off, trade bloc membership will increase to include every country.

The finding that new member country firms can always compensate existing member firms and still retain some of the increased profits, making them better off, is surprising. Intuitively, one would have thought that compensation would not be possible where h^* was large, since [29] suggests a single new member firm has to compensate on average h^*

existing TB firms. The increase in new member firm sales by an amount greater than the lump sum transfer required to compensate h^* existing TB firms, on each of the h^* TB markets, makes an enlargement of the bloc a pareto improvement. Note, the result applies to the enlargement of a bloc and the *consolidation* of a blocs, since a non-member country (or group of countries) is no different to a member of another trade bloc.

The compensation of existing trade bloc firms by new member firms upon their entry into the bloc is similar to the compensation envisaged by Kemp and Wan (1976) between member countries following a bloc's formation or enlargement. In Kemp and Wan however, the new member country may be made worse off by the new market clearing prices it now faces inside the bloc. In the framework of this paper, firms in each new member country unambiguously gain whereas firms in every existing member country are made worse off by an increase in membership above h^* . Both the analysis of Kemp and Wan and this paper demonstrate the ability of lump-sum transfers to propel trade bloc membership towards global membership, consistent with the "pre-Vinerian view that to form a customs union is a move in the direction of free-trade" (Kemp and Wan (1976, 96)).

Can we then expect the formation of a TB combined with a system of side payments to the $h^* k$ existing TB firms to bring about free trade? For free trade to emerge, the new entrant firm's best strategy must be to make compensatory payments in order to gain entry into an existing bloc. It is possible to show that any bloc will not expand beyond h^* members because side payments cannot feature in a general equilibrium. Suppose TB membership is at h^* and that the returns to a potential new entrant firm net of donations is $R(h^*)$. For an existing TB firm to be compensated, they must earn at least $\Pi_{tb}(h^*)$ when a new country enters. Therefore, each new firm will have to compensate, on average, h^* existing firms by an amount $\Pi_{tb}(h^*) - \Pi_{tb}(h^* + 1)$.⁶ Thus when they enter the bloc, a new member firm's returns

⁶ The free rider problem associated with the compensation of existing TB firms could be overcome by a Chamber of Commerce having compulsory membership and making the payments.

will be $R(h^*) = \Pi_{tb}(h^* + 1) - h[\Pi_{tb}(h^*) - \Pi_{tb}(h^* + 1)]$. However, this amount is less than $\Pi_{tb}(h^* + 1)$ which is less than $\Pi_{tb}(h^*)$.

An alternative for this non-member country is to start its own bloc. We know that the size of the first bloc to form is less than half the total number of countries, $h^* < \frac{g}{2}$. Further we know that where TB size is restricted to h^* , the world divides into a minimum of three blocs, at least two of which are of the optimal size. The profits of non-member country firms in this alternative bloc are therefore at least $\Pi_{tb}(h^*)$, because countries in this bloc will not admit new members without compensation to do so which makes them at least as well off. As a result, instead of applying for membership of an existing bloc which already has h^* members, firms have more to gain if their country starts its own bloc or joins a bloc with less than h^* members. As a result, the world equilibrium cannot feature blocs of size larger than h^* , even with side payments between new and existing TB member firms.

5. CONCLUDING COMMENTS

By modelling the expansion of a trade bloc as one of continuous enlargement, this paper has taken the approach of investigating infinitesimal changes in the bloc's size relative to an initial trade bloc size. The fact that trade blocs increase in size discretely rather than by small changes can be addressed by a process of trial and error, directly comparing the operating profits when in a bloc of initial size h with those of being in a bloc of size $h+1$. By evaluating the difference equation $\Pi_{tb}(h) - \Pi_{tb}(h+1)$ for various values of trade bloc size, a firm can determine the optimal number of trade bloc members to have.

The contribution of this paper is the development of a theory of trade bloc formation and size which suggests at some point there will be a powerful incentive against further expansion. Initially, the profits of existing trade bloc firms increase with each enlargement but then decrease, giving rise to disagreement between firms and consumers over what is the *ideal* size of the bloc. The only way that expansion can occur and make existing trade bloc firms unambiguously no worse off is by firms in the new member country making lump-sum

transfers to existing firms. Despite their ability to make these compensatory payments and still gain from trade bloc entry, a more rewarding alternative exists: pressuring their country into forming or entering a smaller bloc, which then generates a greater increase in profits. Were it not for this alternative, trade bloc formation incorporating a system of lump-sum transfers from new member firms to existing member firms would represent a movement in the direction of free trade.

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