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CONTINENTAL TRADING BLOCS: ARE THEY NATURAL, OR SUPER-NATURAL?

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ABSTRACT

Using the gravity model, we find evidence of three continental trading blocs: the Americas, Europe and Pacific Asia. Intra-regional trade exceeds what can be explained by the proximity of a pair of countries, their sizes and GNP/capitas, and whether they share a common border or language. We then turn from the econometrics to the economic welfare implications. Krugman has supplied an argument against a three-bloc world, assuming no transport costs, and another argument in favor, assuming prohibitively high transportation costs between continents. We complete the model for the realistic case where intercontinental transport costs are neither prohibitive nor zero. If transport costs are low, continental Free Trade Areas can reduce welfare. We call such blocs **super-natural**. Partial liberalization is better than full liberalization within regional Preferential Trading Arrangements, despite the GATT's Article 24. The super-natural zone occurs when the regionalization of trade policy exceeds what is justified by natural factors. Estimates suggest that trading blocs like the current EC are super-natural.

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Continental Trading Blocs: Are They Natural, or Super-Natural?

In the 1980s, the world saw an upsurge of movements toward Free Trade Areas and other special regional trading arrangements, from the European Community (EC), to the Association of SouthEast Asian Nations (ASEAN), to the Canadian-U.S. Free Trade Agreement.[1]

In the 1990s, the talk has moved to expansion of the regional Free Trade Agreements within their respective continents. The North American Free Trade Agreement (NAFTA) was negotiated between the U.S., Mexican and Canadian governments in 1992. It is scheduled to go into effect January 1, 1994, provided it is ratified by the three countries. There are provisions to add other Western Hemisphere countries, which is consistent with the Enterprise for the Americas Initiative proposed by the U.S. government in June 1990. In Europe, the talk is of enlarging the EC to a European Economic Space that would include members of the European Free Trade Association (EFTA), and eventually countries from Central and Eastern Europe. Some are concerned that the world is dividing into three continental trading blocs, one in the Americas centered on the U.S., one in Europe centered on the EC, and one in Pacific Asia, centered on Japan.[2]

1. Introduction

Table 1 presents statistics on the intra-regional share of trade undertaken by members

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[1] De la Torre and Kelly (1992) and Fieleke (1992) survey the post-war history of regional trading arrangements.

[2] For example, Thurow (1922, pp.16,65).

of these groupings. Intra-regional shares increased during the 1980s in each of the three major parts of the world: from 23 per cent to 29 per cent in East Asia, from 27 per cent to 29 per cent in the Western Hemisphere, and from 54 per cent to 60 per cent in Europe.

This paper seeks to examine the question: Is this apparent movement toward regionalization of the world trading system good or bad? Let us begin by reminding ourselves that such a question is an exercise in the "second best." (The first-best, world-wide free trade, is assumed not possible politically.)

Since its founding, the GATT has been predicated on the assumption that second-best is a regime where each member accords others the status of Most-Favored Nation (MFN), i.e., treats its trading partners equally. The MFN system was seen as an antidote to the disaster of the 1930s, when the world was divided up into trading blocs: a Sterling bloc, Gold/Franc bloc, Central European bloc, dollar bloc, etc. The GATT incorporated an important exception to the MFN principle in its Article 24: a subset of members could form a Free Trade Area (FTA), provided certain conditions were met, including that barriers within the FTA were removed completely, rather than only partially, and that barriers against non-members not be raised.

Arguments for the merits of the MFN-cum-Article 24 system could take either of two possible tacks. (See Bhagwati, 1992.[3]) First one might try to argue, in a static economic sense, that the formation of FTAs under the conditions specified in Article 24 is likely to

[3] Bhagwati (1992), Deardorff and Stern (1992), and de Melo, Panagariya, and Rodrik (1993) review the literature.

raise economic welfare, and that other deviations from the MFN principle are not.[4] Second one could argue, in a dynamic political economy sense, that FTAs can act as stepping stones, which help build the political support necessary to negotiate freer trade worldwide.[5] In this paper we examine critically the first of these propositions.

Paul Krugman has helped to focus the recent debate on whether a global trend toward the formation of trading blocs would be a good thing or a bad thing. He has, however, supplied equally clever arguments on both sides. In his first contribution (Krugman, 1991a), he focused on the idea that when individual countries form larger groupings, they are liable to become more protectionist, and thus to move further from the ideal of world free trade. The reasoning was that as a group they would set higher tariff levels vis-a-vis the rest of the world, since they would have more monopoly power to exploit. Groupings were assumed to set tariffs at a self-maximizing optimal level.[6] He showed that world welfare is lower with a few trading blocs than with the extremes of one or many blocs, and that for specific plausible parameter values, three turned out to be the worst possible number to have!

His second contribution, Krugman (1991b), included a very simple argument that leads to the conclusion that trading blocs are good, the diametrically opposite conclusion from the first paper. It is observed that even without the formation of regional free trade

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[4] Jackson (1993, p.123), for example, has suggested that the goal of the Article 24 exception to the MFN principle is that FTAs would be trade-creating rather than trade-diverting.

[5] A good argument for the NAFTA, for example, is that it reinforces politically the trend within Mexico toward liberalization.

[6] A later contribution, Krugman (1992), dropped the assumption of optimal or endogenous tariffs. The conclusions were similar.

areas or preferential trading arrangements of any sort, countries trade more with their neighbors than with countries from which they are far removed, presumably because of transportation costs. Imagine, in the limit, that transoceanic transportation costs were so high that all trade took place within continents. Then it must follow from standard trade theory that removal of trade barriers within each continent, that is, the formation of regional free trade areas, would be a good thing: this move within each area would represent the first-best solution of free trade within its own relevant world. Krugman's conclusion is that, to the extent that trade follows the "natural" lines dictated by proximity, the formation of regional trading blocs is good. Such natural blocs are contrasted with "unnatural blocs", free trade agreements between individual countries in different continents, which are less likely to be welfare-improving.[7]

Each of these two arguments is, of course, valid within its own assumptions. One way to characterize them is as the limiting polar cases of zero inter-continental transportation costs and infinite inter-continental transportation costs, respectively. The analysis, to be complete, cries out for a more general model that can handle the intermediate realistic case where transportation costs between continents are less than infinite, while greater than zero (and greater than transportation costs *within* continents).

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[7] In what the Economist called "the shootout at Jackson Hole," Summers (1991) agreed with Krugman that natural blocs were likely to be beneficial, while Bergsten (1991) was on the other side. It should be noted that the idea of proximity as a desiderata for successful FTAs, on the grounds that it would minimize the amount of trade diversion, was not entirely new with Krugman. (See Balassa 1987, p.44, and Wonnacott and Lutz 1989). The leading opponent is Bhagwati (1992), whose reaction to reports from Jackson Hole was: "The prescription is sufficiently strange and hard to defend for me to wonder whether these distinguished economists truly expressed these views" (footnote 8).

Several questions regarding the desirable rules for preferential trading arrangements (PTAs) arise. First, is there an economic justification for encouraging or allowing any sort of exception to the MFN principal? Second, should FTAs be restricted to natural trading partners, as Krugman (1991b) suggests? This would mean that FTAs could only be formed among countries that are located in the same part of the world (e.g., the Western Hemisphere) or perhaps only among neighbors located in the same sub-region (e.g., North America, which would exclude even an agreement between NAFTA and Chile). Third, is the rule sensible that technically requires 100 per cent liberalization within a grouping, i.e., that allows only FTAs? Or should partial liberalization be allowed, as de facto prevails in most PTAs? Is there an optimal degree of regionalization that should be encouraged?

We shall attempt to do several things in this paper. First, we shall measure the extent to which regionalization is actually taking place, by looking at the magnitude of bilateral trade flows after one adjusts, by means of the gravity model, for such natural determinants of bilateral trade as GNPs and proximity. In this paper, we draw the boundaries at the level of large continental blocs (our continents are The Americas, vs. Europe, vs. Pacific Asia, and perhaps Africa/Mideast as a fourth). An alternative place to draw the boundaries, at the level of sub-continental FTAs consisting of a few members each (e.g., NAFTA, MERCOSUR, and the Andean Pact), is considered in a companion paper.[8]

That the share of intra-regional trade is increasing within a given grouping, as in Table 1, does not necessarily mean that the members of this grouping are undertaking

[8] Frankel, Stein and Wei (1993). [The conclusions are similar.]

explicit discriminatory trade policy measures to bring this about. Rapid growth in intra-regional trade could be the result of natural factors, i.e., rapid growth in per capita GNPs. Indeed we find that this is the case for East Asia. In Europe and the Americas, on the other hand, there appears to be a statistically significant role for regional trade policies, even after correcting for natural determinants.

Second, we address welfare implications of different possible rules for the formation of preferential trade groupings. At a theoretical level, we shall attempt to complete the Krugman model of the welfare implications of trading blocs for the realistic case where transportation costs between continents are neither so high as to be prohibitive nor so low as to be the same as costs among neighbors. We consider two applications of the model in turn.

We start with continental FTAs. We shall see that it is not only unnatural FTAs that can leave everyone worse off than under MFN, but that under certain conditions FTAs that are formed along natural intra-continental lines can do so as well. We call such welfare-reducing blocs super-natural.[9] We shall see in simulations that this possibility may obtain, in particular, when intercontinental transportation costs, while not necessarily as low as intracontinental costs, are as low as 10 or 20 per cent.

Next we apply the model to the issue of partial preferential treatment within regional trade groupings. We find that partial liberalization within a regional trade grouping is better than 100 per cent liberalization, in contrast to the Article 24 provision. The super-natural zone, where the regional trading arrangement reduces welfare, occurs for combinations of

[9] The term was introduced in Frankel (1993).

low intercontinental transport costs and high intra-bloc preferences.

In the final part of the paper, we attempt to get a better idea of which of the theoretical welfare possibilities is actually most likely in practice by adopting estimates of the parameters from the 1980-1990 data on bilateral trade that are used in the first part of the paper. A tentative estimate of the inter-continental parameter, based on the gravity model, is 20 per cent. Such an estimate, combined with our other simulation parameter values, would imply that negative returns to regionalization begin to set in as early as the point when regional preferences reach about 10 per cent.

Most of our conclusions regarding economic welfare presume worldwide symmetry. In other words, we look at the consequences of a worldwide regime that allows continental blocs or regional FTAs to form; the consequences of the unilateral formation of a single bloc or FTA in one part of the world is not addressed in this paper. It should be noted from the outset that many of the conclusions are tentative, and that many possible considerations are omitted from the analysis. For example, we focus only on the static economic effects.

2. Are Continental Trade Blocs Forming?

Frankel (1993) applied to the trading bloc question the natural framework for studying bilateral trade, the gravity model. The gravity model says that trade between two countries is proportionate to the product of their GNPs and inversely related to the distance between them, by analogy to the formula for gravitational attraction between two bodies. It has a fairly long history and fits the data remarkably well empirically, though its theoretical

foundations have hitherto been considered limited.[10]

Frankel (1993) and Frankel and Wei (1994), looking at the period 1980-1990, found that: (1) there are indeed intra-regional trade biases in the EC and the Western Hemisphere, and perhaps in East Asia; but (2) the greatest intra-regional bias was in none of these three, but in the APEC grouping, which includes the U.S. and Canada with the Pacific countries; and (3) the bias in the East Asia and Pacific groupings did not increase in the 1980s, contrary to the impression that many have drawn from intra-regional trade statistics such as are reported in Table 1.

Frankel and Wei (1993a, 1993b) extend those results in a number of directions. The papers consider various econometric extensions of the original gravity model estimation: the inclusion of pairs of countries that are reported as undertaking zero trade, and a correction for heteroscedasticity based on the size of the countries. The papers also considered some economic extensions, such as including factor endowment terms. The results turn out to be robust to these extensions.

The earlier results were incapable of distinguishing between regional biases reflecting discriminatory trade policies, and those that might derive from historical, political, cultural and linguistic ties. Here we include terms representing pairs of countries that speak a common language or have other historical ties.

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[10] The results of one extensive early project along these lines were reported in Tinbergen (1962, Appendix VI, pp.262-293) and Linneman (1967). Three recent empirical studies are Wang and Winters (1991), Hamilton and Winters (1992), and Havrylyshyn and Pritchett (1991). Foundations for the gravity model are offered in papers surveyed by Deardorff (1984, pp.503-06), such as Anderson (1979).

2.1 The Gravity Model of Bilateral Trade

One cannot meaningfully investigate the extent to which regional policy initiatives are influencing trade patterns without holding constant for natural economic determinants. The gravity model offers a systematic framework for measuring what patterns of bilateral trade are normal around the world. A dummy variable can then be added to represent when both countries in a given pair belong to the same regional grouping. The goal, again, is to see how much of the high level of trade within each region can be explained by simple economic factors common to bilateral trade throughout the world, and how much is left over to be attributed to a special regional effect.

The dependent variable is trade (exports plus imports), in log form, between pairs of countries in a given year. We have 63 countries in our data set, so that there are 1,953 data points (=63x62/2) for a given year.[11]

The two most important factors in explaining bilateral trade flows are the geographical distance between the two countries, and their economic size.

A large part of the apparent bias toward intra-regional trade is certainly due to simple geographical proximity. Krugman (1991b) suggests that most of it may be due to proximity, so that the three trading blocs are welfare-improving "natural" groupings. Despite the obvious importance of distance and transportation costs in determining the volume of trade, empirical studies surprisingly often neglect to measure this factor. Our measure is the log of distance between the two major cities (usually the capital) of the respective countries. We also add a dummy "Adjacent" variable to indicate when two countries share a common land

[11] The list of countries, and regional groupings, is given in an Appendix.

border.

Entering GNPs in product form is empirically well-established in bilateral trade regressions. It can be justified by the modern theory of trade under imperfect competition.[12] In addition there is reason to believe that GNP per capita has a positive effect on trade, for a given size: as countries become more developed, they tend to specialize more and to trade more. The equation to be estimated, in its most basic form, is:

$$(1) \qquad \log(T_{ij}) = \alpha + \beta_1 \log(GNP_i GNP_j) + \beta_2 \log(GNP/pop_i GNP/pop_j)$$

$$+ \beta_3 \log(DIST_{ij}) + \beta_4 (ADJACENT_{ij}) + \beta_5 (LANG_{ij}) + \gamma_1 (EC_{ij}) + \gamma_2 (WH_{ij}) + \gamma_3 (EA_{ij}) + u_{ij}$$

The last five explanatory factors are dummy variables. *EC*, *WH*, and *EA* are three of the dummy variables we use when testing the effects of membership in a common regional grouping, standing for European Community, Western Hemisphere, and East Asia, respectively.

Table 2 reports results that extend from 1965 to 1990. All five standard variables are highly significant statistically (> 99% level). The results are typical of others we have found.

The coefficient on the log of distance is about -.5 or -.6, when the adjacency variable (which is also highly significant statistically) is included at the same time. This means that

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[12] The specification implies that trade between two equal-sized countries (say, of size .5) will be greater than trade between a large and small country (say, of size .9 and .1). This property of models with imperfect competition is not a property of the classical Heckscher-Ohlin theory of comparative advantage. Helpman (1987) and Helpman and Krugman (1985, section 1.5). We shall see that this is also a property of our theoretical model in Section 3.

when the distance between two non-adjacent countries is higher by 1 per cent, the trade between them falls by about .6 per cent.[13] We checked for possible non-linearity in the log-distance term, as it could conceivably be the cause of any apparent bias toward intra-regional trade that is left after controlling linearly for distance, but this did not seem to be an issue.[14] [We have also tried distance measures that take into account the greater distances involved in sea voyages around obstacles like the Cape of Good Hope and Cape Horn, generously supplied by Winters and Wang, with little effect on the results.]

The coefficient on distance fluctuates some over the earlier observations, but with no clear trend. Disaggregated results show higher distance effects for manufactures than for agricultural products or other raw materials.[15] These findings suggest to us that physical transport costs may not be the most important component of costs associated with distance.

The estimated coefficient on GNP per capita varies in the .3-.4 range from 1965 to 1980, indicating that richer countries do trade more.[16] The estimated coefficient for the log of the product of the two countries' GNPs holds steady at about .75, indicating that, though

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[13] The estimate is .8 if one does not hold constant for adjacency at the same time (Frankel, 1993). [Linnemann's estimate for 1959 is also .8 (1966, pp. 82-88).]

[14] The log of distance appears to be sufficient; the level and square of distance add little.

[15] Reported in Frankel, Stein and Wei (1993).

[16] The coefficient on GDP/capita appears to fall sharply in during the 1980s. This may be an artifact of the use of the standard measure of countries' GNPs, translated into dollars at the current exchange rate. We have also tried an estimate for 1991 using PPP-adjusted GNPs. The coefficient on GNP/capita returns to .35 (with little qualitative change in the estimates otherwise). Perhaps the use of dollar GNPs, which tends to understate the importance of poorer countries like China, only has a serious effect on the estimates after 1980.

trade increases with size, it increases less-than-proportionately (holding GNP per capita constant). This presumably reflects the widely-known pattern that small economies tend to be more open to international trade than larger, more diversified, economies.

Next, we added a dummy variable to represent when both countries of a pair spoke a common language or had colonial links earlier in the century. We allowed for English, Spanish, Chinese, Arabic, French, German, Japanese, Dutch, and Portuguese. Two countries sharing linguistic/colonial links tend to trade roughly 65 per cent more than they would otherwise [exp(.5)=1.65]. We tested whether some of the major languages were more important than the others, and found little in the way of significant differences.

2.2 Estimation of trade-bloc effects

If there were nothing to the notion of trading blocs, then these five basic variables might soak up most of the explanatory power. There would be little left to attribute to a dummy variable representing whether two trading partners are both located in the same region. In this case the level and trend in intra-regional trade would be due solely to the proximity of the countries, and to their rapid rate of overall economic growth.

But we found that many of the dummy variables for intra-regional trade are significant statistically.

As in earlier results, the coefficient for the East Asian grouping [not including Australia and New Zealand] is highly significant during the period 1965-1980, although it

declines slightly thereafter.[17] An estimate like 1.5 for 1990 implies that when two countries are both located in East Asia, they trade more than four times as much [exp(1.5)=4.5] as would two otherwise-similar countries.

The Western Hemisphere bloc first becomes statistically significant in 1980, and reaches its peak in 1990. The 1990 estimate suggests that when two countries are both in the Americas, they trade twice as much as otherwise [exp(0.8)= 2.2].[18]

As recently as the 1970s, the EC bloc effect was not statistically significant. It becomes very high in significance and magnitude in 1985, and declines a bit thereafter.[19] The 1990 estimate suggests that if two countries are both located in the European Community, their bilateral trade is 70 per cent higher than it would otherwise be [exp(0.51)=1.67]. EFTA is never significant.[20]

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[17] In other words, the rapid growth of East Asian economies is in itself sufficient to explain the increase in the intra-regional trade share evident in Table 1. The finding that intra-regional trade bias in Asia diminished in the 1980s, rather than increasing as often assumed, confirms Frankel (1993) and Petri (1993).

[18] Tests on sub-regional blocs suggest that the Western Hemisphere regionalization in 1980 and 1990 is concentrated in the Andean Pact and MERCOSUR groupings. The NAFTA grouping is not statistically significant (though this is what one would expect, given the very small number of observations). These results are reported in Frankel, Stein and Wei (1993).

[19] Why did the EC strengthen so in the early 1980s? One possibility is the accession of Spain, Portugal and Greece during this period, and of the United Kingdom, Ireland and Denmark not long before. (For ease of comparison across time, these countries are included in the definition of the EC grouping throughout the sample.) Another possible contributing factor, considered in Frankel and Wei (1993b), is the stabilization of exchange rates under the European Monetary System.

[20] Results for 1991 show an apparent loss of significance for the East Asia and Western Hemisphere blocs. The 1991 results may be suspect, due to the more limited nature of the data available as of 1993. Along with various other extensions, we have also tried including dummy variables that show when *one* country in a pair belongs to a particular

The gravity model results thus show that statistically significant regional trading arrangements are indeed springing up in a number of places. The next question is whether this trend constitutes an undesirable threat to the world trading system.

3. The Theory of Bilateral Trade with Imperfect Substitutes and Transportation Costs

The remainder of the paper attempts to settle the Krugman vs. Krugman controversy regarding the desirability of trading blocs, by constructing a more general model that can handle the intermediate realistic case where transportation costs between continents are less than infinite, while greater than zero. The ultimate goal is to match the theory up with the preceding section's empirical estimates of the effects of transportation costs and regional trading arrangements on the volume of bilateral trade, in order to evaluate the welfare implications of regionalization of the world economy. But the match-up attempted in the final part of this paper can only be regarded as preliminary.

3.1 The Differentiated Products Model

We work with a model of trade under monopolistic competition due to Krugman (1980).[21] Our contribution is to extend this model to many countries (and many

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grouping, to capture openness/diversion. This coefficient is significantly positive for East Asia and EC members, indicating openness vis-a-vis the rest of the world. It is slightly negative for Western Hemisphere countries in the early part of the sample period, indicating closedness or trade diversion, but turns significantly positive in 1985 and 1990. The presence of these variables reduces the three estimated bloc effects in most years just slightly, and restores the Western Hemisphere bloc effect to statistical significance in 1991 [and 1975].

[21] For the sake of comparability, both the notation and the description of the basic model closely follow Krugman (1980).

continents), allowing for tariffs and transportation costs, both within continents and between continents, and to apply it to study the welfare implications of the formation of continental trading blocs.[22] As often in this literature, the reference to "tariffs" is intended as shorthand for all government-imposed trade barriers.

The Krugman (1980) market structure has the property of ruling out strategic interaction among firms. Goods enter symmetrically into the utility function

$$U = \sum_i c_i^{\theta}; \qquad 0 < \theta < 1 \tag{2}$$

where c_i is the consumption of the i^{th} variety. [There is a large number of goods being produced (n), but this number is much smaller than the potential number of goods or varieties.]

This utility function results in preference for variety by consumers. The higher the parameter θ, the lower the love for variety. In the limit of perfect substitutability, $\theta=1$. In the limit of complete love for variety, consumers care only about the number of varieties consumed, and not at all about the quantity: $\theta=0$.[23]

Labor is the only factor of production. The total national supply of labor is L.

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[22] Krugman introduced transport costs into his (two country) model but applied it to a different purpose: to explore the "home market effect" on trade patterns (the idea that countries tend to specialize in goods for which the home market is relatively large).

[23] Deardorff and Stern (1992, p.22-25) question the realism of this set-up. In their view, the Krugman result that a few large blocks are worse than many small ones can be attributed to excessive emphasis on the utility of consuming a large variety of goods that may differ only in the location of production (i.e., brand name). They suggest that classical theories of comparative advantage would imply that welfare is monotonically increasing in the number of countries per bloc, and that FTAs among a few dissimilar countries may be sufficient to attain most of the gains-from-trade to be had.

Increasing returns are introduced by assuming a fixed cost and a constant marginal cost in the production of each of the varieties. We assume that individual consumers maximize their utility, individual firms maximize their profits, and free entry assures a zero-profit equilibrium. Under these simple assumptions, the scale of output of each variety does not depend on the size of the economy. Rather, it is the number of varieties n that increases when the size of the economy (L) increases:

$$n = \frac{L(1-\theta)}{\alpha} \qquad (3)$$

where α is a parameter representing the fixed costs of setting up production of a new variety. Notice that in the extreme special case of zero substitutability ($\theta = 0$), the bare minimum (one unit) of each of L/α varieties will be produced, since consumers care only about the number of varieties available. (Details of this derivation, and of others below, are given in Stein and Frankel, 1993.)

To see the gains from international trade, which arise here from the opportunity to consume a greater variety of goods, we assume that countries have similar tastes and technologies. If we have two countries of equal size, allowing for unfettered trade will double the number of available varieties in each country and thus raise utility.

3.2 Introduction of Transport Costs and Tariffs

We will think of the world as being divided into a number of continents (C), each of them equidistant from one another. Each of these continents is composed of a number of

countries (N). The transportation system we assume within each continent is a hub-and-spoke network. In each continent there is a hub, through which all trade involving that continent must pass. Each hub has N spokes, all assumed of equal length, connecting it to the N countries in the continent. Transport costs will be assumed, following Krugman (1980), to be of Samuelson's iceberg type, which means that only a fraction of the good shipped arrives; the rest is lost along the way.[24]

The cost of transport through two spokes will be represented as a, while that of transport from hub to hub (across the ocean), is given by b, where $0 \leq a,b \leq 1$. Trade involving two countries on the same continent will have to be transported from the exporting country to the hub, and from the hub to the importing country. This involves two spokes, and so the fraction of a good shipped that arrives to the market is $1-a$. Similarly, the fraction of a good that arrives in the case of trade between countries in different continents, which involves two spokes and a hub-to-hub section, is $(1-a)(1-b)$.

When a consumer buys a foreign good, the government levies an ad-valorem tariff t. We assume that the tariff is levied on the c.i.f. price rather than the f.o.b. price.[25] The level of tariffs is exogenous, and assumed to be uniform across countries, representing the MFN principle, until we are ready to examine preferential trading arrangements.

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[24] The notion of transportation costs should be understood as transactions costs, encompassing not just physical transportation of goods but also costs of communications and the idea that countries tend to have a better understanding of their neighbors and their institutions.

[25] I.e., tariffs are a proportion of the value of the good that leaves the exporting country, in terms of the iceberg model. The c.i.f. assumption is simpler, and probably more realistic as well. Frankel, Stein and Wei (1993) considers the f.o.b. case, where the tariff is levied as a percent of the value of the good that arrives in the importing country.

For simplicity, we will assume that each one of the countries is equal in size. The symmetry of the model now assures that the producers' prices are the same in every country, as well as the number of varieties and the quantity of each variety produced in every country. Prices of home and foreign goods faced by home consumers are different due to transportation costs and tariffs. If the producer prices in every country are p, then the price the domestic consumer will have to pay for every unit of foreign good consumed would be:

$$p_{c,t} = \frac{p(1+t)}{1-a} \qquad p_{nc,t} = \frac{p(1+t)}{(1-a)(1-b)} \tag{4}$$

where the subscript c refers to goods imported from within the continent, and nc otherwise (across continents). Notice that import prices depend positively on tariffs and transportation costs. In the absence of tariffs, the prices faced by the home consumers will be:

$p_c=p/(1-a)$ and $p_{nc}=p/(1-a)(1-b)$.

Since the home consumer pays different prices for the consumption of home and foreign products, he or she consumes them in different quantities. The next step is to derive, from the utility function, the consumption of each foreign variety (both from neighbor countries and from countries in other continents) relative to the consumption of each home variety. We begin by assuming that tariffs t are levied.

For ease of exposition, we will index goods in such a way that the home country produces varieties 1,...,n; neighbors produce varieties $n+1,\ldots,n+n^c$; and countries across the ocean produce varieties $n+n^c+1,\ldots,n+n^c+n^{nc}$. The home consumer maximizes

$$U = \sum_{i=1}^{n+n^c+n^{nc}} c_i^{\theta} \tag{6}$$

subject to the budget constraint

$$\sum_{i=1}^{n} c_i p + \sum_{n+1}^{n+n^c} c_i p_{c,t} + \sum_{n+n^c+1}^{n+n^c+n^{nc}} c_i p_{nc,t} \leq w + T \tag{7}$$

where T is the lump-sum transfer received by each consumer, which they regard as being fixed.

From the maximization problem of the consumers it is possible to derive the elasticity of demand for exports faced by the producers, which turns out to be $\epsilon_x = 1/(1-\theta)$, the same as the elasticity of domestic demand. The equality of these elasticities guarantees that the price resulting from the firm's profit maximization is the same as in the case of the closed economy. So are the quantity produced of each variety and the number of varieties n produced in each country. Transport costs and tariffs, thus, introduce no changes in these variables. But the key point is the effect on consumption patterns.

The first order conditions for the consumer's problem yield the relative consumption of each variety:

$$\frac{c_i^c}{c_i^h} = \left(\frac{p}{p_{c,t}}\right)^{\frac{1}{1-\theta}} \tag{8}$$

$$\frac{c_i^{nc}}{c_i^h} = \left(\frac{p}{p_{nc,t}}\right)^{\frac{1}{1-\theta}} \tag{9}$$

where c_i^c and c_i^{nc} are the domestic consumer's consumption of foreign varieties, from

countries within the continent and across the ocean and c_i^h is the domestic consumer's consumption of the home varieties.

Now we can derive the relative *demand* for varieties by the home consumer. The "demand" for the foreign varieties as defined here (again, following Krugman), is larger than the consumption of those varieties, since it includes what is lost through transportation. We know that in order to consume one unit of a foreign variety, a home consumer will have to demand $1/(1-a)$ in the case of a neighbor country, $1/(1-a)(1-b)$ otherwise. Introducing these terms, as well as the prices given by (4) into equations (5 and 6), we obtain the demand for each one of the foreign varieties relative to the demand for the domestic varieties. We can see that the relative demand for all foreign varieties depends negatively on tariffs and transportation costs, as expected.

$$\sigma_{c,t} = \frac{(1-a)^{\frac{\theta}{1-\theta}}}{[1+t]^{\frac{1}{1-\theta}}}$$

$$\sigma_{nc,t} = \frac{[(1-a)(1-b)]^{\frac{\theta}{1-\theta}}}{[1+t]^{\frac{1}{1-\theta}}} \qquad (10)$$

3.3 The bilateral volume of trade

We now proceed to derive the bilateral volume of trade (BVT) in this model, for the

case of non-discriminatory trade policies.[26] Since we are dealing with a symmetric situation, the bilateral volume of trade between two countries *i* and *j* will be equal to twice the volume of trade in one direction, which is equal to the share of country *j* on country *i*'s demand, multiplied by *wL* (the product of the wage times the labor force being the total demand). The bilateral volume of trade between two countries that belong to the same continent, with uniform tariffs, will be:

$$BVT_c = 2 \left(\frac{\sigma_{c,t}}{1 + \sigma_{c,t}(N-1) + \sigma_{nc,t}(C-1)N} \right) wL \qquad (11)$$

Likewise, the bilateral volume of trade between countries across the ocean will be:

$$BVT_{nc} = 2 \left(\frac{\sigma_{nc,t}}{1 + \sigma_{c,t}(N-1) + \sigma_{nc,t}(C-1)N} \right) wL \qquad (12)$$

It is important, at this point, to note that our monopolistic competition model is consistent with the main implications of the gravity model of trade regarding the bilateral volume of trade. The first of the implications visible in equation (1) is that bilateral trade decreases as distance increases. It follows directly from equations (11) and (12), together with (10), that BVT does indeed depend negatively on transportation costs *a* and *b* in our model, which are in turn presumably a monotonic function of distance.

The second implication of equation (1) is that bilateral trade depends positively on the product of the countries' GNPs. To show that our theoretical model is consistent with this property, it is necessary to depart momentarily from the assumption that all countries are

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[26] In Stein and Frankel (1993), we also derive BVT for the case where FTAs are in effect, and examine implications of FTAs for trade diversion and trade creation, which contributes some intuition to the welfare results.

similar in size. A larger country will now produce more varieties in proportion to its size. For simplicity, we assume for the moment that transportation costs and tariffs are zero, so the consumption of every variety is the same. The bilateral volume of trade between two countries A and B will then be: $BVT = 2(GNP^A/GNP^W)*GNP^B$, where W stands for "world".[27]

We can see that in our model, as in the gravity equation, BVT depends positively on the product of the GNPs, and therefore, relative country size matters. Similar results hold when transportation costs and tariffs are allowed to be non-zero. As Helpman (1986) shows, relative country size helps explain BVT in monopolistic competition models, but does not play a role in models of trade based on comparative advantage.[28] Helpman suggests that the monopolistic competition model provides theoretical foundations for the gravity model. By including transportation costs, we have extended the correspondence between the two models.

In order to explore the desirability of potential trading blocs, we now need to introduce a measure of welfare.

3.4 Welfare implications of trade agreements

Given that we are working with a symmetric model, the natural way to look at world

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[27] See Stein and Frankel (1993) for the derivation of the BVT when non-zero tariffs and transportation costs are assumed, including the effects of trading bloc formation on the BVT.

[28] Deardorff (1984) suggests that the models of trade based on comparative advantage are designed to determine *what goods* will countries trade, but not *how much* they will trade. Specific assumptions about transportation costs (namely, that they should increase with volume) are necessary to determine the volume of trade.

welfare is to derive the utility of a representative individual in any country. To determine the utility of the consumer, we need to know how much he or she consumes of each good, and introduce these values into the utility function. Equation (8) above gives us the relative consumption of each home and foreign variety, so we only need to determine the consumption of each home variety, c_i^h. We do this by expressing the budget constraint in terms of c_i^h, and taking into account the redistribution of the tariff revenue to consumers.

If we normalize n, p, and w to be 1, we can obtain, after some algebra

$$c_i^h = \frac{1}{1 + (N-1)\left(\frac{1}{p_{c,t}}\right)^{\frac{1}{1-\theta}}(p_{c,t}-t) + (C-1)N\left(\frac{1}{p_{nc,t}}\right)^{\frac{1}{1-\theta}}(p_{nc,t}-t)} \quad (13)$$

Once we have the consumption of domestic varieties, the consumption of foreign varieties can be obtained from the relative consumption equations (8):

$$c_i^c = c_i^h\left(\frac{1}{p_{c,t}}\right)^{\frac{1}{1-\theta}} \; ; \qquad c_i^{nc} = c_i^h\left(\frac{1}{p_{nc,t}}\right)^{\frac{1}{1-\theta}} \quad (14)$$

Replacing these into the utility function, we obtain the value of the utility of the representative individual:

$$U = c_i^{h^\theta}\left[1 + (N-1)\left(\frac{1}{p_{c,t}}\right)^{\frac{\theta}{1-\theta}} + (C-1)N\left(\frac{1}{p_{nc,t}}\right)^{\frac{\theta}{1-\theta}}\right] \quad (15)$$

Given the values of the parameters a, b, t, θ, N and C, we can first obtain the value of c_i^h by plugging the price equations (4) into (13), and then the value of the utility of the representative individual, which is used as a measure of world welfare.

Equation (15) is the expression for utility in the absence of free trade agreements. It

is simple to calculate utility under other arrangements in the same manner. When trading blocs are formed, we just introduce the new set of relative prices faced by the home consumers into their maximization problem, and we can obtain new values for utility in a similar way.

4. Three Welfare Implications of Regional Trading Arrangements

We have presented a model that allows us to analyze the desirability of different trade arrangements from a world welfare perspective, as well as the changes associated with these different arrangements in terms of the bilateral volume of trade between countries. We now present some applications.

The first one is a simulation showing that, in the absence of transport costs, a system of three or so trading blocs is the worst of worlds, for plausible values of the parameters. In other words, our model replicates Krugman's U-shaped welfare curve as a function of the number of blocs. In the rest of the applications, we introduce transportation costs and study the welfare implications of forming trading blocs.

In application 2, we explore the desirability of forming natural and unnatural trading blocs, as a function of transportation costs. In particular, in this application we look at free trade areas (FTAs), where the intra-bloc tariffs are completely eliminated.

Next, in application 3, we analyze the implications of what could be considered an intermediate degree of regionalization, a partial movement toward the creation of (natural) FTAs, and compare it to the outcome associated with a full movement in that direction. We allow for the formation of Preferential Trade Agreements (PTAs) that differ from the FTAs

in that the tariff level is reduced among partners, but not necessarily eliminated. Even though it is technically prohibited by Article 24, many existing regional arrangements are in fact of this partial kind. We will show that a partial movement towards regional integration, as in the case of PTAs with preference below 100%, is usually superior to a complete one, associated with natural FTAs. At the same time, this application illustrates the need for a more complete characterization of trading blocs, one that goes beyond the natural/unnatural distinction.

Throughout, we consider only exercises involving symmetric formation of equal-sized blocs around the world. Deardorff and Stern (1992) and Srinivasan (1992) have taken exception to the symmetric logic of Krugman's bloc question. We, like Krugman, do not address here the asymmetric partial equilibrium exercise of examining the effects of forming a single bloc in one part of the world, particularly the effects on countries unfortunate enough to be left out of any bloc. The motivation, as we see it, is to address the desirability of the international regime with respect to blocs worldwide, i.e., Article 24. It is of course true, however, that variation in GNPs across countries, if nothing else, renders the real world an inherently asymmetric place.

4.1: The number of blocs and welfare in the absence of transportation costs

The purpose of this exercise is to confirm that our model yields Krugman's U-shaped welfare curve as a function of the number of blocs, in the absence of transportation costs. We assume a world consisting of 60 countries, and study the welfare implications of dividing the trading system equally into different numbers of blocs. Figure 1 shows the results of our

simulations for a value of $\theta = 0.75$, and tariffs of ten, twenty and thirty percent.[29] We can see that welfare is minimized for a small number of blocs: three in the cases of twenty and thirty percent tariffs, and two blocs in the case of a tariff rate of ten percent. Welfare increases gradually beyond the minimum-welfare number of blocs.[30]

In Krugman's model (1991a), there are two reasons for the increase in welfare as the number of blocs becomes larger. One reason is that blocs set tariffs optimally, and become less protectionist as the market power of each one declines. The other reason is that as the number of blocs increases, a larger portion of their demand is satisfied from outside the bloc, and tariffs become less distortionary. Tariffs introduce a wedge between the prices of bloc varieties and those of non-bloc varieties, but not between two non-bloc varieties. The greater the number of non-bloc varieties relative to those from within the bloc, the smaller the distortionary effect of a given tariff level. In our model, where tariffs are assumed exogenous, the shape of the curve is explained completely by this latter reason.[31]

On what does the minimum-welfare number of blocs depend? We have found that it depends positively on the tariff rate t, other things being equal (an example of this can be seen in figure 1). Additionally, we have found (in simulations not shown here) that the minimum-welfare number of blocs increases with θ, other things being equal.

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[29] Krugman (1991a) considers for his simulations three different values for the elasticity of substitution: 2, 4 and 10. Since the elasticity of substitution is equal to $1/(1-\theta)$, the middle value of 4 is equivalent to our value of $\theta=0.75$.

[30] In Figure 1 the level of welfare is normalized to be 1 in the case of a single bloc.

[31] Krugman (1992) argues that the optimal tariff argument is not crucial, and shows that the U-shape result goes through even when tariffs are set exogenously.

4.2: Transport costs and free trade agreements' welfare effects

In this application, we study how the effect of the formation of continental free trade agreements on welfare depends on intercontinental transportation costs. Thus we are able to fill in the realistic intermediate case between Krugman's polar cases of zero and infinite intercontinental transportation costs. We start with the simple case where the world consists of three continents comprising two countries each. [Transportation costs *within* continents, a, are for simplicity assumed to be zero in the remainder of this paper.]

Figure 2 shows the percentage change in welfare associated with the formation of trading blocs, both of the natural and unnatural type, for $\theta=0.75$ and $t=0.3$.[32] We can see that there is a critical level of intercontinental transportation costs b, which governs the welfare effects. For the case of natural trading blocs, where each country forms a bloc with its neighbor, the critical value of b is approximately 0.186.[33] For higher values of b, the formation of continental trading blocs will result in improvements in welfare. (Remember, in the limit, Krugman's case where $b=1$ and natural blocs are necessarily good.) For lower values of b, continental blocs would reduce welfare. (Remember the limit case where $b=0$.) As noted in the introduction, we label such welfare-reducing arrangements "super-natural

[32] For comparison, the unweighted average tariff rate among the sample of developing countries examined in Pritchett and Sethi (1993, p.12) is .25. [There are two reasons why the true level of protection may be higher than this: we want to include the effect of nontariff barriers in addition to tariffs, and the composition of trade shifts endogenously away from high-tariff goods. There are also two reasons why the true level of average worldwide protection may be lower than this: industrialized countries have lower barriers than developing countries, and statutory tariff rates are in practice subject to many exceptions.]

[33] When tariffs are assumed to be levied on f.o.b. instead of c.i.f. values, the critical value of b is approximately 0.15 [Frankel, Stein and Wei (1993)].

blocs", to indicate that intercontinental transportation costs are not high enough to justify the formation of blocs even along the lines of geographical proximity.[34]

Unnatural trading blocs, where each country forms a bloc with one other country outside the continent, result in distinctly lower welfare for small values of b (when $b=0$ they reduce welfare in precisely the same way as natural blocs). Unnatural blocs then have a steadily smaller effect as b tends to 1 [as can be seen in the graph in Frankel, Stein and Wei (1993), which includes the range up to 1.0]. The reason for this is intuitive: as b gets closer to 1, the bilateral volume of trade between countries in different continents will tend to zero, whether they belong to the same bloc or not. Therefore, the formation of unnatural trading blocs has only negligible effect on welfare when intercontinental transport costs are very high. The limit is the polar case of no intercontinental trade.

Krugman's intuition that the benefits from regional free trade arrangements depends positively on intercontinental transportation costs is confirmed by our results. So is his idea that natural trade arrangements have a better chance of improving welfare than arrangements between unnatural partners (Krugman, 1991a).

4.3: Allowing for Preferential Trade Agreements

In this application, we will have another look at trading blocs of the "natural" kind (among neighbors), but we will allow for the formation of PTAs, i.e., partial liberalization. To do this, we need to modify our model slightly. The tariff level between partners, instead

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[34] Stein and Frankel (1993) and Frankel, Stein and Wei (1993) perform some sensitivity analysis with respect to t and θ. The benefit of forming trading blocs becomes much larger as t and θ increase.

of zero, will now be $(1-k)t$, where $0 \leq k \leq 1$, and k is the degree of preference for intra-bloc trade or intra-bloc liberalization. The price of partner varieties faced by domestic consumers now becomes:

$$p_c = \frac{p[1+(1-k)\,t]}{1-a}$$

Until now we were only considering the special cases of $k=0$ (absence of blocs) and $k=1$ (Free Trade Areas). Now the blocs are allowed to set any level of intra-bloc preference. We will begin, as in the previous application, with a world that consists of three continents, each formed by two countries.

What is the level of intra-bloc preference that will maximize welfare? Figure 3 shows the welfare level as a function of k, for t=0.3, θ=0.75, a=0, and several values of b.[35] This figure is closely related to figure 2 above. There, we were comparing the welfare levels associated with the two extremes of k=0 and k=1 for every possible level of inter-continental transportation cost b. For b<0.186, figure 2 indicates that the formation of FTAs along natural regional lines is welfare-reducing (super-natural).[36] In figure 3, this translates into a higher welfare level for the MFN or no-preference extreme (k=0) relative to the opposite endpoint of full continental FTAs (k=1) for b=0.1.

The important thing to notice in Figure 3 is that for every level of intercontinental transport costs, the degree of intra-bloc preference associated with maximum welfare is in

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[35] For each set of parameter values (transport cost and θ) welfare is normalized to be 1 under free trade in the figure.

[36] When tariffs are assumed to be levied on f.o.b. values, the critical value of b is 0.15 [Frankel, Stein and Wei (1993)].

between 0 and 1, which implies that, in general, PTAs with less than 100% preference are superior to FTAs. This follows from the fact that the welfare functions are strictly concave to the origin so, in general, the maximization problem will have an interior solution. The result is not new in the literature, having been first suggested by Meade (1955). It is noteworthy, however, if we contrast it with GATT's article 24, which allows for FTAs and Customs Unions as exceptions to the Most Favored Nation (MFN) clause, but not for PTAs with less than 100% preference.

Figure 3 suggests that starting from the absence of trading blocs, a small movement in the direction of increased regionalization (by increasing intra-bloc preference) is always a good thing. We can say that there are positive returns to regionalization up to the point of maximum welfare, and negative returns to regionalization thereafter.

Figure 4 provides another way of looking at this issue. For the set of parameters chosen, it represents all possible combinations of intercontinental transport cost b and intra bloc preference k. (As in the other graphs, we only show b up to .5 here, under the reasoning that transport costs higher than 50 per cent are not plausible.) The solid line represents the level of intra-bloc preference that maximizes welfare at each level of transportation cost b. Below this line, there are positive returns to regionalization, i.e., increasing the degree of preference will result in higher welfare. Above this line, increases in the preference are welfare-reducing. We call this the area of negative returns to regionalization NRR.

Within the NRR area, the dotted line represents, for every level of intercontinental transportation cost, the intra-bloc preference level that yields the same welfare as k=0 (i.e.,

the absence of trading blocs). The trade arrangements that lie above this dotted boundary are the ones we call super-natural trading blocs. The term "natural" does not seem appropriate to describe trade arrangements which, even when formed along the lines of geographical proximity, represent a movement so deep toward regionalization that welfare is reduced compared to the no-bloc situation.[37]

In reality, the world of course consists of more than three continents of two countries each. In Figure 4b we repeat the experiment for the more realistic, if still stylized, case where the world consists of four continents of 16 countries each. This 64-country set-up has the virtue of corresponding roughly to the data set in our gravity model. (We could get to four continents either by counting North and South America separately, or adding the Mideast/Africa.) We see that negative returns to regionalization set in sooner than before. If inter-continental transport costs are .2, then the world reaches the welfare optimum when intra-bloc preferences are as low as 10.4 per cent, and enters the super-natural zone when they are 20.4 per cent.[38] If inter-continental transport costs are only .1, then negative returns to regionalization set in even sooner.

We now look, in Figure 5, at the welfare effects of trade agreements, this time not

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[37] The "super-natural" bloc area does not always exist. For certain values of the parameters -- for example, (θ=0.85, t=0.35) in the stylized world of three two-country continents -- welfare under Free Trade Areas is better than welfare under the MFN rule for every value of transportation cost b. This eliminates the possibility of "super-natural" blocs. [In general, the higher θ and t, the less likely blocs will be "super-natural". In addition, the higher θ and t, the higher the optimal preference level k for every level of transportation cost b, which translates into a smaller area corresponding to negative returns to regionalization.]

[38] If tariffs are levied on the f.o.b. value, the welfare optimum when intra-bloc preferences are as low as 27.0 per cent, and enters the super-natural zone when they are 51.5 per cent. [Frankel, Stein and Wei (1993).]

only allowing for less than 100% preferences, but also assuming the world trade system chooses the preference level optimally.[39] We return (for the moment) to a hypothetical world of three continents consisting of two countries each. These arrangements are welfare-improving no matter what the intercontinental transport costs are.

As b increases, the difference between welfare under optimal PTAs and under FTAs diminishes. The reason for this is that, as can be observed in Figure 4, the optimal preference level approaches 1.0 for high values of b, and therefore an FTA becomes closer to being optimal. Recall once again the example of Krugman (1991b): in the limit, as intercontinental transport costs become prohibitive, FTAs become the first best arrangement.

This application, together with the second one, has provided some answers, within the limitations imposed by the structure of our model, to what Bhagwati (1992) calls the static-impact effect question regarding the creation of trading blocs. If intra-bloc preferences are set at the optimal level, regionalism will have an immediate positive effect on world's welfare. If countries are constrained to choose between no preferences and 100% preferences (as in Article 24 in the GATT), the impact of regionalism on welfare will depend on the values of parameters such as transportation costs and consumers' preference for variety. The larger the intercontinental transportation costs, and the lower the preference for variety (or the higher θ), the more likely regionalism will have a positive immediate impact. Furthermore, the

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[39] This "optimal" level is not the result of a Nash non-cooperative equilibrium, where each bloc chooses the optimal preference level given the preference level chosen by the rest of the blocs (and given the tariff level t). It is just the preference level that maximizes welfare in a symmetric world, and can be interpreted as the cooperative solution (again, given the tariff level t).

closer the trading blocs follow along the lines of geographical proximity, the more likely they are to increase welfare, as Krugman has suggested.

Does this mean that GATT should eliminate Article 24's requirement that FTAs stipulate complete liberalization, and perhaps substitute a requirement that preferential arrangements be allowed only among neighbors? From the purely static point of view of our model, the answer to this question would be appear to be yes. Blocs with less than 100% preference formed along the lines of geographical proximity provide the best possible outcome in terms of immediate impact on welfare. However, two (at least) important caveats should be noted. First, the welfare effects appear to be small. In the simulation results shown in Figure 5, welfare effects have the dimension of real GNP. To focus on the case of $b=.2$ in a six-country world (three continents of two countries each), the welfare benefit of moving from MFN to a system of optimally-calibrated PTAs is only about 0.512 per cent of real GNP. [The welfare gain from forming a system of continental FTAs is very small (0.05 per cent). Thus, the difference between the two kinds of regional trading arrangements is only half a per cent of GNP.] These numbers are small, in part, because $b=.2$ is so close to the borderline case.

Second, Bhagwati's "dynamic time-path" question remains. The ultimate goal is the achievement of multilateral free trade among all countries. Limiting the formation of blocs to geographically proximate countries might not be the best way to go, if it led to the permanent fragmentation of the world's trade rather than to a process of continuous integration. The answers are not clear once we include dynamic political economy

considerations in the analysis.[40]

5. Some Estimates of Intercontinental Costs to Evaluate the Extent of Regionalization

It would be useful to obtain estimates of the parameters, especially the crucial magnitude of intra-continental transportation costs, b, to get a better idea where the world economic system lies in terms of the welfare spaces mapped out above. One cannot claim any kind of precision to the estimates, but the exercise may be instructive.

We can think of four ways of estimating b. First is direct data on bilateral shipping costs. One disadvantage here is that the range of variation of actual shipping costs is extremely wide across modes of transport and kinds of goods, especially as a percentage of value, and it would be difficult to know how to aggregate different measures.

Second is the ratio of the c.i.f. value of a country's trade to its f.o.b. value. One disadvantage here is that the data are not available on a bilateral basis. Another disadvantage of using aggregate c.i.f./f.o.b. numbers is that they depend on the composition of trade (which is in turn influenced by the true transportation costs).

The ratio of total worldwide import values, including insurance and freight, to export values is about 1.06.[41] We can infer a rough upper bound on b by assuming that 6 per cent is a weighted average of intra-continental costs and inter-continental costs:

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[40] Political economy considerations like those mentioned in the introduction -- a country that joins an FTA may then experience an increase in political support for further steps toward liberalization -- are modelled by Baldwin (1993), and also in a preliminary way in Wei and Frankel (1993).

[41] 1.066 in 1980 and 1.053 in 1989. Table 36 from Review of Maritime Transport 1990, UNCTAD, U.N.: New York, 1991.

$.06 = ICS\ a + (1\text{-}ICS)(a+b-ab)$, or

$$b = (.06\text{-}ICSa)/[(1\text{-}ICS)(1\text{-}a)] - a/[1\text{-}a] \leq .06/(1\text{-}ICS). \qquad (20)$$

We get our *ICS* estimate from Table 1. Considering only the set of 63 countries examined statistically in the first part of the paper, the intra-continental trade share is about .4. (Somewhat lower in East Asia and the Americas, higher in Europe. The simple average for the three continents is .39 in 1990, up from .35 in 1980. The average of the three weighted by shares in world trade is .44, up from .40 in 1980.) Thus (20) implies an upper bound on b of $.06/(1\text{-}.4) = .10$.

If 10 per cent is a realistic estimate of intra-continental transport costs, then we can see from Figure 2, 3, or 4 that super-natural trading blocs are a real danger. For $b=.10$, our base-case parameter values, and a world consisting of three continents of two countries each, negative returns to regionalization set in when preferences are 49.5 per cent; any greater degree of regional preference moves into the zone of negative returns to regionalization (Figures 3 and 4). For this world, 87.6 per cent preferences put the economy into the super-natural zone. For a world consisting of four 16-country continents, negative returns set in even sooner. The optimum degree of continental preferences is 7.6 per cent, and the super-natural zone begins at 14.8 per cent (Figure 4b).

It is likely that the c.i.f./f.o.b. ratio substantially understates the costs of trade by focusing solely on the cost of physical transport, and omitting for example costs associated with personal contact between buyer and seller. Recent literature on spillovers and geographic concentration suggests that the effects of proximity on stimulating production are much greater than mere transportation costs. In the classic gravity model of world trade,

Linneman (1966) concluded that the effect of distance on trade consisted of three kinds of effects rather than one: (i) transportation costs, (ii) the time element (involving concerns of perishability, adaptability to market conditions, irregularities in supply, in addition to interest costs), and (iii) "psychic" distance (which includes familiarity with laws, institutions and habits).

Within the confines of our theoretical model, the parameter b could be estimated in a simple way from the data on intra-regional trade shares, if we were willing to assume that the observed current tendency for countries to trade with neighbors was the result solely of geographical proximity, and not of preferential trading policies.[42] An estimate along these lines is derived in Frankel, Stein and Wei: it works out to $b = .383$.

Such an estimate of b is, however, likely to be *overstated*. We know from our gravity estimation that statistically significant tendencies toward regional trade preferences already exist, and thus explain part of the proclivity toward intra-regional trade that shows up in Table 1. For this reason, our preferred estimate of b comes from the gravity estimates in Part 2. They hold constant for the effects of regional trading arrangements already in existence, as well as the effect of per capita GNPs, common languages, etc.

Table 3 gives distance in kilometers between some major world capitals. Table 4 gives the average distance between all the pairs of countries in our sample, by continent. Averaging over all countries in the sample, the mean distance between countries on the same continent is 2896 kilometers, and on different continents is 11776 kilometers -- four times as

[42] Krugman (1991) and Summers (1991), for example, use simple calculations to infer roughly the importance of distance in determining trading patterns, without explicitly distinguishing the effect of existing trade preferences.

great. The gravity equations estimate the coefficient of the log-distance between a pair of countries at about .56. It follows that trade between two countries on the same continent will on average be twice as great as trade between countries on different continents, other things equal [.56{log(11776/2896)}=.7855 and exp(.7855)=2.19].

In the algebra in Part 3 of the paper, the elasticity of demand, $\epsilon_x = \frac{dlog(Trade)}{dlog(P)}$, is given by $1/(1-\theta)$. If transport costs show up fully in the price facing the consumer, then our desired estimate of b is $\frac{dlog(P)}{dlog(Distance)} \log(11776/2896)/(1-a) =$

$\frac{dlog(Trade)/dlog(Distance)}{dlog(Trade)/dlog(P)} 1.403/(1-a) = [.56(1-\theta)]\, 1.403/(1-a)$. Choosing again our baseline value $\theta = .75$, and for the simple case where $a=0$, our sample calculation suggests that the difference between inter-continental transportation costs and intra-continental costs is roughly on the order of 19.6 per cent.[43]

If taken at face value, the .196 estimate together with Figure 4 suggests that the optimal degree of preferences within a continental grouping is roughly 60 per cent in a stylized six-country world. In other words, intra-regional trade barriers should be lowered to 40 per cent of the level of world-wide barriers. Only if regionalization proceeds past that point, does it enter into the zone of negative returns to liberalization. For the more realistic 64-country world of Figure 4b, negative returns to regionalization set in as early as at 10.4

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[43] This is in fact a lower bound for b, that holds only when $a=0$. More generally $b=.196/[1-a]$. Even for a as large as .2, however, $b = .245$ and our central qualitative conclusions hold.

per cent preferences and the super-natural zone at 20.4 per cent preferences.

The last step is to try to extract from our gravity estimates of part 2 a measure of k, the degree of preferences prevailing in existing regional trading blocs, in order to help evaluate whether the world trading system has in fact entered the super-natural zone. Our gravity estimates [in Table 2 and earlier work] suggest that the EC in 1990 operated to increase trade among its members by roughly 50 per cent. Other parts of the world have arrangements that are either weaker or stronger. Let us ask the hypothetical question what would be the effect on world economic welfare if the trading system settled down to an array of continental blocs that each had the same level of preferences as the EC.

Let the percentage effect on trade of bloc formation be represented by γ.[44] Using our model of part 4, a bit of algebra reveals that the formation of a bloc with preferences of k lowers the prices of goods in intra-bloc trade by $-tk/(1+t)$. The ratio of the change in quantity to the change in price is equal to the elasticity of demand:

$$\frac{\gamma}{tk/(1+t)} = \epsilon_x = 1/(1-\theta).$$

Solving for the parameter we wish to estimate,

$k = \gamma(1+t)(1-\theta)/t.$

Taking $\gamma = 0.5$ from the EC estimate, $\theta = 0.75$, and t = .30, the implied estimate of k is .54. In other words, EC preferences operate to reduce trade barriers by 54 per cent for intra-bloc trade. This parameter value lies within our super-natural zone. It follows, within the assumptions of our model, that if all continents followed the EC example, the

[44] This is actually -1 + exp (the coefficient in the gravity equation).

regionalization of world trade would be excessive, in the sense that world economic welfare would be reduced relative to the MFN norm.

* * *

The tentative conclusion of this study is that some degree of preferences along natural continental lines, such as an Enterprise for the Americas Initiative, or enlargement of the EC into a European Economic Space, would be a good thing, but that the formation of Free Trade Areas where the preferences approach 100 % would represent an excessive degree of regionalization of world trade. The overall conclusion is that the world trading system is currently in danger of entering the zone of excessive regionalization.

The optimal path to liberalization apparently features a sharp departure from Article 24. It entails reducing intra-regional barriers by only 10 per cent or so. The strategy of concentrating on reducing trade barriers at the multilateral level before liberalizing completely within any one continental trading arrangement appears to be preferable.

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Table 1: Intraregional Trade Shares

		1965	1970	1975	1980	1985	1987	1990
East Asia		.199	.198	.212	.229	.256	.263	.293
Western Hemisphere	.315	.311	.309	.272	.310	.279	.286	
Europe		.502	.532	.524	.538	.548	.601	.602

Table 2: Implicit and Explicit Continental Trade Blocs
(Total Trade, 1965-1990)

	1965	1970	1975	1980	1985	1990
GNP	0.64**	0.64**	0.73**	0.76**	0.56**	0.77**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
GNP per capita	0.28**	0.37**	0.28**	0.31**	0.08**	0.11**
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
Distance	-0.42**	-0.50**	-0.64**	-0.51**	-0.31**	-0.51**
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Adjacency	0.57**	0.64**	0.53**	0.69**	0.76**	0.81**
	(0.16)	(0.15)	(0.15)	(0.16)	(0.18)	(0.16)
WH2	-0.36**	-0.22#	0.07	0.29*	0.33#	0.79**
	(0.14)	(0.11)	(0.14)	(0.13)	(0.17)	(0.16)
EAsia2	1.97**	2.45**	1.82**	2.21**	1.10**	1.90**
	(0.18)	(0.20)	(0.16)	(0.15)	(0.17)	(0.14)
EC2	0.28*	0.13	-0.03	0.25*	1.56**	0.51**
	(0.12)	(0.11)	(0.10)	(0.10)	(0.14)	(0.10)
Common Links	0.52**	0.36**	0.37**	0.62**	0.67**	0.46**
	(0.09)	(0.89)	(0.09)	(0.09)	(0.09)	(0.09)
# observations	1194	1274	1453	1708	1343	1573
SEE	1.05	1.08	1.18	1.21	1.28	1.08
adj. R^2	0.68	0.71	0.71	0.71	0.51	0.77

Notes: (1) Heteroskedastic-consistent standard errors are in parentheses
(2) ** denotes significant at 1% level (t=>2.576)
* denotes significant at 5% level (t=>1.96)
# denotes significant at 10% level (t=>1.645)
(3) All variables except the dummies are in logarithms
(4) "Common Links" -- dummy for common linguistic or colonial links
(German, Japanese, Dutch, English, Spanish, Chinese, Arabic, French, and Portugese).

Table3 : Bilateral Distances for some Major Cities, in kilometers

	Tokyo	Chicago	Geneva	Sydney	SaoPaolo
Tokyo					
Chicago	10142.4				
Geneva	9803.0	7056.8			
Sydney	7835.4	14891.3	16788.5		
Sao Paulo	18546.6	8415.8	9406.3	13370.9	
Nairobi	11278.6	12894.0	6078.1	12162.7	9289.96

Table4 : Average Bilateral Distances, in kilometers

	Europe	Western Hemisphere	Pacific Asia
Europe	1491		
Western Hem.	9585	4163	
Pacific Asia	10995	15902	4293

Figure 1: Number of Blocs and Welfare

(zero transport costs; theta = 0.75)

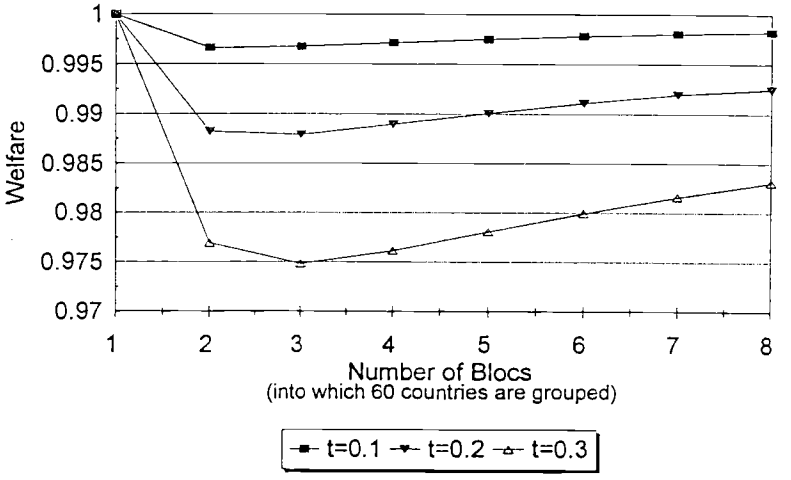
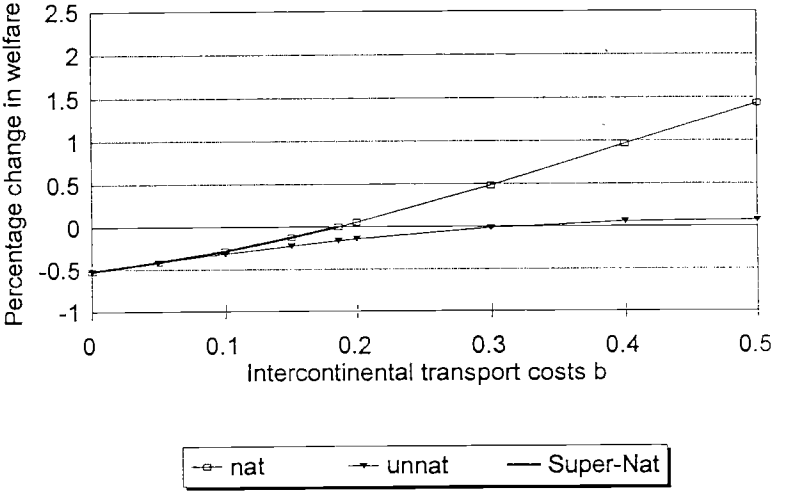


Figure 2: Welfare effect of agreements

(Theta=0.75; t=0.3; a=0; N=2; C=3)



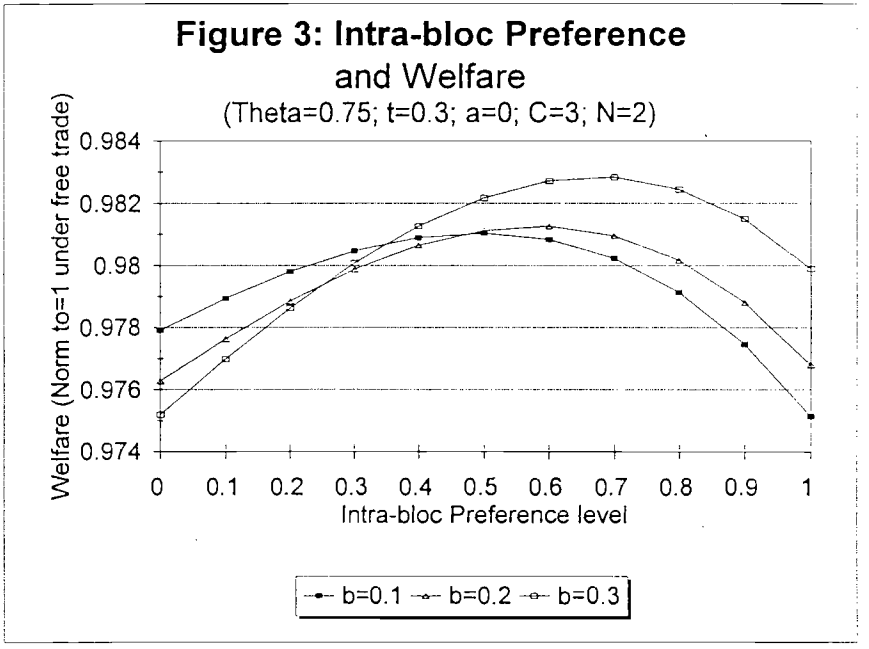


Figure 3: Intra-bloc Preference and Welfare
(Theta=0.75; t=0.3; a=0; C=3; N=2)
Welfare (Norm to=1 under free trade)
0.984
0.982
0.98
0.978
0.976
0.974
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Intra-bloc Preference level
b=0.1
b=0.2
b=0.3

Figure 4: Returns to Regionalization and Supernatural Blocs

(Theta=0.75; t=0.3; a=0; N=2; C=3)

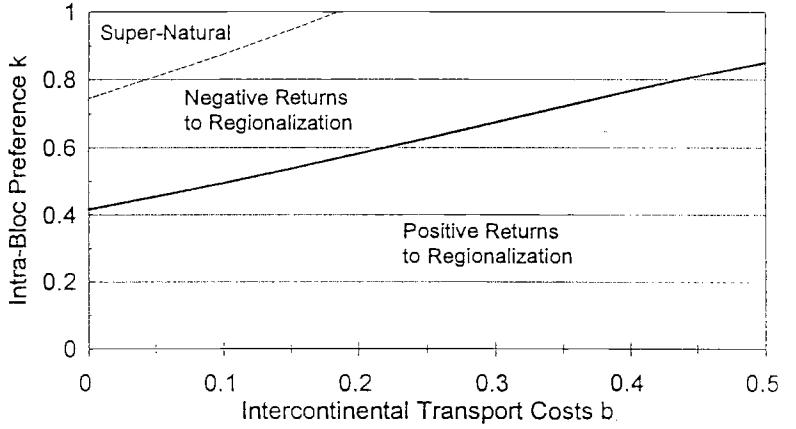


Figure 4b: Returns to Regionalization and Supernatural Blocs

(Theta=0.75; t=0.3; a=0; N=16; C=4)

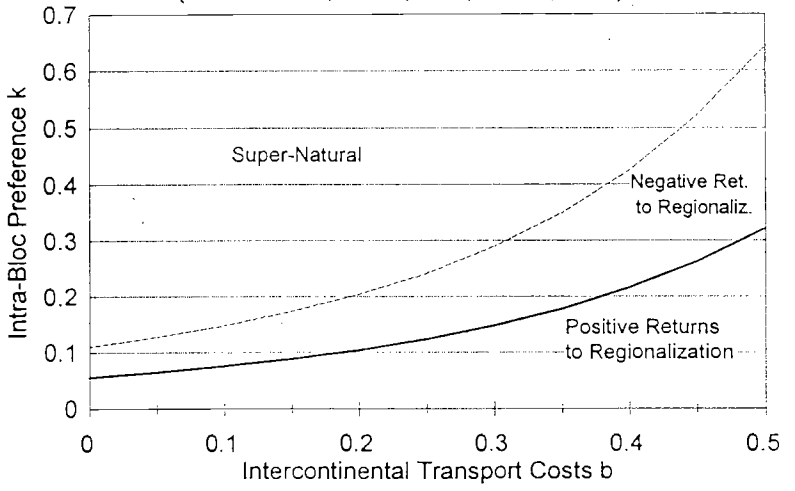
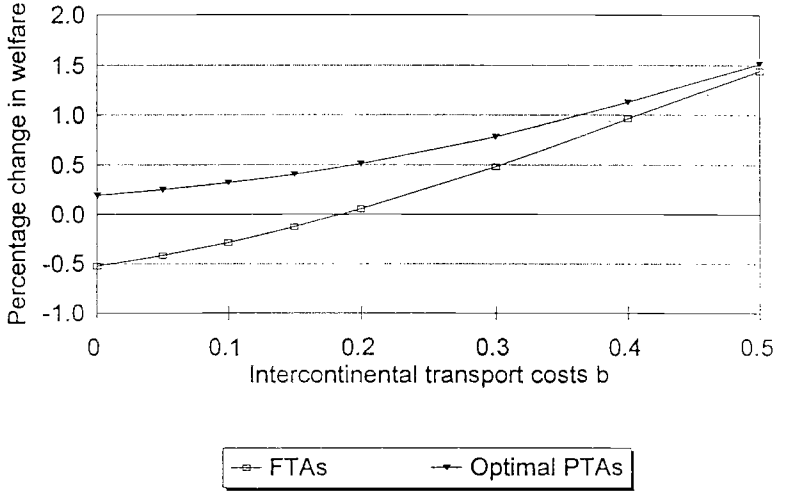


Figure 5: Welfare Effects of FTAs and Optimal PTAs

(Theta=0.75; t=0.3; a=0; N=2; C=3)



Appendix: List of Countries Used in the Gravity Equation

showing regional groupings, and main city

(The distance between countries was computed as the Great Circle distance between the relevant pair of cities.)

Americas (WH, 13)	
Canada	Ottawa
US	Chicago
Argentina	Buenos Aires
Brazil	Sao Paulo
Chile	Santiago
Colombia	Bogota
Ecuador	Quito
Mexico	Mexico City
Peru	Lima
Venezuela	Caracas
Bolivia	La Paz
Paraguay	Asunxion
Uruguay	Montevideo
European Community (EC, 11)	
W.Germany	Bonn
France	Paris
Italy	Rome
UK	London
Belgium	Brussels
Denmark	Copenhagen
Netherlands	Amsterdam
Greece	Athens
Ireland	Dublin
Portugal	Lisbon
Spain	Madrid
European Free Trade Area (EFTA, 6)	
Austria	Vienna
Finland	Helsinki
Norway	Oslo
Sweden	Stockholm
Switzerland	Geneva
Iceland	Reykjavik
East Asia (EAEC, 10)	
Japan	Tokyo
Indonesia	Jakarta
Taiwan	Taipei
HongKong	HongKong
S.Korea	Seoul
Malaysia	Kuala Lumpur
Philippines	Manila
Singapore	Singapore
Thailand	Bangkok
China	Shanghai

Other countries (23)	
S. Africa	Pretoria
Turkey	Ankara
Yugoslavia	Belgrade
Israel	Jerusalem
Algeria	Algiers
Libya	Tripoli
Nigeria	Lagos
Egypt	Cairo
Morocco	Casablanca
Tunisia	Tunis
Sudan	Khartoum
Ghana	Accra
Kenya	Nairobi
Ethiopia	Addis Ababa
Iran	Tehran
Kuwait	Kuwait
Saudi Arabia	Riyadh
India	New Delhi
Pakistan	Karachi
Hungary	Budapest
Poland	Warsaw
Australia	Sydney
New Zealand	Wellington

Note: APEC consists of East Asia, plus Australia, New Zealand, Canada & the United States.