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Winners and Losers from Regional Integration Agreements

Anthony J. Venables*
London School of Economics and CEPR

Abstract:

How are the benefits – and costs – of a customs union divided between member countries? Outcomes depend on the comparative advantage of member countries, relative to each other and relative to the rest of the world. Countries with a comparative advantage between that of their partners and the rest of the world do better than countries with an 'extreme' comparative advantage. As a consequence, integration between low income countries tends to lead to divergence of member country incomes, while agreements between high income countries cause convergence. Results suggest that developing countries are likely to be better served by 'north-south' than by 'south-south' free trade agreements.

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Correspondence address:
A.J. Venables
Dept of Economics
London School of Economics
Houghton Street
London WC2A 2AE
UK

email:
a.j.venables@lse.ac.uk
http://econ.lse.ac.uk/staff/ajv/

1. Introduction:

How are the gains and losses associated with membership of a customs union divided between member countries? Do unions promote convergence of per capita income levels amongst member states, or divergence? The theory of economic integration (from Viner 1950 onwards) tells us that the effects of membership are ambiguous, but gives little guidance on these questions.[1]

The empirical literature is slightly more suggestive. For customs unions containing relatively high income countries there is evidence of convergence. For example, the work of Ben-David (1993, 1996) charts convergence within the European Union. From the late 1940s to early 1980s he finds that per capita income differences narrowed, falling by about two thirds over the period, due mainly to more rapid growth of the lower income countries.[2] More recently there has been the strong performance of Ireland, Spain and Portugal, which have made substantial progress in closing the gap with richer members of the EU. Whereas in the mid 1980s these countries' per capita incomes were, respectively, 64%, 67% and 57% of the income of the large EU countries,[3] by the end of the 1990s the numbers had risen to 113%, 80% and 71%. Clearly, the prospect of convergence is motivating the queue of entrants to the EU.

For low income countries there is some evidence that the opposite process is at work, with regional integration promoting divergence. Perhaps the best documented example of this is the concentration of manufacturing in the old East African Common Market. In the 1960s Kenya steadily enhanced its position as the industrial centre of the Common Market, producing more than 70% of the manufactures, exporting a growing percentage of them to its two relatively less developed partners, and achieving faster GDP growth (Eken 1979). The Common Market collapsed in 1977, partly because of the internal tensions that this divergent performance created. More recent examples include the concentration of industry, commerce and services in and around Guatemala City and San Salvador in the Central American Common Market, and Abidjan and Dakar in the Economic Community of West Africa. El Salvador and Guatemala now account for

over 80% of manufacturing value added in the Central American Common Market, up from 68% in 1980; over the same time period their per capita incomes have gone from 117% and 112% of the average for CACM to 138% and 116% respectively. And in the Economic Community of West Africa the combined share of Cote d'Ivoire and Senegal in manufacturing value added has risen from 55% in 1972 to 71% in 1997, although Cote d'Ivoire's income lead has narrowed.[4] Understanding the effects of regional integration on the distribution of income in 'South - South' agreements is particularly important given the recent rapid growth in the number of such agreements (World Bank 2000).

Many factors may be driving these changes, but this paper concentrates just on comparative advantage and its implications for trade creation and trade diversion. We show that customs union (CU) membership will lead to convergence of income levels within a union composed of high income countries, and divergence within a union composed of low income members.

The argument is based on the comparative advantages of member countries, relative to each other and to the rest of the world. Suppose that countries differ in their endowments of skilled and unskilled labour, and that these differences form the basis of their comparative advantage. Let us take two countries that are unskilled labour abundant relative to the rest of the world (say 'Uganda' and 'Kenya'), and suppose that one of them, Uganda, is also unskilled abundant relative to the other, Kenya. Uganda therefore has an 'extreme' comparative advantage, and Kenya an 'intermediate' one. What happens if these two countries form CU? The comparative advantage of Kenya relative to Uganda will cause Kenya to export the skilled labour intensive good (say manufactures) to Uganda, which will export the unskilled labour intensive good (agriculture) in return. The first of these flows is trade diverting: Uganda is getting its imports of manufactures from Kenya not from the rest of the world, in line with intra-union not global comparative advantage. The second is trade creating: by increasing imports of agriculture from Uganda, Kenya is trading with the global, not just intra-union, lowest cost supplier.

The general argument here is that the country with an 'intermediate' comparative advantage will do better from the union than the one with the 'extreme' comparative advantage. Intuitively, interposing an intermediate country between the extreme one and the rest of the world is exactly the circumstance likely to divert the extreme country's trade. For two poor countries this unequal division of costs and benefits causes income divergence; the extreme country is the one with the least skilled labour, and hence initially poorest. However, for two rich economies (both with above world average skilled labour abundance) the extreme country is the one with the highest skilled - unskilled labour ratio. Thus, exactly the same force that drives income divergence in a CU between Kenya and Uganda, leads to income convergence in a CU between, say, France and Spain.

The remainder of the paper is devoted to developing these ideas more fully. First (section 2), we present a two-good diagrammatic analysis of the relationship between comparative advantage and trade creation/ diversion. Then we develop the argument in a Ricardian trade model (section 3), generalised to have many goods and (in one case) a sector specific factor. Finally (section 4), we present a simulation based exploration of a two-factor and two-sector model which combines a Heckscher-Ohlin structure with product differentiation by location of production (Armington). The model shows how, given the endowment of the rest of the world, the gains and costs of CU membership depend on each country's own endowment and that of its partner. We also use this model to look at the question of South-South versus North-South CUs, arguing, as do Spilimbergo and Stein (1998), that the latter are likely to be preferable for Southern countries.

How does the present paper, with its focus on comparative advantage, relate to existing literature? Much recent work analyses regional integration in models with product differentiation and intra-industry trade, generally abstracting from comparative advantage. This is partly because of the intrinsic importance of some product market issues (eg, competition effects), and partly because these models provide a tractable framework in which to analyse dynamic effects and political economy considerations (eg Krugman 1991, Krishna 1998, Baldwin 1995). In the

competitive equilibrium tradition, the Kemp-Wan-Ohyama (Kemp and Wan 1976) analysis establishes sufficient conditions for gain, but does not investigate the distribution of costs and benefits when these conditions do not hold. Much of the rest of the competitive equilibrium literature is devoted to models in which a very specific structure of trade is assumed; for example, the three -country and three-good models (following Meade 1955, and reviewed in Lloyd 1982), in which integrating countries are simply assumed to export different goods. These models have the drawbacks that a very large number of trade configurations are possible (Lloyd 1982), and that the failure to connect with underlying determinants of comparative advantage makes it impossible to ask questions such as, is a South-South agreement better than a North-South agreement? A recent paper that does address this issue and makes explicit the endowments of the countries is Spilimbergo and Stein (1998). They undertake numerical analysis of a model in which there are two identical low income (capital-scarce) countries and two identical high-income (capital-rich) countries, investigating the effects of alternative trading arrangements. Our analysis provides for a larger set of configurations of comparative advantage, permitting analysis of gains and losses within South-South and North-North agreements.[5]

The fundamental difficulty in the development of the literature perhaps arises from the fact that, in the obvious benchmark trade model, CU formation has no effect whatsoever. If the integrating countries are small and have the same pattern of trade with a large 'rest of the world' both before and after formation of the CU, then prices of all goods so traded are set in the rest of the world and unchanged by formation of the union; formation of the CU then has no effect. An interesting model must therefore have one of the following characteristics. Either goods must switch source of supply or direction of trade; or terms of trade effects must be introduced, so that price changes can occur. In this paper we develop a family of models in order to pursue both approaches. In the diagrammatic analysis and Ricardian models (sections 2 and 3) CU formation has the effect of causing changes in the sourcing of imports. In the Heckscher-Ohlin-Armington

model (section 4) product differentiation means that fixed prices of rest of the world goods are consistent with variation of the prices of goods produced and exported by the integrating economies. We have no completely general theorem, but argue that careful consideration of countries' comparative advantage, relative to their partner and relative to the rest of the world, yields some important insights about the costs and benefits of CU membership, insights that are robust across the family of models studied.

2: Internal and external comparative advantage: A diagrammatic example.

Figure 1 presents the diagrammatic argument. There are two goods, A and M, and three countries, a large rest of the world (country 0), and two small countries, 1 and 2. The figure has on the axes quantities of goods A and M, consumption of which takes place in fixed proportions, along the consumption line illustrated. The world price of good M in terms of A is p_0.[6]

Production possibilities for countries 1 and 2 are illustrated by the solid lines A_1M_1 and A_2M_2. They are constructed such that both 1 and 2 have comparative advantage in good A relative to the rest of the world, and 2 also has a comparative advantage in A relative to 1. Thus, with free trade and prices p_0 countries 1 and 2 would produce at points F_1 and F_2. They would both export good A, country 2 more than country 1, since it has the more extreme comparative advantage (like Uganda in our earlier example).

The initial situation is not free trade, but a position in which all imports by countries 1 and 2 are subject to tariffs at rate $T > 1$.[7] We set this rate sufficiently high that country 1 is self sufficient at point $C_1 = Q_1$, with the domestic price of good M in terms of good A given by the gradient of the production possibility frontier at this point. This price ratio lies between the domestic price ratio that would rule if good M were to be imported (p_0T), and that which would rule if good A were to be imported (p_0/T), so confirming that trade is not profitable. Country 2 has the same tariffs, but its more extreme comparative advantage means that it has some trade in the initial

situation, producing at Q_2 and consuming at C_2. It imports good M, meaning that the domestic price ratio is p_0T, at which Q_2 is profit maximising. The budget constraint holds at world prices, p_0, so country 2's trade vector is Q_2C_2.

What happens if these two countries form a customs union? Country 1 has a comparative advantage in M relative to country 2 and, in the initial position, a lower relative price of M. It therefore starts to export good M to 2, moving Q_1 around towards Q_1*. In the equilibrium illustrated, the CU as a whole continues to import some M from the rest of the world, so the internal price settles at p_0T. Countries 1 and 2 produce at Q_1* and Q_2, and internal trade is the vector Q_1*C_1* = Q_2E (this trade taking place at internal price ratio p_0T). External trade of country 2 is vector EC_2*, while country 1 only has internal trade.

The welfare effects of the CU are given by comparison of consumption points. Country 1 gains from the union (C_1* is above C_1); it now has some gains from trade, where previously it had none. Notice that this arises despite the fact that country 1's production structure has moved in the opposite direction from the way it would go under free trade. In contrast, country 2 loses, the reason being trade diversion: it was getting all its imports of M from the rest of the world, and is now getting some of them from its higher cost partner. As we argued in the introduction, the extreme country's (2's) imports are diverted to a partner country with comparative advantage between it and the rest of the world. However, for the intermediate country, trade with the partner and with the rest of the world are less close substitutes, and therefore less vulnerable to trade diversion.

This diagrammatic analysis provides a rigorous argument, but perhaps seems rather contrived – one of the countries is in autarky in the initial situation, and trades only with its partner once the CU is in place. This reflects the problem noted at the end of the introduction, and is why we now turn to more general models.

3: Generalised Ricardian models.

Multi-product comparative advantage

If there are many goods with technical coefficients varying across countries, then CU formation will generally bring both trade creation and trade diversion as goods change source of supply. How is the distribution of these effects related to countries' comparative advantage? We first construct a diagrammatic approach which suggests, again, that a country with 'extreme' comparative advantage is likely to do relatively badly. A fully specified model with a continuum of products and systematic variation in comparative advantage is then constructed and analysed.

The vertical axis of figure 2 measures the cost of producing a good in country 2, and the horizontal the cost in country 1. Thus, the points labelled with Greek letters represent goods, and their coordinates the costs of producing them in each country. These costs are composed of the wage in each country, w_i, times the unit labour coefficients, b_i, which vary across goods and countries reflecting Ricardian efficiency differences. All goods have rest of the world price 1 (by choice of units) and initially face country 1 and 2 import tariffs at rate T.

Of the set of goods illustrated in the figure, good α is the one with the lowest country 1 unit labour requirement. This good will therefore be exported by country 1 and, since the world price of the good is unity, this sets the country 1 wage at $w_1 b_1(\alpha) = 1$. In the initial situation where all imports bear tariff T, country 1 is self sufficient in goods β, γ, and ϵ since domestic costs ($w_1 b_1$) are less than the private unit costs of import (= T) and greater than unit export receipts (= 1). Goods δ and ζ are imported from the rest of the world ($w_1 b_1 > T$). The analogous configuration for country 2 can be read off the vertical axis. Good β has the lowest unit labour requirement, so the country 2 wage is set by $w_2 b_2(\beta) = 1$. Country 2 is self sufficient in goods δ and ϵ ($1 < w_2 b_2 < T$) and imports α, γ, and ζ ($w_2 b_2 > T$).

Formation of a CU will change the pattern of trade in some goods and not others. Wages in both economies remain constant, because they continue to supply their respective export goods

to the rest of the world. However, country 1 will now buy from country 2 any good for which $w_2 b_2 < w_1 b_1$ (below the 45° line) and $w_2 b_2 <$ T (so cheaper to import duty free from the partner than import from rest of the world). As illustrated, this includes two goods. Good δ goes from being imported from the rest of the world to being imported from the partner country; this is trade diversion with additional cost per unit of $w_2 b_2(\delta) - 1$. Good β goes from country 1 self sufficiency to being imported from 2; this is trade creation, with cost saving per unit of $w_1 b_1(\beta) - w_2 b_2(\beta)$.

Analogously, country 2, now imports from 1 any good for which $w_1 b_1 < w_2 b_2$ and $w_1 b_1 <$ T. Good γ therefore experiences trade diversion, now being supplied by country 1 instead of the rest of the world (since T > $w_1 b_1(\gamma) > 1$). Good ϵ goes from being locally produced in 2 to imported from 1, and this is trade creation, since $w_1 b_1(\epsilon) < w_2 b_2(\epsilon)$, bringing unit cost saving equal to this cost difference.

These effects are summarised in table 1, and the regions of product space within which country 2 experiences trade creation and diversion are illustrated by the shaded areas on figure 3; (analogous country 1 zones are not marked).

Table 1: The direction of trade

	Initial		CU		Welfare Change	
	Country 1	Country 2	Country 1	Country 2	Country 1	Country 2
α	Exp. to R	Imp. from R	Exp. to R	Imp. from R		
β	No trade	Exp. to R	Imp. from 2	Exp. to R&1	↑, TC	
γ	No trade	Imp. from R	Exp. to 2	Imp. from 1		↓, TD
δ	Imp. from R	No trade	Imp. from 2	Exp. to 1	↓, TD	
ϵ	No trade	No trade	Exp. to 2	Imp. from 1		↑, TC
ζ	Imp. from R	Imp. from R	Imp. from R	Imp. from R		

This framework provides a quite general way for thinking about the effects of customs union formation as it illustrates which products change source of supply, and the cost change per unit from such changes. To calculate the overall welfare effect we also need to know the distribution of commodities over the space and the consumption levels of each, before and after CU formation. For example, if countries 1 and 2 consume only goods, α, γ, δ, and ζ, and have perfectly price inelastic demands then CU formation reduces welfare in both countries – goods δ and γ switch to being imported from the higher cost partner, so there is trade diversion without trade creation. If demands are price elastic then the lower consumer prices expand trade volumes, bringing a welfare gain that will offset the loss due to the switch to higher cost source of supply.[8]

Can we now link this to our discussion of countries' comparative advantage relative to each other and relative to the rest of the world. Suppose that the set of products that exist are uniformly distributed within the ellipse shape area on figure 2. Then it is clear that country 1 is 'more like' the rest of the world than is country 2. Country 1's production costs relative to the rest of the world vary at most by an amount equal to the width of the ellipse, and on average by half of this; in contrast, country 2's production costs vary according to the height of the ellipse. Country 1 has comparative disadvantage relative to the world but comparative advantage relative to country 2 ($1 < w_1 b_1 < w_2 b_2$), in all products in the ellipse and above the 45^o line. Thus, for this majority of commodities, it lies 'between' country 2 and the rest of the world.

Comparing the shape of the ellipse with the regions of trade creation and diversion completes the argument. As illustrated, a high proportion of country 2's goods change source of supply (the intersection of the ellipse and the shared areas) and for most of those that do, this is trade diversion, goods such as γ coming from country 1 instead of from the rest of the world. For country 2, a much smaller proportion of goods change source of supply, and most of these changes are trade creation.[9] Thus, this multi-commodity framework confirms our earlier finding. The 'extreme' country does worse than the 'intermediate' one.

A continuum of products:

A formal model can be easily developed if the set of products is restricted to lie on a line in b_1b_2 space, as is usual in such a model (eg Dornbusch, Fischer and Samuelson 1977). We describe manufacturing in this way, and now add to the model an agricultural sector which produces a single product using labour and a fixed factor. The presence of this sector means that the wage in each country rises with the size of its manufacturing sector, enabling us to capture the idea that CU formation may, if it causes manufacturing output levels in the two economies to diverge, also cause divergence of relative wages.

We develop the model for a pair of integrating countries whose comparative advantage, relative to the world, is in agriculture. The total labour force in each of these countries is denoted N, and manufacturing employment is L_i, $i = 1, 2$. The agricultural production function is the same in both, and takes the form $A(N - L_i)$, with function A increasing and strictly concave. The world price of agriculture is unity, and in all cases that we study the integrating countries export agriculture, so the internal price of agriculture in these countries is unity. Their wages are therefore,

$$w_i = A'(N - L_i), \qquad i = 1, 2. \tag{1}$$

There is a continuum of industrial products, indexed by $z \in [0, 1]$, all of which have world price of unity. In country 1 the labour required to produce a unit of product z is $b(z)$, with $b'(z) > 0$. Country 2 labour is less efficient in all industrial products, with labour input requirements $\phi b(z)$, $\phi > 1$. Comparative advantage is such that neither country exports manufactures to the rest of the world, so $w_1 b(z) > 1$ and $w_2 \phi b(z) > 1$ for all z. However, the external tariff means that some range of manufacturing products is produced in each country – those with z below critical values z_1^*, z_2^* defined by,

$$w_1 b(z_1^*) = T, \qquad \text{and} \qquad w_2 \varphi b(z_2^*) = T. \tag{2}$$

where T is the price of imported manufactures. There may also be internal trade in some manufactures because country 1 has lower unit labour requirements in manufacturing than does

country 2. If the internal tariff between these countries is *t*, then this manufacturing trade from 1 to 2 occurs only if

$$w_1 t = \varphi w_2 \tag{3}$$

(which ensures that $tw_1 b(z) = w_2 \phi b(z)$).

To complete characterization of equilibrium we have to find labour demand and hence equilibrium wage rates. Country 2 imports all manufactures in the interval $[z_2^*, 1]$ from the rest of the world, and products in $[0, z_2^*]$ are supplied either by domestic production or by imports from 1; we denote the proportion produced domestically by λ. For simplicity, assume that each variety of manufacturing is demanded in equal quantity, *c*. Manufacturing employment in 2 is then,

$$L_2 = \lambda c \varphi \int_0^{z_2^*} b(z) dz. \tag{4}$$

Country 1 produces manufactures to meet local demand for products in the interval $[0, z_1^*]$, and exports to country 2 products in the interval $[0, z_2^*]$. Its labour demand is therefore,

$$L_1 = c \int_0^{z_1^*} b(z) dz + c(1 - \lambda) \int_0^{z_2^*} b(z) dz. \tag{5}$$

Equations (1) to (5) are seven equations in the seven unknowns, w_i, L_i, z_i^* and λ, and characterise the equilibrium, providing $\lambda \in (0, 1)$.

The equilibrium is illustrated on Fig. 3. Agriculture is, by assumption, exported by both countries so has price and unit cost of unity. Costs of producing manufactures are represented by the solid lines **o----o**, with the upper line representing the initial position. The bottom left end of this line has coordinates $\{w_1 b(0), w_2 \phi b(0)\}$, the upper right end coordinates $\{w_1 b(1), w_2 \phi b(1)\}$, and the gradient of the line measures the ratio of production costs in the two countries, so is $w_2 \phi / w_1$. The critical values z_1^* and z_2^* (defined by equations (2)) are as illustrated. Above these points country 1 (respectively 2) imports from the rest of the world. Below, supply comes from domestic production (country 1) or domestic production plus partner imports (country 2).

What are the effects on the equilibrium of a preferential trade liberalization between countries 1 and 2? The direct effect is to facilitate trade according to intra-CU comparative advantage, so to increase country 2's imports of manufactures from country 1. This expands manufacturing employment in 1 and reduces it in 2, so w_1 rises and w_2 falls, and the line **o----o** rotates down and to the right When $t = 1$ production costs must be the same in both countries (providing both still have some manufacturing), so wages change to the point at which $w_2\phi = w_1$, moving the line **o----o** to the new configuration illustrated on figure 4.

The changing pattern of trade can be seen from the figure. For country 2, products in the interval $[z_2^*, z^{**}]$ experience trade diversion – they were imported from the rest of the world and are now imported from the partner. Country 1 actually increases the set of products it imports from the rest of the world because its wage has increased, now also importing products in the interval $[z^{**}, z_1^*]$.

Explicit expressions for the effects of a small change in t on the equilibrium are given in the appendix. Here we simply record the signs:

$$\frac{dw_1}{dt} < 0, \quad \frac{dw_2}{dt} > 0, \quad \frac{dz_1^*}{dt} > 0, \quad \frac{dz_2^*}{dt} < 0, \quad \frac{d\lambda}{dt} > 0. \tag{6}$$

The changes in w_i and z_i^* are in line with our discussion, and the change in λ reflects country 2's increased imports of manufactures from 1. Summarising then, integration increases intra-CU trade in manufactures, reduces country 2's imports of manufactures from the rest of the world, and increases country 1's.

Evaluation of the gains and losses each country experiences requires a welfare criterion. Total income in country i is $A(N - L_i) + w_i L_i$ and each country consumes a given quantity, c, of each manufacturing product. Since these quantities are fixed, changes in utility arise only from changes in the quantity of agriculture consumed, simply given by income minus the cost of manufactures consumed. We therefore have country 1 welfare indicator, v_1

$$v_1 = A(N - L_1) + w_1 L_1 - cw_1 \int_0^{z_1^*} b(z)dz - c\int_{z_1^*}^{1} dz. \tag{7}$$

where the final two terms are the cost of manufactures produced domestically and imported from the rest of the world (at world price 1). Country 2 welfare is

$$v_2 = A(N - L_2) + w_2 L_2 - c[\lambda\varphi w_2 + (1-\lambda)w_1] \int_0^{z_2^*} b(z)dz - c\int_{z_2^*}^{1} dz. \tag{8}$$

where the third term captures the fact that supply of goods in the interval $[0, z_2^*]$ is split between domestic supply and imports from the partner country. Totally differentiating gives

$$\frac{dv_1}{dt}\frac{1}{c} = [1 - T]\frac{dz_1^*}{dt} + (1-\lambda)\frac{dw_1}{dt}\int_0^{z_2^*} b(z)dz < 0, \tag{9}$$

and

$$\frac{dv_2}{dt}\frac{1}{c} = \left[1 - T\left(\frac{1-\lambda}{t} + \lambda\right)\right]\frac{dz_2^*}{dt} - (1-\lambda)\frac{dw_1}{dt}\int_0^{z_2^*} b(z)dz + w_1(1-t)\frac{d\lambda}{dt}\int_0^{z_2^*} b(z)dz. \tag{10}$$

Country 1 unambiguously gains from preferential trade liberalization (a reduction in t); the first term in (9) is negative, and captures the fact that the increase in wages in country 1 causes it to import more manufactures from the rest of the world. These have price cost wedge (T - 1), so the quantity expansion is beneficial. The second term is a terms of trade improvement on the quantity of manufactures exported to country 2.

For country 2, the first two terms in equation (10) are sources of loss. The first is trade diversion; the range of products imported from the rest of the world is reduced and replaced by a combination of local production and partner country imports. (If $\lambda = 1$ the replacement is entirely local production and the price cost wedge is T - 1; but if $\lambda = 0$ rest of world imports are replaced by partner imports, so the relevant price cost wedge is T/t - 1, capturing tariffs on both external and internal trade). The second term is the terms of trade loss on imports from country 1, occurring as w_1 has increased. The final term is trade creation. When t is reduced λ falls, i.e. the share of

products in the range $[0, z_2^*]$ that are imported from the partner country increases, this raising welfare if there is a price cost wedge, $t > 1$. The overall effect on country 2 welfare is ambiguous, depending on the magnitudes of the differentials in (10), as well as on tariff rates. However, two points are clear. First, if the internal tariff, t, is low enough then there will be welfare loss as the final term in (10) becomes small. Second, the terms of trade change, dw_1/dt, is a transfer from country 2 to country 1.

The general point from this analysis is that the intermediate country, country 1, is able to expand manufacturing exports and production, this increasing its wage and improving its terms of trade. The increase in manufacturing production occurs as it exploits it comparative advantage with the partner country, although it is out of line with its comparative advantage with the rest of the world. It also increases its manufacturing imports from the rest of the world (because of the wage increase) bringing further welfare gain. In contrast, the extreme country, country 2, has a decline in manufacturing production, fall in its wage, and a terms of trade decline, due to both trade diversion and to the increase in its partner's wage. Against this, it has some trade creation. The model therefore captures both the differential impact of trade creation and trade diversion, and the fact that relocation of manufacturing production changes wages and the terms of trade. Both effects work in favour of the intermediate country and against the extreme one.

4: Income divergence and convergence: a Heckscher-Ohlin-Armington model.

The final model analyses a variant of the standard trade model, in which comparative advantage arises from differences in factor endowments. We add to the standard Heckscher-Ohlin model an assumption of product differentiation at the national level, in order to maintain non-specialisation of production and to allow output prices to change rather than being set by supply of homogeneous products from the rest of the world. Analysis of this model requires numerical simulation, although most of the intuition comes from Heckscher-Ohlin.

The model structure is as follows. There are two factors of production, skilled and unskilled labour (S and U), and two sectors, differing in factor intensity. All countries have the same technology and preferences, although we assume some national ('Armington') product differentiation. Thus, products in each sector are differentiated by location of production, although we set the amount of differentiation at minimal levels – the elasticity of substitution between different countries' products in each sector is 50 in the examples that follow. For ease of interpretation we impose a symmetric structure on production and consumption, assuming that consumer expenditure is equally divided between sectors, and that the factor intensity in one industry is the reciprocal of that in the other industry (using Cobb-Douglas technologies, see appendix 2 for details). There are three countries one of which is large and is endowed with equal quantities of the two factors. The other countries, 1 and 2, have factor endowment ratios different from each other and from the rest of the world, and these differences are the basis of their comparative advantage.

Because of the symmetry that is built into the model the equilibrium price ratio of outputs produced in the rest of the world is unity; this world price ratio is held constant in all experiments that follow. In the initial equilibrium all imports face the same tariff rate (set at 30%). The internal price ratios and trade patterns of countries 1 and 2 reflect these tariffs and each country's factor abundance. The experiment we study is the removal of the tariff between countries 1 and 2, and we show how outcomes depend on their endowments, relative to each other and to the rest of the world.

Results are illustrated on figures 4-6, which give contours of welfare change as a function of the factor endowments of countries 1 and 2. Axes measure the factor abundance ratios of each country, and in figures 4 and 5 are constructed with $S_i + U_i = 1$, $i = 1, 2$, (so, e.g. at the point $S_i / U_i = 2$, $S_i = 0.67$ and $U_i = 0.33$). Each country's factor abundance relative to the rest of the world depends on whether S_i / U_i is greater or less than unity, while intra-union comparative advantage is measured relative to the 45^o line, above which country 1 is S abundant relative to country 2.

We look first at relative utility changes, by mapping on figure 4 the contours of the proportionate change in utility in country 2 minus that in country 1. The bold straight lines marked **00** are the zero contours, and along the diagonal through the origin the two integrating economies are identical, with $S_1 /U_1 = S_2 /U_2$. The surface is saddle shaped, and regions in which country 2 does better than country 1 are marked **+**. The figure enables us to make statements about the relative distribution of costs and benefits of CU membership. Thus, suppose that both countries are unskilled labour abundant relative to the world as a whole (below and to the left of the dashed lines). Then country 2 loses relative to country 1 if and only if it is the more unskilled labour abundant of the two economies, i.e. at a point such as A, above the diagonal, with $S_1 /U_1 > S_2 /U_2$. Conversely, in the upper right quadrant both countries are skilled labour abundant (relative to the world) and the most skilled labour abundant country suffers the relative loss -- at point B this is country 2.

Utility changes in the two countries are also equal if endowments lie on the downwards sloping bold straight line. The interpretation is that if countries' endowments lie on opposite sides of the world endowment, then the country that has endowment closer to the world average is the relative gainer. Thus, at point C country 1 is S abundant and country 2 U abundant relative to the world; country 2's endowment ratio is closer (on the logarithmic scale of the figure) to the world average (horizontal distance to $S_2 /U_2 = 1$) than is country 1's (vertical distance to $S_1 /U_1 = 1$). Thus, the country with endowment ratio closer to the world average is the relative gainer.

How general are these results? Providing differences arise only from two factor endowments, then the surface is quite generally a saddle with a zero-contour on the 45% line from the origin, along which the two economies are identical. However, the second zero-contour line need not be straight, nor necessarily downwards sloping everywhere; its linearity in figure 4 is a consequence of the symmetry built into the model.

Figure 5 illustrates the welfare change of country 2 (as a proportion of 2's initial welfare)

which, like the relative change, forms a saddle on endowment space. The lines marked **00** are zero contours, and the plus and minus signs indicate regions of country 2 gain and loss. There are very small gains along the 45^o line, arising from the product differentiation in the model. Figure 5 illustrates that countries with 'extreme' endowments have a potential for absolute (as well as relative) loss; country 2 can lose from CU formation if S_2 / U_2 is either very high or very low, but not at intermediate values. Second, actual welfare loss occurs if the extreme country forms a CU with a country relatively close to the world average. Thus, at point A country 2 is unskilled labour abundant while country 1 lies closer to the world average (S_1 / U_1 close to unity), and country 2 suffers welfare loss.

In figures 4 and 5 the factors S and U enter the model symmetrically, so to refer to them as skilled and unskilled labour is a misnomer -- the wage of S is on average no higher than that of U, and countries with much S are on average no richer than those with much U. To capture the idea that S abundant economies are relatively high income we now modify the analysis in the following way. In figures 4 and 5, if an economy gained a unit of S it lost a unit of U (since $S_i + U_i = 1$). Now, in figure 6, we hold U constant, and simply vary the amount of S. Thus, at a high value of S_i / U_i the representative individual in country *i* has the fixed endowment of U, plus a large number of units of S (eg, more units of human capital). S and U enter production as before, but S abundant economies will now tend to be richer. For example, moving from $S_i / U_i = 0.5$ to $S_i / U_i = 2$ holds U_i constant at 0.5, raises S_i from 0.25 to 1, and approximately doubles country *i* equilibrium income.

Contours in figure 6 illustrate, like figure 5, the country 2 welfare change due to CU formation. Two main messages come from the figure. The first is the original argument, that CU formation between two poor countries tends to lead to income divergence, and between rich countries leads to convergence. Consider point A. At this point country 2 is poorer than country 1 (it is S scarce relative to its partner), and suffers a welfare reduction, while country 1 experiences

a welfare gain, causing divergence. (The country 1 gain is not illustrated directly, but can be seen by reversing country labels and looking at point A', the reflection of A around the 45^o line). Conversely, at point B both countries are S abundant, but country 2 relatively more so, and therefore relatively rich. It is now country 2 that loses and country 1 that gains, causing convergence of their real incomes.

The second point concerns the attractiveness of 'North-South' agreements for low income countries. Let us take a fixed and low value of S_2/U_2, and ask: what type of partner is country 2 best off forming a CU with? The answer is clearly a skilled labour abundant economy (high S_1/U_1). There are two forces driving this. One is that trade creation is maximised and trade diversion minimised with such a partner (this force shows up on figure 5 as well as figure 6). The other is a terms of trade gain. If the skill abundant country has relatively high total income, then the low income country experiences relatively large growth in export demand which improves its terms of trade, giving it a larger share of the aggregate gains from CU formation. The argument is similar to that of Spilimbergo and Stein (1998), derived by computing outcomes in a model with two identical low income countries and two identical high income countries.

5: Concluding comments

Systematic analyses of the comparative advantage of customs union members – relative to each other and relative to the rest of the world – establish how the real income effects of regional integration are distributed amongst member countries. In general, countries with 'extreme' comparative advantage do worse than those with comparative advantage intermediate between the partner and the rest of the world. This resolves the apparent paradox that formation of a CU containing high income members is a force for convergence of per capita incomes, while developing country CUs have sometimes been associated with divergence. In the former case the extreme countries are those with the highest per capita incomes, while in the latter they are those with the

lowest. The analysis warns of the dangers from 'South-South' integration schemes, showing how they may draw manufacturing production into richer countries at the expense of poorer members of the union. It also suggests that low income countries are better served by integration with high income countries.

The mechanism underlying the analysis is comparative advantage. To focus on comparative advantage we have abstracted from all differences between economies except for differences in endowments or technologies. It would be interesting to explore how other differences – such as in initial tariff rates – affect results. We have also abstracted from other mechanisms that are undoubtedly important in determining the outcome of regional integration agreements. These include policy stance, technology flows, foreign direct investment and agglomeration forces.[10] Agglomeration forces can lead to clustering of manufacturing in selected locations in a CU, and might be particularly powerful in developing countries, possibly reinforcing the divergence argument made in this paper. If manufacturing starts from a small base and if activities complementary to manufacturing (for example, provision of business services, telecommunications and transport infrastructure) are thinly distributed, then the likelihood of manufacturing development agglomerating in a few locations is relatively high. This suggests that, particularly for developing countries, the forces analysed in this paper might understate the extent of divergence that could be caused by regional trade agreements.

Appendix:

Section 3:

Comparative statics: Totally differentiating equation (2),

$$\frac{dw_2}{w_2} = \frac{dw_1}{w_1} + \frac{dt}{t}, \tag{A1}$$

Totally differentiating (1) with L_i substituted from the manufacturing employment equations (4) and (5) gives,

$$\begin{aligned} -dw_2 &= c\varphi A''(N-L_2)\left[\lambda b(z_2^*)dz_2^* + d\lambda\int_0^{z_2^*} b(z)dz\right], \\ -dw_1 &= cA''(N-L_1)\left[b(z_1^*)dz_1^* + (1-\lambda)b(z_2^*)dz_2^* - d\lambda\int_0^{z_2^*} b(z)dz\right]. \end{aligned} \tag{A2}$$

Totally differentiating equations (3)

$$\begin{aligned} dw_2 b(z_2^*) + w_2 b'(z_2^*)dz_2^* &= 0, \\ dw_1 b(z_1^*) + w_1 b'(z_1^*)dz_1^* &= 0. \end{aligned} \tag{A3}$$

Adding equations (A2) gives:

$$-\frac{dw_2}{\varphi cA''(N-L_2)} - \frac{dw_1}{cA''(N-L_1)} = b(z_1^*)dz_1^* + b(z_2^*)dz_2^* \tag{A4}$$

Using (A3) to eliminate dz_2^* gives

$$H_2\frac{dw_2}{w_2} + H_1\frac{dw_1}{w_1} = 0 \tag{A5}$$

where

$$H_1 = \left[\frac{b(z_1^*)^2}{b'(z_1^*)} - \frac{w_1}{cA''(N-L_1)}\right] > 0, \qquad H_2 = \left[\frac{b(z_2^*)^2}{b'(z_2^*)} - \frac{w_2}{\varphi cA''(N-L_2)}\right] > 0 \tag{A6}$$

Using (A5) and (A1) we derive

$$\frac{dw_1}{w_1} = -\frac{dt}{t}\left(\frac{H_2}{H_1+H_2}\right) < 0, \qquad \frac{dw_2}{w_2} = \frac{dt}{t}\left(\frac{H_1}{H_1+H_2}\right) > 0. \tag{A7}$$

These equations sign the changes in wages. Changes in z_1^* and z_2^* follow directly from (A3). Using (A3) in (A2) we obtain the following expression for $d\lambda$

$$\frac{\lambda b(z_2^*)^2}{w_2 b'(z_2^*)} - \frac{1}{c\varphi A''(N-L_2)} = \frac{d\lambda}{dw_2}\int_0^{z_2^*} b(z)dz > 0. \tag{A8}$$

Welfare change: The welfare indicators can be simplified, using equations (4) and (5) for L_i, to the form:

$$\begin{aligned} v_1 &= A(N - L_1) + w_1(1-\lambda)c\int_0^{z_2^*} b(z)dz - c\int_{z_1^*}^{1} dz, \\ v_2 &= A(N - L_2) - w_1(1-\lambda)c\int_0^{z_2^*} b(z)dz - c\int_{z_2^*}^{1} dz \end{aligned} \tag{A9}$$

Totally differentiating and using (2) and (3) gives (9) and (10) of the text.

Section 4:

There are two goods, *x* and *y*, (indicated by superscripts), two countries 1 and 2 (indicated by subscripts), and the rest of the world (indicated by subscript 0). Factor endowments are S_i and U_i with respective prices v_i and w_i. Technologies are described by cost functions,

$$c_i^x = w_i^{\lambda} v_i^{1-\lambda}, \qquad c_i^y = w_i^{1-\lambda} v_i^{\lambda}, \qquad \lambda = 0.25. \tag{A10}$$

Factor market clearing takes the form

$$S_i = \frac{\partial c^x}{\partial v_i} q_i^x + \frac{\partial c^y}{\partial v_i} q_i^y, \qquad U_i = \frac{\partial c^x}{\partial w_i} q_i^x + \frac{\partial c^y}{\partial w_i} q_i^y, \qquad i = 1, 2. \tag{A11}$$

where q_i^k denotes the quantity of good *k* produced in country *i*.

Preferences are described by

$$m_i = u_i (G_i^x G_i^y)^{1/2}, \tag{A12}$$

where m_i is income, u_i is utility, and G_i^k is the price index of good *k* in country *i*, defined by

$$G_i^k = \left[(p_i^k)^{1-\sigma} + (tp_j^k)^{1-\sigma} + T^{1-\sigma}\right]^{1/(1-\sigma)}, \qquad i,j = 1,2, \quad i \neq j. \tag{A13}$$

where p_i^k denotes the price of good *k* produced in country *i*, equal to unit cost, *t* denotes the internal tariff and *T* the external tariff. σ is set at 50, and *t* and *T* both take initial value 1.3, *t* dropping to 1 when the customs union is formed. Demands are derived from utility maximisation, and income is given by

$$m_i = w_i U_i + v_i S_i + p_j^x q_{ji}^x (t-1) + p_j^y q_{ji}^y (t-1) + q_{0i} x(T-1) + q_{0i} y(T-1), \qquad i,j = 1,2. \quad \text{(A14)}$$

where q_{ij}^k denotes the quantity of good *k* produced in *j* and sold in *i*. In addition, country 0 has demands q_{i0}^k which have demand elasticity σ and are scaled such that in the initial equilibrium an average of 10% of the output of countries 1 and 2 are exported to country 0.

In figures 4 and 5 endowments vary in the interval S_i = [0.25, 0.75] with U_i = 1 - S_i.
In figure 6 endowments vary in the interval S_i = [0.1667, 1.5] with U_i = 0.5.

Endnotes:

[1] Two recent surveys are Baldwin and Venables (1995) and Panagariya (2000).

[2] Differences measured by the standard deviation across countries of log per capita incomes.

[3] The average of France, Germany, Italy and the UK. All numbers in this and the next paragraph for per capita income PPP, from World Bank, World Development Indicators.

[4] Another good example is the divergence in economic performance between East and West Pakistan which was one of the factors leading to the break up of the country. See World Bank (2000) for fuller discussion of these cases.

[5] Levy (1997) uses a factor endowment based model to analyse the political economy of CU formation, but allows only for situations of completely free trade or autarky: thus, countries in a CU are assumed to have no trade with the rest of the world.

[6] p_0 is the relative price on international markets. There are no trade or transport costs, and internal prices differ from p_0 only because of tariffs.

[7] We use ad valorem tariff factors throughout, so T = 1 is free trade.

[8] If demand is sufficiently elastic and the price in the partner country relatively close to the world price then welfare may increase. A 'triangle' of consumer surplus is gained to offset the rectangle of loss due to sourcing from the higher cost supplier.

[9] Of course, this also holds for other distributions of goods over the space. The change in country 2 (analogously country 1) welfare can be found as follows. If products are indexed χ and consumed in fixed quantity c(χ) then the change in country 1 welfare is

$$\Delta w_1 = \int_{X \in D_1} [w_2 b_2(\chi) - 1] c(\chi) d\chi + \int_{X \in C_1} [w_2 b_2(\chi) - w_1 b_1(\chi)] c(\chi) d\chi$$

where D_1 and C_1 are the sets on which there is respectively trade diversion and trade creation.

[10] See Puga and Venables (1997, 1998) for analysis of the way in which integration might trigger agglomeration in a subset of ex ante identical countries.

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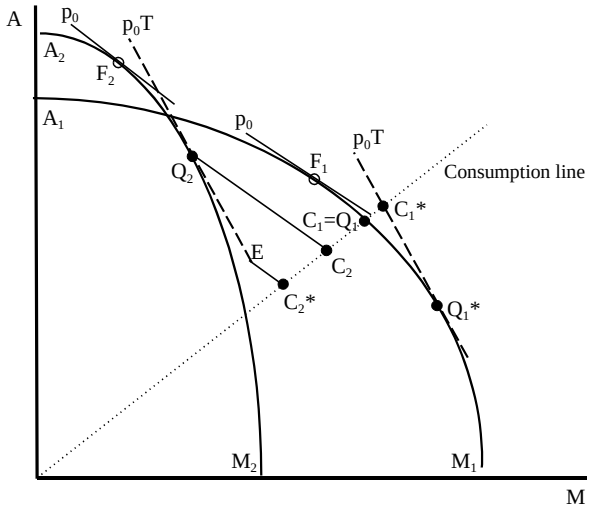

Figure 1: Preferential liberalization

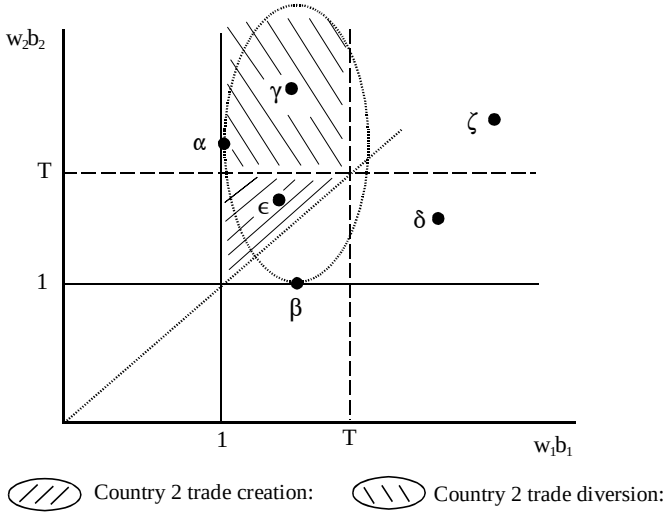

Figure 2: Sourcing of manufactures

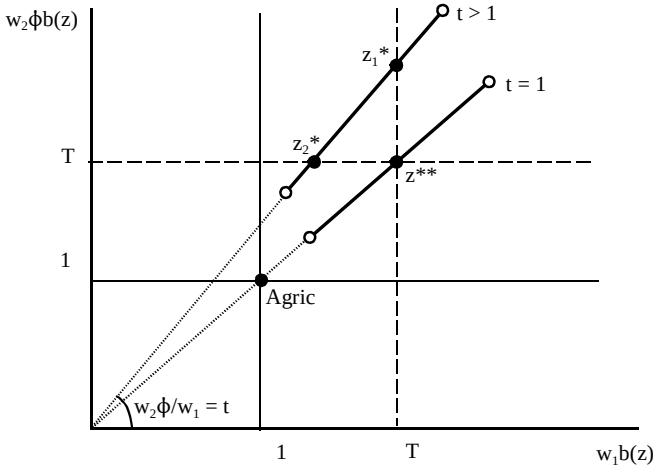

Figure 3: A continuum of products

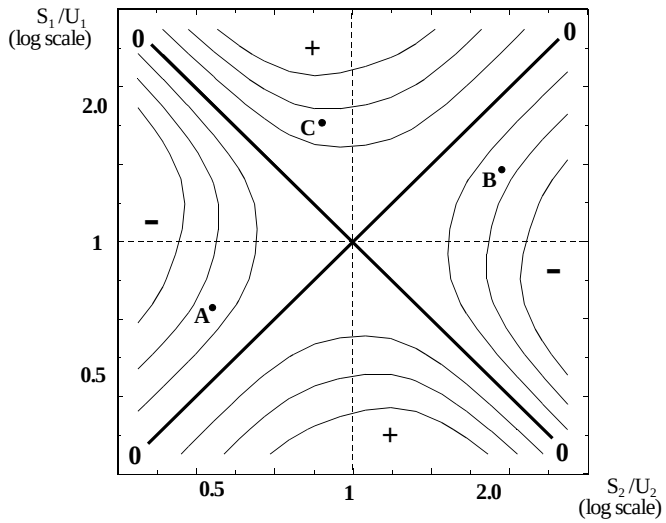

Figure 4: Relative changes in welfare (country 2 minus country 1)

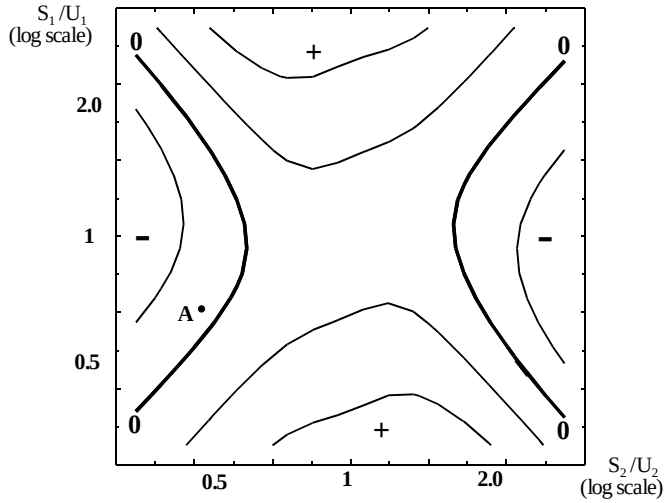

Figure 5: Country 2 welfare change contours.

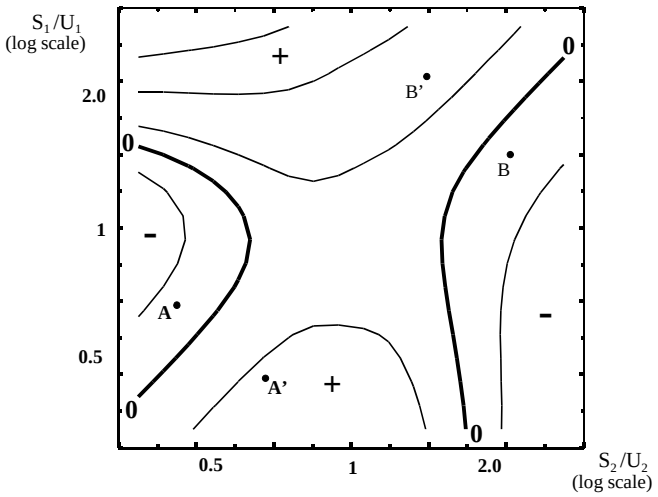

Figure 6: Country 2 welfare change contours: (U_i = constant)