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INTEGRATION AND THE COMPETITIVENESS OF PERIPHERAL INDUSTRY

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ABSTRACT

Integration and the Competitiveness of Peripheral Industry*

This paper analyses economic integration between two economies; one central, with a large local market, and the other peripheral, with a small local market. Each economy has an imperfectly competitive manufacturing sector. Trade liberalization creates a strong incentive for the imperfectly competitive industry to concentrate in the central region, near the large market. This may cause the direction of net trade to be the opposite of that predicted by factor endowments. This effect may be offset by a lower wage in the periphery than in the centre; we find that in the early stages of integration relative wages in the centre and periphery diverge, with convergence occurring only in the later stages.

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NON-TECHNICAL SUMMARY

Considerable concern has been expressed about how the drive towards greater economic integration in the European Community will affect its peripheral regions, and this concern has been accentuated by the entry of Southern European countries into the EC. On the one hand, economic integration should permit these economies to exploit their comparative advantage, and might therefore be expected to lead to expansion of relatively labour-intensive manufacturing sectors. On the other hand, Northern Europe is more economically central in the EC, so firms in this region have closer and more direct access to larger and richer markets than do firms in Spain, Portugal or Greece. Despite the generally lower level of wages, manufacturing in peripheral regions might not be able to compete with the advantages associated with being located in the centre of the EC.

This paper attempts to analyse some of the forces at work in determining the relative competitiveness of industry located at the centre and industry located at the periphery of a region undergoing economic integration. This is done by constructing a model of two countries, one central with a large local market and the other peripheral with a small local market. We focus on the manufacturing sectors of these economies and assume they are imperfectly competitive. There are increasing returns to scale in manufacturing as firms are assumed to have fixed costs that they need to cover. Intra-industry trade will occur in the products of this sector, as firms located in both countries supply consumers in both countries.

We conduct the following experiment. As barriers to trade between the two countries come down, what happens to the relative competitiveness of manufacturing in the two countries, and hence to production and trade? We find that there are strong forces at work tending to pull manufacturing industry towards the central economy at the expense of the periphery. If trade barriers are very high, then markets in both the centre and the periphery will be served by local firms. Prices must be relatively higher in the small economy, as only then can firms in that market cover their fixed costs. As trade barriers are reduced, this price differential is narrowed, causing a reduction in the number of firms operating in the periphery. Production moves to the centre, and the periphery becomes a net importer of manufactured goods.

The advantages of greater access to the larger market are most important at intermediate levels of trade barriers. If trade barriers are very high, self-sufficiency determines the location of production. If trade barriers are very low, firms in any location have equally good access to all markets. It is at intermediate levels of barriers that the centripetal forces are strongest.

The tendency for manufacturing industry to be pulled to the centre by market access considerations is of course countervailed by factor price differences between the centre and the periphery. Suppose for example that the peripheral economy is labour-abundant and that manufacturing is labour-intensive. When trade barriers are very low the periphery will export manufactures to the centre, as would be expected on the basis of the two economies' relative factor endowments. But at intermediate levels of trade barriers, market access may be a more powerful determinant of the direction of net trade than is relative factor endowment, and the peripheral economy may be a net importer of manufactures.

We analyse these two forces in more detail by embedding our industry model in a simple general equilibrium model in which factor prices are endogenously determined. We find that during the process of integration relative wages at first diverge, and then converge. It is at intermediate levels of trade barriers, just when market access considerations are most powerful, that peripheral wages (relative to those in the centre) are also lowest. This is because of the decline in the periphery's manufacturing output associated with the initial stages of dismantling barriers to trade. Wages begin to converge again as free trade is approached and output in the periphery begins to rise. The model also suggests that forces which tend to equalize factor prices across countries, such as international factor mobility, will have the same effect as free trade in goods, increasing the importance of market access considerations in determining the location of manufacturing.

Our analysis therefore suggests that although economic integration may lead to convergence in the limit, this is not a monotonic process. Relative wages and levels of output in the periphery may both follow a U-shaped path during the process of integration -- and we do not know which side of the U we are on.

These results suggest a fundamental ambiguity in the effects of 1992 on the relative competitiveness of manufacturing in the peripheral nations. Lower barriers to trade could make it more attractive to move production out towards the lower-wage periphery, and thereby allow a rise in peripheral wages; or they could make it more attractive to concentrate production in the centre, requiring a fall in peripheral wages relative to those in the centre. Anything that impedes the necessary changes in relative wages will reinforce the tendency to concentrate production in the centre. This will include such 'natural' trade barriers as transport costs, difficulty of communication and cultural differences, as well as government-imposed costs.

As the Southern European countries enter the European Community, a key question is how that entry will affect the competitiveness of their manufacturing sectors. Optimists believe that the mutual opening of markets, reinforced by 1992, will make manufacturing in Southern Europe highly attractive; they thus expect that manufacturing sectors in the entering countries will expand, and that manufacturing wages in the Southern entrants will converge over time toward Northern European levels. Pessimists worry that in spite of lower wages, Southern industry will have difficulty competing with Northern, and that there will have to be both a shrinkage of manufacturing and a reduction in relative manufacturing wages.

This dispute is immediately crucial for macroeconomic and exchange-rate policy. If the pessimistic view is right, then the new entrants ought to be trying to keep their exchange rates somewhat undervalued in order to start out with a cost advantage that will ease their adjustment. Even if the pessimistic view only might be correct, the countries might want to err on the side of undervaluation, as argued in Krugman (1989). As the case of Spain has recently shown, however, financial markets are currently

inclined to be optimistic rather than pessimistic, which can make an attempt to follow a prudent exchange rate policy difficult.

The dispute is also important for structural policy, especially regional policy. The size and kinds of assistance that will be needed will depend on the effect of the enlargement on industrial competitiveness. Also, understanding the mechanisms of the change in competitiveness may give clues to which kinds of policies will help the adjustment and which may actually make the problem more difficult.

The purpose of this paper is to focus on one particular source of ambiguity regarding the effects of integration on the manufacturing competitiveness of the entrant nations: the role of comparative market access.

The paper is in seven parts. The first section sets out some general considerations regarding the role of market size in assessing the effects of trade liberalization. Section 2 sets out a formal model that can be used to address some of these effects. Sections 3 and 4 look at the effects of increased integration on manufacturing output for given wage rates, while sections 5 and 6 look at the effects on wage rates themselves. A final section draws some conclusions.

1. Market access and manufacturing competitiveness: defining the issue

A glance at the economic geography of Europe reveals that the richest regions in per capita terms are also, by and large, the

most densely populated. Furthermore, the wealthy regions are clustered close together, in the northwestern part of the continent. Exactly why this should be so is a matter of some dispute -- how much represents cultural contagion, how much the cumulative processes that result from economies of agglomeration? -- but it has the definite implication that the high-wage regions are also the regions with the best access to markets.

The European Commission has developed a simple index of "peripherality" based upon distance from purchasing power, and used it to classify regions into a number of categories. There is a striking gradient in per capita income, and thus presumably also in wages, as one moves away from the central areas toward the peripheral ones (Table 1).

Table 1: Peripherality and per capita GDP

Type of region	GDP per capita (Europe=100)
Central	122
Intermediate	105
Inner periphery	89
Outer periphery	64

Why should peripheral areas pay lower wages? At least in part the answer must be that their peripheral location makes them less attractive, other things equal, as a site for production than the central regions. Thus in order to attract firms the peripheral regions must offer a compensating wage differential.

Now what both entry into the EC and the effect of 1992 on the working of the Community should do is make mutual market access easier and cheaper. Carried to its limit, this process would eliminate any advantage to a central location, and thus work to the advantage of production in the peripheral areas. One might therefore suppose that a step in that direction will necessarily have the same effect -- that the reduction in barriers to trade due to EC enlargement and 1992 will tend to increase manufacturing production and relative manufacturing wages in the Southern European nations. The point of this paper is to argue that this is not necessarily true. While a complete elimination of obstacles to trade always raises the competitiveness of the peripheral regions, a partial elimination may in principle have a perverse effect.

The reason for this ambiguity may be conveyed by a highly oversimplified example. Imagine that there is some product that could be produced either in Belgium (a central nation) or in Spain, or in both. We assume for simplicity that the demand for the good is completely inelastic, so that total shipments can be taken as given. We also suppose that, if only direct production costs were considered, it would be more expensive to make the good in Belgium than in Spain; but because there are economies of scale, it is still more expensive to produce in both. In addition to production costs, however, there are shipping costs; if the good is produced only in the centre, some units must be shipped to the periphery; if the good is produced only in the periphery, a larger number of units must be shipped to the centre. Finally, we assume that somehow a cost-minimizing location of production is

chosen.

Under these assumptions, the situation might look like that in Table 2. As described, it is cheapest to produce the good in Spain alone, and most expensive to produce in both locations. However, the shipping costs may change this decision. In the "high" shipping cost case, the cheapest locational structure overall is to produce in both locations: the savings in transportation outweigh the extra production cost.

Table 2: Hypothetical effects of lowering trade barriers

	Production costs	Shipping costs		
		High	Medium	Low
Produce in Belgium	10	3	1.5	0
Produce in Spain	8	8	4	0
Produce in both	12	0	0	0

What we can now note is that reducing shipping costs does not necessarily cause production to move to the low-cost location. A complete elimination of these costs, shown as the "low" cost case in Table 2, will indeed give Spain the advantage. However, a shift from the "high" to the "medium" cost case -- in which all shipping costs are reduced to half their level in the "high" case -- actually causes production to shift to Belgium.

The point is that while high barriers to trade encourage local production, moderate barriers interacting with economies of scale may encourage concentration of production in high-cost locations with good market access rather than in low-cost locations. While this is a contrived and oversimplified example, it conveys a general point. In the remainder of this paper we will consider a more sophisticated (although still highly abstract) model to demonstrate the nature of the ambiguity in a less *ad hoc* way.

2. A model of trade liberalization

In order to focus on the effects of market access in trade liberalization, we make some severe simplifications in terms of the representation of economic geography, market structure, and the sources of international differences in per capita income.

First, despite some reservations, we maintain the long tradition of international economics by representing countries as if they were dimensionless points. Increasingly it makes sense in practical terms to think of economic Europe as consisting not of a collection of internally homogeneous countries, but of a collection of regions, of varying degrees of peripherality from a centre located somewhere around Brussels; although Belgium and the Netherlands are small countries, they have close and (especially after 1992) easy access to very large markets. For the purposes of this exercise, however, we will represent the centre-periphery issue by considering trade liberalization between a single relatively small economy and its larger partner. The smallness of the "small" country should be taken to represent, not actual small

size, but a peripheral position that gives it less good access to markets, while the "large" country's size really represents a central location. In other words, you should think of Spain as part of the small country and Belgium as part of the large. Trade liberalization is modelled as reduction in the costs of getting access to the "foreign" market. These trade costs should be interpreted as a synthetic measure of a wide range of barriers to trade including trade taxes, transport costs, and costs of frontier formalities and differing product standards.

Second, the model presented here is one of the simplest possible models of intra-industry trade, capturing two motives for such trade. One is the efforts of oligopolistic firms to raid each others's markets, in the tradition of Brander and Krugman (1983), Dixit (1984) and Venables (1986). The other is that each firm produces a product type differentiated from that of other firms, and demanded by consumers in both countries.

Third, since the aim of the paper is to make a point rather than to be realistic, a number of extreme simplifying assumptions are made. For example, firms compete in quantities sold in segmented markets, and all firms are assumed to have linear demand and cost functions (as in Dixit (1984)). These assumptions produce quite sharp and clearcut results, but exaggerate some effects while minimizing others. For example, quite small price changes generate large quantity changes. This produces huge changes in the location of production in response to modest changes in trade barriers; it also implies implausibly small effects of trade barriers on relative factor prices. We choose to

present most of our results by developing a numerical example. This is an efficient way of illustrating the insights generated by the model, but is intended to illustrate qualitative not quantitative effects. The numerical results reported below should not be taken as even stylized estimates. To model the quantitative effects of policy change requires a significantly richer model, and one fitted to data.

Finally, the model is developed in a series of stages, moving from the simplest to the more complex. In order to focus on the effects of peripherality vs. centrality, we initially assume away comparative advantage. Until section 6, the countries are permitted to differ only in relative size; differences in both technology and relative factor endowments are assumed away.

The two countries described in the model are labelled 1 and 2. The size of the market in each country is measured by a parameter s_1, s_2, and we shall call the country with the smaller market country 1, so $s_1 < s_2$. Each economy has two sectors. One is a perfectly competitive sector producing a tradeable output which will be taken as the numeraire. The other is imperfectly competitive, and it is this sector on which attention will be focussed. We shall call this sector 'manufacturing'. The number of firms in the manufacturing sector of countries 1 and 2 are denoted n_1 and n_2. Each of these firms produces its own variety of differentiated product, but we shall assume that all products produced in a particular country are symmetric. We may then use p_{ij} and x_{ij} to denote the price and quantity of a single one of these products produced in country i and consumed in country j,

where the indices i and j take values 1 and 2. We shall assume that demand curves for these products are linear. The inverse demand curve for a single variety produced in country i and sold in country j, (i,j = 1,2) then takes the form,

$$p_{ij} = a - \frac{1}{s_j}\left\{\frac{(1+\theta)}{2}x_{ij} + \theta[(n_i-1)x_{ij} + n_j x_{jj}]\right\}$$

$$p_{ii} = a - \frac{1}{s_i}\left\{\frac{(1+\theta)}{2}x_{ii} + \theta[(n_i-1)x_{ii} + n_j x_{ji}]\right\} \qquad (1)$$

$$a > 0, \quad \theta \in [0,1], \qquad i, j = 1, 2, i \neq j.$$

That is, the price of the single variety depends on the quantity of this product sold, (with coefficient $(1+\theta)/2$) and on the quantities of the n_i-1 other varieties from country i and n_j from country j (with coefficient θ). The demand parameter θ measures the extent of product differentiation, with products being homogeneous if $\theta = 1$ and differentiated when $\theta < 1$; since $\theta > 0$ products are substitutes.

Firms have increasing returns to scale, represented by linear cost functions. Each firm in country i has a fixed cost of f_i, and marginal cost c_i; t is the cost of shipping one unit of output between countries. The profits of a country i firm, π_i, may be expressed as,

$$\pi_i = (p_{ii} - c_i)x_{ii} + (p_{ij} - c_i - t)x_{ij} - f_i$$

$$i,j = 1,2, \; i \neq j. \qquad (2)$$

We assume that firms compete as Cournot competitors in each market separately. Choosing sales in each market to maximise profits

implies,

$$x_{ii} = (p_{ii} - c_i)s_i 2/(1+\theta)$$

$$x_{ij} = (p_{ij} - c_i - t)s_j 2/(1+\theta) \qquad i,j = 1,2,\ i \neq j. \quad (3)$$

Because of the linear structure of the model it is possible to derive explicit expressions for equilibrium prices and quantities, given the number of firms operating in each country. Using equations (1) and (3) we obtain,

$$p_{ii} = \frac{c_i(1-\theta)}{2} + \frac{(1+\theta)}{2}\left\{\frac{a + \theta n_i c_i + \theta n_j(c_j + t)}{1 + \theta(n_1 + n_2)}\right\}$$

$$p_{ij} = \frac{(c_i+t)(1-\theta)}{2} + \frac{(1+\theta)}{2}\left\{\frac{a + \theta n_j c_j + \theta n_i(c_i + t)}{1 + \theta(n_1 + n_2)}\right\}$$

$$i,j = 1,2,\ i \neq j. \quad (4)$$

$$x_{ii} = s_i\left\{\frac{a - c_i + \theta n_j t + \theta n_j(c_j - c_i)}{1 + \theta(n_1 + n_2)}\right\}$$

$$x_{ij} = s_j\left\{\frac{a - c_i + (1+\theta n_j)t + \theta n_j(c_j - c_i)}{1 + \theta(n_1 + n_2)}\right\}$$

$$i,j = 1,2,\ i \neq j. \quad (5)$$

In order to highlight the economic forces at work, his model will be developed as follows. In sections 3 and 4 we shall assume that costs, c_1, c_2, f_1, f_2 are constant, and are the same in both countries, so that no comparative cost considerations enter the analysis. In section 3 we also assume that the numbers of firms in each country, n_1 and n_2, are constant and unchanged by integration. This assumption is relaxed in section 4, and entry

and exit of firms may occur; section 4 therefore develops the model from one of oligopoly to monopolistic competition. In sections 5 and 6, we remove the assumption that costs are constant, by making factor prices depend on the level of manufacturing employment. Until section 6 it is assumed that the two countries differ only in size, having no other sources of comparative advantage. In section 6 we adopt a Heckscher-Ohlin framework, in which countries may differ both in size and in relative factor abundance.

3 Oligopoly.

Suppose that the initial situation is one in which market access is restricted by high trade barriers, although these are not so high as to choke off intra-industry trade. What is the effect on the industry of a reduction in these barriers, as represented by a fall in the trade cost, t? Given the numbers of firms and cost levels in each country, the effects are immediate from equations (5). As would be expected the reduction in t reduces home sales, x_{ii}, but raises trade volumes, x_{ij}. The effect of a small reduction in trade costs, -dt, on total production in country 1 is,

$$\frac{dx_{11}}{-dt} + \frac{dx_{12}}{-dt} = \frac{s_2 + \theta n_2(s_2 - s_1)}{1 + \theta(n_1 + n_2)} \qquad (6)$$

Country 1, the small country ($s_2 > s_1$), therefore experiences increased production as barriers are reduced, although it is possible that production in the large country contracts. The reason for this is simply that firms in the small country are

getting improved access to the larger market, while firms in the larger country only gain access to a smaller market.

This effect is mirrored in the balance of trade. If costs are the same in both countries, ($c_i = c$, $i = 1, 2$), then country 1's net manufacturing imports are (in physical units),

$$n_2x_{21} - n_1x_{12} = \left\{ \frac{(a-c-t)(n_2s_1-n_1s_2) + n_1n_2t\theta(s_2-s_1)}{1 + \theta(n_1 + n_2)} \right\} \qquad (7)$$

Providing country 1's share of firms is not more than its relative size, i.e, $s_1/s_2 \geq n_1/n_2$, then, from equation (7), country 1 is a net importer of manufacturing and as t is reduced net imports fall. These effects are illustrated in Figure 1, which, for an example described in the appendix, traces out quantities produced, traded, and consumed in the small country as a function of t. (In this and all following figures quantities are expressed as a proportion of consumption at t=0, and t, the tariff equivalent, is expressed as a proportion of marginal costs). Figure 1 extends to values of t high enough to drive country 1 exports to zero; reductions in t at levels greater than this reduce country 1 output, as they increase imports while leaving exports at zero.

The price effects of reduction in trade barriers can also be obtained from equations (4). As is apparent, reductions in t reduce price, and therefore raise consumer surplus. Notice that if there are more firms in the large economy than the small ($n_2 > n_1$), then positive t implies a relatively high goods price in the small economy, i.e., consumers in the small economy are disadvantaged by the lower level of competition. Corresponding to

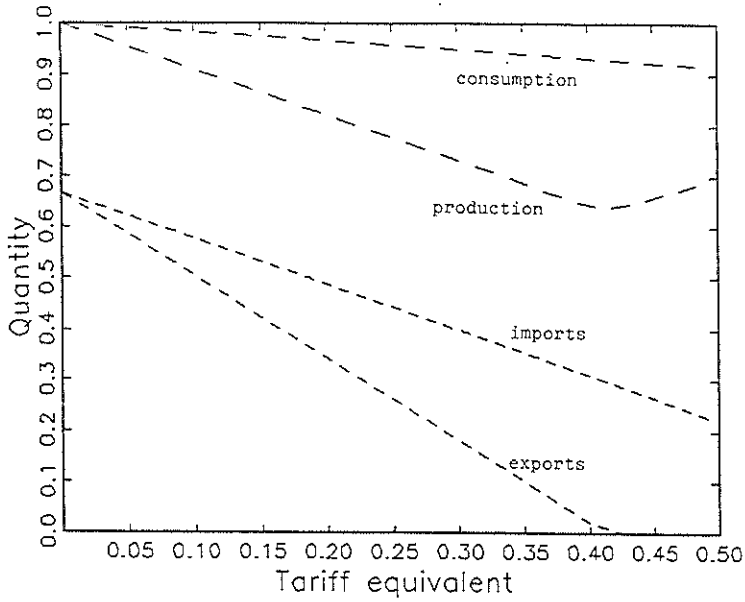

Fig. 1 Oligopoly: output and trade

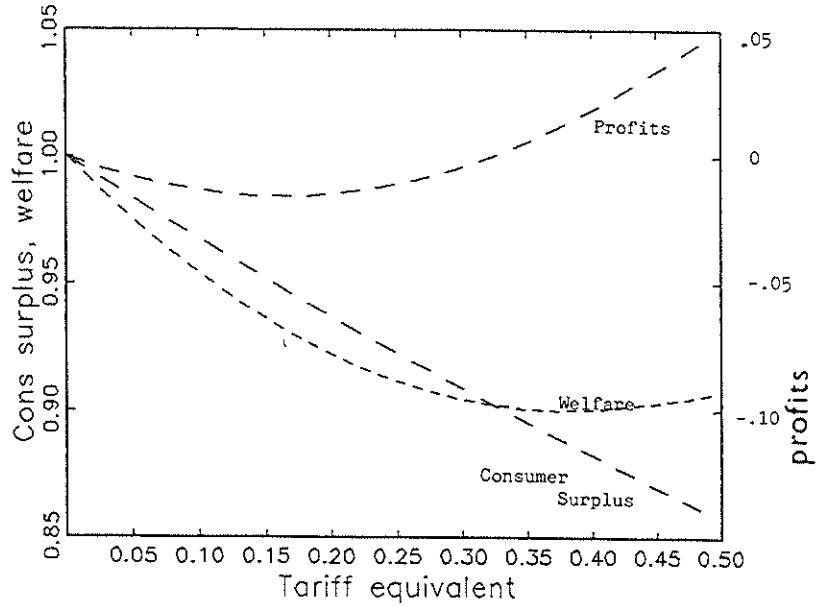

Fig. 2 Oligopoly: profits and welfare

this, reductions in t bring relatively larger gains to consumers in the small economy than in the large.

The behaviour of profits is more complex, as it involves the interaction of price and quantity effects. We know that, in the symmetric case, going from autarky to free trade reduced profits (Donsimoni & Gabsziewicz [1989]), but this need not be a monotonic process. This is illustrated by the profits curve in Figure 2, which gives country 1 profits per firm as a function of t. Profits fall in the early stages of liberalization (as increased competition from imports erodes market power), but rise in the later stages as exports become very large, so the direct cost saving effects of reductions in t come to dominate. The fact that profits move in this way has two implications. First, possible reductions in profits mean that the welfare effects of trade liberalization are ambiguous. This is illustrated in Figure 2 which reports, in addition to profits, consumer surplus, and, as a welfare indicator, the sum of country 1's total profits and consumer surplus (expressed as a proportion of their value when t = 0). With a given number of firms we see welfare falling in the early stages of liberalization. Second, changing profit levels suggest that we should expect to see the number of firms in each country changing as trade barriers are removed. It is to this that we now turn.

4 Monopolistic Competition.

The preceding story was incomplete, as it took as exogenous the number of firms in each country. We now endogenise these, but, in order to bring out the importance of the effect of

relative market size, we maintain the assumption that the two countries have identical and unchanged costs whatever the size of the trade barriers. What we can show in this case is that the smaller country is always a net importer of manufactured goods, because its firms are placed at a disadvantage by their inferior market access. Perhaps more surprisingly, this trade deficit in manufactured goods will actually be greater, the lower the barriers to trade. The reason is that already suggested by the example in Table 2: a reduction in barriers to trade reduces the incentives for self-sufficiency faster than it reduces the incentives to concentrate production near the larger market, so causing relocation of firms towards the larger market.

In terms of the formal model, the equilibrium number of firms, n_1 and n_2 are obtained by adding the condition that firms in each country should earn zero profits. Using equations (3) in the definitions of profits, equations (2), the industry equilibrium conditions can be written as[1]

$$\begin{aligned} \pi_1 &= (p_{11} - c_1)^2 2s_1/(1+\theta) + (p_{12} - c_1 - t)^2 2s_2/(1+\theta) - f_1 = 0 \\ \pi_2 &= (p_{22} - c_2)^2 2s_2/(1+\theta) + (p_{21} - c_2 - t)^2 2s_1/(1+\theta) - f_2 = 0 \end{aligned} \tag{8}$$

Providing there are a positive number of firms in each country equilibrium prices and numbers of firms can be solved from this pair of equations, together with equations (4).

The first point to note is that if $c_1 = c_2$, then the number of firms, comparative prices and the pattern of trade depend on relative country size. Specifically, it is straightforward but

tedious to show that if $s_1 < s_2$, country 1 will have a higher price of manufactured goods and also be a net importer of manufactured goods (and a net exporter of the other good). A formal demonstration is given in Venables (1986) for the case when $\theta = 1$; the point, of course, is that firms in the smaller country are at a disadvantage, and they can only cover their fixed costs if the home market is less competitive than the foreign.

How does this result change if the barriers to trade are reduced? The effects of reductions in t can be derived directly from differentiation of equations (8) and (4). Doing this gives,

$$\frac{dp_{11}}{-dt} = \frac{(1+\theta)x_{12}(x_{21}-x_{22})}{2(x_{11}x_{22}-x_{12}x_{21})}, \qquad \frac{dp_{21}}{-dt} = \frac{dp_{11}}{-dt} - \frac{(1-\theta)}{2}. \tag{9}$$

The denominator of the right hand side of the first of these equations is certainly positive if $t > 0$. The numerator term $x_{21} - x_{22}$ is the difference between export and home sales for firms in country 2 and is certainly negative (see equations (5)). This means that reductions in t reduce p_{11}; p_{21}, the price of imports to country 1, falls by more, because of the direct effect of the reduction in t (see second equation (9)). So the small country will find that prices of manufactured products necessarily fall.[2] If we can ignore any possible costs of adjustment, this represents a clear gain. This is especially true if the trade barriers captured by t are taken to represent the kinds of nuisance costs that 1992 is supposed to reduce, rather than revenue-generating tariffs; if government revenue is unchanged by the reductions in t, then reductions in p_{11} and p_{21} necessarily mean an increase in

social welfare, since it raises consumer surplus and, in the free entry case, producer surplus is always zero. Ignoring problems of adjustment, reductions in t raise welfare in the small economy.

Unfortunately, adjustment problems are all too likely to arise, because reductions in trade barriers are associated with dramatic effects on the number of firms operating in country 1. We know that if trade barriers are large enough, then both n_1 and n_2 are positive -- as must be the case under autarky[3]. However, for a sufficiently small but positive level of trade barriers the number of firms in the small economy is zero. To see this subtract π_2 from π_1 (equations (8)), use equations (4), and rearrange to obtain,

$$(\pi_1-\pi_2)\left\{\frac{1+\theta(n_1+n_2)}{1+\theta}\right\} = 2t(a-c)(s_1-s_2) + t^2\{\theta(s_1+s_2)(n_2-n_1)+s_2-s_1\}/2 \qquad (10)$$

For small enough values of t, t^2 is approximately equal to zero. Since $(a-c) > 0$ and n_1 and n_2 are bounded, $s_1 < s_2$ implies $\pi_1 < \pi_2$. Neither π_2 nor π_1 can be positive at equilibrium, so this tells us that $\pi_1 < 0$, i.e., for small enough t there can be no surviving firms in the small economy's industry.

For intermediate levels of trade barriers it turns out that reductions in barriers lead to a progressive reduction in the number of firms in the small country. The implications of this relocation of firms for production and trade are illustrated in rather stark terms in Figure 3 (details of the example underlying this are given in the appendix). Production declines steadily (despite rising output per firm, as in section 3), and imports

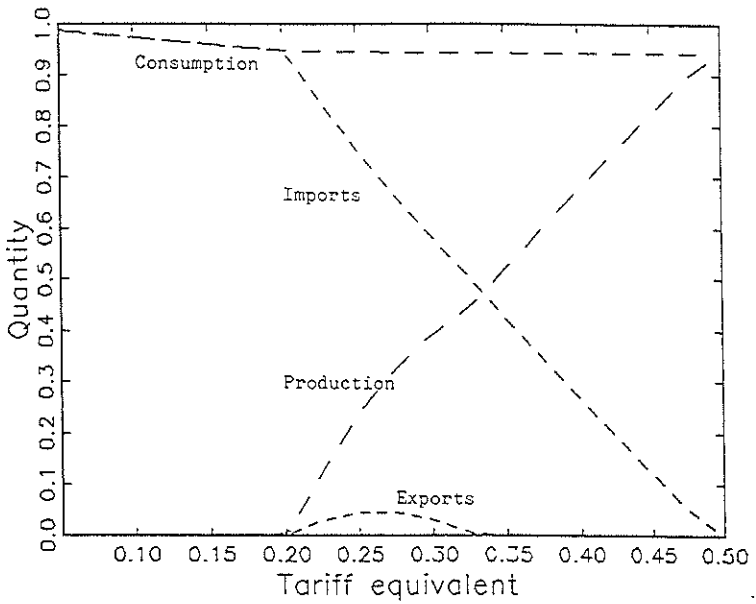

Fig. 3 Monopolistic competition: output and trade

rise to meet domestic consumption (which rises somewhat as p_{11} and p_{21} are falling). Country 1 exports per firm increase as t falls, but as the number of firms falls total exports reach a peak and decline thereafter. The small economy's net manufacturing imports increase steadily as t falls.

5. Variable costs.

The example given in the last section points up rather clearly the idea that a reduction in barriers to trade may actually cause production of manufactured goods to shift toward rather than away from regions with better market access. In one way, however, this model conveys a misleading impression: that barriers to trade actually seem to become more important the lower they are. The reason for this impression is that when costs are both fixed and equal, the only countervailing force against concentration of production is self-sufficiency. As the barriers to trade go down, the incentive for self-sufficiency is reduced while the advantages of concentrating in the larger market remain. Realistically, however, there may also be general equilibrium effects causing changes in factor prices and costs, and these effects may work against the concentration of production.

One source of general equilibrium effects could be changes in the price of the perfectly competitive sector's output in each country. So far we have assumed that the price of this good is the same in both economies at all levels of trade costs. This assumption is correct if trade costs on this good are negligible, or if the price of the good is set on an integrated world market.

But what if trade costs between the two countries cause the price of this good to differ between countries? Suppose that trade costs apply to trade in the perfectly competitive good, as well as to manufacturing, and that these costs are reduced by trade liberalization. As noted above, the small economy is the exporter of this good, and the large economy the importer. When trade costs are positive the internal price of the perfectly competitive good is therefore higher in the large economy than in the small. This is translated into higher wages in the large economy, so putting manufacturing in the large economy at a cost disadvantage relative to the small economy. How does this modify the argument of the preceding section, as illustrated in Figure 3? It can be shown that the qualitative shape of the diagram is unchanged, but the decline in the small economy's manufacturing output is now less steep. At high levels of t the small economy has a cost advantage so giving higher output (but remaining a net importer). As trade costs go to zero (for both sectors of the economy) the wage and cost differences between countries disappear and country 1's output goes to zero, as in Figure 3.

A second source of general equilibrium effects will arise if there are upward sloping supply curves of resources to manufacturing. In this case changes in the size of manufacturing will induce factor price changes, and these will tend to offset the forces for concentration of production. In order to capture this the remainder of this section reworks our analysis for the case where the imperfectly competitive sector faces an upward sloping input supply curve. For simplicity we suppose that labour is the only input in the imperfectly competitive industry, f

denoting the labour employed in fixed costs, and c the labour per unit output. If w_i is the wage rate in country i, then country i marginal and fixed costs take the form,

$$c_i = cw_i, \qquad f_i = fw_i, \qquad i = 1, 2. \tag{11}$$

We assume that the perfectly competitive sector produces output y_i, using labour and a sector specific factor of production k_i which has price r_i. The unit cost function for the perfectly competitive industry is denoted $b(w_i,r_i)$ and the equality of price to unit cost gives equilibrium condition

$$b(w_i,r_i) = 1, \qquad i = 1, 2, \tag{12}$$

where the price of the perfectly competitive sector's output is unity.

Each economy has labour endowment l_i, and we assume that factor endowment ratios in the two economies are the same, i.e., $l_1/k_1 = l_2/k_2$. Factor market clearing is given by

$$\begin{aligned} l_i &= y_i b_w(w_i,r_i) + n_i[(x_{ii} + x_{ij})c + f] \\ k_i &= y_i b_r(w_i,r_i) \end{aligned} \qquad i = 1, 2. \tag{13}$$

Equilibrium is now characterised by equations (4), (5) (8), (11), (12) and (13).

If the cost function b is independent of r then this model is identical to that of the preceding section; there are constant returns to the use of labour in the perfectly competitive sector, and the marginal product of labour and wage rate are constant. If

$b_r > 0$ then there are diminishing returns to labour, and the wage rate is lower the greater is employment in this sector. Since the algebra of this case is fairly complex, we restrict ourselves to a pair of numerical examples. We let b take the form $w_i^{\alpha} r_i^{1-\alpha}$, where α is the share of labour in the industry and investigate the cases when $\alpha = 0.9$ and $\alpha = 0.5$.

Figure 4 shows the consequences of varying trade barriers for the case $\alpha = 0.9$, for the consumption, output, and trade of the manufacturing sector of the smaller country. When a high trade barrier is reduced, the results appear similar to those in Figure 3: the small country's output falls. At sufficiently low trade barriers, however, further reduction actually leads to a rise in production. The same U-shaped production locus emerges for other values of α, with the minimum point occuring at higher output levels the lower is α.

The reason for this shape is that once labour supply to the manufacturing sector is less than perfectly elastic, the smaller country will have a lower wage rate (providing intra-industry trade is occuring). Precisely because it is a net importer of manufactured goods, the smaller country will have smaller manufacturing employment relative to its total labour force, and hence a lower marginal product of labour in the constant returns sector. Now when barriers to trade are lowered, there are two opposing effects. On one side, the incentive to produce in the smaller country for its own market, as opposed to concentrating production in the large country, is reduced; this was the only effect in the zero-wage-differential considered above. On the

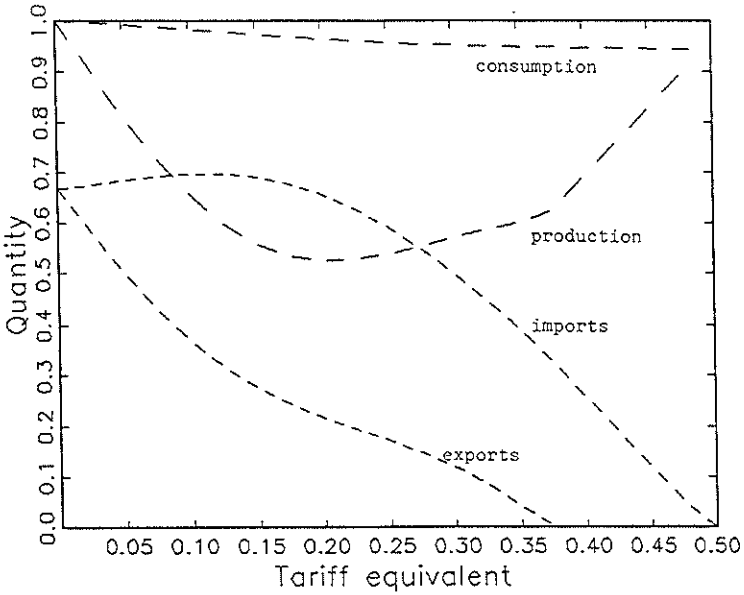

Fig. 4 Output and trade when wages are flexible

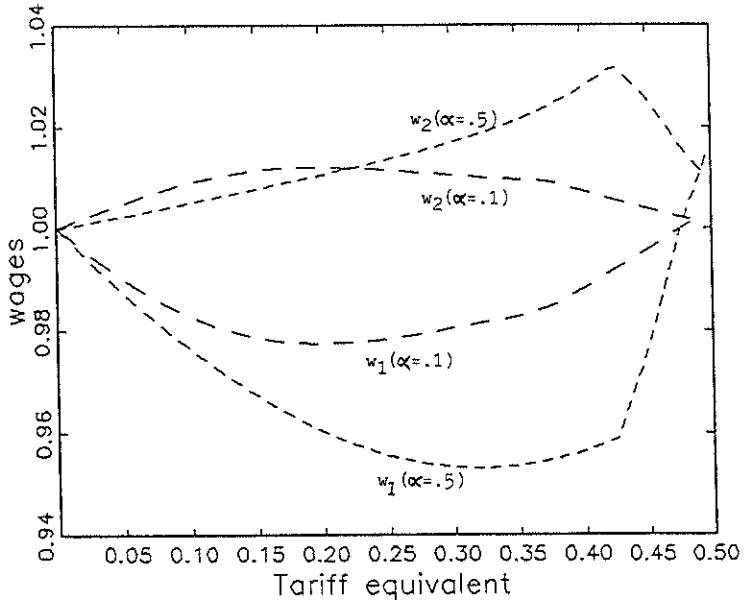

Fig.5 Relative wages

other side, however, there is a greater incentive to export from the low-wage to the high-wage country.

In the limit, with no barriers to trade, the latter effect would predominate: it would always be desirable to produce wherever production was cheaper. So not surprisingly, as one approaches that limit, production moves toward the smaller rather than the larger country. Conversely, when the tariff equivalent is large, this effect is small, and the concentration of production in the larger country dominates.

For peripheral countries attempting to get their initial exchange rates right, a key question is the effect of reduced trade barriers on equilibrium wage rates. Given what we have already seen about output, it is not surprising to see the results shown in Figure 5. When the tariff equivalent is reduced from a high level, the wage rate (in terms of the competitive good) rises in the large country, falls in the small; so the relative small-country wage falls. At sufficiently low tariff rates, however, relative wage rates move the other way, with the relative wage of the smaller country rising. In the limit, with no barriers to trade, the equilibrium wage rates are equal.

We therefore see that in this extended model it is not true that trade barriers matter more for location, the smaller they are. What emerges instead is that the tendency to concentrate production in the centre, and the resulting wage differential of centre against periphery, is largest when there are moderate barriers to trade -- not too high to prevent concentration of

production, but not so low as to promote factor price equalization. This example captures perfectly both the positive and the negative positions we described in the introduction. Starting from high trade barriers the smaller economy experiences falling manufacturing production and downward pressure on wages as barriers fall. As the process continues manufacturing production increases and there is a convergence of peripheral wages to those of the centre.

6. Factor abundance and comparative advantage.

The previous section developed the simplest possible model to illustrate the way in which factor market interaction countervailed the centripetal forces due to market access. In this section we go one stage further, by embedding our model of imperfect competition in a 2 factor Heckscher- Ohlin trade model. This means that countries may now differ in two respects -- market size, and relative factor abundance. We do this in order to address the following question. Suppose that the small economy has a comparative advantage in manufacturing; how does this interact with the market access effects studied in preceding sections? Specifically, suppose that the small economy is relatively labour abundant, and the manufacturing sector relative labour intensive. What then happens to the small economy's wages and manufacturing output during the process of trade liberalization?

In order to model this the model of the previous section needs only slight modification. We suppose that both industries use labour and sectorally mobile capital. The perfectly competitive

sector's cost function is as in the previous section, and the manufacturing sector now has marginal and fixed costs given by

$$c_i = c(w_i, r_i), \qquad f_i = f.c(w_i, r_i) \qquad i = 1, 2. \tag{14}$$

In this formulation we assume that both fixed and marginal costs have the same capital/labour ratio. Factor market clearing conditions are

$$l_i = y_i b_w(w_i, r_i) + n_i[(x_{ii} + x_{ij}) + f]c_w(w_i, r_i)$$

$$k_i = y_i b_r(w_i, r_i) + n_i[(x_{ii} + x_{ij}) + f]c_r(w_i, r_i)$$

$$i = 1, 2. \tag{15}$$

Equilibrium is now characterised by equations (4), (5) (8), (12), (14) and (15).

Once again we use numerical techniques to illustrate levels of production, trade and wages associated with different values of t. The example underlying Figure 6 is constructed to give the small economy a comparative advantage in manufacturing, and parameters are chosen such that at free trade the small economy produces 50% more manufacturing output than it consumes, so its net exports of manufacturing are one third of production. (Details of this example are given in the appendix). The main result apparent from Figure 6 is that, even with this comparative advantage in manufacturing, early stages of trade liberalization are associated with a decline in manufacturing output. This means that the direction of net trade is in the opposite direction to that predicted on the basis of factor endowment; at relatively high levels of t the small economy is a net importer of manufactures, this switching round only at lower levels of t. The result that

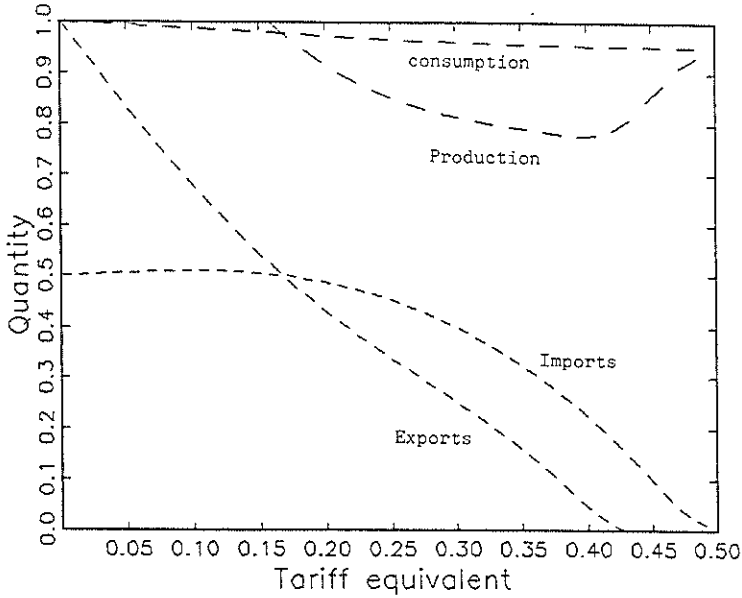

Fig. 6 Output and trade when manufacturing is labour intensive

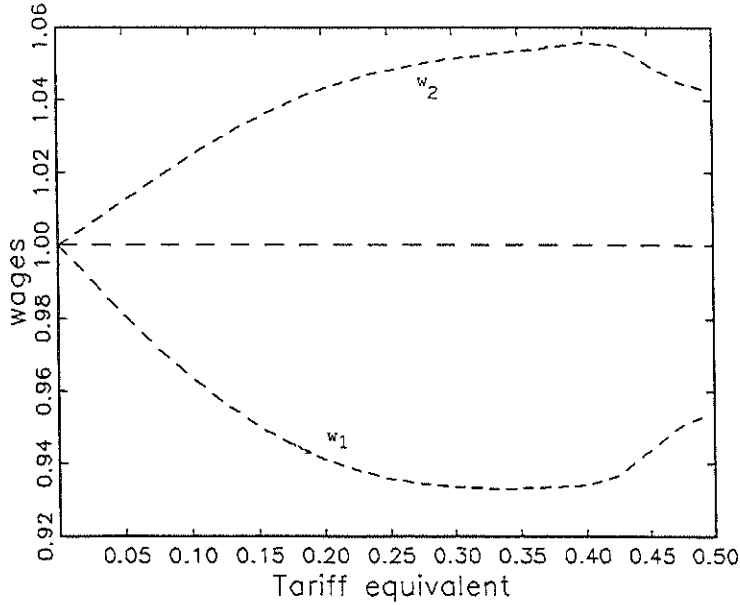

Fig. 7 Relative wages

there is some interval of t on which the small country is a net importer seems quite robust. Increasing the difference in relative factor endowments reduces the range of t on which this result holds, but does not eliminate it.

Figure 7 gives the wage paths associated with this case, and these are as would be expected. Under autarky the labour abundant economy has a lower wage, and with free trade there is factor price equalisation. However, because of the decline in the small economy's manufacturing output at high levels of t, wage convergence is not monotonic. There is an interval of t on which trade liberlization brings relative wage divergence.

So far we have assumed that factors of production are internationally immobile. Several remarks can be made on the consequences of relaxing this assumption. First, consider international capital mobility. Suppose that, in the model of this section, we allow capital to be perfectly mobile. This will equate the rate of return in the two economies, $r_1 = r_2$, and, if there is free trade in the perfectly competitive good, (equation (12)), must also equate wages, $w_1 = w_2$. Essentially one mobile factor and one freely traded good are sufficient to bring about factor price equalisation even in the presence of trade barriers on other traded goods. The model of this section then collapses back to that of section 3, with the manufacturing production path illustrated in Figure 3. The general point here is that forces which tend to equalise factor prices across countries will increase the importance of market access considerations in determining the location of manufacturing.

The same remarks apply if labour is internationally mobile. But in this case we must also add that as labour migrates so does demand. Labour mobility therefore reinforces the centripetal tendencies associated with integration both by reducing the magnitude of wage differentials, and by accentuating market size differences between the centre and the periphery.

7. Concluding remarks;

The analysis of this paper is suggestive of what may occur to a small country engaged in mutual and equal reductions in barriers to trade with a larger economy. Smallness seems to have the following consequences.

First, it is important to stress that there are large potential gains in welfare. The traditional gains from exploitation of economies of scale are reinforced in a world of imperfect competition. In a position of restricted trade the small country does relatively badly as it is unable to both achieve economies of scale and a high level of competition. This cost of smallness is removed by trade.

On the other hand, it is quite possible that there will be a reduction in the number of firms in the small country, and relocation of the industry towards the larger country. When trade barriers are high large national markets require national firms to serve them. As the barriers come down, there is a tendency for production to relocate to be close to the larger market even if this goes against the direction of trade predicted on the basis of

relative factor endowments. The resulting decline in manufacturing production in the peripheral regions may be accompanied by a decline in wages. However, this tendency toward concentration in the centre may be offset by the fact that peripheral regions have lower wages. While the U-shaped curves shown in our Figures are the result of particular numerical examples, they are suggestive of a general tendency for the process of concentration to reverse itself when barriers to trade fall sufficiently.

These results suggest a fundamental ambiguity in the effects of Europe 1992 on the relative competitiveness of manufacturing in the peripheral nations. Lower barriers to trade could make it more attractive to move production out toward the lower-wage periphery, and thereby allow a rise in peripheral wages; or they could make it more attractive to concentrate production in the centre, requiring a fall in peripheral wages at least relative to those in the centre. Anything that impedes the necessary changes in relative wages will reinforce the tendency to concentrate production in the centre.

One might naively suppose that since 1992 is supposed to produce a Europe without borders, it is equivalent to setting t=0 in our simulations. The parameter t, however, is meant to include such "natural" trade barriers as transport cost, difficulty of communication, and cultural differences as well as governmentally imposed costs. The strong income gradient in the Community shown in Table 1 is much larger than could be explained by official barriers alone, suggesting that the natural barriers are

substantial. The point is that we do not know which side of the U-shaped curve we are on -- whether 1992 will improve or worsen the competitiveness of peripheral industry.

FOOTNOTES

[1]For the remainder of the paper we assume that the equilibrium number of firms, $n_1 + n_2$ is large enough to be treated as a continous variable, so we ignore integer problems.

[2]This is not necessarily true for the larger country. It is possible that reductions in t raise p_{22} as the export sales of small country firms (x_{12}) may exceed home market sales (x_{11}).

[3]We assume that the economies are large enough, relative to the degree of returns to scale, to support at least one firm each under autarky.

Appendix

All the numerical simulations have demand parameters;

$a = 5; \quad \theta = 0.333; \quad s_1 = 2.5; \quad s_2 = 5.0.$

In sections 3, 4 and 5 cost parameters are;

$c_1 = c_2 = 1; \quad f_1 = f_2 = 0.4.$

In section 3 the number of firms is set at $n_1 = 13$, $n_2 = 26$. These values of n_1 and n_2 give zero profits in both countries when $t = 0$, i.e, the oligopoly values of n_i (section 3) are an equilibrium of the monopolistic competition model (section 4) when $t = 0$. At this equilibrium price is 19% above marginal cost.

In section 5 $b(w_i,r_i) = w_i^{\alpha} r_i^{1-\alpha}$.

When $\alpha = 0.9$, $k_1 = 6.55$, $l_1 = 91.7$, $k_2 = 13.1$, $l_2 = 183.4$.

When $\alpha = 0.5$, $k_1 = 32.7$, $l_1 = 65.5$, $k_2 = 65.5$, $l_2 = 131.0$.

When $t = 0$ the equilibrium is $w_i = r_i = 1$, and prices and quantities in the manufacturing sector are exactly as in sections 3 and 4. These values imply that at $t = 0$ one third of consumers' expenditure is on manufacturing, the remainder on the perfectly competitive good.

In section 6 $b(w_i,r_i) = w_i^{\alpha} r_i^{1-\alpha}$, $c(w_i,r_i) = w_i^{\beta} r_i^{1-\beta}$ and $f_i = 0.4$. Figures 6 and 7 were constructed with $\alpha = 0.6$ and $\beta = 0.8$, $k_1 = 36$, $l_1 = 78.6$, $k_2 = 62.2$, $l_2 = 117.9$. When $t = 0$ the equilibrium has the same manufacturing sector prices and quantities as in sections 3 - 5.

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