Comparative and Absolute Advantage*

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The doctrine of comparative advantage states that each nation can find a set of commodities in the production of which it can successfully compete in world markets, regardless of the degree of efficiency of its technology or resource-base. Essentially it rests on the notion that each nation has resources which are immobile from country to country, so that they avoid direct competition from other nations' factors. Home labor may be devoted to clothing production despite an absolute advantage possessed by foreign labor in producing clothing if home labor's absolute disadvantage in other activities is more pronounced. If factors were not trapped within a nation's borders, the "second-best" solution involving home clothing production would be replaced by a migration of all factors to the foreign country if, indeed, foreign technology is superior in all lines and that technology cannot be exported to the home country. The purpose of this paper is to examine the relevance of the doctrines of comparative advantage and absolute advantage in a world of "mixed trade", in which some productive factors are trapped by the nation's borders and other productive factors are free to locate where returns are maximised.

The strategy of the paper is to start with the most basic model of trade – the Ricardian model – and work outwards. Thus Section II follows the Ricardian analysis and discusses these issues in a world of two trapped factors – a Heckscher-Ohlin world. Section III allows explicitly for local production of internationally mobile productive factors (intermediate goods or raw materials) and focuses on questions of the effects of price changes on the international distribution of income. In Section IV I offer a few brief observations on the nature of the distinction between comparative and absolute advantage in a world in which international differences in government policies, not treated formally in the body of the paper, can vitally affect the international location of productive activity.

I. The Ricardian Model

In the Ricardian trade model a nation's own productive resources are aggregated into a single, homogeneous factor of production, labor. This provides the most simple setting in which to analyse the roles of comparative and absolute advantage in determining international production patterns.

Further simplify by assuming two countries – home and foreign – each with its own productive capability for producing two commodities, X and Y. The

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per-unit-output labor requirements in each country, a_{Lj} and a^*_{Lj}, are assumed fixed and reflect a mixture of that country's labor skills and technological knowledge. Whereas commodity X can be produced only with labor, commodity Y requires, as well, a fixed amount of factor A per unit output, a_{AY} and a^*_{AY} (perhaps different). At this stage consider factor A as a factor that must be hired from somewhere other than these two countries. It may be an intermediate product. Indeed, in Part III I consider the possibility of its being produced (along with X and Y) either at home or abroad. But first suppose it is a factor obtainable only from the outside and interested in maximising the return it can get from employment in one of the two countries. The country which can afford to pay the higher return to A (R_A or R^*_A) is the country which will import A in order to produce Y.

Assume both home and foreign economies are small enough to be price-takers in the world market for X and Y. Given values for p_x and p_y, I am ultimately interested in the production pattern in the home and foreign countries. But first consider how world prices and home and foreign technology define the range of possible values for wage rates and the return that could be paid for the use of factor A. Inequalities (1) and (2) describe the competitive profit conditions at home:

$$a_{Lx}w \geq p_x. \qquad (1)$$

$$a_{Ly}w + a_{AY}R_A \geq p_y. \qquad (2)$$

If the strict inequality holds in either sector, there can be no local production of that commodity in a competitive equilibrium. The restrictions that are thus imposed on w and R_A are illustrated in Figure 1. The heavy broken line is the country's factor-price frontier. The wage rate must lie on or above the horizontal line, as inequality (1) suggests. Similarly, the downward sloping straight line shows (2) being satisfied with equality. Only if factor returns are shown by point ① could the home country produce both commodities simultaneously.

The value R_A achieves at point ① is the maximum factor A could earn in the home country. Points due east of ① reflect a situation at home in which only commodity X can be produced. If no Y is produced locally, there is no demand for factor A.

How can the foreign country's factor price frontier differ? Both countries face the same prices for X and Y. If the foreign country's absolute labor costs in producing X are lower, its horizontal line is higher, the wage would tend to be higher, and this would reduce the amount it could pay to attract footloose factor A. Of course differences in labor and A-costs in producing Y are also important. Suppose both countries share the same A-requirement in producing commodity Y; a_{AY} equals a^*_{AY}. Then a simple calculation would show that the R_A maximum value at ① would exceed what the foreign country could pay footloose factor A at a comparable point, ①*, if and only if

$$\frac{a_{Ly}}{a_{Lx}} < \frac{a^*_{Ly}}{a^*_{Lx}}. \qquad (3)$$

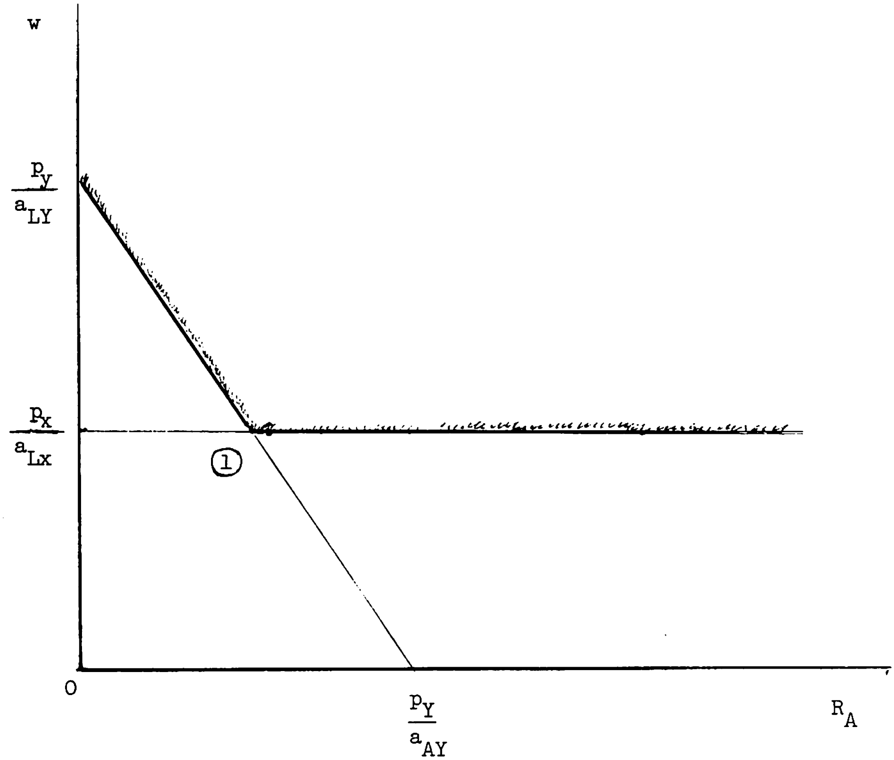

Figure 1

This is the standard criterion in the Ricardian Theory of comparative advantage[1].

Figure 2 illustrates the case in which foreign labor is uniformly twice as efficient as home labor but both countries share the same fixed coefficient technology for the requirements of footloose factor *A* in producing commodity *Y*. With comparative advantages equalized and no difference in absolute *A*-requirements, the allocation of (X, Y) production is indeterminate. Foreign labor superiority is precisely offset by the higher foreign wage rate in comparing ① with ①* if foreign labor is more than twice as efficient in *X*-production, the corner point on the foreign factor-price frontier would move to ②* and, as (3) now indicates, the home country reasserts its advantage in attracting *A* to produce *Y*.

This example, in which comparative labor costs determine the efficient production pattern, is special in that although absolute labor costs are allowed to

[1] This is an example of a general phenomenon proved in *Jones* [11], for any number of countries and commodities if intermediate products (such as *A*) are freely traded but intermediate product requirements are the same for all countries. There it was shown that efficient patterns of world specialization in such a case correspond to positions that minimize the product of labor coefficients. In (3) above, the home country has a comparative advantage in *Y* and foreigners in *X* since $a_{Ly}a^*_{Lx}$ is smaller than $a_{Lx}a^*_{Ly}$.

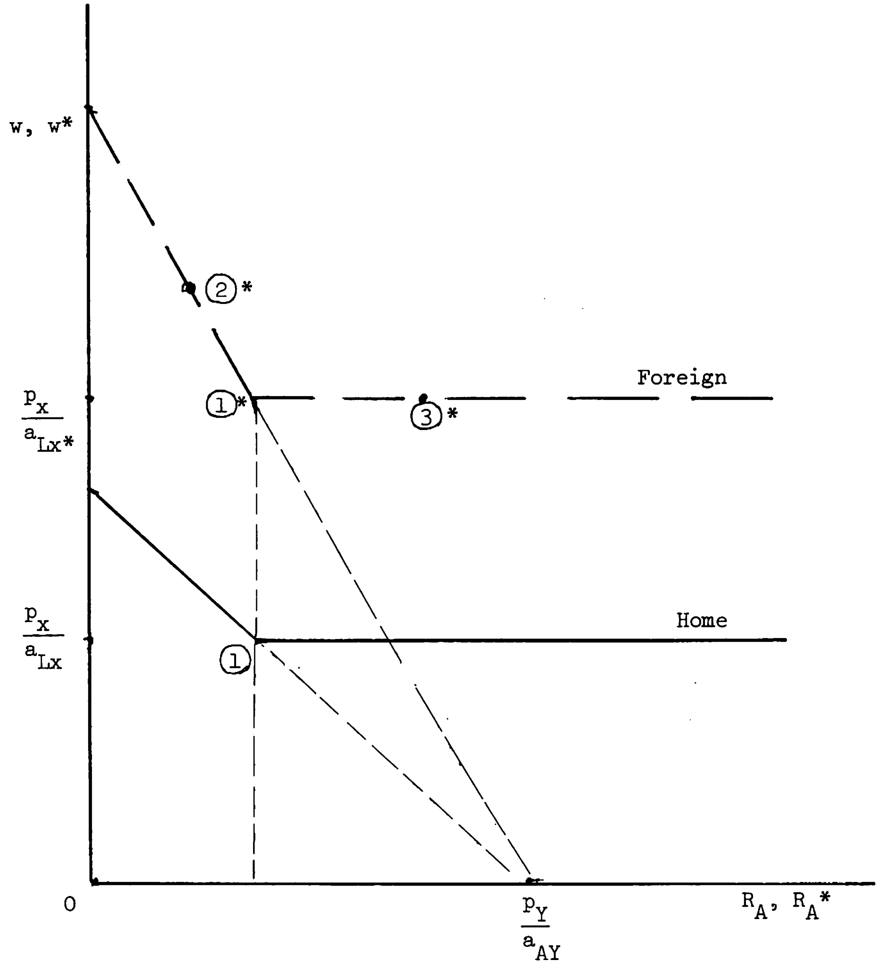

Figure 2

differ between countries, the input requirements for footloose factor *A* are not. Consider the alternative case, in which comparative labor costs are the same, but, say, the foreign country can utilize *A* more effectively. Indeed, suppose foreign technology is uniformly superior to home technology in the sense that a^*_{AY} is half the value of a_{AY} (as well as a^*_{Lj} being half the value of a_{Lj}). In Figure 2 point ③* (which lies on the ray from the origin through point ①) would represent the new corner point on the foreign factor-price frontier. There is no difference in comparative labor costs, but foreign *absolute* advantage in input requirements for factor *A* establish the foreign country as the superior producer of *Y*.

These two cases have illustrated two ingredients in the technological comparison between countries that guides the location of production: (i) *comparative* ad-

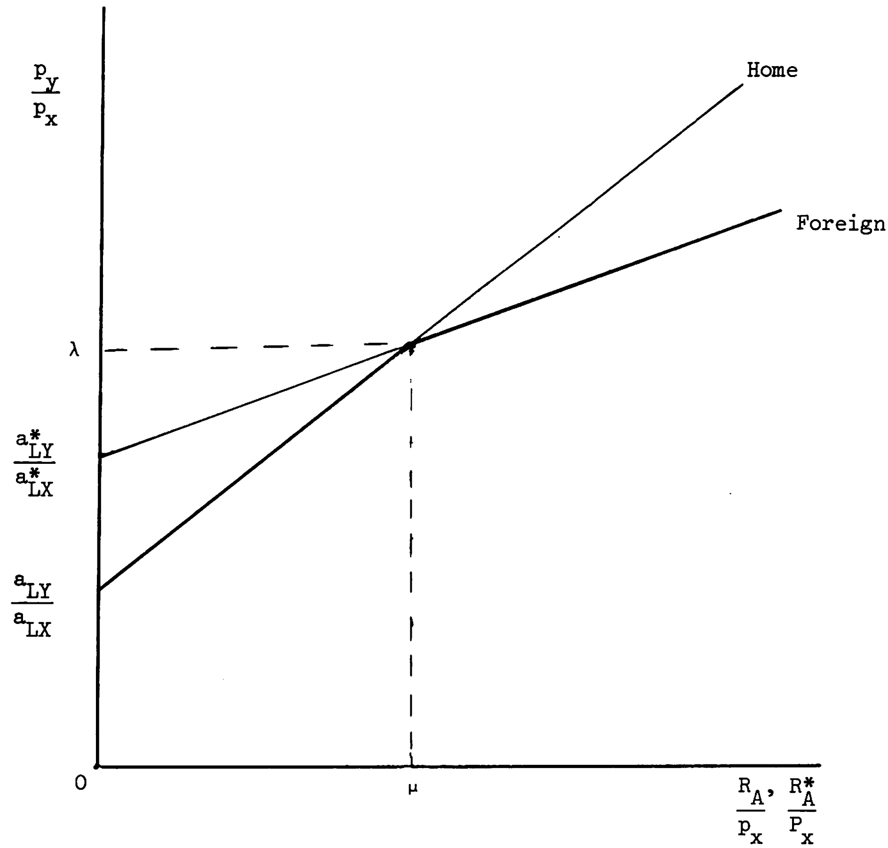

Figure 3

vantage for the factor (labor) that is immobile between countries, and (ii) *absolute* advantage for the factor (A) that is footloose on world markets. Now suppose that the two countries differ in respect of both these technological factors, in such a way that comparative labor costs favor the home country as the efficient Y-producer (as in (3)), but the foreign country has an absolute advantage in A-requirements, as in (4):

$$a^*_{AY} < a_{AY}. \tag{4}$$

Figure 3 illustrates how the maximum value either country can reimburse factor A changes with Y's relative price or, alternatively, how Y's costs would differ between countries if they both paid the same amount for A. For example, along the home line it is assumed that the wage rate equals the value (from (1)) that would allow home production of X, and this value is substituted into (2) to illustrate how the costs of producing Y would depend upon technology *and* the return that must paid footloose factor A:

$$\frac{p_y}{p_x} = \frac{a_{Ly}}{a_{Lx}} + a_{AY} \frac{R_a}{p_x}. \tag{5}$$

Equation (5) brings together comparative labor costs and absolute footloose factor *A* costs. Inequalities (3) and (4) have assumed that these two influences on costs pull in different directions in the two countries. If the two countries had to shop for factor *A* in a world market in which *A*'s price (return) were less than μ (in Figure 3), home comparative labor cost advantage would be decisive and *Y* would be produced at home (and *X* abroad). However, foreign superiority in the productivity of *A* in making *Y* becomes the more important factor in influencing costs if R_A is sufficiently high–greater than μ in Figure 3. Alternatively viewed, if $\frac{p_y}{p_x}$ is lower than $\frac{a_{Ly}}{a_{Lx}}$, neither country can afford to produce *Y*. For *Y*'s relative price between $\frac{a_{Ly}}{a_{Lx}}$ and $\frac{a^*_{Ly}}{a^*_{Lx}}$, the home country can afford to pay a positive return for the use of factor *A* in making *Y*, but the foreign country cannot. Should *Y*'s relative price on world markets exceed λ, not only can foreigners afford to pay a positive amount to hire *A* without making losses in *Y*-production, they can outcompete home producers. The efficient pattern of production completely reverses.

This reversal is not to be found in a more simple Ricardian world with no internationally footloose factors (or traded intermediate products) or in a world with footloose factors if the technology describing their use is common to all countries. This is not to deny that the pattern of production in a Ricardo-Graham model depends upon relative commodity prices. Suppose only labor is required to produce commodity *Y* as well as *X*. Given our assumed ranking of relative labor coefficients, as in (3), the foreign country might produce *Y* (if *Y*'s relative price were high enough), or the home country might produce *X* (if *X*'s relative price were high enough). More typically, the home country might specialise in *Y* and the foreign country in *X*. But it could never be the case that the home country produces *X* while *simultaneously* the foreign country produces *Y*. It is precisely this switch that occurs in Figure 3 when *Y*'s relative price rises from a value less than λ to a value exceeding λ[2].

Of course such switches in production patterns need not take place. The two pure cases already discussed had either home and foreign schedules in Figure 3 parallel (a_{AY} equal to a^*_{AY}) or coming out of the same point on the vertical axis (equal comparative labor costs).

[2] In [11] I sought a criterion to establish positions of comparative advantage that involved *only* technological coefficients. This could be done if traded intermediate product structures were the same (see footnote 1). But I was frustrated in my attempt to establish similar criteria in the more general case in which technologies differ. The problem was that there seemed no way to eliminate relative prices. As Figure 3 illustrates, this in general cannot be done. See also the comments by *Amano* in [1]. The type of diagram showing technological reversals in positions of comparative advantage (Figure 3) was developed for a Heckscher-Ohlin model in *Jones* and *Ruffin* [14]. A similar diagram, relating commodity prices to wage rates, has been used by *R. Bel* [2].

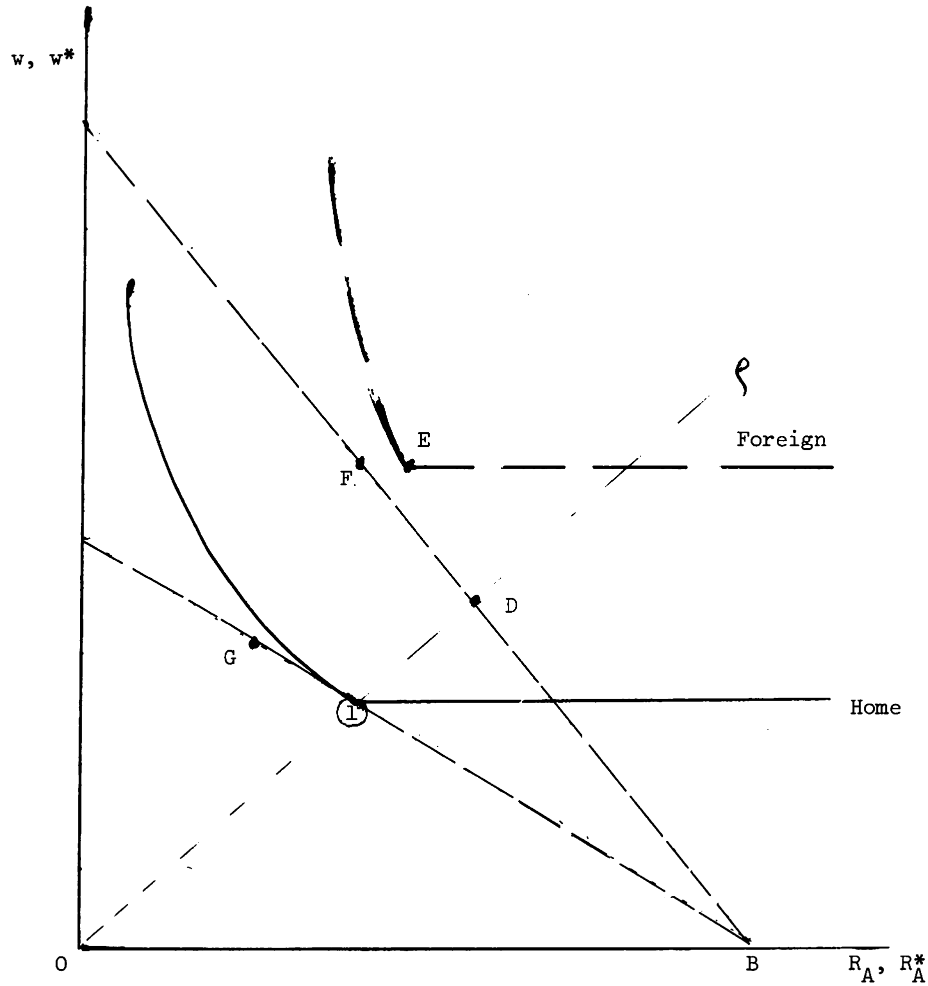

Figure 4

The concept of absolute advantage that proved crucial in determining which country attracted footloose factor *A* to set up the *Y*-industry was the productivity of *A* directly rather than absolute labor productivities. A country with more productive labor must also pay a higher wage. Now suppose there exists some flexibility in the proportions with which factor *A* and labor can be combined in producing *Y*. Does the existence of a higher wage in the country with a (presumed) uniformly more efficient labor force now serve to repel or attract footloose factor *A*? That is, does the possibility of factor substitution alter the assertion that absolute labor cost differences do not influence production patterns?

Figure 4 is an aid to thinking about this issue. Suppose originally both countries had the same technology all around, with the common shaded factor price frontier with a kink at ①. The possibility of factor substitution in the *Y*-sector implies a bowed-in constraint on factor prices provided by *Y*-technology[3]. Now let foreign labor become twice as efficient in the sense that at the *same* ratio of wages to rentals the labor coefficients would be halved, but suppose in addition there is no change in the absolute input coefficient, a^*_{AY}, at the initial ratio of factor prices. If input coefficients had been fixed, the resultant corner point on the foreign factor price frontier would have moved vertically upwards from ① to *F*, just as in Figure 2 it shifted from ① to ①*. At point *D* (where w^*/R^*_A has the same value as at ①) a^*_{Lx} and a^*_{Ly} are cut in half and a^*_{AY} is unchanged. But the new corner point with flexible coefficients is *E*, where substitution possibilities abroad have cut costs below what they would have been in the case with fixed input-output coefficients. For the wage rate shown at *F* (double the previous wage), more is available (at *E*) to attract footloose factor *A*. Thus the foreign country's absolute advantage in labor seems to spill over to impart an advantage in producing *Y*.

The difficulty with this argument is that it can seemingly turn the other way if taken in reverse. Suppose originally both countries' factor price frontiers had looked much like the foreign country frontier drawn in Figure 4, except with the kink at *F* instead of *E*. Now assume the home country suffers a uniform *increase* in labor costs such that at the initial factor price ratio (shown by the slope of a ray through *F*) labor coefficients are increased by the same relative amounts but the footloose *A*-factor coefficient a_{AY}, is unchanged. That is, the new home frontier would be tangent at *G* to line *BG* (extended). The new corner of the home frontier would, because of substitution possibilities in *Y*, lie due east of ①, which allows a higher R_A than the R^*_A at *F*. That is, *inferior* home labor now conveys an advantage in *Y*-production.

There is no real paradox revealed by these examples. Comparing a state of possible input substitution with a state of rigid coefficients favors the former if substitution actually takes place. And substitution will take place if costs can thereby be pared. At any given wage, such savings in costs can be used to attract the footloose factor.

Labels are often misleading. The model in this section has been termed Ricardian, despite the fact that some productive processes (*Y*) require more than one factor of production. If this other factor (*A*) were an intermediate good, itself produced by labor alone, perhaps the label "Ricardian" would seem more appropriate. However, as I discuss in Section III, if *Y* is produced in one country and *A* in another, in a sense two distinct productive factors (home labor and foreign labor) are involved in the productive process, and the model should perhaps be labelled Heckscher-Ohlin. Labels aside, the distinction I wish to make about numbers of productive agents concerns the numbers of factors *trapped* within each nation's boundary.

[3] Had coefficients been fixed in *Y*, the straight line from *B* through point ① would have shown possible R_A, w combinations supported by *Y*-technology.

In this section there is only one (labor), whereas in the next section, arbitrarily entitled "the Heckscher-Ohlin Model", I assume each region has two geographically immobile factors.

In an earlier piece, Roy Ruffin and I [14], dealt with a model that may help clarify this distinction. It was termed a Heckscher-Ohlin model because capital and labor, neither specific in its occupational use, were both involved in producing two commodities. Each country's labor force was employed only within that country. Capital, however, was free to move internationally and would seek its highest return. In our treatment we avoided questions associated with the production of capital, e. g. which country produces capital and what is the rate of capital accumulation. Instead, we asked how changes in relative commodity prices would require an alteration in the location of capital between regions. The basic structure of that model and the one I have considered here is the same once what we termed "capital" is identified with what is called footloose factor A. Of course in the piece with Ruffin, footloose "capital" was used in both sectors and coefficients of production were variable. But the key relationships remained. For example, Figure 3's illustration of the link between relative commodity prices and the return to the footloose factor exhibits the same kind of properties in both cases. Positions of comparative advantage could be reversed. And, a point not stressed previously in this "Ricardian" model, a change in relative commodity prices results in a "magnified" response in the return to the footloose factor. This is a key property of Heckscher-Ohlin models[4].

II. The Heckscher-Ohlin Model

Heckscher-Ohlin theory has highlighted the possibility that countries may differ from each other in the *composition* of their productive resources as well as in the overall productivity of the aggregate. I pick up this theme now by assuming there are a number of countries which possess internationally immobile and fixed quantities of capital and labor.

As previously, commodity X requires only local factors. Assume that the technology whereby X can be produced allows continuous substitutability between capital and labor and that a common technology is shared by all countries.

[4] *D. G. Ferguson* [9] has pushed the theme that international capital mobility in a Heckscher-Ohlin model gives such a model a destinctive "classical", Ricardian form. In [12] I argued that *Vernon's* concept of the product cycle [19], could be captured by a Heckscher-Ohlin model in which a third factor (in addition to capital and "ordinary labor") is introduced, this factor comprising a range of special skills that are required early in the product cycle, but not later. Furthermore, such a three-factor setting could be reduced to a two-factor setting to the extent that capital was internationally mobile, earning the same return in all countries. As this section of the present paper has demonstrated, if the input requirements of capital (or footloose factor A) differ between countries, production assignments cannot be made without taking this factor into account, even if R_A is equalized between countries. But such a qualification could be overcome if the footloose factor *embodies* a technology that is common for all countries. Such an assumption characterized the model for the export of technology discussed by *Berglas* and *Jones* in [3].

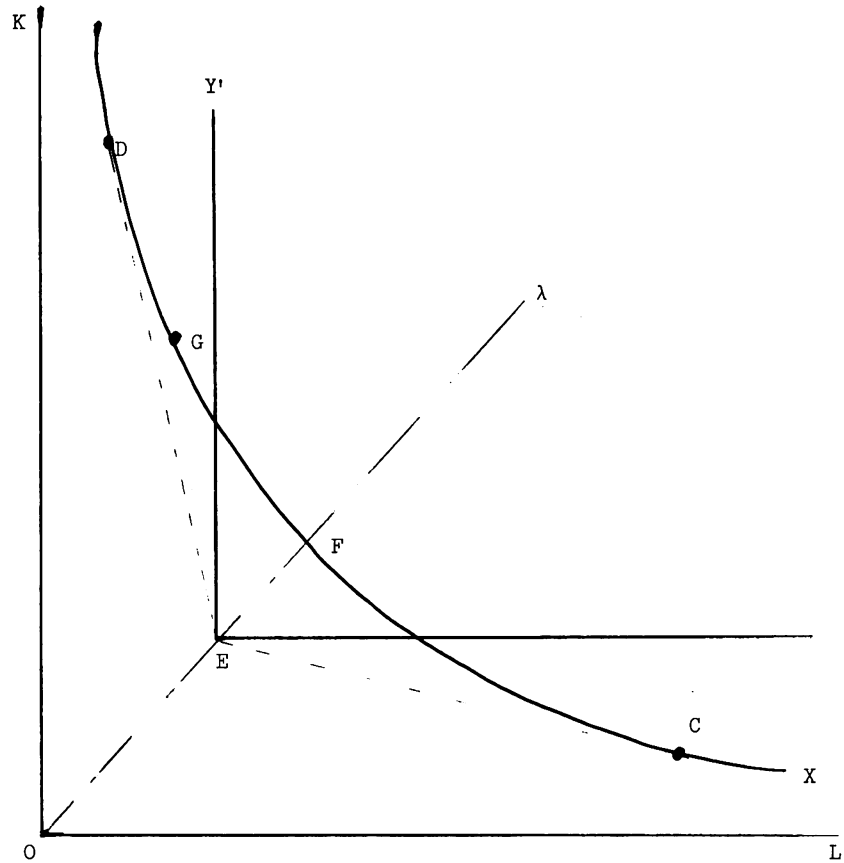

Figure 5

Figure 5 illustrates the unit-value isoquant for X assuming the price of X is given. If X were the only commodity produced, all nations would participate in its production, but the techniques locally used would reflect that nation's factor endowment proportions, which in turn determine the local ratio of factor prices, w/r. For example, a country with a capital/labor endowment ratio shown by the λ-ray would produce X with the local wage/rental ratio indicated by the slope of the unit-value isoquant at F. By contrast, a much more labor abundant country would have a lower wage/rental ratio.

Commodity Y also requires capital and labor. But in addition, it is necessary to combine capital and labor with a footloose factor A, which is seeking its highest returns on world markets. I assume now that in Y production fixed coefficients prevail for all inputs and that a common technolgy is available to all countries. This allows me to focus on the question: which country is best suited,

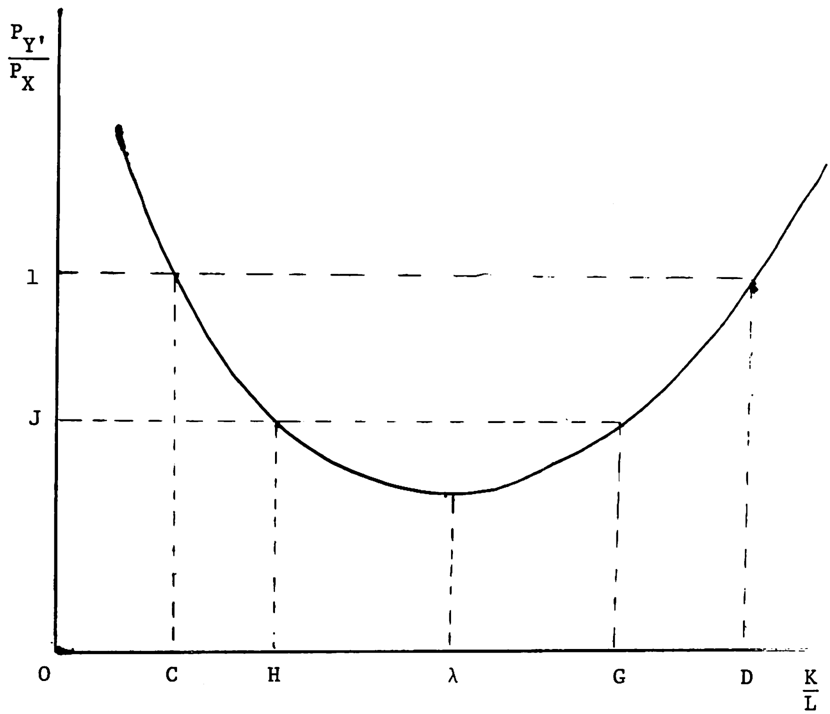

Figure 6

by virtue of the composition of its trapped resources, to attract footloose factor *A* and establish itself as the most efficient producer of *Y*?

With fixed coefficients, *Y* technology allows *separability* of the production process. Local capital and labor produce a substance I call *Y′*, and this, combined with footloose factor *A*, produces final commodity *Y*. The price of *Y* is assumed to be given on world markets. The *Y′* right-angled isoquant shown in Figure 5 reveals combinations of capital and labor that produce just the amount of *Y′* that is required per dollar's worth of final *Y*. Because countries differ in their local wage/rent ratios, given they produce *X*, they will as well differ in the costs of producing the first units of *Y′*, and therefore as well differ in the amount they could offer footloose factor *A*.

Consider, first, the position of a country whose endowment proportions are shown by a ray from the origin to point *D* in Figure 5. Its wage/rent ratio if it produces only *X* is indicated by the slope of the X-isoquant at *D*, and the tangent line passes through corner point *E* on the *Y′* isoquant. That is, at that country's initial factor prices it would cost the same to produce a dollar's worth of *X* as it would to produce the amount of *Y′* necessary to produce a dollar's worth of *Y*. If the country were required to make any payment for *A*, it would make losses. This same point is made in Figure 6. A country with a capital/labor endowment ratio shown by OD would for the first units of Y' have a relative cost of unity for $\frac{p_{Y'}}{p_X}$, where p_X equals 1 and one unit of Y' is the quantity required to produce (in combination with A) one dollar's worth of final Y. By a similar argument, the extremely labor-abundant country whose endowment ray passes through point C in Figure 5 could also begin to produce Y' at a cost of a full dollar. Clearly the endowment proportions most suited to production of Y' (and therefore of Y) are intermediate between OD and OC – those shown by the λ-ray in Figure 5.

The concept that plays a key role in this argument is that of a *factor-intensity reversal*[5]. In Figure 5 all countries with capital/labor endowment rays higher than shown by the λ-ratio would use relatively labor-intensive techniques in producing Y'. Therefore an increase in the wage-rent ratio would drive up the relative price of labor-intensive Y'. Higher autarkic wage-rent ratios are associated with higher capital/labor endowment ratios, so that the relative cost curve is positively sloped to the right of λ in Figure 6.

By contrast, countries more labor-abundant than shown by λ would find, were they to produce Y' and X, that Y' is relatively capital-intensive. Any increase in the wage/rent ratio would drive down the relative price of capital-intensive Y'. Hence the negative slope of the relative cost curve to the left of λ in Figure 6.

I have been assuming that there are many countries, with widely varying endowment proportions. If a single country possessed the proportions shown by the λ-ray, it would be the best producer of Y. From the information provided it is not clear if its potential capacity as a Y-producer would fulfill market demand at prevailling prices. But suppose it does not; extra producers of Y must be found. Clearly the next in line are those whose factor proportions most closely resemble λ – on either side. With reference to Figure 6 equilibrium in world markets may require all countries in the range HG to produce Y by attracting A. The price of Y' (relative to unit price for X) would be shown by OJ[6]. Countries whose endowment proportions are exactly OG and OH are incipient Y producers; countries in between will produce positive amounts of X and Y. The country with the λ factor proportions will specialise in Y, and *both* its capital and its labor will earn proportionally higher returns as $p_{Y'}$ rises – these are the "rents" its resources receive by virtue of having the most preferred "balance" between capital and labor in producing Y'.

The assumption I have imposed in order to illustrate the crucial role of the factor-intensity reversal phenomenon in determining production assignments with a footloose factor are much more stringent that I require. Suppose the world is a much richer place in terms of the spectrum of commodities that can be pro-

[5] Recall the relevance of this concept for an appraisal of the Leontief paradox. See *Jones, R. W.* [10], and *Leontief, W.* [15].

[6] Assuming the price of Y remains constant (units chosen so that it is also unity), the increase in $p_{Y'}$ to OJ must drive down the return to footloose factor A. I avoid the details of showing how full market equilibrium prices are determined.

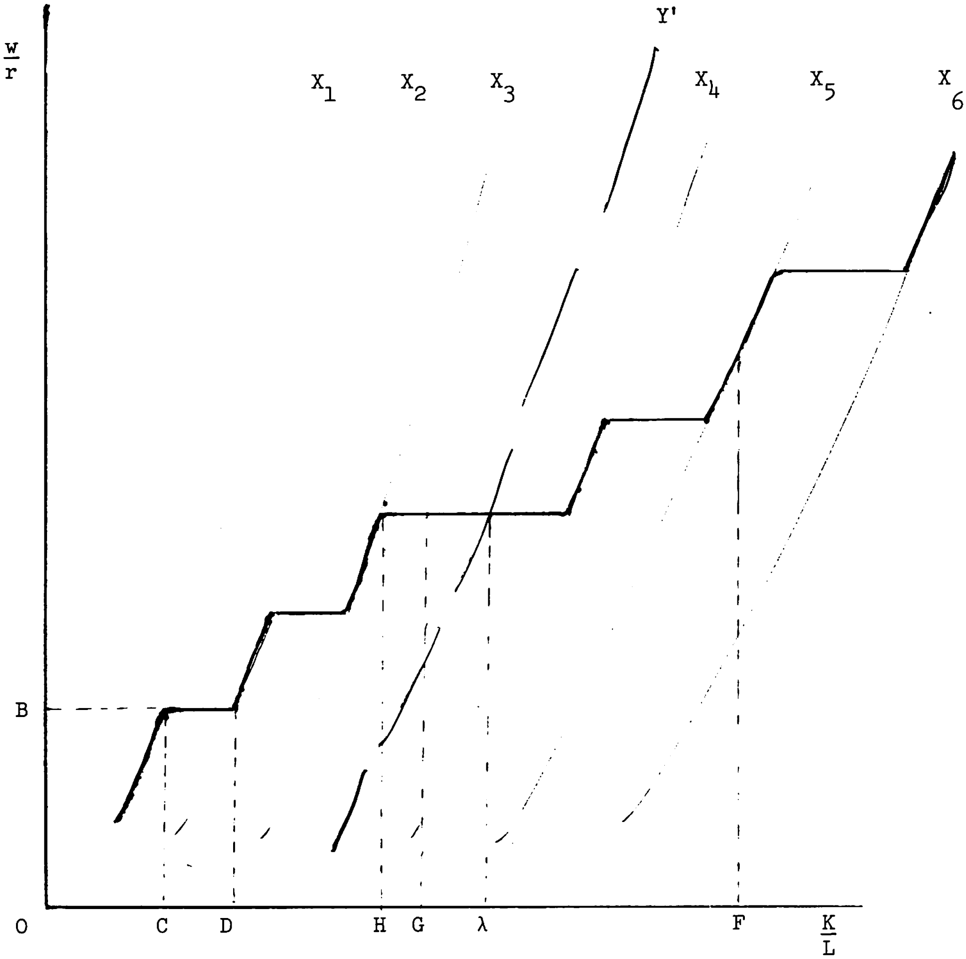

Figure 7

duced with just capital and labor. In Figure 7 I have illustrated six such commodities: X_1, ..., X_6. Explicitly shown is how the ratio of capital to labor employed in each is assumed to rise with increases in the wage/rent ratio. Absolutely no factor intensity reversals are built into the assumptions about technology. Instead, for any common wage/rental ratio, commodity X_1 is the least capital intensive, commodity X_2 the next, and so on to commodity X_6.

Again I have retained the assumption that this group of countries shares the same technology and faces the same set of commodity prices.

As explained elsewhere[7], given world prices a composite unit-value isoquant can be constructed for this group of commodities for countries which share a common technology[8]. It will have the same shape as the X-isoquant in Figure 5,

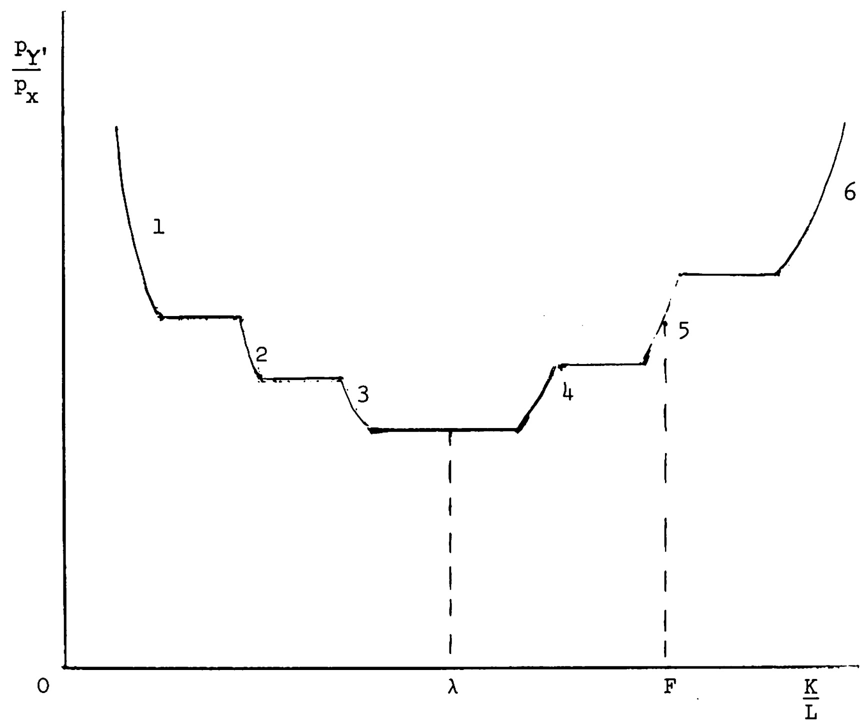

Figure 8

bowed towards the origin, except that it will have linear segments. If all commodities $X_1, \ldots, X_6$ appear in the convex hull forming the composite unit-value isoquant, there will be five flats. For example, consider a country with a very low wage/rental ratio, smaller than *OB* in Figure 7. It could only produce the most labor-intensive commodity, X_1. Should its capital/labor endowment proportions rise to *OC*, raising the wage/rental ratio to *OB*, the country would just be able to produce X_2 as well (at the given world prices). As the capital/labor endowment ratio rises in the range *CD*, the country is incompletely specialized in X_1 and X_2, its factor prices are uniquely determined by the given world commodity prices (as per the standard factor-price equalization argument) and remain at *OB*, and increases in the capital/labor proportions are absorbed by (magnified) increases in the output of commodity X_2. At *OD*, specialization in X_2 is complete, and remains so (as K/L rises) until X_3 becomes a viable candidate at the given world prices. In such a fashion the heavy jagged line in Figure 7 suggests how relative wages respond positively to rising capital/labor endowment ratios in a world

[7] See *Jones* [13], or *Caves* and *Jones* [6], Chapter 7.

[8] There may be other countries with different technologies which help determine world prices. Attention here is focussed on how production patterns differ for the subset of countries which share the same technical knowledge.

with fixed commodity prices. The plateaux in this response reflect the rigid link between commodity prices and factor prices when the number of commodities produced for the world market (2) matches the number of internationally immobile factors (2).

Also drawn in Figure 7 is the technological relationship between wage/rental ratios and the capital/labor ratios that would be adopted to produce a commodity, Y', which is then combined with footloose factor A, to produce final commodity Y. I retain the assumption that the production process for Y is *separable* so that local labor and capital are only required to produce Y'. And, to keep matters simple, I assume that A and Y' are required in fixed quantities per unit of Y produced. However, as Figure 7 illustrates, substitution between capital and labor is allowed in producing Y'. Although no factor-intensity reversal is assumed between Y' and any other single traded commodity, there is the reversal phenomenon evident between Y' and the *composite* unit-value isoquant. Thus for reasons similar to the case (Figures 5 and 6) of a single alternative commodity X, the locus in Figure 8 shows the relative cost of producing Y' lower for countries with "middle" values of their capital/labor endowment proportions and higher costs for countries at either extreme. The plateaux in Figure 8 illustrate that if a country attempts to produce Y' and *two* of the X_i (whose prices are given on world markets), its local factor prices will remain at a constant level even if its factor endowments change until it is forced to abandon production of one of the X_i. For example, a country with endowment proportions given by OF in Figure 7 or Figure 8 produces commodity X_5. If it also produces Y', X_5 would be produced by capital intensive techniques (compared with Y'). Therefore, should that country increase its capital/labor endowment proportions by a slight amount, the local wage/rent ratio would rise, causing the price of labor-intensive Y' also to rise.

Once again it is countries with endowment proportions near λ in Figure 7 or 8, close to the point of intensity reversal between Y' and the composite unit value isoquant for $X_1, \ldots, X_6$, which are in the best position to attract footloose factor A and set up production facilities for Y. But how do two countries with differing capital/labor endowment proportions which nonetheless lie on the same flat in Figure 7 compare in their attractiveness as Y producers? A country with endowment proportions given by λ in Figure 7 would initially be producing X_3 and X_4, as would a country with endowment proportions shown by OG. Wage/rental ratios in each would be the same and local costs of establishing a few units of Y' production also the same. But the country with the λ factor proportion ratio could channel *all* its local resources into producing Y'; the country with endowment proportions OG could at most devote a fraction of its resources to Y' [9].

[9] Indeed, at the point of maximum Y' production for the country with proportions shown by OG in Figure 7, the local X_4 industry would be shut down. A weighted average of the capital/labor ratios used in X_3 (OH) and Y' (λ) would have to equal OG. These weights would reflect the fraction of the labor force used in each industry.

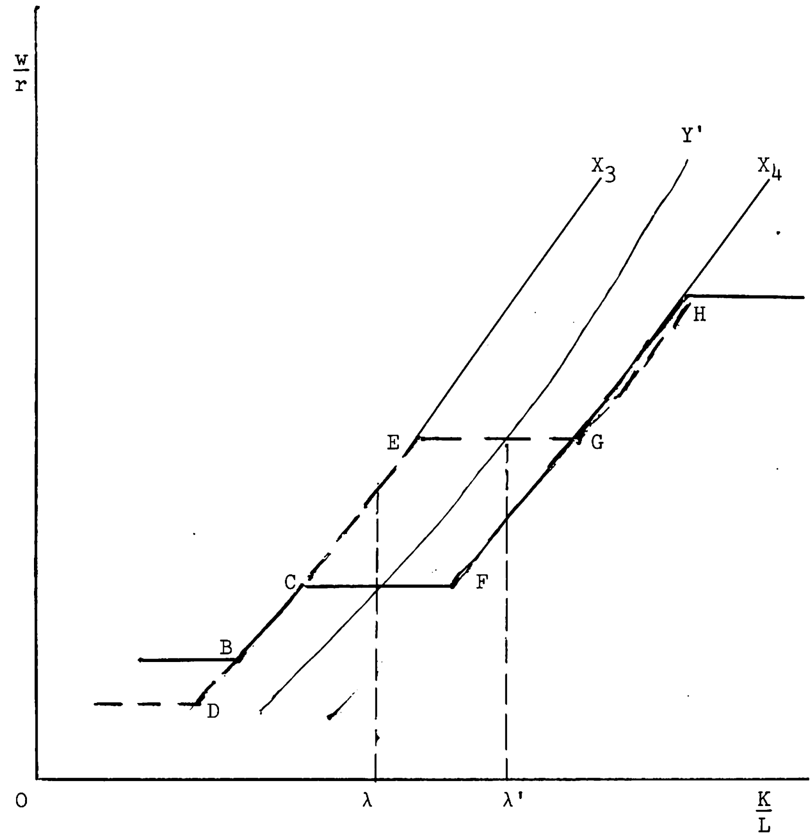

Figure 9

In Section I's discussion of the Ricardian model it was pointed out that a change in world prices for final commodities could cause a complete switch in the competitive production assignments, so that at one set of prices the home country might produce *X* and the foreign country *Y*, while at another the home country might switch to *Y* and the foreign country to *X*. Much the same kind of phenomenon can happen here. To avoid cluttering up Figure 7, the factor proportions curves for X_3, X_4 and Y' have been redrawn in Figure 9. At initial prices a section of the *composite* factor proportions curve for the X_i is shown by *BCFH*. The country with proportions shown by λ is most suited for producing Y' (and attracting footloose factor *A*). The country with proportions λ' would produce commodity X_4. Now let the world price of X_3 rise, all other prices (for other X_i and *Y*) remain the same. In Figure 9 this has the effect of lengthening the range along the composite curve that is now devoted to X_3 from *BC* to *DE*[10].

[10] Details of the impact of commodity price changes on this schedule are given in *Jones* [13].

The section of the new composite curve is the dashed curve $DEGH$. The country with proportions shown by λ' becomes the new best producer of Y', while the country with the λ proportions now switches over to produce X_3. Changes in world prices have caused this switch in production patterns. Of course it is not a complete switch, since X_3 is different from X_4 (previously produced by the λ' country). But it does reverse the role of which country produces the commodity requiring the footloose factor versus which country produces *a* commodity (in the composite of the X_i) which does not.

III. Distributional Consequences of Mixed Trade

In this section I focus on some consequences for international income distribution of changes in prices of traded commodities when trade is mixed in the sense that some agents of production are trapped behind national boundaries while others (or intermediate products) are footloose on the world scene.

First I return to the discussion of the Ricardian model in Section I to analyze the consequences of having the footloose factor A, be a commodity which is, or can be, produced either at home or abroad. At home the inequality that captures the competitive profit condition is:

$$wa_{LA} \geq R_A, \tag{6}$$

where I assume only labor is required to produce footloose factor, A, whose return, R_A, should be interpreted now as the price of an intermediate product. The type of factor-price frontier for the home country which was illustrated in Figure 1 is now extended by virtue of (6) to the heavy shaded contour in panel (a) of Figure 10, The "A" ray from the origin shows combinations of home wage rate w, and price of the intermediate product R_A, that will allow positive production of A at home.

As drawn in Figure 10 (a), the home factor-price frontier has three sections. The prices of X and Y are assumed fixed. If R_A is small enough, the home country would not attempt to produce A or X. Instead, encouraged by the low price at which A can be obtained from the world market, the home country would import footloose product A and produce only Y. For somewhat higher R_A, Y production becomes unprofitable relative to putting all labor directly into X. Finally, of course, if R_A were sufficiently high on world markets, the home country would concentrate on producing A.

These answers to the question of production assignments in the home country have taken no notice of what the response is in the foreign country. This is entirely appropriate if prices of traded goods (including footloose intermediate product A) are given parametrically, leaving aside until a later stage the role of world demand in helping to determine equilibrium prices. But the focus in the previous sections was somewhat different: Given world prices for final commodities, I asked which of the countries explicitly considered was in the best position to

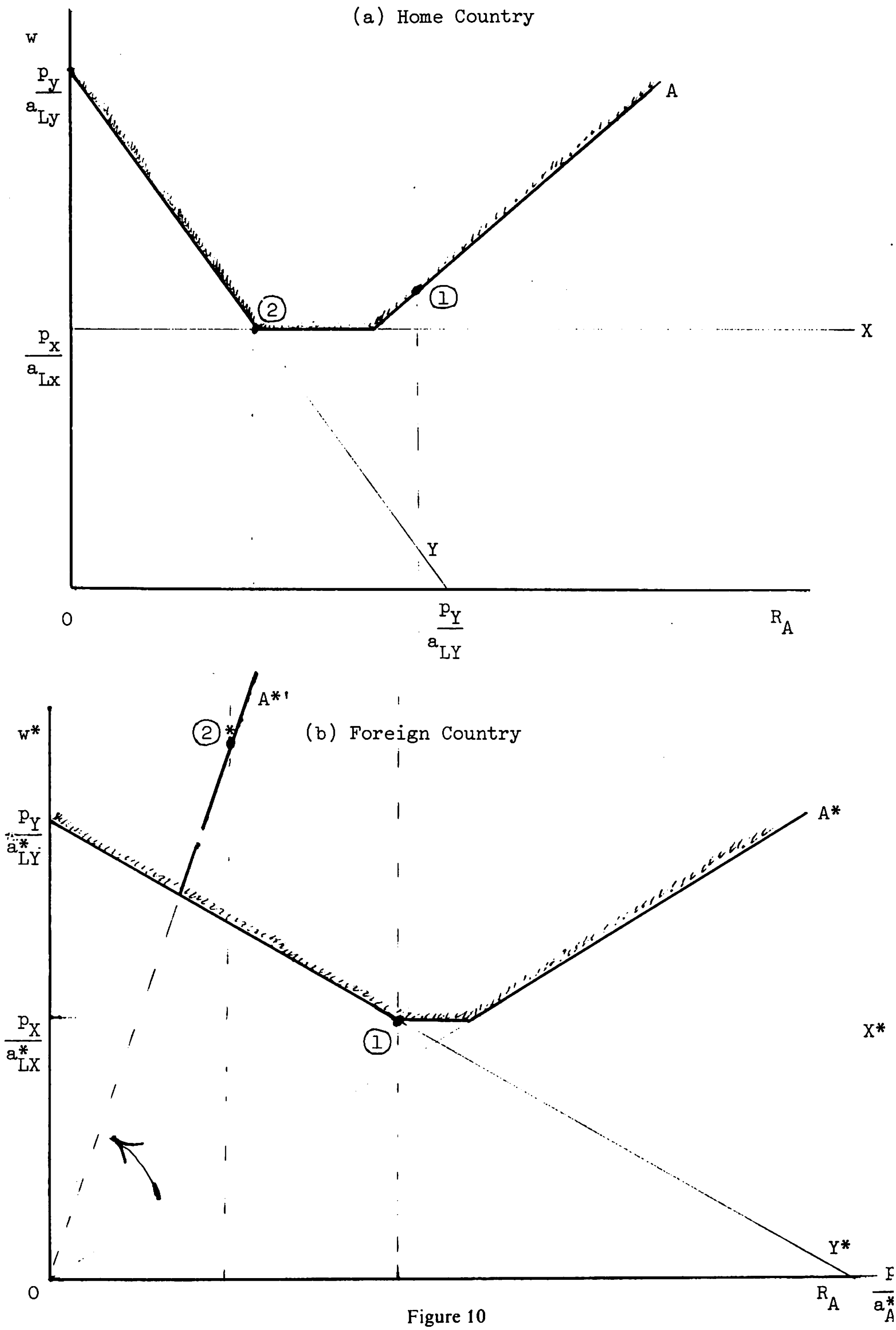
(a) Home Country
w
p_y / a_Ly
A
2
1
X
p_x / a_Lx
Y
0
p_Y / a_LY
R_A
A*'
2*
(b) Foreign Country
w*
p_Y / a*_LY
A*
p_X / a*_LX
1
X*
Y*
0
R_A

Figure 10

attract footloose factor A. If all prices, including R_A, are taken from a larger world market, the answer to the question "which of the two countries imports A in order to produce Y", could be "neither" or "both". Revert, now, to the earlier procedur and search for appropriate solutions in which R_A reflects the maximum that can be obtained in the two countries, with the current added proviso that one of the two countries be capable of producing A.

Figure 10 is constructed to illustrate two possible solutions to the production assignment problem – a "before" and an "after" some change disturbs the system. Initially suppose in panel (b) the A^*, X^*, and Y^* schedules bound a three-part factor price frontier for the foreign country (heavily shaded). In conjunction with panel (a) for the home country it shows a feasible solution in which at points ① and ①* the home country produces footloose intermediate product A at the maximum value A can obtain in this group of two countries. This maximum value is at point ①* in panel (b). Note that points due east of ①*, although on the factor-price frontier, are not relevant for factor A because neither of the two countries shown here could afford to produce Y at such high prices for A. (This also holds for points northeast of (1)* along the A* section.) Both commodities X and Y are produced in the foreign country, with the foreign Y-sector obtaining its requirements of A from the home country.

The "after" situation reflects a change in the technology of producing footloose intermediate commodity A in the foreign country. The labor-input coefficient a^*_{LA}, is assumed to be reduced to swivel the A^* ray to $A^{*\prime}$. I assume no change in world prices of commodities X or Y. But the international pattern of production gets radically shifted. The foreign country, previously the optimal location for the Y industry which uses A, has experienced a drastic rise in wages as a consequence of developing superior techniques for producing A. This change, far from helping local Y producers, drives up the wage rate (to point ②*) and causes the foreign Y-industry to collapse[11]. In the home country, the industry producing A has been mortally afflicted by the technological success abroad. As a consequence, local wages fall, and previously unprofitable industry X, as well as industry Y, are stimulated. Despite the departure of locally-produced A, cheaper foreign imports of A, plus a lower wage rate, help capture the Y industry for the home country.

This scenario merely suggests an example of possible outcomes. Other examples would follow with the changes in the presumed labor coefficient rankings or commodity prices. But it nonetheless remains the case that the optimal assignment of countries to commodities depends both upon comparative costs for

[11] This is a severe example of what has been called the "Dutch Disease". Favorable developments in an industry servicing a traditional export sector (natural gas in the Netherlands, or oil in the U.K. and Norway), may so raise the wage rate (or exchange rate in variations on this model) that traditional export sectors (Y in the foreign country) are hurt (or completely knocked out). For an analysis of this phenomenon, see *W. M. Corden* and *J. P. Neary* [8], and Chapters 5 and 6 of *Caves* and *Jones* [7].

those resources which cannot move internationally and absolute costs for those which can[12].

The model outlined above is asymmetric in the sense that two final consumer goods are produced, one of them (X) in a single stage, using only labor, and the other one (Y) requiring the use of labor directly and, as well, the labor embodied in intermediate commodity A. Symmetry could be achieved by adding one more footloose intermediate product, B, and requiring that it be used, in fixed proportions, to produce a unit of X.

Which country should produce which commodities? This question admits of many possible answers, depending both upon a comparison of labor productivities and upon the requirements of A and B, respectively, in producing Y and X. To simplify, suppose the two countries share a common technology with reference to footloose intermediate product technology so that $a_{AY}=a_{AY}^*$ and $a_{BX}=a_{BX}^*$. This is a simplification adopted in a recent paper by Kalyan Sanyal [18], to discuss trade in raw materials. Indeed, each of the above coefficients is unity as he assumes it takes one unit of a raw material to make one unit of output. As I earlier discussed, if the productivity structure for traded intermediates is identical between countries, efficient productivity assignments depend only upon comparative labor costs, as in a pure Ricardian model. One possible trade pattern would have the home country concentrating its resources to produce both footloose products A and B, while the foreign country's specialty is in further refining A and B into their final state (Y and X). This is a scenario that might fit the notion that less developed countries have a comparative advantage at earlier stages of fabrication.

The ranking according to comparative labor costs that was of special interest to Sanyal was different. Suppose:

$$\frac{a_{LA}}{a_{LA}^*}<\frac{a_{LX}}{a_{LX}^*}<\frac{a_{LY}}{a_{LY}^*}<\frac{a_{LB}}{a_{LB}^*}. \tag{7}$$

That is, if only direct labor coefficients in producing X and Y are examined, the home country has a comparative advantage in X. However, the home country also has a comparative advantage in producing A, the raw material that is used in producing Y. Suppose, furthermore, that demands are fairly evenly matched so that with trade the home country produces raw material A, ships it abroad for further processing into commodity Y, and obtains from abroad raw material B which is developed locally with home labor to produce units of X. Each final commodity thus has been handled at some stage by the labor force of the two countries. Given this pattern of trade the pricing relationships are shown in

[12] Note that in the previous example it was the development of a new comparative labor cost advantage in producing footloose factor A that drove up foreign wages and rendered the foreign country a less adequate site for producing Y (which uses A), despite its absolute superiority in A-productivity as an input into Y.

equations (8) and (9):

$$a_{LX}w + a^*_{LB}w^* = p_x. \tag{8}$$

$$a_{LA}w + a^*_{LY}w^* = p_y. \tag{9}$$

In these competitive profit equations the cost of raw materials has been broken down to its initial labor costs, making use of the assumption that units have been chosen such that it takes one unit of *B* for example, to contribute to one unit of final commodity *X*.

This model, with its simple Ricardian structure, becomes a model with strictly Heckscher-Ohlin properties! Although there is a built-in time structure to the production process (first *A* is produced at home, then it is shipped and further processed into *Y* abroad), the pricing relationships[13] behave precisely as if home and foreign labor are two cooperating factors engaged in the production of two final commodities. Productive activity is decomposed into stages. The possible international spread of these stages through trade suggests that for each final commodity it is important to focus upon the relative importance of the two labor forces in its construction. This comparison provides the key to the international distributive consequence of a change in final commodity prices. Differentiate (8) and (9), letting a hat, "^", over a variable indicate relative changes ($\hat{w}$ equals dw/w) to obtain:

$$\theta_{LX}\hat{w} + \theta_{L*X}\hat{w}^* = \hat{p}_x. \tag{10}$$

$$\theta_{LY}\hat{w} + \theta_{L*Y}\hat{w}^* = \hat{p}_y. \tag{11}$$

The θ's represent distributive shares and θ_{L*X} represents the foreign contribution to a dollar's worth of *X* via foreign sales of commodity *B*. Clearly if the price of *X* rises relative to the price of *Y*, real incomes (i.e. real wages) in the country exporting *X* (the home country) are improved, *not* automatically, but only if the contribution of home labor in producing *X* (θ_{LX}) exceeds the (indirect) contribution of home labor in producing *Y* by producing the raw material (*A*) that is used in *Y*. If not, a paradoxical-sounding result emerges; a country is hurt by an improvement in its terms of trade. Furthermore, as in standard Heckscher-Ohlin theory, changes in final commodity prices revert backwards to affect each nation's wage rate by a *magnified* amount[14].

This crucial comparison of labor shares really involves the question of how important a component in costs are raw materials. If, in general, final commodities tend to be assembled in locations different from the ones in which their components were produced, and if the value of these components is relatively high, workers at the final stages of production will generally be adversely affected by

[13] Any interest costs involved in the passage of time are ignored.

[14] See, for example, *Caves* and *Jones* [6], Chapters 6 and 7. Note also that this magnified effect of commodity prices on returns to the footloose factor were found in the Ricardian model discussed in Section I (e.g. see Figure 3).

price rises of the commodities they help produce. Such workers will be the "scare" factors.

This same focus on the relative importance of the two nation's resources in producing commodities can yield insights into a different trading pattern. Suppose that intermediate products do not enter trade. Instead, primary factors (labor, capital) can be invested abroad. That is, in any country foreign nationals and foreign-owned capital are combined with local labor and capital to produce commodities which enter trade. The underlying redistributive effects of price changes on a country's own nationals must then be sorted out by distinguishing, for each commodity, the share of the country's owned resources involved in its manufacture from the share of foreign-owned resources[15].

The possibility that production is broken down into several stages is the central feature of a recent model I developed jointly with Sanyal [17]. There we envisaged international trade as taking place somewhere in the middle of the productive spectrum. In each country primary, non-tradeable resources are combined to produce what we call "middle products". These items are not in a final state ready for consumption. But they can be traded. The function of international trade is to allow a nation to proceed to the final stages of production (what we call the "Output Tier" of the economy) with a different bundle of productive factors (local labor plus a new mix of traded "middle products") than it would have possessed had trade not been allowed. In the Output Tier each final, non-traded consumption good is produced with the aid of a specific middle product plus labor. Although the productive structure of the Output Tier is that of the Specific-Factor Model[16], the existence of international trade in middle products allows them to be aggregated and the model behaves as if there were two local mobile factors (labor and "middle products"). Geographical mobility of middle products serves completely to compensate for occupational specificity.

In this model much depends on a crucial distinction involving factor intensities in the Output Tier: which sector is intensive in its use of traded middle products? Suppose local tastes change and greater quantities of the commodity intensively using traded middle products are demanded. Extra quantities can only be obtained by switching more local resources (labor) into the "Input Tier" of the economy which produces middle products for trade thus allowing more middle products to be used in the Output Tier. But such a move drives down wages and is in general deflationary.

In our paper we also enriched the production structure in the Output Tier by adding non-traded specific factors. However, for many questions this change did not alter the main features of the analysis: trade introduces a crucial distinc-

[15] Analyses of distributional consequences of changes in trade parameters when some local means of production are foreign-owned can be found in *Bhagwati* and *Brecher* [4], and *Brecher* and *Bhagwati* [5].

[16] That is, each commodity is produced with labor and a middle product (intermediate good, raw material) used only in that sector.

tion among commodities that has to do with a comparison between the share of final output that goes to local factors versus the share that is destined for payment to internationally traded middle products. Typical Heckscher-Ohlin theory counted on a functional distinction between two factors – usually labor and capital – and had to defend itself against the argument that the number of factors really exceeded two. In the model with middle products the number "two" reflects a natural binary distinction between local inputs and traded inputs. Or, in Sanyal's paper on raw materials [18], the number "two" reflects a natural distinction between "ours" (labor) and "theirs".

IV. Comparative Advantage and Relative Attractiveness

This paper has attempted to shed light on a trading world that is mixed – some productive agents are trapped behind their nations' boundaries whereas others are geographically free to seek their highest returns. The bulk of the theory of international trade has dealt with the case where all factors are trapped and, from Ricardo's time to date, the moral of the concept of comparative advantage has been that any nation can find something for its productive agents to do that will allow them successfully to compete in world markets for the wares they produce. Lack of skills at home compared with other nations' productive agents will be compensated by lower absolute returns. No nation need be excluded from the gainful exchange of commodities.

While trapped productive factors seek the best occupational use for their talents within a country, agents that are footloose in world market seek locations that are most attractive. Trapped factors ask: what shall we do?; Footloose factors ask: where should we go? The economic and non-economic variables affecting their answers can be quite different.

As an example consider differences in tax structures from country to country. Admittedly most tax structures bite unevenly within the nation's borders, and can thus affect the position of comparative advantage for a nation's trapped factors of production[17]. But probably more important would be the uneven effect between countries of differences in tax levels. In the language of Section I's Ricardian model, home and foreign countries may share the same labor costs and absolute productivity of footloose factor A. But if A's returns are going to be more heavily taxed in the home country, the foreign country will attract A and the Y-industry using A. Recall how differences between countries in absolute labor costs are balanced by compensating differences in wages that must be paid. Internal competition insures that wages get bid up. But other kinds of differences, such as differences in tax treatments, are not captured by rents or local factors. That is, they are not captured *until* account is taken of international movements of footloose factors. To continue the tax analogy, foreign wages could be bid up

[17] For example, see the analysis of this issue in *J. Melvin* [16].

precisely by the attraction of footloose factor *A* until *after tax* returns are equalized among all regions which attract *A*.

The role of government policies in affecting the international pattern of production becomes much more important if there are many footloose factors which can pick and choose their location. Concern over the role of multi-nationals reflects this view. Although each nation can, by the law of comparative advantage, find something to produce, it may end up empty-handed in its pursuit of industries requiring footloose factors. Once trade theorists pay proper attention to the significance of these internationally mobile productive factors, the doctrine of comparative advantage must find room as well for the doctrine of "relative attractiveness" where it is not necessarily the technical requirements of one industry versus another that loom important, it is the overall appraisal of one country versus another as a safe, comfortable, and rewarding location for residence of footloose factors.

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Zusammenfassung

Komparative und absolute Vorteile

Der Diskussionsbeitrag von Jones beschäftigt sich mit der Theorie des komparativen Vorteils im internationalen Handel. Jones geht dabei von einem Modell aus, in dem ein Teil der Produktionsfaktoren international vollkommen immobil ist, während der andere Teil frei ist, unabhängig von nationalen Grenzen dorthin zu wandern, wo er den höchsten Ertrag erwirtschaften kann.

Während die immobilen Produktionsfaktoren die bestmögliche Beschäftigung innerhalb ihrer Landesgrenzen suchen, suchen die mobilen Faktoren auf den Weltmärkten nach den attraktivsten Standorten. Die ökonomischen und nicht-ökonomischen Faktoren, die das Verhalten der beiden Faktortypen bestimmen, dürften dabei sehr verschieden sein. Die Wichtigkeit politischer Massnahmen, die die internationale Verteilung der Produktion beeinflussen, nimmt daher mit steigendem Anteil international mobiler Faktoren zu. Obwohl nach dem Gesetz des komparativen Vorteils, das in seiner Urform auf völliger Faktorimmobilität beruht, jede Nation sich auf irgendwelche Produktionszweige spezialisieren kann, ist es durchaus möglich, dass die Industriezweige, die hauptsächlich mit mobilen Produktionsfaktoren arbeiten, abwandern. Die Doktrin des komparativen Vorteils muss also durch eine Doktrin der «relativen Attraktivität» ergänzt werden, die nicht nur die technischen Gegebenheit zweier Länder vergleicht, sondern auch andere Faktoren materieller und immaterieller Art, die die Standortwahl der international mobilen Produktivkräfte beeinflussen, berücksichtigt.

Résumé

Avantages comparatifs et absolus

La contribution fournie par Jones traite de la théorie de l'avantage comparatif dans le commerce international. En la matière, Jones se base sur un modèle dans lequel une partie des facteurs de production sont parfaitement immobiles sur le plan international, tandis que les autres sont indépendants des frontières nationales et libres dès lors de se voir transférés là où le profit maximum peut être réalisé.

Tandis que les facteurs de production immobiles visent l'emploi le meilleur possible à l'intérieur de leurs frontières nationales, les facteurs mobiles, eux, recherchent les localisations présentant les attraits les meilleurs sur les marchés mondiaux. Les éléments économiques et non-économiques qui déterminent le comportement des deux types de facteurs peuvent être vraisemblablement très différents. Il en découle que l'importance des mesures politiques qui influencent la distribution internationale de la production augmente en fonction de la part croissante des facteurs mobiles. Bien qu'en vertu de la loi de l'avantage comparatif – laquelle, dans sa forme primitive, repose sur l'entière immobilité des facteurs – il est concevable pour chaque pays de se spécialiser dans une branche quelconque de production, il est tout à fait possible que les secteurs industriels dont l'activité est principalement

basée sur les facteurs de production mobiles émigrent vers l'étranger. La doctrine de l'avantage comparatif doit donc être complétée par une doctrine de l'«attractivité relative»; cette dernière ne devant pas uniquement comparer les données techniques de deux pays, mais également tenir compte d'autres facteurs de nature matérielle et non-matérielle qui influent sur le choix de localisation des forces productives mobiles.

Summary

Comparative and Absolute Advantage

The contribution of Jones deals with the theory of comparative advantage in international trade. Jones starts out with a model in which part of the factors of production are internationally completely immobile, while the rest are independent of national boundaries and free to be transferred to those places where the highest profit can be made.

While the immobile factors of production search for the best possible employment within their national boundaries, the mobile factors are looking for the most attractive operational sites on the world market. The economical and non-economical elements which determine the reaction of these two types of factors are probably very different. Therefore, the importance of political measures influencing the international distribution of production grows with the increasing share of internationally mobile factors. Although under the law of comparative advantage – which in its original form rests on complete factor immobility – every nation may specialise in some field of production, it is well possible that those sectors of the industry working mainly with mobile factors find their way abroad. The doctrine of comparative advantage must, therefore, be supplemented by a doctrine of "relative attractivity", which would not only compare the technical data of two countries, but also take into account other material and immaterial factors which influence the choice of site by the mobile factors of production.