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PART

II. Responses to Import Competition: Lobbying et al.

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6 Shifting Comparative Advantage, Protectionist Demands, and Policy Response

Jagdish N. Bhagwati

6.1 Introduction

Although the threat of "new protectionism" has arisen with reference to a whole range of industrial activities in the Western countries and although there is a tendency to consider all such threats as part of a general political-economic phenomenon to be attributed to factors such as generalized unemployment, increased demands for job security from the state, etc., it is useful to distinguish between two extreme, idealized situations.

On the one hand, the pressure of import competition, no matter how significant, can be seen as being addressed to industries undergoing a basic shift in comparative advantage, not because of technological advances arising in different parts of the world which are not being shared by competing nations, but rather because of shifts in labor costs or because "learning by doing" by latecomers is altering the traditional competitive edge of industries in the West. These are the "senescent," "declining" industries such as textiles, and shoes and footwear which are labor-intensive and mostly unintensive in skills and R & D, where the newly industrializing countries of the South are increasingly demonstrating comparative advantage. Since these industries are characterized by low technical progress—which is perfectly compatible with increasing

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capital intensity, of course—Schumpeterian responses in the nature of induced technical progress à la Weiszacre-Kennedy-Samuelson are not in evidence. Hence the responses of the enterpreneurs, labor, and communities or townships in which these industries are located, as well as the nature of the governmental policy options and responses, are likely to be quite different from those occurring when the industries are of the type considered immediately below.

This second class of industries is at the other end of the technological scale, being largely characterized by changing comparative advantage because R & D leads to technical change that gives the competitive edge to new countries. These industries are at the front end of the dynamic, Schumpeterian capitalist process. The resulting shifts in comparative advantage yield a very different set of responses by the industries losing comparative advantage, and the policy options available to the countries where they are located are also correspondingly different.

In considering these two idealized models, it will be critical to note that the response to shifting comparative advantage will involve differential interaction with international "factor" mobility. In the former case, a possible and indeed empirically important response (hitherto neglected altogether in the literature) is lobbying for a greater inflow of foreign *labor*. In the latter case, however, among the important responses are a variety of patterns of direct foreign *investment*: for example, the use of threats of protection to induce a reverse flow of foreign investment into the country or mutually penetrating investments in differential but similar products where the different countries have differential advantages.

Moreover, it will be useful to distinguish the following "actors" among the lobbies seeking governmental response to the shift in comparative advantage: (i) the entrepreneurs, who may be interested in sales à la Burnham and Galbraith but are generally identified in the formal arguments below with the owners of equity capital in the industry; (ii) labor, distinguished in practice by nationality, skills, and age but again treated in the formal analysis below as a homogeneous entity; and (iii) the community-cum-township where the affected industry may play a dominant role. The analysis will try to identify which policy responses will be sought by one or more of these actors and therefore what political forces the government is likely to confront by choosing one policy response option in preference to another.

6.2 Technically Unprogressive, "Traditional" Industries

Since technical change is not important in these industries, the *shift* in their comparative advantage largely reflects changing factor endowments and/or learning in the newly industrializing countries. They are thus also primarily labor-intensive, low-skills industries—in competition with the

less developed countries (LDCs). How are these industries in the developed countries likely to react to the adversely shifting comparative advantage?

6.2.1 The Relaxation of Immigration Quotas as a Policy Response Option

As comparative advantage shifts against these unprogressive industries, pressuring them toward a (relative or absolute) contraction of their output, it might appear that all the potential lobbies that were distinguished above—entrepreneurs, labor, and the community—would be seeking relief via only one type of governmental response, namely, some sort of protection. However, this is plainly not the case. For these unprogressive industries are often at a comparative disadvantage precisely because cost conditions have moved against them, and in labor-intensive industries this is often because labor abroad has become relatively cheaper. Now, introduce into this picture the fact that international mobility of labor is severely regulated by immigration quotas and that the real wages of labor are substantially higher in the West than in many developing countries. It follows immediately that one additional policy response in which entrepreneurs could be interested is for the government to increase the availability of imported labor.

Note that the entrepreneurs' response will typically not include in this case their leaving for the foreign countries where the comparative advantage has shifted. This is due to the fact that these are unprogressive industries where, with no Hymer-like firm-specific know-how to take advantage of, the migration of domestic entrepreneurship is likely to mean merely that the migrant entrepreneurs will have to operate in unfamiliar, relatively riskier foreign situations, without any offsetting technological advantage, and hence at a competitive disadvantage with local producers.[1]

On the other hand, domestic labor should find its own interests better served by a policy of protection rather than by the alternative policy of relaxed immigration quotas. Therefore, while a governmental response in the form of allowing the increased importation of foreign labor will satisfy entrepreneurs, it will not generally satisfy domestic labor. To consider these issues rigorously, turn now to the formal analysis below.

6.2.2 Some Formal Models

Heckscher-Ohlin-Samuelson Model

Take first the $2 \times 2 \times 2$ model of trade theory to develop the main implications of our policy-choice problem rigorously. Assume two goods X and Y, and two factors K and L, and let Y be L-intensive and the importable good, in conformity with the empirical reality of the problem

at hand. I would like to distinguish between the two types of shift in comparative advantage that may affect the L-intensive importable industry Y: (1) that which arises *externally*—either from a shift in the foreign offer curve facing our country or from a tariff cut by our country as in the across-the-board tariff cuts of the Kennedy Round; and (2) that which results *internally*, e.g., from capital accumulation or productivity change. In each case, it will also be relevant whether the comparisons between the two policies involve a tariff-free or a tariff-ridden economy when the policy chosen is to import more labor. Throughout, I assume a small country and negligible lobbying costs.

Case I: External shift in comparative advantage, zero initial tariff. Figure 6.1 shows the economy moving from external price ratio P_1 to P_2, adversely affecting production of good Y.

The tariff policy will then restore production of Y to the initial level Y^0 at Q_1 but, as seen in figure 6.2, will yield welfare U_t. The alternative policy of restoring Y production to Y^0 by importing labor, on the other hand, will lead to welfare level U_{Lm} as follows. As labor is imported, holding the goods price ratio unaltered at its new free-trade position P_2, we can trace the Rybczynski line Q_2R which, at Q_3, yields Y production equal to Y^0. Importation of the corresponding amount of labor (Lm) would then restore domestic importable output to the initial, preshift level. But the *national* welfare level, defined *exclusive* of imported labor's welfare, would be U_{Lm}, with the national budget line Q_2C_{Lm}, since imported labor earns the value of its marginal product, which, in turn, equals the increment in output along the Rybczynski line.

A comparison of the two policies, both achieving identical production in the importable industry and thus satisfying entrepreneurs equally in that respect,[2] then shows that the policy of reduced restrictions on the importation of labor dominates that of increasing trade protection insofar as economic welfare conventionally defined is concerned ($U_{Lm} > U_t$), and hence should be the preferred option of an economic-welfare-oriented government.[3] At the same time, from the viewpoint of international relations, it should again be a preferred option, since relaxing immigration restrictions gives the government good marks whereas increasing trade protection gives it bad marks. On the other hand, at Q_3 and Q_2 under the policy of reduced immigration restrictions, the real wages of labor are less than at Q_1 under the tariff policy, à la the Stolper-Samuelson argument.[4]

The choice between the policy option of reducing immigration restrictions and increasing trade protection in response to an adverse shift in comparative advantage therefore primarily involves the conflicting interests of the *government* (or, more precisely, that part of the government [e.g., in the United States, the executive rather than the legislative] which

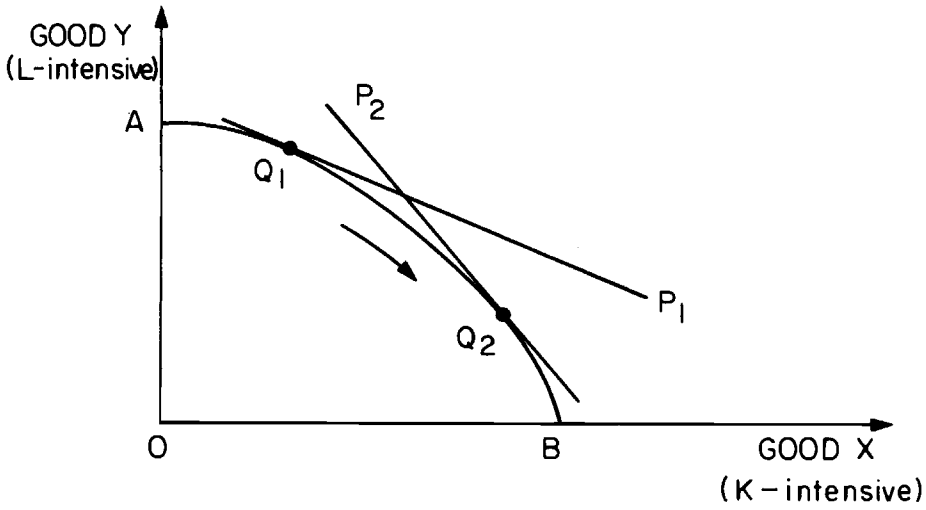

Fig. 6.1

is presumably interested in welfare as defined by conventional economics) and *consumers*, who face lower prices for importables, on the one hand, and *domestic labor*, on the other hand, while leaving the entrepreneurs somewhat indifferent between the two policy options insofar as industry output is concerned but in favor of the policy of importing more foreign labor since this implies greater reward to capital. I shall later amplify other aspects of the conflicting interests involved in the choice between these policies, especially those involved at the community-cum-township level, which cannot be accommodated in the present model. For the present, however, let me go on to show that this basic pattern of conflicts between the different sectors resurrects itself when the external shift is in the presence of a trade restriction, though there are important differences to note, as argued immediately below.

Case II: External shift in comparative advantage, positive initial tariff. The presence of an initial tariff makes a significant difference to the analysis of the effects of different policy responses to an external shift in comparative advantage. This is because the policy of increasing the importation of labor is itself to be judged in the context of a tariff-ridden economy. For the choice now, when the external price ratio shifts from P_1 to P_2, is between increasing the tariff to restore production of Y to Y^0 at Q_1 and, instead, increasing the importation of labor to achieve Y^0 while maintaining the tariff at the initial level.

While in case I, with zero initial tariff, the importation of labor left the national welfare unchanged at the free-trade level (since imported labor earned the value of its marginal product at domestic prices as well as at

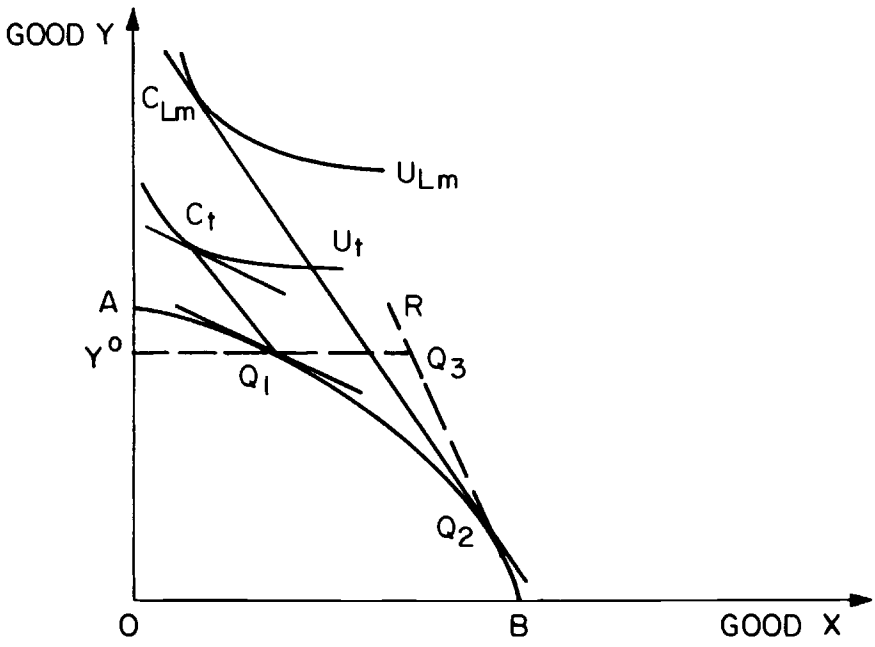

Fig. 6.2

international prices thanks to free trade), the importation of labor when the labor-intensive importable industry is protected by a tariff is necessarily immiserizing! This result, derived by Uzawa (1969) and Brecher and Alejandro (1977) independently of one another, is seen in figure 6.3. There, after the shift of the external price ratio to P_2, the continuing initial tariff makes P_2^D the new tariff-inclusive domestic price ratio. With labor imported, the corresponding Rybczynski line is then Q_2R. Now, if no labor were imported, the equilibrium consumption would be at C_2, which lies on P_2 and on the income-consumption line IC (P_2^D) which is drawn with reference to price ratio P_2^D. If, however, labor is imported and is paid the value of its marginal product at domestic tariff-inclusive prices, the *national* income at domestic prices will be identical to P_2^D through Q_2. Thus, if labor importation takes production on the Rybczynski line to Q_3, and (for simplicity) we assume that foreign labor consumes entirely in the country of residence, the *national* (net-of-foreign-labor-consumption) bundle of production will be along the stretch EF on the national income line P_2^D through Q_2. And, by putting the new international price line P_2 through E and F, and cutting IC (P_2^D), we see that the resulting national consumption will lie in the range of $C'_{Lm}C''_{Lm}$. Evidently therefore importing labor will necessarily be immiserizing.

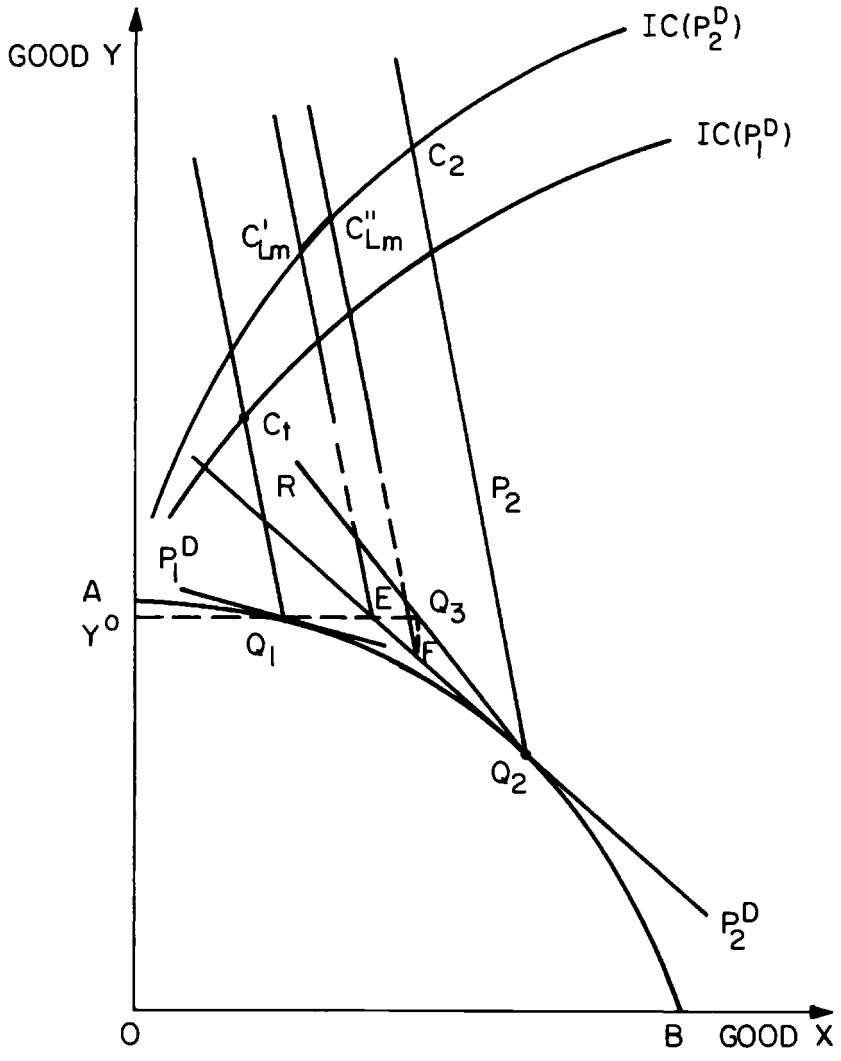

Fig. 6.3

However, it is equally evident that the alternative policy of resorting to trade protection to restore Y production to Y^0 by shifting back to Q_1, with the new international price ratio P_2, yields consumption at C_t on the income-consumption curve IC (P_1^D) which is drawn with reference to P_1^D (tangent to AB at Q_1). Evidently this is *inferior* to any equilibrium consumption, on C'_{Lm} C''_{Lm}, reached under the labor importation policy.

Note therefore that the welfare loss from importing labor is constrained so as to make the labor-importing policy nonetheless a better

alternative than the trade protection policy.[5] This means that the basic nature of the conflicting interests of the different actors, as emerging from case I, survives the complication of an initial tariff while weakening the economic-welfare advantage that the government would derive from a policy of importing labor.

Case III: Domestic shift in comparative advantage, zero initial tariff. Nor does a shift in comparative advantage resulting from either domestic factor supply or technical change affect the basic nature of the conflicting interests on the two policy options being considered.

Thus take figure 6.4, where a domestic shift of the production possibility curve from AB to $A'B'$ leads to a strong decline in the "production advantage" of good Y: at identical goods price ratios, the production of good Y actually declines, as at Q_2 compared with Q_1.[6] The international goods price ratio remains unchanged at P_1. It should be manifest to the reader now that a labor-importing policy will lead to consumption along Q_2P_1 at price ratio P_1, whereas an alternative policy of protection to retain output of Y at Y^0 will lead to production at Q_4 and consumption not merely on the inferior budget line Q_4P_1, but also on a further distorted price-ratio tangent at Q_4 to $A'B'$.

Case IV: Domestic shift in comparative advantage, positive initial tariff. The case where the domestic shift in comparative advantage occurs in the presence of a tariff does not need to be spelled out, since it modifies the argument of case III in much the same way as case II modifies case I: it weakens the economic-welfare case for importing labor while leaving it as the preferred option to trade protection.

The analysis in the $2 \times 2 \times 2$ model therefore underlines the robustness of the conclusion that, while entrepreneurs will marginally prefer the importation of more foreign labor to an increase in protection when comparative advantage shifts against their industry, the policy option of increasing the influx of foreign labor will be preferred by consumers and by that branch of the government (if any) which concerns itself with economic welfare conventionally defined, while being considered detrimental to its interests by domestic labor.

However, I might add that cases III and IV, where the shift is domestically induced, suggests an important difference from cases I and II, where the shift is externally induced. In the former case, if the shift results from capital accumulation leading to a decline in the output of the labor-intensive importable activity (à la Rybczynski), the real wages of labor will be *maintained*; it is just that the "drawing power" of the importable activity for domestic labor has been reduced as a result of the change in the accumulation. In this case, it is not likely that domestic labor will oppose the import of foreign labor; the labor import will be seen rather as

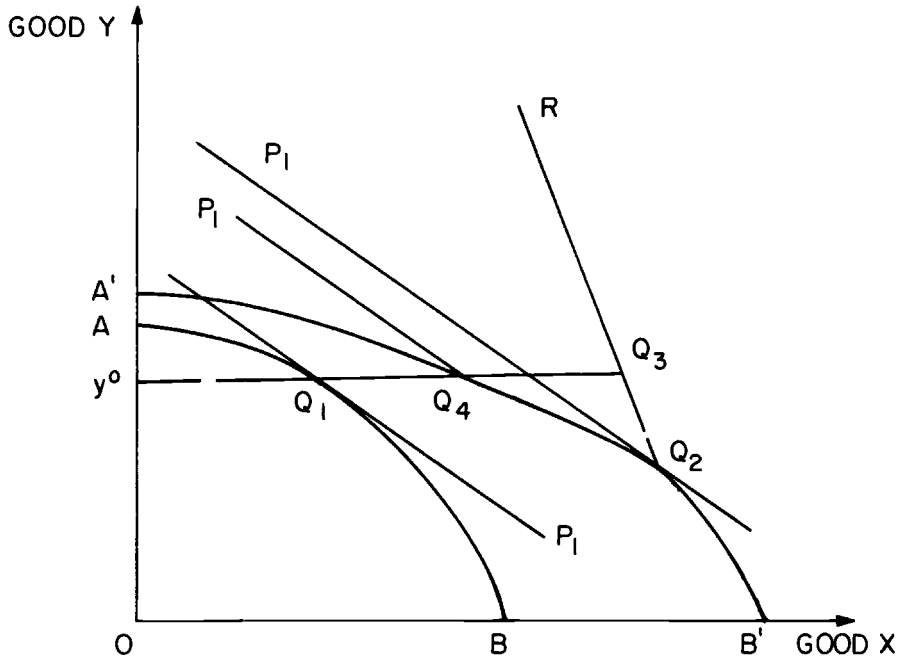

Fig. 6.4

supportive of the output of the labor-intensive industry without coming at the expense of domestic wages. (Of course, the protection option will *increase* the real wages of labor; but this is unlikely to make the same impression on labor as actually *losing* ground through reduced real wages). In cases where the shift in comparative advantage is external, however, the loss of real wages in the present model is necessarily actual, not just in an opportunity-cost sense, when the shift occurs; and therefore the importation of labor as a policy option is likely to be opposed passionately.

Jones-Neary Model

Consider instead the model of Jones (1971) and Neary (1978) in which capital is specific but labor is mobile between the two sectors. This may be considered to be the "short-run" version of the standard 2×2 model, if labor is assumed to be mobile in the short-run but capital is not, an interpretation given by Neary (1978), Mussa (1974), and Mayer (1974).[7] What happens to the choice between labor importation and protection in

this model when the terms of trade shift adversely against the labor-intensive importable activity?[8]

The effect of the shift in the terms of trade is now an unambiguous fall in the rental on capital in the labor-intensive importable industry while the return to labor (after reallocation) will rise in terms of the importable but fall in terms of the exportable good. (If the importable sector is "small," then evidently the real wages of labor are likely to fall, as the weight of the exportable good in consumption will be greater). In this model, therefore, both capitalists and labor are likely to have the incentive to lobby for protection. But capitalists may also settle for increased importation of labor. For as Mayer (1974) has shown, such an increment in labor, at a constant goods price ratio, will increase the rental unambiguously to capital in both sectors while the real wages fall unambiguously.[9]

Insofar as economic welfare is concerned, the choice is again clear-cut in the Jones-Neary model, as long as an otherwise free-trade situation without distortions is considered. Thus the protection option implies the standard cost of distorted production and consumption. However, with the real wages declining as labor is imported, the importation of a finite quantity of foreign labor yields a "surplus" to the host country: labor importation is therefore welfare-improving. Thus that branch of government that responds to an economic-welfare motivation will favor labor importation over instituting a protective tariff.

Industry-specific Foreign Labor Paid a Differential Wage

The preceding two models considered foreign labor to be industry-nonspecific and equally assumed that the return to foreign and domestic labor was equal. However, approximating the West European *gastarbeiter* system more closely, we may assume that foreign labor is imported on an industry-specific contractual basis and can be effectively paid lower wages than domestic labor.

Take this model then and assume a Haberler-Brecher model with Haberler (1950)–type sector-specific factors and Brecher (1974*a*, *b*)–type sticky real wages for labor. Let Q_1 be the initial production vector, AQ_1B being the production possibility curve, given the immobility of factors. When the terms of trade shift from P_1 to P_2, turning against the importable, labor-intensive good Y, labor in Y production insists on maintaining its real wages in terms of good X. This leads to workers being laid off in industry Y until the marginal physical product of labor in Y rises sufficiently at Q_2 to restore Y labor's real wages in terms of good X.

In this situation, if the Y capitalists are allowed to import foreign labor to restore their output to Q_1, and foreign labor allows itself to be hired at lower real wages than what local labor insists on, then part of the incremental output of good Y (this increment being Q_2Q_1) will accrue to

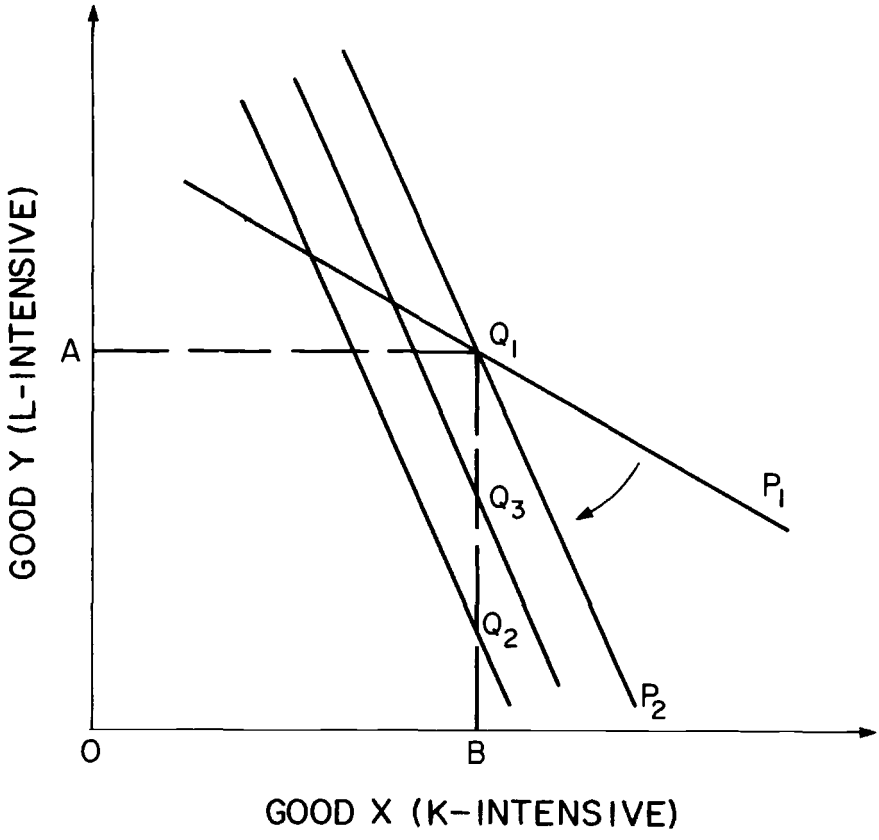

Fig. 6.5

the capitalists, as demonstrated in figure 6.6. There, *OS* represents the real wages of domestic labor in terms of *Y* at Q_2 in figure 6.5; *OZ* is the lower, fixed real wages at which foreign labor can be imported in numbers permitted by the immigration quota; *OJ* is the immigration quota; *SHR* is the marginal product curve for imported labor in industry *Y*, given the employment of domestic capital and labor at Q_2 in figure 6.5. The total increment in *Y* output that results is then *SHJO*, which is assumed to correspond to Q_2Q_1 in figure 6.5. But of this increment, only *OZHJ* accrues as earnings of foreign workers, and the rest, *SHZ*, accrues to the domestic capitalists; this division corresponds to Q_3Q_1 for foreign workers and Q_2Q_3 for domestic capital in figure 6.5. Thus, reverting to figure 6.5, national welfare is now defined, in the labor-importation option, by the availability line P_2 passing through Q_3.

By contrast, the protection option will maintain domestic labor's real wages while restoring labor employment as well; it will also increase

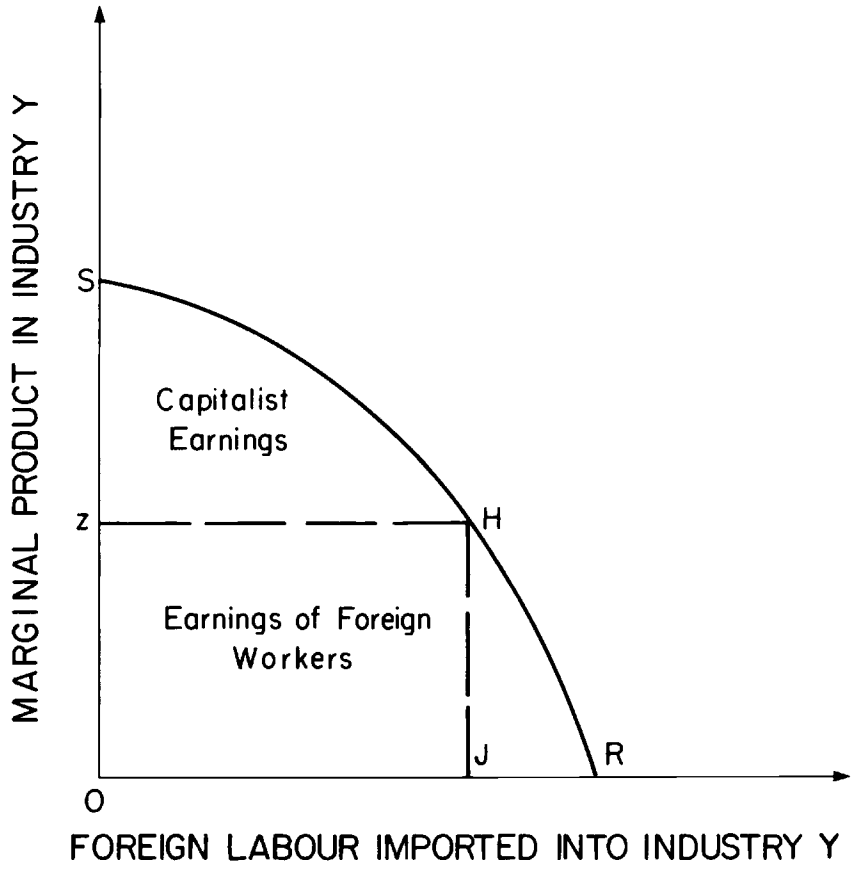

Fig. 6.6

capitalist earnings, but this increase cannot be rank-ordered with the increase under the labor-importation option; and economic welfare may be above or below that at Q_3 (the labor-importation option) since protection will mean that production will be restored to Q_1 but there will be a consumption-distortion cost which may be large enough to outweigh the production gain vis-à-vis the labor-importation option.[10]

6.2.3 Likely Lobbying Outcomes

What type of lobbying may then be expected in the labor-intensive industries, once we recognize the possibility of using immigration quotas as a policy instrument? Evidently the answer depends critically on the production-cum-trade model that applies to a specific situation; it is also clearly dependent on the precise immigration control system that the country operates. Thus, if we contrast the results of the three models, it is

interesting that, in the Heckscher-Ohlin-Samuelson (HOS) model, capitalists would find protection harmful and labor importation of no effect on their earnings whereas in the other two models *both* options are helpful. Again, labor is actually hurt by labor importation in the Jones-Neary model but is neither hurt nor helped in the other models, whereas protection helps it in all three models. The precise conflicts of interests, reflecting the implications of the two policy options of protection and labor importation, will therefore depend on the specifics of the situation concerning factor-market and immigration-system behavior. No general conclusions are possible, as indicated by table 6.1, which categorizes the outcomes.

On the other hand, the models uniformly suggest that entrepreneurs have an interest in getting governments to agree to relax immigration quotas, that governments themselves have a potential interest in the relaxation of immigration quotas since economic welfare is such an important objective, and that labor, in contrast, has a relatively greater interest in the adoption of protection measures instead. I would therefore expect governments to expedite the inflow of foreign labor whenever (*a*) domestic labor's opposition to this policy option is weak and its lobbying for protection is correspondingly weak (as when labor is not effectively organized due to geographical dispersion of the industry, for example), (*b*) the government's ability to grant protection is weak (because, for example, of fear of retaliation or respect for GATT Article XIX), and (*c*) the government's ability to augment immigration is not constrained greatly by the social consequences of increased immigration. More specifically, the following types of hypotheses may well be worth exploring.

1. When the shift in comparative advantage is domestically induced (as in cases III and IV of the HOS model above), the opposition of domestic labor to the importation of labor will be the less, for reasons spelled out earlier. By contrast, when the shift comes from external changes (as in cases I and II), the opposition of domestic labor to the importation of labor will be the greater. Therefore I would expect that the policy response to a shift in comparative advantage would be, *ceteris paribus*, greater for imported labor when the shift is domestic rather than external.

2. Moreover, where the external shift in comparative advantage is combined with the presence of a native labor force which has low-mobility characteristics (e.g., higher age, residency traditionally in towns or communities in which the roots and ties are strong, which raises the nonpecuniary costs of mobility), the likelihood of protection emerging as the outcome of the lobbying response will be all the greater. For in this case, the option of importing foreign labor will appear particularly unattractive to the low-mobility labor, whose real wages will otherwise face a significant decline. The role of the community or township as a lobbying

Table 6.1 **Effects of Output-restoring Labor-Importation and Protectionist Responses to Import Competition in Labor-intensive Industries**

Model	Policy Response	Capitalists*	Labor	"Economic Welfare"
Heckscher-Ohlin-Samuelson	Labor Importation	Earnings unchanged	Earnings unchanged	Welfare Unchanged (cases I & III)
	Protection	Earnings reduced	Earnings increased (back to preshift level)	Reduces welfare
Jones-Neary	Labor Importation	Earnings increased	Earnings lowered	Increases welfare
	Protection	Earnings increased	Earnings increased	Reduces welfare
Haberler-Brecher	Labor Importation	Earnings increased	Earnings unchanged	Increases welfare
	Protection	Earnings increased	Earnings increased (via increased employment)	May increase or lower welfare (while increasing domestic employment)

Note: The comparison is with the situation where import competition (i.e., shift in comparative advantage) occurs and there is no policy response. The comparison is *not* therefore with the situation *before* import competition

*The entries here relate, in the Jones-Neary and Haberler-Brecher models, to capitalist earnings in the importable industry.

force in cases where labor has strong historical ties to an area, as in traditional "textile towns," may also be very important quite independently of the labor force itself. For where such geographical specificity is involved, other jobs are likely to be seen as being dependent not merely on the size of the industry's output but also on traditional spending patterns, and imported labor, with its usual high savings and remittance rates, is unlikely to be quite an adequate replacement in that regard! Moreover, the social cohesion of the community itself may militate against introducing a sizable foreign labor component into such communities.[11]

What type of evidence would indicate that such hypotheses make empirical sense? The foregoing arguments suggest that one may be able to examine episodes such as the response to across-the-board tariff cuts in the Kennedy Round and hypothesize a set of testable propositions.

I would expect, for example, that when across-the-board tariff cuts are made, as after the Kennedy Round, the tariff-cut exemptions (adjusted insofar as they were offset by domestic subsidies—as they were often, and in varying degree, in West Germany according to Riedel 1977) would be generally greater in those traditional industries where the labor force is largely domestic, is geographically concentrated in close-knit communities, or is relatively immobile. In contrast, when quota restrictions are relaxed, I would expect there to be a relatively greater growth of the foreign labor component in those industries in which the labor force already has a significant foreign element, is geographically dispersed, or has a domestic component that is relatively skilled and mobile.

Furthermore, if cross-sectional regressions were run, I would not be surprised if (the subsidy-adjusted) tariff-cut exemptions were inversely related to the initial proportion of foreign labor in the total labor force and to the skill level of the labor force, and positively related to the average age of the labor force, as seems to be indicated to some degree in Cheh's (1974) analysis of the United States and Riedel's (1977) analysis of West Germany. And this is the important *new* possibility: that the growth rate of foreign labor (absolute or relative to domestic labor) in these industries, reflecting the relaxation of immigration quota restrictions, may be positively related to the initial proportion of foreign labor in the total labor force and to the skill level of the labor force, and inversely related to the average age of the labor force. And thus, also, there may then exist an inverse correlation between the tariff-cut exemptions an industry receives and the growth rate of its foreign labor force, in cross-sectional analysis.

6.2.4 Labor Lobbying and the Efficient Tariff: An Aside

Where the labor interest in protection is deep-seated, the foregoing arguments suggest that the governmental response will be to yield to

protectionist pressures from the labor lobby; the relaxation of immigration quota restrictions will not be the preferred option.

In these cases, the "bargaining" between the government and labor may be visualized as being over the degree of protection to be granted to the industry when the comparative advantage has shifted, with labor's primary interest consisting in fully restoring its preshift economic position and the government's in minimizing the cost of such restoration of labor's economic position.

Viewing the conflict this way, we can develop the notion of an "efficient tariff" (as is done rigorously by Feenstra and Bhagwati in chapter 9), once we recognize that the levy of a tariff will generally raise revenue. Thus, consider for simplicity the $2 \times 2 \times 2$ model where labor's real wage declines with the relative price of the importable good. A shift in comparative advantage improving the terms of trade will hurt labor, triggering the lobbying for a tariff. If then the tariff is used for restoring the real wages of labor, there will be an associated loss of welfare to society. However, since the tariff raises revenue, we may consider the following alternative. Suppose that this tariff revenue itself is used to compensate labor through a direct subsidy such that labor's real income (defined as the *sum* of its real wages in employment and this subsidy, as in Bhagwati 1959) is equivalent to its preshift real wages. Then the resulting welfare cost to society would generally be lower. Thus a tariff which restores the real *wages* of labor to their original level would generally be inferior to the efficient tariff which is chosen so as to minimize the welfare cost of a tariff which restores labor's real *income* to the original (real wage) level by additionally utilizing the tariff revenue proceeds to subsidize labor's income.[12] This notion of the efficient tariff makes a good deal of sense insofar as the revenue used for redistribution is being generated as a side effect of the protection itself and is *not* being raised *ab initio* for the redistribution![13]

What this notion of the efficient tariff does therefore is to provide a rationale for a direct subsidy to lobbying labor, as long as it is kept within the bounds of the tariff revenue raised from the partial protection granted, when the labor lobby seeking protection is strong and the government feels that there is no political alternative to maintaining the labor lobby's economic position in face of a shift in comparative advantage.

6.2.5 Protectionist Response to Import Competition and the Welfare of the Exporting Country: Some Paradoxes

While the foregoing analysis was addressed to lobbies, policy options, and likely outcomes, focusing exclusively on the country facing import competition, the novel element of foreign labor additionally introduces

an interesting, and surely important, element of paradox into the situation regarding protectionist responses to import competition as far as the welfare of the *other* trading countries is concerned.

For it is no longer possible to identify the levying of protective tariffs on one's exports by another country as necessarily welfare-worsening—short of standard paradoxes in trade theory—for the simple reason that the protection also redounds to the welfare of foreign labor, and this labor may very well be one's own emigrant labor. Thus, if the United States levies protective tariffs on Mexican textile exports, this will worsen the welfare of the Mexican nonemigrant population but, since some Mexican labor is employed in textiles production in the United States, it will also improve the welfare of the Mexican emigrant population. So, depending on what distributional welfare weights are assigned, one could easily argue that United States protection *improves* the welfare of the Mexicans (emigrants *plus* nonemigrants)![14] Interestingly, this paradox is the mirror image of the paradox (analyzed in Bhagwati and Tironi 1980, Bhagwati and Brecher 1980 and Brecher and Bhagwati 1981) in which the reduction of a tariff in the presence of foreign-owned factors of production may be accompanied by a decline in national welfare even though the country is small and no other domestic distortions are present.[15]

Another interesting paradox that arises in the presence of foreign labor from LDCs and the DCs (developed countries) is that the country from which foreign labor is coming and the country producing the imports may not coincide. Thus textiles in the United States may be using Mexican labor while they face competition from South Korea. Hence there may be inter–LDC conflicts inherent in the decision of the DCs to use or not to use protection in the face of a shift in comparative advantage. For instance, West Germany uses a great deal of Turkish, Yugoslav, and Greek labor in industries that face competition from the less developed newly industrializing countries such as Brazil, Taiwan, South Korea, Hong Kong, and Singapore.

6.3 Technically Progressive, Schumpeterian Industries

The scenarios concerning lobbying and policy response options discussed in the preceding section change dramatically as attention is shifted to technologically progressive industries. These industries might be described as Schumpeterian since they represent the essence of the dynamic capitalist system that Schumpeter described so beautifully. Technological change, resulting from R & D (whether private or public), is critical to the shifts in comparative advantage in these industries, and this essential fact fundamentally transforms the nature of the lobbying responses and policy options that open up in the face of the ongoing shifts in comparative advantage.

6.3.1 Two Alternative Models of Direct Foreign Investment in Progressive Industries

It will be appropriate to distinguish in the analysis that follows between two models in the direct investment literature, both an offshoot of Hymer's (1960) ground-breaking work on direct foreign investment: the "product cycle" (PC) model of Vernon (1966) and the "mutual penetration of investment" (MPI) model set forth in my review of Vernon's *Sovereignty at Bay* (Bhagwati 1972) and then amplified in Bhagwati (1978, 1979).

The "Product Cycle" Model

In the PC model, firms develop R & D–based new products in one country, with a corresponding conferral of comparative advantage of manufacture in that country. As long as the product and its associated processes need to be "debugged" and simplified, the location of production at home, close to the R & D facilities, is important. With the passing of this stage, the production of the products is freed from this locational requirement and production facilities will shift to wherever wages are cheapest. Thus this model is premised on a shift in comparative advantage in the location of production that reflects a process where R & D–created comparative advantage self-destructs and the process is essentially a result of domestic R & D rather than a result of external changes induced by R & D.

The "Mutual Penetration of Investment" Model

In contrast, the MPI model is based on the observation that competition occurs among differentiated but similar products and that increased competition can typically occur in the progressive industries through R & D–induced intensification of the advantages enjoyed by the competitors for their differentiated products. For example, European and Japanese small cars compete with American large cars; and this competition intensifies with time as the Japanese get better at the game (e.g., Toyota started production only after World War II) of R & D in production, marketing, and sales and the Americans get steadily better at producing the "gas guzzlers." The MPI thesis then is that the response to such intensified competition could be a mutual investment by the competing firms in one another's R & D–induced advantages. Contrasting the resulting MPI pattern of direct investment and Vernon's PC model, I wrote the following in 1972:

> There is also at least one more dramatic form of international investment which neither Vernon nor other researchers in the MNC field has noted but which may well be the pattern to emerge as a dominant form. In contrast to the case where the MNC's, having developed new

products via R&D, export them and then transit to producing them abroad, there is an alternative "model" where MNC's in different countries have R&D–induced advantages in producing different types of sub-products (e.g. one MNC in Japan is excellent with small cars and one MNC in U.S. has an edge on large cars; or tire firms in different types of tires). In competing in each other's home countries or in third markets in both types of sub-products, it is natural that each MNC would find it difficult to compete effectively with the other in sub-products where it does not have the edge. I would expect that, in this situation, there is likelihood of these MNC's deciding that mutual equity inter-penetration, with productionwise accommodation in sub-product specialization according to the advantage possessed, is profitable. Thus, the MNC in U.S. (say, GM) that finds it difficult to compete in the small-car field with the MNC in Japan (say, Toyota) that finds it difficult to compete with the MNC in U.S. in the large-car field, would each decide that the best strategy if you cannot compete with comfort is to follow the policy: "if you cannot beat them, buy them." Thus GM would want to buy equity in Toyota for the small car production and Toyota in GM for the large-car production: and GM in U.S. would go off spending resources in producing and improving its own small cars while Toyota in Japan would similarly hold back on its own large-car efforts. One thus gets mutually interpenetrating MNC's within industries, with accompanying division of labour and a novel form of "cartelisation" which goes by sub-products. Linder has made us familiar with trade in commodities between similar countries as consisting of sub-product exchanges: and Hymer and Rowthorn have noted that MNC's from different countries penetrate into each other's countries. My "model" essentially combines these two and predicts that MNC's with R&D–induced specialization in different types of sub-products within an industry in different countries will interpenetrate.

I then noted that the MPI model was perfectly illustrated by an account in *Forbe's* magazine of 15 November 1970 (p. 22) of the following "international marriage":

> Long the friendliest of competitors. Dunlop and Pirelli neatly complement each other. Dunlop is primarily a manufacturer of conventional cross-ply tires. Pirelli concentrates on radials. In Europe, Dunlop has perhaps 18% of the market, Pirelli 12%, as against 12% for Michelin, the next largest competitor. In Europe, Pirelli crosses Dunlop's path only in West Germany: Elsewhere, where Dunlop is active, Pirelli stays out; where Pirelli is active, Dunlop stays out. Outside of Europe, Pirelli is active mostly in Latin America. Dunlop in the Commonwealth and North America.

> The two companies have even diversified into different areas—Dunlop into sporting goods and precision engineering products, Pirelli into paper, electronics and cables.
>
> Eventually, of course, both marketing organizations will work as one, with Dunlop pushing Pirelli products where Dunlop is strong, and Pirelli pushing Dunlop products elsewhere. "The greatest benefits should come from a pooling of R&D, however," explains J. Campbell Fraser, a Dunlop director: "In the 'seventies and 'eighties, competition will be more and more in terms of innovations. In the U.K. we have a home base of about 55 million people—that isn't big enough for the kind of R&D we'll need. Pirelli has an even smaller home base, about 45 million. By merging, we'll have a home base of 100 million, enough for the kind of R&D we'll need around the world. . . . There will not even be any exchange of public shares. Instead each will acquire an interest in the other's operating subsidiaries. The British and Italian companies will operate on their own.

The report went on to note (p. 23) that there will be four companies: Dunlop Home (the United Kingdom and Europe) with Dunlop owning 51 percent and Pirelli 49 percent; Dunlop International (the rest of the world) with Dunlop holding 60 percent and Pirelli Milan and Pirelli Switzerland 20 percent each; Pirelli Milan (the Common Market) with Pirelli Milan holding 51 percent and 49 percent; and Pirelli Switzerland (all other Pirelli operations) with Dunlop holding 40 percent, Pirelli Milan 20 percent, and Pirelli Switzerland 40 percent.

6.3.2 Shifting Comparative Advantage, Lobbying, and Policy Response Options: Three Patterns

The preceding review of major models of direct foreign investment evidently bears directly on the questions being addressed in the present paper: namely, what kind of lobbying responses can one expect, and what options are open for governmental response, when a shift in comparative advantage occurs in technically progressive industries? For one can now think of three idealized patterns: (i) the *"product cycle" scenario*, where the shift in comparative advantage occurs from the emergence of cheaper factor costs abroad overtaking the relative cheapness of domestic production due to the proximity to R & D facilities once the new product processes are simplified and debugged; (ii) the *"mutual penetration of investment" scenario*, where international competition is among similar products and technical change intensifies competition among them without conferring a dominant advantage to one class of products (and hence firms and nations) as against another; and (iii) the *"growing dominance of external products" scenario*, where, as in the MPI case, there is international competition among similar products but the technical change (or

even a shift in demand, as in the case of the shift in demand away from "gas guzzlers" toward small cars and hence in favor of non-American car makers, who have traditionally specialized in small cars) favors the external producers and represents a growing, adverse shift in comparative advantage.

The first two patterns evidently include, as possible responses to the shift in comparative advantage, the corresponding patterns of direct foreign investment, i.e., the outward migration of entrepreneurs and firms. The last pattern, on the other hand, opens up a more complex set of responses.

The "Product Cycle" Scenario

In this case, the shift in comparative advantage toward producing abroad and the subsequent transfer of production abroad essentially reflect entrepreneurial decision making. Besides, the direct foreign investment response is consistent with governmental interest insofar as it represents an economic-welfare-improving move (unless there are domestic or foreign distortions present).

The lobbying response is therefore to be expected from domestic labor insofar as labor feels that it is "losing jobs" as a result of this response by the entrepreneurs.[16] Again, therefore, the actors likely to be involved in the lobbying process, in response to the shift of production abroad as comparative advantage shifts abroad, are likely to be labor lobbies.

However, the policy instruments that the labor lobby can turn to are not identical to those in the case of the "traditional" industries. Thus, if the market for the product shifts mainly overseas before the production shift overseas takes place, as in some of the PC folklore, then protecting domestic production evidently does not help! Rather, labor would have to ask for a subsidy on production or trade, neither of which is likely to appeal very much to the government because of its budgetary implications and because it opens up the possibility of countervailing action under GATT rules. An obvious alternative instrument which labor is likely to seek therefore is the imposition of restrictions on foreign investment—which is indeed what labor unions in the United States have occasionally done. Together with this route, one can also expect the unions and labor lobbies to attempt to make such direct foreign investment less attractive by complaining that the practices resulting in cheaper costs abroad are in violation of GATT and other standards, and thus require the imposition of countervailing duties, a procedure which again can help only insofar as the domestic (as against the overseas) market is still of some importance for the product. Again, this option is also occasionally exercised, as in the frequent complaints about the exploitation of child labor abroad in violation of International Labour Organization (ILO) standards, about regional subsidies that aid competing firms

abroad, about special concessionary treatment of profits made by foreign firms, etc.

Given, therefore, the nature of the shift in comparative advantage to produce abroad, the lobbying game reduces in the present instance essentially to one between the government and the entrepreneurs, on one hand, and labor lobbies, on the other. But instead of the lobbying essentially focusing on trade protection, it is likely to focus primarily on the need for controls on investment abroad except in cases where the domestic market still accounts for a major fraction of total sales. Such a situation therefore contrasts with the case of "traditional" industries, where the tariff is a more effective instrument for protecting labor's economic interests. Here, the question of controlling foreign investment by the domestic entrepreneurs is a meaningless option; entrepreneurs in these industries do not seek to respond by out-migration since they do not have Hymer-type know-how that would make it economical to do so, as already noted in section 6.2.

But it *is* pertinent to ask whether the importation of foreign labor is not an option that entrepreneurs would seek as an alternative to investing abroad when the product is standardized and debugged and cheap foreign labor becomes correspondingly decisive. It must be admitted that the failure to consider this option altogether is a major weakness of the PC doctrine, which has focused wholly on the choice between producing at home with local factors and producing abroad with foreign factors. This omission does make sense when immigration quotas are taken as exogenously specified, but it does not when firms can seek to have the quotas liberalized in response to a shift in comparative advantage. Eschewing formal analysis of a firm's choice between going abroad and seeking more importation of foreign labor, I think it would be fair to assert that, since the wage costs of imported labor are likely to be substantially higher than the wage costs of similar labor abroad, the labor importation option will be outweighed by the out-migration of production option unless the industry and the countries involved are such as to make the potential risks and costs of direct foreign investment unduly high. It would appear from casual observation that United States entrepreneurs have followed the direct investment route à la Vernon's PC model fairly automatically whereas West European entrepreneurs in technically progressive industries have followed a mixed strategy, investing in cheap-labor countries abroad but also relying on increasing numbers of *gastarbeiters* much as in the "traditional," labor-intensive industries of section 6.2. It may well be that the greater willingness of West European governments to increase importation of *gastarbeiters* in the 1960s and much of the 1970s and the relative stringency of United States immigration policy in regard to unskilled labor account for this differential. Whether domestic labor unions would have permitted a shift in United States policy in this regard,

leading to a shift from the Vernon-style direct investment abroad to importation of cheap labor to the United States in the technically progressive industries for their standardized, debugged, labor-intensive operations, is a question that I cannot answer but one that would be interesting to explore. In fact, it is not at all clear that domestic labor would be worse off under a policy where entrepreneurs out-migrate à la the PC scenario than it would be under a policy where entrepreneurs are allowed to import cheaper foreign labor!

The "Mutual Penetration of Investment" Scenario

In contrast to the case of PC–type shifts in comparative advantage, I have earlier distinguished shifts in comparative advantage that occur from increased competition from similar products, a state of affairs often brought about by R & D–induced changes in know-how. I have also distinguished between two polar cases: the case in which the intensification of competition does not confer an advantage to one product (and nation) as against another, and that in which the competitive advantage of one product (and nation) increases at the definite expense of the other. Before I proceed to analyze these two cases, however, it is necessary to discuss how trade in similar products comes about.

Alternative theories of trade in similar products. Recent analytical work in trade theory by Lancaster (1980), Dixit and Norman (1980), and Krugman (1979) has undertaken formalization of the original notion, inherent in Linder's (1961) pioneering work and in subsequent writings by Balassa (1967) and Grubel and Lloyd (1975), that much of the trade in manufactures among developed countries occurs in what might be called "similar" products. This formalization has proceeded on the basis of models that assume *identical* know-how among different countries and that specialization in different "similar" products ensues primarily as a result of scale economies, with basic indeterminacy as to which country produces which of the similar products and with Linder-like conclusions concerning the *volume* of trade in place of the Heckscher-Ohlin emphasis on predicting the *pattern* of trade. Therefore these theories share the Heckscher-Ohlin assumption of identical know-how but emerge with a contrasting set of outcomes concerning whether the volume or the pattern of trade can be explained.

On the other hand, I find it difficult to accept this type of formalization of trade in similar products among nation-states, neat as it is, and prefer an alternative "theory," which I will sketch below with a broad brush. Essentially, it seems to me that if we want to introduce the notion of "similar" products, with different nations trading such products to one another, we really have to give up the Heckscher-Ohlin assumption that all firms, and nations, share identical know-how *ex ante*. I would thus

start with the notion that, just as in biological theorizing the "environment" interacts with "genetic factors" to produce a phenotype, we can think of an economic process whereby a specific choice of a product type emerges within a nation-society.[17] Thus, think of the income level and the level of R & D in manufacturing as defining the capacity of the society to come up technologically with a given set of characteristic product combinations, e.g., small, medium, and large cars.

The United States and Japan share this "genetic" set of traits; Zaire and Gabon do not. But which phenotype is selected in the market depends on the interaction of this common set of genetic traits with the specific "environment" of Japan and the United States. Thus the land-man ratios, the size and structure of the family, etc., may lead to the evolution of "gas guzzlers" in the United States and of smaller, fuel-economy cars in Japan, as, in fact, has been the case. At the next stage of the argument, then, the successful development of small cars in Japan and of gas guzzlers in the United States gets reinforced by localized technical change in precisely these types of cars with the result that one is now dealing with a situation of *ex ante* differentials in the know-how of producing and selling different types of cars. Next, since "cars" represent a generic product, representing a certain manner of transportation, the taste for small cars diffuses to the United States and for gas guzzlers to Japan as part of the Schumpeterian process of dynamic capitalism, aided by advertising in search of new markets. Thus trade in similar products arises. Scale economies with identical *ex ante* production functions do not play any role in this "theory," of course, and I believe that this scenario may have a greater claim to truth than the recent formal theorizations regarding trade in similar products. A formal characterization of this theory building on his recent theoretical work is presented in the appendix by Feenstra.

The MPI scenario. Whether the trade in similar products arises owing to scale economies in the presence of *ex ante* identical production functions or because of an "ecobiological process" theory like the one I have delineated above, what happens when the competition among similar products intensifies? When it results in a standoff, with the products of neither country's firms gaining dominance through R & D breakthroughs or taste shifts (whether exogenous or advertising-induced), the response of the entrepreneurs is likely to be of the MPI variety if the competition gets tough.[18]

Because no jobs are threatened, this then is an outcome to which unions ought to be indifferent. The entrepreneurs reduce the threat to their profits from import competition by *de facto* product-wise cartelization, and the government may not be unduly disturbed about the out-

come (unless the result is the total elimination of competition in the industry *and* the government has an antitrust policy which it seeks to implement to this instance.)[19] The results are therefore far more sanguine in the MPI scenario than in the PC scenario!

The "Growing Dominance of External Products" Scenario

However, as soon as the comparative advantage has shifted dramatically in favor of the foreign products so that the domestic and foreign products do not both have a comfortable niche in the market, the picture changes drastically.

In this case, the entrepreneurs will want protection but may settle for greater access to cheaper foreign labor to offset the loss of comparative advantage if they can get the government to oblige them. While entrepreneurs may be indifferent between protection and greater access to foreign labor, the labor lobby will generally prefer protection to labor importation for reasons which need not be spelled out again. However, labor may be indifferent between a policy of actual protection and one in which they can merely use the *threat* of protection to get the foreign firms to invest where labor is, for the policies will equally secure their jobs. On the other hand, the entrepreneurs will prefer actual protection to the policy that merely uses protectionist threats to draw in foreign firms. For, while the United Auto Workers, for example, does not care whether its members are employed by Datsun or Ford, Ford does!

Thus we have the intriguing response possibility of domestic labor trying to import foreign entrepreneurs (with superior know-how), whereas in the "traditional" industries (of section 6.2) we had the spectacle of domestic entrepreneurs trying to import foreign labor (which will imply lower wages)!

As it happens, the protectionist threat resulting from the deteriorating competitive position of the United States car industry is a splendid example of the scenarios spelled out above. The American car industry, thanks largely to the steady erosion of the market for gas guzzlers in recent years, has been turning increasingly to producing small cars for survival, and this has shifted the problem of competition from one where the makers of American and foreign cars each had their own special niche in the market, with MPI (and variants thereof in the form of mutually supportive and profitable arrangements for marketing, joint production, etc.) as the relevant model, to one where the competition is more fierce and over a product type (the small car) where the makers of foreign cars have always had the edge. The result has been indeed for labor unions to go abroad and threaten the makers of foreign cars to produce in the United States or face protection. The following *New York Times* reports are revealing:

Douglas A. Fraser, head of the United Automobile Workers union, warned Japanese car makers today that they must invest in auto assembly plants in the United States or face the threat of immediate legislation to restrict rising imports of their small fuel-efficient cars.

He told Prime Minister Masayoshi Ohira and Foreign Minister Saburo Okita at separate meetings today that 220,000 auto workers were unemployed in the United States and that there was a 10.3 percent unemployment rate in Michigan, his home state and the center of American auto industry. Japanese auto makers should open operations in the United States to reduce unemployment there, even if only by small amounts, Mr. Fraser said. "You ought to have a sense of urgency," Mr. Fraser said he had told the Japanese leaders. He is making a short trip to Japan at the suggestion of Mike Mansfield, the United States Ambassador.

American vehicle imports totaled 2.2 million units in 1979, including about 1.7 million cars, and shipments in 1980 may increase as Americans turn to light, front-wheel-drive Japanese cars. By contrast, Japan imported fewer than 20,000 American cars last year.

The tall, heavily built U.A.W. chief said that Nissan Motor, a leading auto maker here that markets Datsun cars, offered yesterday to build a truck assembly plant in the United States, to avoid a pending 25 percent import tariff.

"That won't be sufficient," Mr. Fraser said. (*New York Times.* 1980*a*)

A stiff Congressional warning went out to Japan today to cut back voluntarily on automobile exports to the United States or face protectionist quota legislation that would damage the trading interests of both countries.

The chairman of a House trade sub-committee, Charles A. Vanik, Democrat of Ohio, called on the Japanese to roll back their American exports to 1977 levels over a two-year period to avoid what he called the "last resort" of legislated quotas.

In addition, he said, underscoring recent demands by Douglas A. Fraser, president of the United Automobile Workers, the Japanese must be convinced of the necessity to build important quantities of cars in the United States to avoid protectionist reaction here.

Declining international values for the yen, which make it more profitable to export from Japan, and the current emphasis on producing competing small cars by the American industry are behind the resistance of the two biggest Japanese producers—Toyoto and Nissan—to construct assembly plants in the country. But Honda, a smaller company, has announced plans to manufacture relatively modest numbers of cars in an assembly plant in Ohio.

Mr. Vanik's call for voluntary restraint, made at committee hearings crowded today with Japanese reporters, came shortly after two bills were introduced by Michigan legislators to impose quota restraints.

But Congressional analysts believe that sentiment is not yet ready to jell, though it well might if automotive unemployment continues to rise. More than 200,000 auto workers have already been laid off.

At 1977 levels, Japanese sales here would be some 25 percent below the current rate of 2 million cars a year, which represents well over 20 percent of all cars sold in the United States.

No other country permits such penetration, Fred G. Secrest, executive vice president of the Ford Motor Company, told the panel.

He reported that, by agreement between British and Japanese producer associations, Japanese imports into Britain were held to about 11 percent of the market. France, he said, applies an informal but very effective share limit of 3 percent to Japanese cars. By bilateral agreement, Italy limits Japanese imports to 2,000 cars and trucks, while Spain limits imports of automobiles to a value of $500,000 from any exporting country.

Thomas J. Downey, Democrat of Suffolk County, said that American consumers were welcoming Japanese products "with open arms" and that even during the committee proceedings news photographs were being made by Nikon cameras and voice recordings by Panasonic.

He warned that failure to cut back the flow of Japanese cars would mean "a wave of protectionism that will sweep across the country and do irreparable harm to the Japanese economy and ultimately to us." (*New York Times*, 1980*c*)

The reaction to this protectionist lobbying by Japanese car makers is likely to be a response which combines some voluntary export restraints (VERs) and some accommodation to the demands for direct investment in the United States either à la Honda in Ohio or in some joint ventures in the United States with United States car makers like the proposed deal in Italy between Alfa Romeo, the state-owned car maker, and Nissan, which produces the Datsun, to produce a new medium-sized car at Alfa's plant in Alfasud in Pamigliano, Naples, with Alfa engines and Nissan bodies.[20]

6.4 Concluding Remarks

The primary emphasis of this paper has been to examine the strong relationship that exists between the response to intensifying import competition in goods and the nature of international labor and entrepreneurial mobility. In doing this, the paper has sought to provide a framework to systematize alternative patterns of responses to shifts in comparative advantage, without undertaking a rigorous, theoretical formulation of many of the ideas set forth.

Perhaps the major analytical limitation of the paper is the lack of consideration of what political scientists would call the issue of how a

nation is governed. Whether, for example, the importation of foreign labor is legal, as in Western Europe, or illegal, as in the United States, and whether the unions are successful in their bid for protection instead of permitting a market-oriented adjustment to shifting comparative advantage are issues that require an analysis of how the corporate state works, i.e., how representative democracy interacts with industry and labor. Such a "political" and public-choice-theoretic analysis would nicely complement the analysis I have set forth here, essentially by explaining cross-country contrasts in the choices of policy response that have actually occurred as comparative advantage has shifted in recent years.

Notes

1. The only important exception to this hypothesis (i.e., that in the declining, senescent, unprogressive, labor-intensive industries the typical response would not be for entrepreneurs to move) would appear to come from Japanese experience. However, the shift of some Japanese textiles, for example, to South Korea and other countries in the Far East appears to have been partly a question of "investment shunting" prompted by GSP. It may also be useful to examine whether the shift has occurred from the technologically more progressive firms among these industries. Again, the few United States apparel producers who have gone abroad to take advantage of United States tariff provisions under GSP or 806.30-807 (the offshore assembly provision) seem to be the smaller firms with special designing or marketing skills. For a discussion of how Japanese direct investment differs in this respect (i.e., insofar as it occurs also in the "traditional" labor-intensive industries) from Western direct investment, see Kojima (1978).

2. In fact, the reward to capital is higher at Q_2 and Q_3 under the labor-importation policy and thus should please entrepreneurs more.

3. Note that, even if a production subsidy were used for protection, the corresponding welfare (U_{ps}) would, while avoiding the consumption cost of the tariff, still be inferior to that under the policy of relaxing the immigration restrictions on labor.

4. Note that the real rewards at Q_2 and Q_3 are identical, since the goods price ratio does not change along a Rybczynski line.

5. This strong ranking would not have followed if the policy comparison had not required identical Y^0 production. Thus it is easy to see in figure 6.3 that further shifts up along the Rybczynski line and hence IC (P_2^D) could lead eventually to welfare levels below that at C_t. Note also that the strong ranking might not hold if we were to use a sticky-wage model of either the Brecher (1974*a*, *b*) or the Harris and Todaro (1970) variety since that would introduce a domestic distortion in the sense of Bhagwati and Ramaswami (1963), Johnson (1965), and Bhagwati (1971).

6. Types of factor accumulation or technological progress which can lead to an increase in the production of the exportable good X and a fall in the production of Y are as follows: an increase in the stock of capital (used intensively in the export industry), and neutral or labor-using technological progress in the export industry (see Findlay and Grubert 1959).

7. It is a moot point whether labor is, in fact, always more mobile than capital is malleable!

8. The analysis of this model and the next could be extended to cases where the shift in comparative advantage is domestically induced, as in cases III and IV above. This can be done readily by the interested reader.

9. Note that the output of the importable industry expands under a policy of protection or labor importation.

10. The production is, of course, identical under both options; i.e., both policies are assumed to take the economy back to Q_1. However, under the labor-importation option, the net-of-remuneration-for-foreign-workers "production" point is Q_3 ($<Q_1$).

11. The project at Sussex University's Center for European Studies under the direction of Professor Ronald Dore ought to shed more light on these questions.

12. In chapter 9 of this volume, the analysis considers the lobbying costs of the labor lobby as well.

13. If we could raise any amount of revenue in a lump-sum fashion, it would of course be trivially true that we could bribe the labor lobby out of any protectionist pressure! The notion of the efficient tariff, on the other hand, is a second-best one, and the beauty of it is that the revenue being used for the bribe to labor is generated by the tariff itself. For further discussion, see chapter 9.

14. In the standard $2 \times 2 \times 2$ model, it is possible to work out the conditions under which the paradox of welfare-worsening tariff imposition will arise. See Bhagwati and Rivera-Batiz (1980). This paradox was first noted in Bhagwati (1979).

15. Needless to say, varying the tax on foreign capital to its optimal level would eliminate the paradox. This is, however, as removed from reality as differential taxation of foreign labor in the argument in the text and in Bhagwati and Rivera-Batiz (1980).

16. Of course, it is easy enough to construct analytical cases where the shift outward of technology-cum-capital, by profit-maximizing entrepreneurs, neither increases domestic unemployment in a Brecher-type model nor lowers the real wages of labor with full employment in the $2 \times 2 \times 2$ model.

17. Thus a typical popularized statement of the modern genetic theory is the following: "The phenotype is the result of a particular heredity acting on a particular environmental background. Any variation we observe among the members of a related group of organisms living under natural conditions must be phenotypic variation, because it will be the result of different environmental pressures and different genetic histories. Phenotypic variation in a population is the sum of genotypic variation inherent in the combined heredity of the group plus that part of the environmental variation which affects the phenotype" (Alland, Jr., 1972, p. 9).

18. Impure forms of the MPI phenomenon may involve a one-way equity purchase in exchange for marketing facilities.

19. Governments, of course, manage to get worried about direct foreign investments for all sorts of reasons; so perhaps I ought not to be overly optimistic about their benign neglect in this case!

20. However, the foreign investment response, as already indicated, may not meet with the approval of the entrepreneurs in the Honda type of investment or with that of the entrepreneurs other than the one going into joint venture in the Alfa-Nissan type of investment. In fact, as the *New York Times* (1980*b*) reported on the Alfa-Nissan proposal: "Fiat, not surprisingly, reacted strongly against the proposal, charging that the Nissan deal could become the opening wedge for a Japanese invasion of the Italian automobile market. Fiat, auto industry experts say, is particularly vulnerable to fresh competition because it has been losing some of its market share to other European car makers. . . .

"Fiat is also beset by sabotage and work stoppages by its workers. The company says that the violence and wildcat strikes caused a 12 percent decline in production last year and pushed its operating costs up sharply.

"To head off the Nissan-Alfa venture, Fiat made a proposal of its own to Alfa early this month, offering to buy 40,000 to 50,000 Alfa engines—the same number that would be involved in the Nissan deal—and mount them on new flat models over the next several years. There has also been talk about possible construction of a new Fiat body factory near the Alfasud plant."

Trade unions, if organized by firms, may also then have conflicting interests; and differential location of different firms may also pose questions of conflicting interests, e.g., workers in Alfa Romeo versus workers in Fiat.

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Appendix *Product Creation and Trade Patterns: A Theoretical Note on the "Biological" Model of Trade in Similar Products*

Robert C. Feenstra

Introduction

In this appendix I shall draw on the recent research of Feenstra (1980) to formalize the "biological" model of trade in similar products outlined by Bhagwati in this chapter.[1] The main features of the model to be presented are as follows: (1) As in models of "learning by doing" (see Arrow 1962) or induced technological innovation (see Kennedy 1964; Samuelson 1965), the technologies available within a country are endogenously determined by tastes, research and development (R & D) costs, and other parameters. (2) The returns to R & D activity are the monopoly profits associated with developing and marketing a new product, and an equilibrium of the R & D process is determined as a Chamberlinian "tangency solution" where profits on the last R & D project are zero. (3) If we allow countries to reach an R & D equilibrium in autarky, then it follows from (1) and (2) that countries with differing tastes, R & D costs, etc., will have different sets of available products and technologies. We shall assume that technological knowledge cannot be transferred abroad. Then opening the countries to international trade, we may observe trade in "similar" products arising from the fact that some countries may

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produce unique varieties of a differentiated product, and therefore export these varieties and import others. This bilateral trade in similar products, or intraindustry trade, is not related to scale economies in the post–R & D technologies (which are assumed to exhibit constant returns to scale), but, rather, depends on differences in the post–R & D technologies across countries and therefore, from (1), on cross-country differences in tastes, R & D costs, and other parameters.

It can be seen from this brief outline that our model is closely related to the ideas sketched by Bhagwati, and offers an alternative explanation for trade in similar products from the models of monopolistic competition and trade given in, among others, Krugman (1979) and Lancaster (1980), and in these authors' contributions to this volume. In the next section we shall present our model in detail and show how the autarky equilibrium is established. The pattern of trade between two countries is analyzed in the third section. In the last section we contrast our results to those from models of monopolistic competition and trade, and give brief conclusions.

Autarky Equilibrium

We shall consider the group of markets for a differentiated product, where the aggregate demand for product (i.e., variety) i is given by

$$q_i = a_i d^i(p, I; S(t)), \tag{A1}$$

where p is the vector of prices, I is total consumer income, a_i is a parameter reflecting tastes for different varieties, and $S(t)$ denotes the set of products which are currently available for purchase and which change over time due to R & D. It is assumed that the demand functions d^i correspond to a *symmetric* utility function.[2] It is also assumed that demand is homogeneous of degree one in income and negative one in prices, and that goods are substitutes in the sense that an expansion in the set $S(t)$ of goods available implies a fall (or no change) in the demand for any good previously available.[3]

Note that the aggregate demand functions given in (A1) can be aggregated from individual demand functions under either of the following conditions: (1) all consumers have identical homothetic utility functions, in which case the parameters a_i, reflecting tastes for different varieties, are identical across consumers; (2) the distribution of income across consumers is fixed, and the individual utility functions are homothetic and differ only in the parameters a_i, in which case the *aggregate* parameters a_i reflect *differences* across individuals in their tastes for different varieties.[4]

We shall model an R & D project as spending fixed costs of f to discover the technology to produce good i. It is assumed that the post–R & D unit costs c_i of producing good i are nonstochastic and known even

before the R & D takes place: this assumption is made for simplicity, but may not be unrealistic in situations where, prior to R & D, one has an accurate estimate of the inputs needed to produce a good even though the manner in which the inputs will be combined (i.e., the design of the product) is unknown. The post–R & D technologies are assumed to be linearly homogeneous, and the factor prices which determine c_i are held constant throughout the analysis. If the fixed costs $\tilde{f}$ of R & D are stochastic, then f denotes the certainty equivalent of $\tilde{f}$.[5] We shall assume that after the technology for producing any particular good is known, no further R & D on this good takes place; our model is thus one of *product creation* rather than process innovation on the technologies of existing goods.

In general terms, the R & D process we wish to model is one in which R & D proceeds sequentially over different products, where private firms decide which products to develop and when to stop creating new goods. It will be convenient to assume that, at any point in time when R & D is occurring, only *one* product (and corresponding technology) is being developed, and only *one* firm is engaged in this R & D. We shall suppose that the knowledge embodied in any new technology is protected by a one-period patent and that after the patent expires this knowledge is fully appropriable by all firms in the domestic (but not foreign) market. It follows that the returns to creating a new product through R & D are simply the one-period monopoly profits associated with the product:

$$\text{(A2a)} \qquad \Pi_i(S(t)) = (p_i^* - c_i)a_i d^i(p^*, I; S(t) \cup \{i\}) - f,$$

where p_i^* denotes the profit-maximizing price (where marginal revenue equals marginal cost), p^* is the corresponding vector of prices, and the notation $S(t) \cup \{i\}$ denotes the set obtained by adding product i to the set of products $S(t)$ previously available for purchase.

After a patent expires and other firms begin production of that good, it is assumed that the market structure is perfectly competitive, so that the good is sold at its marginal (and average) cost of c_i. Thus the prices p_j in the vector p^* are determined as follows:

$$\text{(A2b)} \qquad p_j = \begin{cases} c_j & \text{for } j \in S(t) \\ p_i^* = c_i \quad \left[\dfrac{e_i}{e_i - 1}\right] & \text{for } j = i \\ +\infty & \text{for } j \notin S(t) \text{ and } j \neq i, \end{cases}$$

where e_i denotes the elasticity of demand for product i, $e_i > 1$, and we adopt the convention of setting prices equal to $+\infty$ for products which are not available for purchase. The monopolistic equilibrium given in (A2a, b) is assumed to exist.

To complete our model, we must specify how R & D proceeds over time, that is, how the set of products $S(t)$ available for purchase at the competitive price changes. Loosely speaking, we shall assume that starting from any set of initial products S_0, R & D occurs on the product of highest profitability and then proceeds sequentially (i.e., one good at a time) to the products next highest in the rank order of profitability, stopping when the remaining profits are nonpositive. This description is not precise, since it is possible for the rank order of products by profitability to depend on the set of goods $S(t)$, and therefore the rank ordering can change over time.

More formally, given any set of products $S(t)$ available for purchase at the competitive price, we shall assume that the next product selected for development is i^*, which satisfies

$$\text{(A3)} \qquad \Pi_{i^*}(S(t)) = \max_{i \notin S(t)} \Pi_i(S(t)).$$

If more than one product i^* satisfies (A3), any one can be selected. Let $\Delta(t)$ denote the length of time between the introduction (availability) of the last, and next, product sold at its competitive price. We shall assume that $\Delta(t)$ is inversely related to the current profitability of R & D:

$$\text{(A4a)} \qquad \Delta(t) = 1/\psi(\Pi_{i^*}(S(t))),$$

where

$$\text{(A4b)} \qquad \psi(x) = 0 \quad \text{for } x \leq 0,$$
$$\psi'(x) > 0 \quad \text{for } x > 0.$$

Finally, note that the set of products $S(t)$ available for purchase at the competitive price changes in the following manner:

$$\text{(A5)} \qquad S(t + \Delta(t)) = S(t) \cup \{i^*\}, \qquad t \geq 0$$
$$S(t) = S_0, \qquad 0 \leq t < \Delta(0),$$

where the set S_0 of initial products is given and nonempty. Equations (A2)–(A5) are a complete description of our R & D process.[6]

From (A4) we see that as the profitability of the most attractive remaining R & D project falls, the length of time $\Delta(t)$ between the introduction of new products increases, and when $\Pi_{i^*} \leq 0$, then $\Delta(t) = +\infty$ in which case no further R & D takes place and we shall say that the set $S(t)$ of available products has converged.[7] We shall refer to the set $\bar{S}$ of available products and the associated competitive prices as an *autarky equilibrium* of the R & D process.

What products do we expect to be produced in the autarky equilibrium (i.e., included in the set $\bar{S}$)? Clearly, those products which are most

profitable—which have a high a_i or low c_i—will be produced. Thus, suppose that $c_i = c$ for all i so that products differ only in the demand parameter a_i. We can rank-order products from the highest to lowest a_i, and this clearly corresponds to the rank ordering by profitability and is invariant to the set $S(t)$ of goods produced. Then R & D will begin at the product with highest a_i and proceed down the rank ordering, stopping when the profits from R & D become nonpositive. Similarly, if $a_i = a$ for all i and products differ only in their unit costs c_i, then the rank ordering of products from lowest to highest c_i corresponds to the rank ordering by profitability and is invariant to the set of goods produced, and R & D will begin at the product with lowest c_i and proceed along the rank ordering until the profits from R & D are nonpositive.

For given demand parameters a_i and unit costs c_i, the number of goods produced in the autarky equilibrium is determined by total consumer income I and the fixed R & D costs f. From our assumption that goods are substitutes, an increase in the number of products (i.e., an expansion of $S(t)$) lowers the returns to R & D on any remaining product. A rise in consumer income or fall in fixed costs of R & D increases the profits from R & D, and therefore expands the number of goods produced in the autarky equilibrium.[8]

To make explicit the relationship between our formalization and the "biological" model of trade in similar products outlined by Bhagwati, note that we can identify the total consumer income I spent on all varieties of the differentiated product, and the fixed costs of R & D, as "genetic" traits defining the capacity of an economy to create products through R & D. Given countries with similar "genetic" traits, the actual set of product varieties developed (i.e., phenotype selected) depends on the interaction between this common set of genetic traits and the specific "environment" of a country, where we identify the demand parameters a_i and post–R & D unit costs c_i as determined by the environment (e.g., factor endowments; transportation and communication infrastructure, including advertising; social habits) of a country. We have seen that slight differences in the environmental parameters may lead to marked differences in the set of product varieties developed in autarky, and thus a situation of technological differentials across countries in the production of different varieties.[9] These cross-country differences in the sets of products developed in autarky will lead to trade in similar products, as we shall analyze in the following section.

Trade Equilibrium

We shall consider trade between two countries A and B, where it is assumed that the functions d^i in (A1) are identical in the two countries so that tastes differ only in the demand parameters a_i. The countries may

also differ in consumer income I, unit costs c_i, or fixed R & D costs f, which are measured in terms of a common numeraire in the two countries and are denoted with a superscript A or B. Note that given any set $S(t)$ of products available in both countries, the *world* demand for product i is

$$\text{(A6)} \qquad a_i^A d^i(p, I^A; S(t)) + a_i^B d^i(p, I^B; S(t)) = (a_i^A I^A + a_i^B I^B) d^i(p, 1; S(t)),$$

since the demand functions d^i are homogeneous of degree one in income. The sets $S^A(t)$ and $S^B(t)$ denote those products which have been *developed* in countries A and B, respectively, and the set $S(t)$ of goods *available* in both countries with trade is given by $S(t) = S^A(t) \cup S^B(t)$.

Because of the dynamic nature of our R & D process, in order to determine the set of products available in a trade equilibrium we must specify the *timing* of trade liberalization. Accordingly, we shall assume that each of the two countries A and B reaches an autarky equilibrium $\bar{S}^A$ and $\bar{S}^B$, respectively, and that trade is opened only *after* the autarky equilibria have been established. This assumption corresponds to the empirical observation that firms usually develop new products for the home market before considering export possibilities, and can be justified on the basis of various forms of uncertainty when marketing products abroad. We shall also assume that technologies cannot be transferred internationally, so that if firms in any country wish to produce a good which is not yet produced at home (but may be available through trade), they must first develop the technology through R & D.[10]

Within our model, the trade equilibrium is determined in the following manner. After the opening of trade, the profits from R & D activity are evaluated using world rather than domestic demand so that, from (A2a) and (A6), the returns to R & D on product i are given by

$$\text{(A2a')} \qquad \Pi_i^k(S(t)) = (p_i^* - c_i^k)(a_i^A I^A + a_i^B I^B) d^i(p^*, 1; S(t) \cup \{i\}) - f^k, k = A, B,$$

where at the time T when trade is opened the set $S(t)$ of products available in both countries is $S(t) = \bar{S}^A \cup \bar{S}^B$.

Note that in general R & D in one country may occur in goods which are already produced abroad, where this *product imitation* may be profitable if one country has a sufficient cost advantage in production over the other country. However, if countries have similar post–R & D unit costs (measured in terms of a common numeraire), then product imitation is unlikely to occur, and we shall assume that this is the case. It follows that in (A2a') product i is not included in the set of products already available for purchase ($i \notin S(t) = S^A(t) \cup S^B(t)$) and that the vector of prices p^* is given by

$$\text{(A2b')} \qquad p_j^* = \begin{cases} \min\{c_j^A, c_j^B\} & \text{for } j \in S^A(t) \cap S^B(t) \\ c_j^A & \text{for } j \in S^A(t), j \notin S^B(t) \\ c_j^B & \text{for } j \in S^B(t), j \notin S^A(t) \\ c_i^k \left[\frac{e_i}{e_i - 1}\right] & \text{for } j = i \text{ and when evaluating } \Pi_i^k, k = A,B \\ +\infty & \text{for } j \notin S(t) \text{ and } j \neq i. \end{cases}$$

In this specification of p^* it is recognized that for products which have been developed in both countries ($j \in S^A(t) \cap S^B(t)$), production and export will take place in the country of minimum unit cost and competitive price.

Turning to the dynamics of R & D, we shall assume in general that, after the opening of trade, R & D will occur in a country if and only if the monopoly profits from R & D as given in (A2') are positive for some product. When the maximum profits over all remaining products are nonpositive in both countries, then the sets $S^A(t)$, $S^B(t)$, and $S(t)$, of the R & D process will have converged to some sets $\bar{\bar{S}}^A$, $\bar{\bar{S}}^B$, and $\bar{\bar{S}} = \bar{\bar{S}}^A \cup \bar{\bar{S}}^B$, respectively, and we shall refer to these sets of products developed and available, and the associated competitive prices, as a *trade equilibrium* of the R & D process.[11]

While it is difficult to specify a general set of equations governing the R & D process with trade, one can easily describe certain special cases. For example, suppose that the countries "take turns" in R & D in the sense that the first country—say, country A—engages in R & D in a manner analogous to the autarky process until the profits (as given in [A2']) from remaining R & D activity are nonpositive, after which country B develops products sequentially until profitable R & D opportunities have been exhausted. From our assumption that goods are substitutes, this process will converge after the two "turns" we have indicated, since the introduction of new products by country B will lower the profits from R & D activity in country A.

As another example, suppose that the time intervals $\Delta^A(t)$ and $\Delta^B(t)$ between the introduction of the last, and next, product sold at its competitive price are equal and constant in both countries whenever profits from R & D are positive; that is,

$$\text{(A4')} \qquad \Delta^k(t) = \begin{cases} \bar{\Delta} & \text{if } \Pi_{i_k^*}^k > 0, \\ +\infty \text{ if } \Pi_{i_k^*}^k \leq 0, \end{cases} \qquad k = A,B,$$

where i_k^* satisfies

$$\text{(A3')} \qquad \Pi_{i_k^*}^k(S(t)) = \max_{i \notin S(t)} \Pi_i^k(S(t)), \qquad k = A,B.$$

Then the change in the set of products $S(t)$ available for purchase at the competitive price is determined by

(A5′)
$$S(t) = S^A(t) \cup S^B(t),$$
$$S^k(t+\bar{\Delta}) = \begin{cases} S^k(t) \cup \{i_k^*\} & \text{if } \Pi_{i_k^*}^k > 0 \\ S^k(t) & \text{if } \Pi_{i_k^*}^k \leq 0, \end{cases} \qquad t \geq T,$$
$$S^k(t) = \bar{S}^k \quad \text{for} \quad T \leq t < T + \bar{\Delta}, k = A,B.$$

In this case the R & D process with trade is completely described by (A2′)–(A5′), and is assumed to converge to a trade equilibrium.

What trade patterns do we expect to observe in a trade equilibrium? First, let us consider the pattern of trade which emerges in the *temporary* competitive equilibrium immediately following the opening of trade, but before any additional R & D has occurred. Suppose that the sets $\bar{S}^A$ and $\bar{S}^B$ of products developed in countries A and B, respectively, have no products in common, where the difference between these sets may be attributed to differing demand parameters a_i^k and post–R & D unit costs c_i^k in the two countries, $k = A,B$, which leads to different products being developed in autarky (e.g., small and big cars, different varieties of furniture, etc.). In this equilibrium, all products in the set $\bar{S}^A$ will clearly be exported from country A to country B, and conversely for products in the set $\bar{S}^B$. The volume of exports from one country to the other is determined by the number of goods the exporting country produces (i.e., in $\bar{S}^k$), where for given tastes and post–R & D unit costs, the number of goods produced in the autarky equilibrium is directly related to total consumer income I^k and inversely related to the fixed costs of R & D f^k, $k = A,B$.

More generally, suppose that the sets $\bar{S}^A$ and $\bar{S}^B$ of products developed have some goods in common. For these goods, production and export in the temporary equilibrium will take place in the country of minimum unit cost and competitive price, while for goods developed in only one country, the trade pattern is determined as before. In this case the volume of trade depends on the relative unit costs of production between the countries, since the country with a cost advantage in the larger number of products will tend in aggregate to be a net exporter of those products both countries have developed.

Do we expect to observe additional R & D after trade is opened to move the economies away from the temporary equilibrium we have just described? Such R & D will occur if and only if the evaluation of profits from R & D is changed from nonpositive to positive as a result of using world rather than domestic demand (i.e., shifting from [A2] to [A2′]). This shift in demand has two effects on profits: (1) profits are increased due to the expansion of market income, that is, evaluating profits using $I^A + I^B$ rather than I^A or I^B; (2) profits are decreased due to the greater variety of products available, that is, evaluating profits using

$S(T) = \bar{S}^A \cup \bar{S}^B$ rather than $\bar{S}^A$ or $\bar{S}^B$. It is quite possible for effect (2) to dominate effect (1) so that there is *no* additional R & D after trade is opened, and the *temporary* equilibrium which we have just analyzed is identical to the *trade* equilibrium.

In fact, the following result can be established.[12] Suppose that demand and unit costs of production are identical across products and countries, $a_i^A = a_i^B = a$ and $c_i^A = c_i^B = c$ for all i, that as more products are introduced goods become stronger substitutes, that the sets of goods $\bar{S}^A$ and $\bar{S}^B$ produced in each country in the autarky equilibrium have no products in common, and that the number of goods produced in each country in the autarky equilibrium is large. Then after trade is opened there is *no* additional R & D activity. By continuity, we can allow slight differences in the demand parameters a_i^k and c_i^k across commodities and countries, $k = A,B$, and under the remaining hypotheses still find that the amount of R & D activity after trade (if any) is small. The difference between the sets $\bar{S}^A$ and $\bar{S}^B$ of products developed in autarky is now determined by cross-country differences in tastes and post–R & D unit costs (as well as differences in total consumer income and fixed costs of R & D), and the implications for trade patterns are as previously described: products in $\bar{S}^A$ will be exported to country B, and conversely. We have thus arrived at the model of trade in "similar" products outlined in the introduction to this appendix and a formalization of the ideas sketched by Bhagwati.

Last, we must consider the case where additional R & D activity *does* occur after the opening of trade. The products which firms in each country select to develop need not be identical across countries, though identical rank orderings by profitability will obtain if the post–R & D unit costs of production are equal in the two countries. In general we expect the rate of product creation in each country to depend on the profits from R & D, which may differ across countries due to different unit costs of production or fixed costs of R & D, and some exogenously specified "rate of product creation" function (or parameter) such as ψ in (A4) (or $\bar{\Delta}$ in [A4′]). Countries with a quicker rate of product creation will tend in aggregate to be a net exporter of those products which are developed after trade is opened.

Conclusions

A general conclusion from models of monopolistic competition and trade, such as Krugman (1979) and Lancaster (1980), is that the *volume* of trade between countries is determined in the trade equilibrium, but the geographical origin of any particular product is indeterminate; the latter result follows since countries are assumed to have identical technologies. The above model of product creation differs in several respects. First, the geographical origin of production is determinate for any good which is developed in one country but not the other, where this situation is likely

to occur whenever one country has a demand bias or cost advantage in certain product varieties while the other country has a demand bias or cost advantage in other varieties. In particular, countries will tend to export those products which are developed in autarky.[13] The resulting intraindustry trade is not related to scale economies in the post–R & D technologies, but, rather, is determined by scale economies (due to the spreading of fixed costs) of R & D and cross-country differences in tastes, post–R & D unit costs, etc. Note that for goods which are developed in *both* countries, the location of production is indeterminate if the post–R & D unit costs are identical.

The volume of trade in any particular product is determined by the number of goods produced, and, as in models of monopolistic competition, this number is established in a Chamberlinian "tangency solution" and is directly related to total consumer income and inversely related to the fixed costs of production or R & D.[14] For the case where additional R & D activity occurs after the opening of trade, the aggregate volume of trade in equilibrium is determined by the rates of product creation in the two countries, whereas this effect does not enter the models of monopolistic competition and trade (which are primarily of a static nature).

In conclusion, we should indicate that the model of product creation we have presented can be fruitfully extended in a wide variety of directions (see Feenstra 1980), e.g., modeling "product imitation" by one country to lead to a model of the "product cycle", or an examination of the Linder (1961) hypotheses concerning the importance of domestic demand in determining potential and actual trade.

Notes

1. This formalization demonstrates how the "biological model" of trade in similar products can be cast in theoretical terms, but is incomplete in that certain aspects of the proposed model are not fully investigated.

2. In order to correspond to a symmetric utility function, the demand functions d^i must satisfy the following condition: if the vector $\tilde{p}$ is equal to p except that the components p_i and p_j have been interchanged, then

$$d^i(p,I;S(t)) = d^j(\tilde{p},I;S(t)).$$

An example of a utility function leading to demand equations as in (A1) is

$$U = \sum_{i=1}^{N} a_i v(q_i/a_i), \qquad v'>0, v''<0.$$

The corresponding demand functions are

$$q_i = a_i \phi(\lambda p_i),$$

where ϕ is the inverse function of v' and λ is the marginal utility of income.

3. That is, for $i \in S$ and $S \subseteq S'$, we have

$$d^i(p,I;S') \leq d^i(p,I;S).$$

4. Lancaster (1980) assumes that each consumer has a most preferred product variety, that demand for neighboring varieties decreases in a uniform manner, and that the distribution of consumers' preferred varieties is also uniform across products, in which case *aggregate* demand is identical across product varieties.

5. If firms evaluate profits using the utility function U, an approximate certainty equivalent to $\tilde{f}$ is given by

$$f = \bar{f} + \frac{1}{2}\sigma_f^2 R_A,$$

where $\bar{f} = E(\tilde{f})$, $\sigma_f^2 = E(\tilde{f} - \bar{f})^2$, and $R_A = -U''/U'$ is the index of absolute risk aversion.

6. I have permitted myself one sleight of hand in specifying the equations for the R & D process. Specifically, given equation (A4), it would be natural to let $\Delta(t)$ denote the length of time between the introduction of the last, and next, product sold at its *monopolistic* (rather than competitive) price. However, this definition would complicate the specification of p^* in (A2b) since, depending on the length of time needed to complete the R & D for one product, at any point in time a variable number of products are sold at their monopolistic price. Because of this complication, we have adopted the simpler, but less natural, definition of $\Delta(t)$.

7. We shall assume that convergence is obtained; that is, the R & D eventually stops. This seems to be a reasonable assumption of a market where total demand is stationary (i.e., consumer income I is fixed) and the introduction of new goods does not affect the demand or cost parameters a_i, c_i, and f_i.

8. But note that, starting from an autarky equilibrium, a *fall* in I or *rise* in f has *no* effect on the set $\bar{S}$ of available products: these parameter changes decrease the profits from remaining R & D projects and also decrease the *hypothetical* profits from duplicating the R & D activity on any existing product (and hypothetically selling the product at its monopoly price for one period), but neither of these outcomes has any effect on the set of products available. This illustrates a basic difference between our model and models of monopolistic competition: in the model being presented the set of products available can expand but never contract, since the fixed costs of R & D are borne in only one period, whereas in models of monopolistic competition where fixed costs are paid every period, the number of products available can expand or contract as a result of parameter changes. However, if we compare two *different* economies which are identical except that the first has lower consumer income or higher fixed costs of R & D than the second and these parameters have not changed over time, then in their autarky equilibria the first economy will have a smaller number of products available than the second.

9. Note that even if the demand parameters a_i and unit costs c_i are *identical* across commodities, in which case *any* undeveloped product satisfies (A3) and may be selected for development, we may still obtain cross-country differences in the sets of products developed in autarky due to random differences in the products selected for R & D. If the number of potential product varieties is large relative to the number actually developed, this random selection procedure will probably lead to little overlap across countries in the sets of products developed in autarky, and therefore to a considerable amount of trade in these similar products (as analyzed in the next section).

10. That is, in the model being presented we shall assume that the fixed costs of R & D in any country do not depend on whether the product has previously been developed abroad. In some cases it may be more realistic to assume that the additional fixed costs of adapting a foreign technology for production at home are considerably less than if the technology had not been developed abroad, and our model can be extended in this direction (see Feenstra 1980).

11. Note that our analysis is partial equilibrium, and we do not require that trade is balanced in the trade equilibrium.

12. A similar result, using a CES utility function, is established in Feenstra (1980).

13. Note that in the models of Krugman and Lancaster it is assumed that aggregate demand and production costs are identical across goods. If we adopted this assumption within our model, then we would not be able to predict which goods would be developed in autarky (as discussed in note 9), though it would still be the case that countries would tend to export the autarky set of products. On the other hand, if we weakened the "symmetry" assumption of identical aggregate demand and production costs within Lancaster's model, but retained the assumption that countries have identical technologies and factor prices, then we would still find that the geographical origin of production is indeterminate (in contrast to the model of product creation). The "symmetry" assumption cannot be weakened within Krugman's model, since this would lead to the nonexistence of a long-run equilibrium with zero profits for every firm in the industry; this existence problem may be recognized as a weakness of the Chamberlinian approach to monopolistic competition theory, as also discussed by Chipman in his comment to chapter 7.

14. A difference in the determination of the number of goods produced between our model and that of monopolistic competition is discussed in note 8.

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