

PRODUCT INVENTION, FOREIGN OWNERSHIP AND WELFARE

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THE CRITICAL role played by new technology – its adaptation and diffusion – in the growth process of a developing economy is now widely accepted. The importance accorded to technological progress is of course not limited to LDCs only. Modern growth theory stresses that it is the technological application of labour and capital and not merely their presence which crucially influences the rate of economic growth in an economy. However, given the enormous technological gap that currently exists between the MDCs and the LDCs and the opportunity for the latter to draw upon the vastly increased stock of operationally useful knowledge now possessed by the former, technological advance as a factor determining growth rates acquires a still greater significance for the LDCs.

Technology represents knowledge incorporated into new processes, etc., which in turn must be capable of converting inputs into outputs at competitive costs. It is recognized that the process of creating new technology involves research and development effort, which is an enormously costly hit and miss affair; furthermore, the needed skilled manpower is not always available in the LDCs. By adopting established technologies, however, less developed countries, it is argued, can bypass the risky invention and innovation stages and thereby make a significant leap forward. Hence, the emphasis on transfer of technology in discussions pertaining to the growth in developing economies.

The introduction of new technology could be cost-saving, reducing the cost of inputs necessary to obtain a given amount of output. Or new technology could mean the introduction of new product activities, processes or new products. Of course, it does not follow from this that the transfer of technology from MDCs to LDCs will be unequivocally beneficial. The potential gain by the LDCs from such a transfer will depend upon the suitability of the technology transferred.

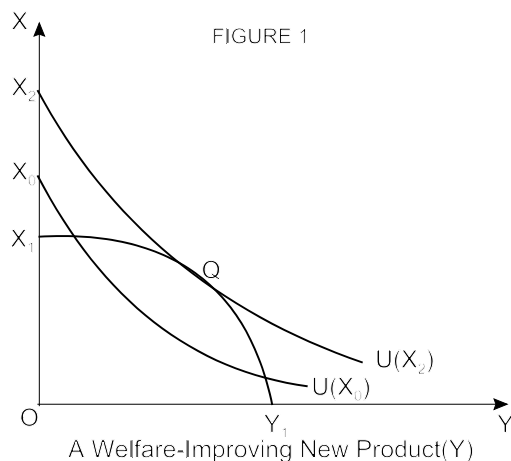
There is, however, another dimension to the issue of appropriateness – an issue largely neglected in the literature dealing with the transfer of technology. This relates to the suitability of products rather than the appropriateness of factor use. It is true that the initial choice of technique model was concerned with choice of technique for a *given* product. Empirical research into choice of techniques,

however, revealed that variations in techniques of production frequently involved variations in products. It is being increasingly recognized that product invention, therefore, is of major significance in its own right, independent of the issue of factor proportions and the choice of techniques. The nature of products available determines how a society satisfies its needs. It is well known products developed in advanced countries would be inappropriate for consumers in the developing countries, for they could embody many characteristics which are unnecessary for relatively poorer people residing LDCs [see, for example, Helleiner (1975), James and Stewart(1981)].

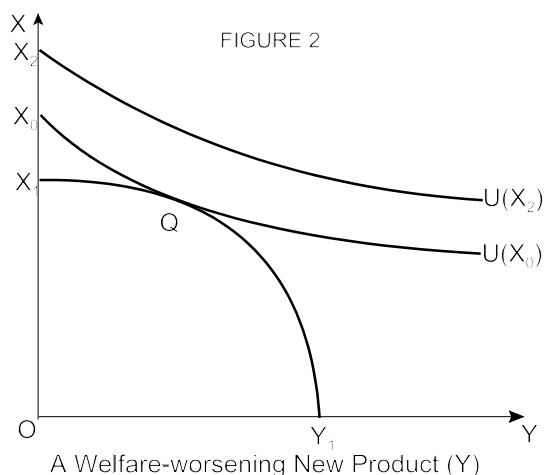
The purpose of this paper is twofold. *First*, it develops a diagrammatic technique representing product invention where research cost underlying the invention is positive. *Second*, it analyses various possibilities of welfare changes when the product is invented in the presence of foreign ownership, an issue that has recently attracted much attention [See Bhagwati and Tironi (1980), Bhagwati and Brecher (1980), Brecher and Bhagwati (1980), Svensson (1981)].

I. PRODUCT INVENTION: A DIAGRAMMATIC ANALYSIS

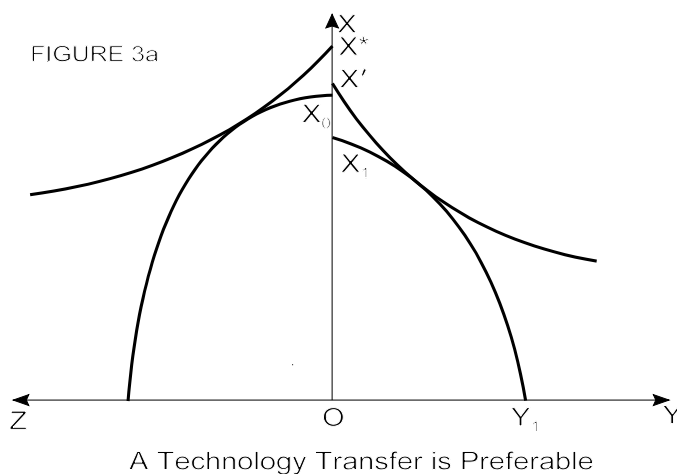
Product invention is one important aspect of economic life that has so far been quite elusive to simple theoretical modeling. Fortunately, Usher (1965) has suggested a diagrammatic technique for representing non-costless invention in terms of the familiar tool of production possibility which we believe is particularly suitable for our present purposes. Let us consider a country which behaves as a utility-maximising unit, possessing perfect foresight and endowed with a fixed supply of two homogeneous factors of production, capital and labour. Assume initially that there is no international trade. Call X the composite of all existing goods, X_0 is the full-employment output of the country prior to any product-inventing research. Inventing a new product, say Y, means adding Y to the X-basket or, diagrammatically, erecting a production possibility curve



connecting X to Y (Figure 1).



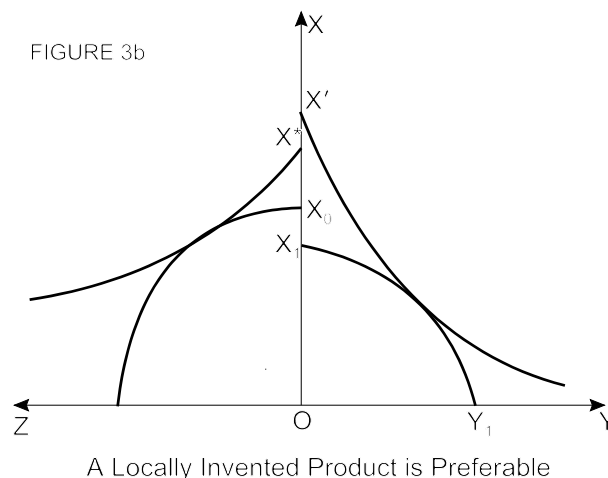
The distinctive feature of this production possibility curve is that its very emergence must be preceded by an irreversible expenditure on research which can be expressed in terms of X as $X_0 - X_1$. This amount (as a flow in perpetuity) reflects the diversion of the resources from the production of X to the research for Y. Put differently, the country could continue to consume X_0 per period, had no research been attempted. If the research were elected to carry out (with the sure result that the invention will be made, as perfect foresight is assumed throughout) the most of X that the country can consume thereafter is X_1 per period. The entire broken line $X_0X_1Y_1$ can thus be regarded as the Invention-Production Possibility Curve (IPPC) relating X and Y.



For each period, the country may have in mind many new products that it wishes to invent. For each pair of existing and potential products the country's preferences are assumed to be represented by a set of well-behaved Community

Indifference Curves (CICs). With no loss of realism, it can also be posited that all CICs will intersect the X-axis at finite points (i.e., there is no new product which is indispensable), allowing a direct comparison of utility levels by their X-equivalents.

Introduction of a new product Y, illustrated in Figure 1, is welfare-improving. Without Y the country could consume at most X_0 which yields a utility $U(X_0)$; when Y is available, it could consume bundle Q, which is equivalent to X_2 , yielding a utility $U(X_2)$. Thus an improvement of $U(X_2) - U(X_0)$ in social utility could be achieved by inventing Y. Evidently, not every potential product would improve welfare in the manner just described. The invention of a product whose highest X-equivalent attainable falls short of X_0 (i.e., the CIC tangential to its IPPC would cut the X-axis below X_0) would clearly bring down social utility (Figure 2). On the other hand, it is also possible that there are more than one potential products which, like Y, are welfare-improving. Assuming that only one product can be invented per period, a utility maximizing country with perfect foresight would scan all new potential products and pick the one which raises its utility to the highest attainable level.

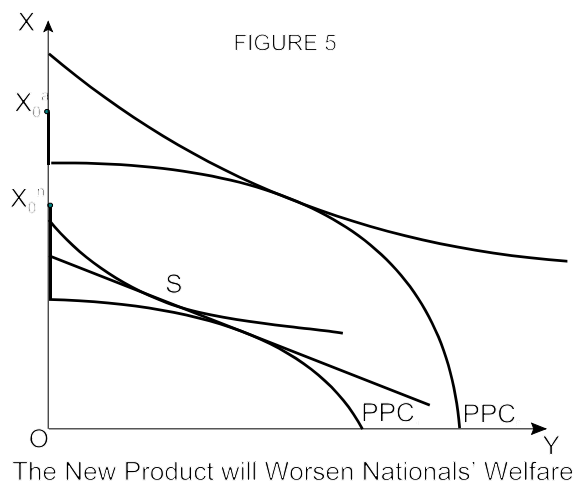
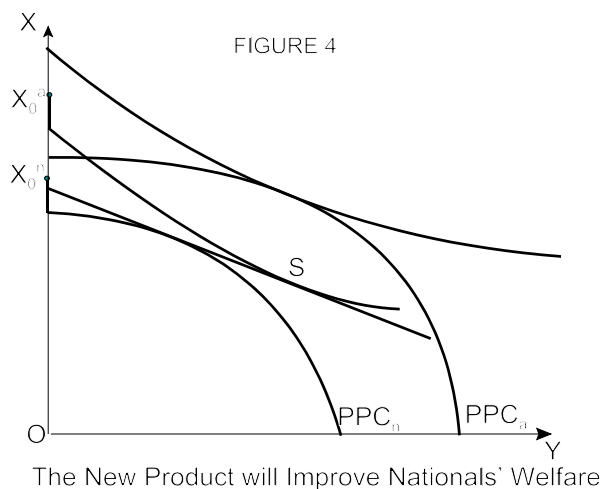


The preceding analysis can be readily used to cast light on the decision facing a country which is offered by a foreign country, free of charge, a new product technology. Retain the assumption that there is no international commodity trade and that the country can assimilate only one new product technology per period. In Figures 3 (a & b) X is the existing commodity, Y is the utility maximizing new product that the country would invent if there is no technology transfer, and Z is the foreign invented product whose technique of production is offered without cost. X' is the predicted new utility level with Y, X^* is the new utility with Z. Clearly, depending on whether X^* is higher (Figure 3a) or lower (Figure 3b) than X' the country should accept the Z-technique or invent its own Y. Evidently, it is not always best for the country to accept the technology transferred, even if it is free, and to overlook the possibility of inventing its own

product, even if the research is not costless.

II. PRODUCT INVENTION IN THE PRESENCE OF FOREIGN OWNERSHIP

Now suppose that of the aggregate endowment K^a and L^a of the two factors of production K^n and L^n are owned by the country's nationals and $K^f = K^a - K^n$ and $L^f = L^a - L^n$ are owned by its foreign residents. No repatriation of income earned by the latter is permitted. Without weakening our results it is also assumed that as a group nationals have the same set of community indifference curves as that of the nation as a whole. The full-employment output prior to product inventing research is now denoted by X_0^a , X_0^n of which is the product of K^n and L^n .



Let Y be invented, because it will maximize the aggregate utility level. The PPCⁿ, which corresponds to the nationals' resources, will nest inside the aggregate PPC_a (Figure 4). Its exact position depends, among other things, on the portion of research costs borne by nationals. In the absence of international trade in commodity, the aggregate production and consumption level will be where the PPC and a CIC come into being tangential. The slope of the corresponding tangent gives the (domestic) price ratio between X and Y. It is clear that this ratio also determines the allocation of domestically owned resources between the two products. Thus, the nationals will produce where the price line just touches the PPCⁿ. To avoid unnecessary complications, let us assume that incomplete specialization prevails at both the aggregate and the nationals' levels. In other words, neither of the two parallel price lines meets its PPC at any corner (see Bhagwati and Brecher, 1980).

Although the country is assumed to be in autarky, domestic trade is still possible. Thus the nationals could consume at a point such as S (Figures 4 and 5) which, given the existing product being Y, will maximize their utility. Figure 4 illustrates a case in which the new product invented to maximize aggregate welfare will also raise the nationals' welfare. On the other hand, Figure 5 clearly demonstrates that there is indeed the possibility that the invention of Y would worsen the welfare of the nationals.

Further examination of these diagrams suggests the following:

First, the share of research cost is a critical factor, *ceteris paribus*. At the extreme, if the nationals do not have to absorb any part of the research cost, their welfare will definitely be improved by the invention of a product regardless of its type. In general, then, for any given group the higher the share of research cost that it bears, the stronger the likelihood that its welfare would be worsened due to the invention.

Second, the ranking of potential products on any aggregate utility scale may not be the same as the ranking of these products on the nationals' utility scale. In other words, it is entirely possible that the product, which maximizes aggregate utility, does not maximize nationals' utility and *vice versa*.

Third, even in the absence of international trade, each group in the country could still benefit from domestic trade. This indirect gain could be the sole benefits for the nationals created by the emergence of the new product. In other words, if domestic trade were not possible, the chances of welfare deterioration for the nationals will be much higher.

The foregoing analysis can be easily extended to cast light on the welfare implications of the transfer of a new product technology to a country in the presence of foreign ownership in that country. Specifically, it follows from the second observation that there exists the possibility that the welfare of one group

may be worsened by the acceptance of an aggregate welfare-improving technology.

III. CONCLUDING REMARKS

The paper has demonstrated that the welfare of one group in the economy, here called the nationals, could be worsened by the introduction of a new product, invented domestically, which benefits the country as a whole. Of course, if the product is foreign invented, the result is even stronger. While the analysis has been carried out under the assumption that there is no international trade in commodity, it can be readily grafted onto the Bhagwati- Brecher- Tironi treatment to shed light on the welfare implications of trade to various groups in the country in the presence of product invention possibility. For a given group, then, the changes in its welfare caused by trade, transfer, tariff, or growth may offset (partly or totally) or reinforce the change in its welfare caused by product invention discussed here. The only definite conclusion that we can draw is that an improvement at the aggregate level does not necessarily entail an improvement for every group in the economy, even when "groups" are distinguished only on the basis of some productivity-neutral trait.

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