

# TRANSFER OF TECHNOLOGY TO DEVELOPING COUNTRIES

—Japanese Type versus American Type—

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## I. Introduction

Recently, much attention has been paid to the role of direct foreign investment as a potent agent of economic transformation and development, not only in the more laggard developed countries but also in the developing countries. The essence of direct foreign investment is its transmission to the host country of a package of capital, managerial skill, and technical knowledge. Direct foreign investment (and therefore activities of multinational corporations) is one of the most efficient means for transferring technology to developing countries but, because of host country nationalism, there have been strong demands for an 'unpackaged' transfer of technology.

I have been developing elsewhere<sup>1</sup> a macro-economic theory of trade-oriented (Japanese type) versus anti-trade oriented (American type) foreign direct investment.<sup>2</sup> In parallel fashion, in this paper I would like, first, to identify two types of technology transfer to developing country's manufacturing industry: "orderly transfer of technology" which can be typically found in Japanese direct investment, and "technology transfer in reversed order" which is embodied in American oligopolistic direct investment (let us briefly call these "Japanese type" and "American type" technology transfer)—Sections II and III.

Secondly, the difference between these two types of technology transfer is theoretically reduced to "comparative advantages in improving productivity." There are the primary cause of changes in comparative costs between the investing and host countries. Then, it is possible to examine the correspondence between the two types of technology transfer and those of direct foreign investment. And these logical inferences lead to an important policy implication for economic development and trade expansion (Section IV).

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<sup>1</sup> Kiyoshi Kojima, "A Macroeconomic Approach to Foreign Direct Investment," *Hitotsubashi Journal of Economics*, June 1973, pp. 1–21 (reprinted in Fred Bergsten, ed., *Toward A New World Trade Policy—The Maidenhead Papers*, Lexington Books, 1975, pp. 75–104), and "International Trade and Foreign Investment: Substitutes or Complements," *Hitotsubashi Journal of Economics*, June 1975, pp. 1–12.

<sup>2</sup> Favourable evaluation on my thesis had been received, among others, from Fred Bergsten, "Introduction" to the above *Maidenhead Papers*, and from G.C. Hufbauer, in saying "Kojima (1973) contends that Japanese direct investment is largely pro-trade oriented. Japanese multinational firms specialize in the exploitation of raw materials and the overseas manufacture of labor-intensive goods. Much of the output is then shipped back to Japan. By contrast, American multinational firms tend to manufacture their most sophisticated products abroad for locally protected markets . . . . Eventually, the pattern of multinational investment could come to resemble Kojima's portrait of Japan. But the outlook is far from clear." G.C. Hufbauer, "The Multinational Corporation and Direct Investment," Peter B. Kenen, ed., *International Trade and Finance; Frontiers for Research*, Cambridge University Press, 1975, pp. 281–282.)

Thirdly, the Japanese type of technology transfer, combined with the characteristics of the Japanese type of direct foreign investment, makes it easier to transplant new industry, having larger spill-over effects in the host country, and makes the new industries competitive in international market. This is the role of direct foreign investment as a "tutor". There is a dilemma in the Japanese-type transfer of technology through direct investment for it plays the role of tutor efficiently and, consequently, erodes its own role in the host country. Fade-out may thus be unavoidable—Section V.

## II. *Japanese-type Technology Transfer*

In the transfer of technology, mainly through direct foreign investment, it is most important for developing countries to choose carefully what kind of industry and what type of technology they had better receive. This choice will affect substantially the host country's economic development, employment and trade. However, since an investing firm usually selects and the host country requires introduction of the most up-to-date prevailing technology in each industry, the kind of industry and the over-time pattern of transfer is a crucial factor determining the success or failure of technology transfer in manufacturing industries to developing countries.

Raymond Vernon points out characteristics of products suitable for developing countries, arguing from the basis of his theory of product cycle which is basically a theory of location rather than a theory of trade and investment: (1) their production function is such as to require significant inputs of labour; (2) they are products with high price elasticity of demand for the output of individual firms; (3) products whose production processes do not rely heavily upon external economies would be more obvious candidates than those which required a more elaborate industrial environment; (4) the implications of remoteness also would be critical: products which could be precisely described by standardized specifications and which could be produced for inventory without fear of obsolescence would be more relevant; (5) high-value items capable of absorbing significant freight costs would be more likely to appear than bulky items low in value by weight. Thus, "standardized textile products are, of course, the illustration par excellence of sort of product that meets the criteria. But other products come to mind such as crude steel, simple fertilizers, newsprint, and so on."<sup>3</sup>

In short, the most suitable manufacturing industry to developing countries is "traditional industry" which is labour-intensive, well-standardized and price-competitive. This is the kind of industry which Japanese direct investment has transplanted so far to neighbouring developing countries and this is what I identified as Japanese-type or trade-oriented direct foreign investment. Although Vernon reached his conclusions from the viewpoint of his product cycle model, I prefer, independently of the product cycle theory,<sup>4</sup> to see traditional labour intensive industry as, overtly or potentially, having a comparative advantage in labour abundant developing countries according to the theory of factor proportions or the Heckscher-Ohlin theorem.

<sup>3</sup> Raymond Vernon, "International Investment and International Trade in the Product Cycle," *Quarterly Journal of Economics*, May 1966, pp. 203-4.

<sup>4</sup> This point is examined later in Section III.

I shall draw on the excellent research of Terutomo Ozawa,<sup>5</sup> Colorado State University, for evidence concerning the type of technology Japan has transferred to developing countries. He identifies the unique and prominent characteristics of Japan's technology transfer to developing countries and interrelates them with those of Japan's direct investment.

In general, Japanese technology, exported to developing countries is quite different in nature from that directed to advanced countries. The latter consists largely of patented, high-level technology involving chemicals (e.g., pharmaceuticals), and electronic products (e.g., diodes, special condensers, wire memory, etc.). In contrast, the technology transferred by Japan to developing countries is not so specific in technical nature. It is given in the form of know-how or in the form of general industrial experience, covering a wide spectrum of production activities such as assembly techniques (e.g., cars, trucks, radios, television sets, sewing machines, coolers, refrigerators), material selection, combination, and treatment techniques (e.g., dyes, inks, and paints), machine operation and maintenance techniques (e.g., spinning and weaving), provision of blueprints and technical data, training of engineers and operators, plant lay-out, selection and installation of machinery and equipment, quality and cost controls, and inventory management.

This type of rather general and comprehensive technical transfer inevitably involves a great deal of person-to-person contact from the very top down to routine operations. Therefore the training of engineers and operators is perhaps one of the most crucial phases of technology transfer. Needless to say, personnel training is often a highly labour-intensive process, requiring a considerable amount of manpower on the side of transferring firms.<sup>6</sup>

This summary exposes the very core of Japan's transfer of technology to developing countries. Japan's export of technology is rather limited both in number and size, and a large proportion of technology transfer is embodied in and achieved through direct investment. Terumoto Ozawa also stresses this particular aspect of Japan's technology transfer to developing nations.

(1) "The mechanism of Japan's technology transfer to developing countries in Asia is less capital-intensive or to put it more appropriately, is highly labor-intensive, a great deal of manpower being involved on the part of both the transferors and the transferees. Japan may prove to have a comparative advantage in this human-centered activity of transferring industrial knowledge to her neighboring countries where socio-cultural conditions are not totally dissimilar."<sup>7</sup> This is supported by the fact that Japan's direct investments have been concentrated on small-sized labour-intensive industries.

(2) "Japanese technology transferred to developing countries, as already pointed out, is not so much specific production techniques but rather know-how or general industrial experience involving not the latest but mature techniques. This type of technology often requires the actual participation of the transferors at the production and management levels for a considerable period of time." Because transferred technology is so mature and stan-

<sup>5</sup> Terutomo Ozawa, *Transfer of Technology from Japan to Developing Countries*, The United Nations Institute for Training and Research (UNITAR), New York, 1971. (Also see his *Japan's Technological Challenge to the West, 1950-1974; Motivation and Accomplishment*, The MIT Press, 1974, Chap. 6).

<sup>6</sup> *Ibid.*, pp. 3 and 6.

<sup>7</sup> *Ibid.*, p. 10.

standardized, "developing countries do not fully assess the economic value of industrial technology and tend to consider it almost a free good."

"Being unable to expect profits from the sale of standardized technology, transferors try to compensate for the bargain sale of knowledge by securing, or monopolizing, the supply of intermediate goods such as raw materials, parts and components. To this end, capital ownership and management participation become strategically important."<sup>8</sup> The unique role of Japanese trading companies is pointed out as "intermediating the shipping of required machinery, equipment, raw materials, and semi-finished products from Japan and the exporting, if any, of the overseas ventures' products overseas." "Generally speaking, 50 per cent of the total capital of these ventures is locally-owned in a developing country, 25 percent is owned by the Japanese manufacturer involved, and 25 percent is financed by a trading company."<sup>9</sup>

Here we find a very interesting aspect of the Japanese-type transfer of technology, symbolised by the link between mature and standardized technology, joint ventures, and the unique role of Japanese trading firms.

(3) "Because of the nature of technology transferred, i.e., mostly production techniques of standardized products and general industrial experience, no fundamental technical change seems to be required of a given technology so transferred. . . . Of course, there are many cases of slight modifications such as production processes are re-oriented to more labor-intensive methods."<sup>10</sup> Here the point is that technology should be transferred gradually in proper order from those industries where technical gap is smallest.

(4) Though developing countries are pursuing import substitution industrialization or export-oriented industrialization by offering tariff protection and other measures they have unavoidably to face "diseconomies of scaling down" because of the narrowness of their markets. But small-scale production of products which require mature and standardized techniques would not face such difficulties, as in the case of direct investment by small and medium-sized Japanese enterprises. Because of the labour shortage and wage raise in Japan, they have been transplanting their production activities to developing countries where low-wage labour is available without facing the diseconomies of scaling down. Therefore, "managerial and industrial techniques to run small operations efficiently and profitably are exactly what developing countries need to learn in the early stage of industrialization"<sup>11</sup>

(5) "The technology transferred by Japanese firms to developing countries is largely know-how or modernization experience and skill associated with standardized production techniques. This type of technology cannot be easily embodied in capital equipment, blueprints, or instruction sheets but is mostly embodied in labor at all levels of operation. Under those circumstances, technical assistance must be provided on the site of actual operations until transferees acquire the necessary skills through experience. On this account, joint ventures appear to be the most effective form of organization, since both parties to the contract will be involved in the common pursuit of profits, will be sharing responsibilities and solving technical and managerial problems as they arise . . . . Labor training may be characterized as the inner mechanism of technology transfer, the joint venture being then

<sup>8</sup> *Ibid.*, p. 12.

<sup>9</sup> *Ibid.*, p. 13.

<sup>10</sup> *Ibid.*, p. 13.

<sup>11</sup> *Ibid.*, p. 28.

considered as its outer mechanism."<sup>12</sup>

In brief, what Ozawa isolates as unique characteristics of Japan's technology transfer to developing countries can be theoretically described as an orderly transfer of technology which begins in those industries where the technological gap between providing and receiving countries or firms is smallest and, accordingly, the transfer of technology is easier and its spread effects larger.

### III. *American-type Technology Transfer*

Most technology transfer and direct investment to developing countries through American firms has distinctly different characteristics from that through Japanese firms. American direct investment in developing areas has been heavily concentrated in natural resource extraction but about a quarter of it has been directed to manufacturing industries, the latter increasing more rapidly than the former. American manufacturing firms usually undertake direct investment in the most sophisticated industries even in developing countries. These industries rank at the top of United States' comparative advantage and the investment seeks to maintain and extend their monopolistic or oligopolistic position in the host country through superior advantage in their technology, marketing and world-wide network. This type of direct foreign investment contradicts the comparative advantage pattern of trade and works in an anti-trade oriented fashion. At the same time, it implies a transfer of technology from the industry in which very large technological gap exists between the providing and receiving countries (therefore I call it "reverse-order" technology transfer). This type of technology transfer is certainly not only very difficult but also actually results in "no transfer" taking place, that is, a mere out-station of new technology in the host country.

In order to identify the characteristics of American-type transfer of technology, instead of undertaking my own empirical research, I draw again upon two extant studies: First, we will look into Charles Cooper's criticism on the product-cycle theory to support our argument that American direct investments and technology transfers have been "reverse-order" in nature. Second, we will survey Constantine Vaitsos' critical review of patent system in developing countries.

In the view of Raymond Vernon, as already noted, products suitable for production in developing countries (that is, at the final stage of his product-cycle theory) are standardized and labour-intensive. This being true, American direct investment in developing countries should have been directed to such industries as has Japan's. In reality, however, American direct investment has been concentrated on highly technology-intensive products not only in developed economies but also in developing areas. Raymond Vernon mentions elsewhere<sup>13</sup> that there can be hardly any possibility that an American entrepreneur will launch into direct investment to developing nations in the field of standardized products such as textile or steel. Why is this the case with America? Perhaps, American firms are not interested in direct foreign investment in those standardized products because they do not

<sup>12</sup> *Ibid.*, p. 35.

<sup>13</sup> Raymond Vernon, "The Economic Consequences of U.S. Foreign Direct Investment," *United States International Economic Policy in an Interdependent World* (Williams Commission Report) *Papers I*, Washington, D.C., July 1971, p. 940.

generate any monopolistic or oligopolistic advantage and gains.

Production of standardized goods can be explained by the Hechscher-Ohlin theorem on which trade-oriented direct investment is based, quite independently from the product-cycle theory. The product-cycle theory deals with the correlation between monopolistic behaviour of entrepreneur and location of production. It is promonopoly or prooligopoly and cannot suggest an appropriate direction for direct investment and technology transfer to developing nations.

Charles Cooper<sup>14</sup> raises important questions about the product-cycle theory and these make clear one critical aspect or the characteristics of American-type technology transfer.

(1) The product cycle model assumes that there is some link between the age of the product and the extent of quasi-monopoly. But this link is quite vague, and it is possible that many products will be monopolistically controlled long after they have graduated as "mature," because technological monopoly is usually supported by other types of monopolistic advantages. It may take much longer than the theory proposes and it may last until the product is 'mature', which is supposedly the point at which transfers to developing countries take place.

(2) The theory takes given factor availabilities in developing economies as the ultimate determinants of when (that is, at which phase) production will be transferred. But if international movements of factors such as direct investment are admitted, it is hard to say that mature products will be the only one which are transferred to developing countries. Any attempt to use the product-cycle theory to explain international movements of factors of production is not very satisfactory.

(3) In many cases, enterprises which own technology are forced to set up production in developing countries because if they do not a competitor may capture the protected market. This type of defensive investment, which is the nature of American direct investment, as Vernon himself explains, will take place even if it results in high costs of production compared with those in the home-country—and it can lead to the transfer of technologies to developing countries at a very early stage in the life of the product. In addition, however, market protection, which is often high in developing countries, can help the enterprise to maintain the monopolistic advantages it originally got from the technology, after the technology monopoly *per se* has been eroded in the markets of the advanced countries. Competitors from the advanced countries are kept out, and because of basic technological weakness there is not much danger of a competitive threat from local firms.

In other words, American oligopolistic enterprises usually set up wholly-own subsidiary or "enclave" in developing countries in producing most sophisticated and differentiated products in order to exploit their quasi-monopolistic advantages in Third World markets. This seems to be the core problem of American type or "reverse-order" transfer of technology.

The patent system seems to be another critical concern for developing countries. Patent holding enterprises can control production and the patent system enables them to use patents as source of monopolistic gain. The Japanese Government White Paper on Science and Technology evaluates patents as follows: the patent system is meant to publi-

<sup>14</sup> Charles Cooper, "Science, Technology and Production in the Underdeveloped Countries: An Introduction," Charles Cooper, *Science, Technology and Development: The Political Economy of Technical Advance in Underdeveloped Countries*, Frank Cass, London, 1973, p. 10.

size newly invented technology and to encourage indigenous technological exploitation, and it is supposed to avoid redundant research activities on similar technologies while admitting a certain period of time in which inventor can be guaranteed monopolistic usage of the technology to get remuneration.<sup>15</sup>

Based on his study at Colombia, Constantine Vaitsos examines such features of technology monopoly and technology transfer where patents play an important role. Vaitsos takes a somewhat too heretical view of patent system for developing nations, but his view is worth referring to. He set out to show that (1) the patent system in developing countries has a predominantly negative effect and is devoid of significant benefits for these countries; (2) virtually all patents are owned by large foreign corporations, and are used as a vehicle for the achieving monopoly privileges; (3) monopoly privileges militate against conditions conducive to foreign investment, and hinder the flow of technology to developing countries while restricting their technological advance through imitation and adaptation; (4) for developing countries to license patents is therefore tantamount to granting import permits under restrictive conditions.<sup>16</sup>

The first reason why the patent system works disadvantageously to developing nations is that virtually all patents registered in those countries are owned by foreign enterprises or foreigners. There is asymmetry or one-sidedness in research and development activities. It is a typical case of reverse-order transfer of technology usually found in American direct investment where technological gap is largest or such superior technology does not exist in the host economy at all. This problem concerns not only developing countries but developed countries, for there is gap in size of R & D activities among them. The patent system is too an urgent issue for those who have backwardness in technology capability. The second reason, from a more general point of view, is that the main function of the patent system is not to encourage inventive activities, but to assist profit maximisation of large multinational enterprises by keeping out the power of their competitors. Big enterprises use patents as powerful strategic weapons to achieve their monopolistic gains, and for this reason, the most advanced technologies are registered as patents.

Vaitsos raises three important issues in this context. First, the key motive that foreign enterprises register patents particularly in developing countries stems from a defensive strategy to preserve markets from potential competitors. If either local or foreign enterprises wish to produce products using patented technology, they have to pay royalty to patent holders. In most cases they also have to purchase technology specific know-how and are put under various restrictions by patents such as the price, market or quantity of the product. The costs of production in developing nations are usually higher than those in the home-countries from where patent holders can export the same products at lower price. This being the case, any local or foreign firms who use patented technology cannot survive in competition. Therefore, it becomes clear that patents are registered in developing countries by holders to preserve or to expand export markets for their products. It might be said that a patent is meant to block entry of potential competitors since a patent is hardly used except by holders.<sup>17</sup>

<sup>15</sup> Japanese government, *White Paper on Science and Technology*, 1973, p. 233.

<sup>16</sup> Constantine Vaitsos, "Patents Revisited: Their Function in Developing Countries," Charles Cooper, ed., *Science, Technology and Development*, *op. cit.*, p. 71.

<sup>17</sup> Vaitsos, *ibid.*, pp. 77-8.

Secondly, there is the relation between patents and direct investments. As long as patent holders can enjoy patent-protected markets, there is no need for them to launch into direct investment. The only occasion might be when developing countries impose import restrictions or tariffs, or try to foster production by local entrepreneurs (or by other patent holders and competitors). In short, patents, instead of transferring technologies, preserve export markets for patent holders without necessitating direct investment and block investment by potential competitors. Patent owners can impose restrictions on the right to use or to imitate certain technologies, and allow only particular firms to use patents. It becomes easy for patent owners to intervene in the management of or to take over the patent-using firms since these firms are fully subordinate to patent owners. Even in the case of launching into direct investment, they can easily purchase local firms through the monopoly privileges of patents without blocking any other foreign direct investment.<sup>18</sup>

Thirdly, patents cannot be identified as a means or vehicle for transfer of technology. As has been discussed, patents are meant to secure monopolistic export markets for the holders and they have nothing to do with technology transfer. When direct investments take place by patent holding firms, they only create "enclaves" in developing economies, for monopoly privileges derived from patents work in such way as to displace local firms. Technologies are not absorbed and improved locally, and do not stimulate indigenous technological advance and exploitation.<sup>19</sup>

"In conclusion, practically the totality of patents granted in developing countries are foreign owned, and their main function is clearly not to encourage inventive activity (domestic or even world wide) but to assist the profit maximization of large transnational corporations."<sup>20</sup>

"Thus, a technological monopoly is transformed into an *institutional* one. *Viewed in this light the product cycle theory is seen as a theory of monopoly cycles.*"<sup>21</sup>

Edith Penrose tries to evaluate the patent system more fairly considering not only Vaitsos' view but some other arguments. She concludes that foreigners seeking patents in less-developed countries will not assist industrialization nor benefit local industry but will primarily enhance the monopoly position of the foreign patentees in the local market or as a means of transferring funds or facilitating restrictive practices. Since non-industrial countries have very few inventions worth patenting in developed countries, they cannot expect reciprocal advantages from granting patents to foreigners on inventions developed in those countries.<sup>22</sup>

Then, how should we revise the patent system so as to let genuine transfer of technology take place? This is certainly an important issue but not even Penrose could find any easy solution. To find a solution to this problem is not the aim of the present paper, however.

To conclude, the above observations have made clear two points. First, American transfer of technology and direct investment is different in all key respects from its Japanese

<sup>18</sup> *Ibid.*, pp. 79-80.

<sup>19</sup> *Ibid.*, pp. 80-83.

<sup>20</sup> *Ibid.*, pp. 77.

<sup>21</sup> Constantine Vaitsos, *Intercountry Income Distribution and Transnational Enterprises*, Clarendon Press, Oxford, 1974, p. 18.

<sup>22</sup> Edith Penrose, "International Patenting and the Less-Developed Countries," *Economic Journal*, September 1973, p. 783.



counterpart. Big American firms transfer technology and products which do not exist in developing countries or for which there is very a big technological gap between them. This might be called "reverse-order" transfer of technology. This type of technology transfer and direct investment heavily protected by the patent system, is motivated by monopolistic or oligopolistic behaviour. Secondly, reverse-order transfer results in no-transfer of technology whether it is undertaken through direct investment or through the unpackaged transfer of technology. There is no reason for developing countries to prefer the unpackaging to packaged transfer of technology.

#### IV. *Comparative Advantages in Improving Productivity*

In order to examine theoretically the two types of technology transfer which we have identified, it is best, first of all, to make clear whether the concern is with technology of different industries (products) or different production method in each industry.

Theoretically speaking, there can be a wide variety of effective techniques for the production of a particular product, but the choice of technique is limited, or it might be proper to say there is only one 'best' method of production. Once a product is chosen, the technique used in its production should be the one which is currently installed in the West.<sup>23</sup> A core part of the production process should be carried out by the latest machines, but in subsidiary parts of the production process there might be some room for modification to use more labour-intensive techniques. Countries which try to supply products of quality in world markets must follow global technological advances and install the newest method of production, otherwise their products will not be acceptable in world markets. Having very limited choice of production methods, developing countries should choose products which suit appropriately their factor proportions.

Therefore, we limit our concern to the choice of industry or product. Now, we have identified two types of technology transfer. Let us define each of them more exactly. When the transfer of technology in which the technological gap is smallest among all other industries between the two countries, this is called the "orderly transfer of technology." In contrast, when transfer of technology is undertaken for such industry in which the technological gap between providing and receiving countries is largest among all other industries, this is called "reverse-order transfer of technology."

In addition to these theoretical criteria, the former is called "Japanese-type transfer of technology" since it is typically found in Japanese direct foreign investment with which technology is transferred mainly through the training of labour and management and which is undertaken under free competition in usually labour-intensive, traditional industries. The latter is called "American-type transfer of technology" since it is predominantly found in American direct foreign investment which is undertaken as part of monopolistic or oligopolistic strategy in sophisticated, knowledge-intensive, and product-differentiated

<sup>23</sup> See, Frances Stewart, "Choice of Technique in Developing Countries," Charles Cooper, ed., *Science, Technology and Development*, *op. cit.*, p. 109. See also some empirical study by R. Hal Mason, *The Transfer of Technology and the Factor Proportions Problem: The Philippines and Mexico*, UNITAR Research Report, No. 10, 1970, and "Some Observations on the Choice of Technology by Multinational Firms in Developing Countries," *Review of Economics and Statistics*, August 1973.

industries and is not usually associated with transfer of any technology for it establishes an "enclave" and technology is protected by patents.

It is expected that the orderly transfer of technology is much easier than the other type, resulting in faster improvement in productivity and greater spill-over effects. That the technological gap is smallest means that there exists already in the recipient, developing economy some, though inefficient, competitive firms and some, though inferior, technological foundation. The transferred technology is easily learned, absorbed, diffused and even improved so as to suit better local conditions; labourers and managers are trained and local competitive firms are established. To realize these spread effects is the essence of the transfer of technology.

In contrast, when the technological gap is largest, as has already been mentioned, the transfer of technology is very difficult or impossible, resulting in the establishment of "enclaves," that is, mere out-stations of sophisticated technology in developing countries, because of their lower capital/labour endowments, the lack of complementary factors such as scientists, engineers, skilled labourers, and top managers who can command big enterprise, and market as well.

The difference between the two types of technology transfer is theoretically summarized as "the pursuit of comparative advantages in improving productivity." Certainly the orderly transfer of technology through direct investment is easier and much more beneficial to economic development in developing countries.

In practice, industries for which the technological gap between developed and developing countries is smallest is labour-intensive traditional manufacturing industry and these are the industries in which developing countries have comparative advantage, overt or potential. Thus, we come to examine the relationship between the technology transfer and trade.

I have elsewhere<sup>24</sup> identified two types of direct foreign investment. Direct foreign investment going from a comparatively disadvantageous industry in the investing country (which is a potentially comparative advantageous industry in the host country) will harmoniously promote an upgrading of industrial structure on both sides and thus accelerate trade between the two countries. This is "trade-oriented" or "Japanese-type" direct foreign investment. In comparison, American-type direct foreign investment goes from a comparative advantage industry in the investing country which produces most sophisticated, capital and/or knowledge intensive new products. This does not conform to the direction of trade which comparative costs suggest, and works in an anti-trade oriented fashion. But this type of direct foreign investment is pursued for the sake of monopolistic or oligopolistic profit maximization.

Now, it is usual, as we have assumed, that it is easier to transfer technology from labour-intensive and simple-technology industry such as textiles in which the investing country is losing or has lost comparative advantage and the host country has comparative advantage, overt or potential, because of the smallness of the technological gap, and consequent improvement in productivity than it is to transfer technology from capital- and/or knowledge-intensive industries such as steel and large scale computers. Foreign direct investment improves the production function of that specific industry in the host country

<sup>24</sup> Kiyoshi Kojima, "A Macroeconomic Approach to Foreign Direct Investment," *Hitotsubashi Journal of Economics*, June 1973.

through its spread effect as mentioned above, and leads to realization of potential cost advantage in the international market. This is the role of foreign direct investment as a "tutor."<sup>25</sup> This case satisfies harmoniously two criteria: comparative advantage in trade and in improving productivity, and no conflict between macro-economic point of view of international division of labour and micro-economic interests of individual direct-investors.

However, it is theoretically conceivable to have a case of conflict: while the investing country has comparative advantage in Y-industry, productivity in the host country increases in that industry through foreign direct investment much more than in the other industry, X. This type of investment should be restricted from the point of view of national economy both of investing and host countries since it destroys commodity trade, but it will be undertaken from individual firms' interests in so far as it is profitable. But, it seems to me that practically any such conflict may not be possible as far as comparative advantage in trade dominates the improving productivity criterion mentioned above, except that foreign direct investment, as in the case of the American type, is motivated by monopolistic or oligopolistic performance.

#### *V. The Role of Japanese-Type Technology Transfer Through Direct Investment*

The Japanese type transfer of technology through direct investment must be more beneficial than American type to steady and balanced economic development and trade growth of developing countries. Nevertheless, criticism against it is unavoidable. One comment is such that an orderly transfer of technology and thus an orderly establishment of industries in the developing country starting from the labour-intensive and with simple technology step-by-step wise capital-intensive end with more sophisticated technology may keep down the host country at lower and inferior stage of industrialisation compared with investing country. This may be true. And it is also true that developing countries desire to catch up with developed economy as fast as possible. However, developing countries should not ignore comparative costs and economic efficiency. Economic development along the line of comparative costs, to which Japanese type direct investment conforms, will ensure most steady and efficient economic development.

A second comment comes basically to the same point. Instead of labour-intensive industry with simple technology, more capital intensive industry with more sophisticated technology commands a greater income elasticity of demand, a better price and higher rewards to labour, and, therefore, fosters economic development faster. This may be true but this entirely neglects feasibility and economic efficiency. Without long experience of industrialization, accumulation of capital, technology and well-trained, high-quality manpower, it is impossible or involves huge costs to have those capital-intensive, sophisticated industries in many developing countries. Even if these industries are established in developing countries through the American type direct investment, it does not transfer technology, nor increase the income of local people, but monopolistic profits are absorbed by the parent firm. Moreover, those industries supply luxurious goods for the benefit of a

<sup>25</sup> See, Kiyoshi Kojima, "International Trade and Foreign Investment: Substitutes or Complements," *Hitotsubashi Journal of Economics*, June 1973, p. 7.

small number of wealthy people in the developing countries and no benefits are spread to ordinary mass of the people.

I would like to recommend a steady catching-up as the Japanese 100 year modernization has experienced, namely, a gradual upgrading and diversification in the order of industries from agriculture to light industries and then to heavy and chemical industries, and within each industry imports are substituted by domestic productions which grow later to be exportable through the learning process and economies of scale.<sup>26</sup> It takes a long time to accomplish the catching-up and it should be carefully fostered according to changes in comparative advantage which, in turn, depend upon the capital-labour endowment ratio or modernization of the entire national economy. But presently developing countries should not be too pessimistic for the future of their economies. If they continue a steady growth measured in terms of their own national income, instead of in comparison with the wealth and industrial structures of advanced countries, at certain stage, economic development will be accelerated and they will be able to specialize horizontally vis-à-vis advanced countries on equal footing. Moreover, the catching-up process is efficiently supplemented by foreign direct investment if it is properly used. Certainly the Japanese type or orderly transfer of technology through direct investment meets more properly this objective.

The main role of direct foreign investment is to transplant superior production technology through training of labour, management and marketing, from advanced industrial countries to lesser developed countries, or, in brief, it is the transfer of superior production function which replaces inferior ones in the host country. Foreign direct investment should be an initiator and a tutor of industrialization in less developed countries. The fact that a subsidiary or joint venture firm is established in a host country is only the beginning of national (or macro) economic effects, although in contrast with so-called "enclave" direct investment the establishment of a joint-venture alone is significant. Foreign direct investment gradually has an effect spread over the specific industry in the host country through the training of labourers, engineers and managers, and makes the establishment of competitive firms by local capital possible, ultimately improving the production function of the industry in general. When the process is completed, it can be said the new technology is really transferred and established in the host country.

Japanese-type transfer of technology through direct investment faces a dilemma, however.

(1) It plays the role of tutor very efficiently since it transfers technology and industries one after the other starting from the one where technological gap is smallest. This orderly transfer conforms to the comparative advantage of trade and accelerates orderly catching-up by the developing countries.

<sup>26</sup> This thought is based upon the late Professor Emeritus Kaname Akamatsu's "catching-up product cycle" and on this we need much further research. A number of studies have been published: Kiyoshi Kojima, "The Japanese Experience and Attitudes toward Trade Adjustment," World Bank Publication, *Prospects for Partnership: Industrialization and Trade Policies in the 1970s*, Johns Hopkins University Press, 1973. Christian Sautter, *Japon; Le Prix de la Puissance*, Editions due Seuil, 1973, pp. 233-51. William V. Rapp, "Theory of Changing Trade Patterns Under Economic Growth: Tested for Japan," *Yale Economic Essays*, Fall 1967, pp. 69-135. *Ditto*, "The Many Possible Extensions of Product Cycle Analysis," *Hitotsubashi Journal of Economics*, June 1975, pp. 22-29. Ippei Yamazawa, "Industry Growth and Foreign Trade—A Study of Japan's Steel Industry," *Hitotsubashi Journal of Economics*, February 1972, pp. 41-59. *Ditto*, "Industrial Growth of Trade Policy in Prewar Japan," *The Developing Economies*, March 1975, pp. 38-65.

(2) Since its transfer of technology mainly consists of the training of labourers and managers, it is not successful without the cooperation of people in the host country and, therefore, joint ventures, instead of wholly-owned subsidiaries, are more successful.

(3) The objective of Japanese direct investment is well-standardized products which are not privileged with sophisticated technology. That kind of technology is available for the host country not only from a specific source but from many firms in advanced countries. Therefore, Japanese-type direct investment is undertaken in a free competitive fashion and sometimes results in excessive competition and over-presence in certain host country markets.

(4) It is easier for Japanese type direct investment than for other types to complete its role of "tutor." In other words, the host country is able to imitate and master the technology and to establish its own competitive firms within a fairly short period. Then the host country feels the presence of Japanese direct investment is not only of no need but also harmful. The more successfully Japanese direct investment plays its role as a tutor, the more rapidly it becomes unwelcome.

Accordingly, a fade-out, that is, a gradual transfer of ownership and control of management within certain period, say 20-30 years, is inevitable for the Japanese type direct investment when it finishes successfully its role. The fade-out should be considered if the Japanese type direct investment is faithful to its role as a tutor and promoter of orderly industrialization in developing countries. It is important, however, to set out a reasonable international code to encourage fade-out. Japanese firms may have to fade out from one country where they have finished their role but there will remain plenty of opportunity to move to other areas where they are welcome. Moreover, even after fading out of a country, a new comparatively advantageous industry which encourages more profitable and prosperous trade between the host country and the rest of the world will have been created.

It is a debatable question whether fade-out or divestment, not particularly of Japanese-type investment but in general, is justified. It seems justifiable to me, although this conclusion runs against capitalistic development. Labourers, the majority of people of a nation, are not allowed to move freely to foreign countries, and, therefore, economic development and welfare have to be considered within the framework of a national economy and an international division of labour. Under such circumstances, it is rather unfair that only enterprises are allowed to move freely to foreign countries and assured permanent ownership. The right of patents is limited for 15-20 years; even a leased territory is limited in period. The worse case of foreign ownership is surely where direct foreign investment ensures a permanent source of monopolistic or oligopolistic profits as in the case of American-type investment.

American-type direct investment is undertaken for quite different reasons from Japanese-type investment. American firms, particularly giant multi-national corporations, invest abroad as part of a global strategy in order to maximise monopolistic or oligopolistic profits. Therefore, they prefer wholly-owned subsidiaries, that is, an enclave, protecting technological monopoly by patents, and prevent technology transfer and spread effects.

Recently, developing countries have requested strongly an unpackaged transfer of technology which transmits technology alone, instead of a packaged transfer of technology,

capital and managerial knowledge in the form of direct foreign investment.<sup>27</sup> It seems to me that an unpackaged transfer of technology is neither efficient, economical nor feasible. Whether it is a packaged or unpacked transfer of technology is not the most important, but which type of direct foreign investment a developing country chooses is crucial. If developing countries welcome American-type technology, whether with in direct investment or unpackaged, the result is "no transfer" of technology. If they welcome Japanese-type direct investment and if it is accompanied with fade-out agreements, through that direct investment technology is transferred more efficiently and economically and there is no reason for the developing countries to prefer the unpackaged transfer of technology.

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<sup>27</sup> See, for example, UNCTAD, *Guidelines for the Study of the Transfer of Technology to Developing Countries*, United Nations, New York, 1972. Jack Baranson, "Technology Transfer through the International Firm," *American Economic Review*, May 1970. Kiyoshi Kojima and Miguel S. Wionczek, ed., *Technology Transfer in Pacific Economic Development*, Japan Economic Research Center, January 1975. Kiyoshi Kojima, ed., *Technologies for Accelerated Economic Growth: Transfer and Selection Process*, Institute of Developing Economies, Tokyo, March 1975.