THE PRODUCT CYCLE HYPOTHESIS IN A NEW INTERNATIONAL ENVIRONMENT

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The last decade has produced a flowering of hypotheses that purport to explain the international trade and direct investment activities of firms in terms of the so-called product cycle. My purpose in this paper is to suggest that the power of such hypotheses has been changing. Two reasons account for that change: one, an increase in the geographical reach of many of the enterprises that are involved in the introduction of new products, a consequence of their having established many overseas subsidiaries; the other, a change in the national markets of the advanced industrialized countries, which has reduced some of the differences that had previously existed between such markets.

A Word on Theory

The fact that new products constantly appear, then mature, and eventually die has always fitted awkwardly into the mainstream theories of international trade and international investment. Hume, Ricardo, Marshall, Ohlin, Williams, and others have observed the phenomenon in passing, without attempting any rigorous formulation of its implications for international trade and investment theory. In the past decade or two, however, numerous efforts have been made to fill the gap. Some have dealt mainly with the trade aspects of the phenomenon.[1] But some have pushed beyond the immediate trade effects, tracing out a pattern that eventually culminated in foreign direct investments on the part of the innovating firm.[2]

According to the product cycle hypothesis, firms that set up foreign producing facilities characteristically do so in reliance on some real or imagined monopolistic advantage. In the absence of such a perceived advantage, firms are loath to take

* David Felix, Seev Hirsch, Sanjaya Lall, L. T. Wells, Jr. and L. H. Wortzel reacted critically to various points in an earlier draft, a fact that led to some significant revisions.

[1] For instance, M. V. Posner, 'International Trade and Technical Change', *Oxford Economic Papers*, October 1961, pp. 323–341; Gary Hufbauer, *Synthetic Materials and the Theory of International Trade* (Cambridge: Harvard University Press, 1966); Seev Hirsch, 'The Product Cycle Model of International Trade—A Multi-Country Cross Section Analysis', *Oxford Bulletin of Economics and Statistics*, November 1975, vol. 37, no. 4, pp. 305–317; W. B. Walker, 'Industrial Innovation and International Trading Performance', mimeo. Science Policy Research Unit, Sussex University, October 30, 1975; and M. P. Claudon, *International Trade and Technology: Models of Dynamic Comparative Advantages* (Washington, D.C.: University Press of America, 1977).

[2] S. H. Hymer, *The International Operations of National Firms* (Cambridge: MIT Press, 1976) based on the author's 1960 Ph.D. thesis; Raymond Vernon, 'International Investment and International Trade in the Product Cycle', *Quarterly Journal of Economics*, May 1966, pp. 190–207; W. H. Gruber and others, 'The R & D Factor in International Investment of US Industries', *Journal of Political Economy*, February 1967, pp. 20–37; Thomas Horst, 'The Firm and Industry Determinants of the Decision to Invest Abroad: An Empirical Study', *Review of Economics and Statistics*, vol. 54, August 1972, pp. 258–66; S. P. Magee, 'Multinational Corporations, The Industry Technology Cycle and Development', *Journal of World Trade Law*, vol. 11, no. 4, July–August 1977, pp. 297–321; P. J. Buckley and Mark Casson, *The Future of the Multinational Enterprise* (New York: Holmes and Meier, 1976); Paul Krugman, 'A Model of Innovation, Technology Transfer, and The World Distribution of Income', *Journal of Political Economy*, April 1979, pp. 253–266.

on the special costs and uncertainties of operating a subsidiary in a foreign environment.[3] One such special strength is an innovational lead.

The product cycle hypothesis begins with the assumption that the stimulus to innovation is typically provided by some threat or promise in the market.[4] But according to the hypothesis, firms are acutely myopic; their managers tend to be stimulated by the needs and opportunities of the market closest at hand, the home market.

The home market in fact plays a dual role in the hypothesis. Not only is it the source of stimulus for the innovating firm; it is also the preferred location for the actual development of the innovation. The first factor that has pushed innovating firms to do their development work in the home market has been simply the need for engineers and scientists with the requisite skills. That requirement, when gauged through the eyes of the typical innovating form, has tended to rule out sites in most developing countries and has narrowed the choice to some site in the advanced industrialized world. As between such advanced country sites, the home market has generally prevailed.[5] Locating in the home market, engineers and scientists can interact easily with the prospective customers whose needs they hope to satisfy, and can check constantly with (or be checked by) the specialists at headquarters who are concerned with financial and production planning.

The propensity to cluster in the home market is fortified by the fact that there are some well-recognized economies to be captured by an innovating team that is brought together at a common location.[6] These include the usual advantages that go with subdividing any task among a number of specialists, and the added advantages of maintaining efficiency of communication among the research specialists.[7]

The upshot is that the innovations of firms headquartered in some given market tend to reflect the characteristics of that market. Historically, therefore, US firms have developed and produced products that were labour-saving or responded to high-income wants; continental European firms, products and processes that were material-saving and capital-saving; and Japanese firms, products that conserved not only material and capital but also space.[8]

[3] That is a central proposition of the S. H. Hymer work, cited earlier. See also my 'The Location of Economic Activity', in J. H. Dunning, *Economic Analysis and the Multinational Enterprise* (London: George Allen and Unwin, 1970), pp. 83–114.

[4] Various empirical studies demonstrate that innovations which do not arise out of a market stimulus—innovations, for instance, that are dreamed up by the laboratory as a clever application of some new scientific capability—have a relatively low chance of industrial success. See for instance Sumner Myers and Donald Marquis, *Successful Industrial Innovations*, National Science Foundation Report No. 69–17, G.P.O., Washington, 1969, p. 31.

[5] For econometric evidence of the tie between the choice of a production location, skills and innovation, see Sanjaya Lall, 'Monopolistic Advantages and Foreign Involvement by U.S. Manufacturing Industry', *Oxford Economic Papers*, forthcoming, March 1980.

[6] For evidence of such clustering, see D. B. Creamer, *Overseas Research and Development by United States Multinationals, 1966–1975* (New York: The Conference Board, 1976); Robert Ronstadt, *Research and Development Abroad by U.S. Multinationals* (New York: Praeger Publishers, 1977); and Vernon, *Storm Over the Multinationals*, pp. 43–45.

[7] See especially T. J. Allen, *Managing the Flow of Technology* (Cambridge: MIT Press, 1978). An important exception is pharmaceuticals, a case in which US regulation has driven the innovation process abroad. See e.g. H. G. Grabowski and J. M. Vernon, 'Innovation and Invention: Consumer Protection Regulation in Ethical Drugs', *American Economic Review*, vol. 67, no. 1, 1977, pp. 359–364.

[8] For evidence, see W. H. Davidson, 'Patterns of Factor-Saving Innovation in the Industrialized World', *European Economic Review*, No. 8, 1976, pp. 207–217.

If innovating firms tend to scan their home markets with special intensity, the chances are greatly increased that their first production facilities will also be located in the home market. In many cases, the transitions from development work to pilot plant operation to first commercial production take place in imperceptible steps. But other factors also figure in the choice. One is the fact that if the firm perceives its principal market as being at home, it may prefer a home location to minimize transport costs. The second factor is that the specifications for new products and the optimal methods for manufacturing such products are typically in flux for some time; hence, fixing the optimal location of the first production site is bound to be an exercise based on guesswork. A final factor that may explain the tendency to produce at home is the characteristic inelasticity in the demand of the earliest users of many new products. That inelasticity is thought to make the innovator relatively indifferent to questions of production cost at the time of introduction of a new product.

Once the innovator has set up its first production unit in the home market, any demand that may develop in a foreign market would ordinarily be served from the existing production unit. Eventually, however, the firm may consider other alternatives, such as that of licensing a foreign producer or of setting up its own producing subsidiary abroad. For new products, the licensing alternative may prove an inferior choice because of inefficiencies in the international market for technology.[9] If licensing is not the preferred choice, then the firm makes the usual familiar comparison between the delivered cost of exports and the cost of overseas production. That is, the marginal costs of producing for export in the home unit plus international transport costs and duties are compared with the full cost of producing the required amount in a foreign subsidiary.

Although not essential to the product cycle hypothesis, it is commonly assumed that a triggering event is likely to be required before the producer will seriously make the calculations that could lead to the creation of a foreign producing facility. The triggering event ordinarily occurs when the innovator is threatened with losing its monopoly position. In the usual case, rival producers appear, prepared to manufacture the product from locations that could undersell the original innovator.

The obvious question is why the original innovator was not already aware that the costs of production might be lower abroad. Part of the answer may lie in the indeterminateness of the threat before it has actually materialized: the difficulty of deciding what is at stake in failing to find the least-cost location, what alternative sites need to be investigated, and what the costs of investigation are likely to be.

These conditions change, however, as the threat begins to crystallize. Eventually, it may be clear that the innovator is threatened with the loss of its

[9] See Buckley and Casson, pp. 36–45, 68–69. Their observations are strengthened by data presented in Raymond Vernon and W. H. Davidson, 'Foreign Production of Technology-Intensive Products by U.S.-Based Multinational Enterprises', Working Paper 79–5, Harvard Business School, 1979, xeroxed, p. 66. These data show that in establishing a source of foreign production for 221 innovations, 32 large US-based multinational enterprises elected the subsidiary route far more frequently than licensing, but the degree of preference declined as the innovation aged. For similar conclusions relating to petrochemicals, see R. B. Stobaugh, 'The Product Life Cycle, U.S. Exports, and International Investment', unpublished D.B.A. thesis, Harvard Business School, 1968.

business in a given foreign market. At that point, the areas to be investigated as possible production sites have been narrowed while the size of the risk has been more explicitly defined. Accordingly, the decision whether to invest in added information is more readily made. Once having felt compelled to focus on the issue, the innovator will decide in some cases to set up a local producing unit in order to prolong some of the advantages that were created by its original monopoly.

Two Critical Changes

The networks' spread. For the past three decades or so, the process of innovation, export, and investment has been progressing full tilt. One result has been a transformation in the industries in which innovations tend to be especially prominent, such as chemicals, electronics, machinery, and transportation equipment. In industries such as these, innovating firms that are limited to their own home markets no longer are very common. Instead, enterprises with highly developed multinational networks of producing units typically account for more than half the global output in their respective product lines.

In spreading their networks of subsidiaries around the world, multinational companies have followed some reasonably well-defined patterns. These patterns offer some strong clues regarding the changing perceptions of the enterprises and their likely lines of future behaviour.

First, a word on the extent of the spread itself. Table 1 compares the scope of

TABLE 1

Networks of Foreign Manufacturing Subsidiaries of 315 Multinational Companies 1950 and 1970s

Number of enterprises with networks including	*180 US-based MNCs*		*135 MNCs based in UK and Europe*	
	1950	*1975*	*1950*	*1970*
Fewer than 6 countries	138	9	116	31
6 to 20 countries	43	128	16	75
More than 20 countries	0	44	3	29

Source: Harvard Multinational Enterprise Project.

the overseas subsidiary networks of a group of the world's largest firms in 1950 with the networks of those same firms in the 1970s. The dramatic increase in the overseas networks of such firms is apparent.

Detailed data have been developed for the 180 US firms in the group, indicating more exactly how the overseas spread took place.[10] According to these data, the overseas spread of the firms in our sample was consistent and stable throughout the three decades following World War II. Firms typically set up their subsidiaries, product lines, and new products in a sequence that began with the geographical areas with which they were most familiar, such as Canada and the United Kingdom, and eventually spread to those that had originally been least familiar, such as Asia and Africa. As time went on, however, the unfamiliar became less so, and the

[10] The data on which the next few paragraphs are based are presented in detail in Raymond Vernon and W. H. Davidson, 'Foreign Production of Technology-Intensive Products by U.S.-Based Multinational Enterprises', cited earlier.

disposition to move first into the traditional areas visibly declined. To illustrate: For product lines introduced abroad by the 180 firms before 1946, the probability that a Canadian location would come earlier than an Asian location was 79 percent; but for product lines that were introduced abroad after 1960, the probability that Canada would take precedence over Asia had dropped to only 59 percent.

The consequences of this steady shift in preferences could be seen in a corresponding shift in the geographical distribution of the foreign subsidiaries of the 180 firms. Before 1946, about 23 percent of the subsidiaries had been located in Canada; but by 1975, the proportion was about 13 percent, with the offsetting gains being recorded principally in Asia, Africa, and the Middle East.[11]

With numerous indications that US firms were feeling at ease over a wider portion of the earth's surface, it comes as no surprise that the interval of time between the introduction of any new product in the United States and its first production in a foreign location has been rapidly shrinking. Table 2 portrays the time lapse between the introduction of 954 products in the United States and their first overseas production via the manufacturing subsidiaries of the introducing firm.

The data also suggest in various ways that the trends just discussed have been strongly self-reinforcing. For instance, firms that had experienced a considerable number of prior transfers to their foreign producing subsidiaries were quite consistently quicker off the mark with any new product than were firms with fewer

TABLE 2

Spread of Production of 954 New Products by 57 US-Based MNCs to their Foreign Manufacturing Subsidiaries, Classified by Period when initially introduced in the United States

Period when introduced in US	*Number of products*	*Percentage transferred abroad, by number of years between US introduction and initial transfer*	
		within 1 year after	*within 2–3 years after*
		%	%
1945	56	10.7	8.9
1946–1950	149	8.1	10.1
1951–1955	147	7.5	10.2
1956–1960	180	13.3	17.8
1961–1965	165	22.4	17.0
1966–1970	158	29.7	15.8
1971–1975	99	35.4	16.2
Total	954	18.0	14.0

Source: Vernon and Davidson, cited in text.

prior transfers. Besides, as firms introduced one product after another into a given country, the lapse of time between the introduction of successive products in that country steadily declined.

All told, therefore, the picture is one of an organic change in the overseas networks of large US-based firms. The rate of spread of these networks, whether measured by subsidiaries or by product lines, is slightly lower in the first half of the

[11] Some measures employed in the Vernon–Davidson study—counts based on 954 individual products rather than on subsidiaries or product lines—show Latin America also increasing its relative share. See Table 17, p. 52 of the report.

1970's than in the latter half of the 1960's; but the spread persists at rates that are rapid by historical standards. Besides, the changes in the rate of spread, according to various econometric tests, seem quite impervious to changes in exchange rates or in price-adjusted exchange rates;[12] so it seems reasonable to assume that we confront a basic change in the institutional structure of the MNCs concerned.[13]

The environmental changes. In the period after World War II, the descriptive power of the product cycle hypothesis, at least as it applied to US-based enterprises, had been enhanced by some special factors. In the early part of the post-war period, the US economy was the repository of a storehouse of innovations not yet exploited abroad, innovations that responded to the labour-scarce high-income conditions of the US market. As the years went on, other countries eventually achieved the income levels and acquired the relative labour costs that had prevailed earlier in the United States. As these countries tracked the terrain already traversed by the US economy, they developed an increasing demand for the products that had previously been generated in response to US needs. That circumstance provided the consequences characteristically associated with the product cycle sequence: exports from the United States in mounting volume, followed eventually by the establishment of foreign producing subsidiaries on the part of the erstwhile US exporters.

But many of the advanced industrialized countries that were tracking over the US terrain were doing something more: They were closing in on the United States, narrowing or obliterating the income gap that had existed in the immediate postwar period. In 1949, for instance, the per capita income of Germany and of France was less than one-third that of the United States; but by the latter 1970's, the per capita income of all three countries was practically equal. In the same interval, Japan increased its per capita income from 6 percent of the US level to nearly 70 percent of that level. That shrinkage, of course, weakened a critical assumption of the product cycle hypothesis, namely, that the entrepreneurs of large enterprises confronted markedly different conditions in their respective home markets. As European and Japanese incomes approached those of the United States, these differences were reduced. And as the United States came to rely increasingly on imported raw materials, the differences in the factor costs of the various markets declined further still.

Not only have the differences in income levels among these major markets been shrinking; the differences in their overall dimensions also have declined. This has been due partly to the convergence of such income levels, but partly also to the development of the European Economic Community. As a result, entrepreneurs with their home base in these different markets confront conditions that are much more similar than they had been in the past.

Some of the starting assumptions of the product cycle hypothesis therefore are clearly in question. It is no longer easy to assume that innovating firms are

[12] Vernon and Davidson, pp. 19–20.

[13] Although the data for testing the assumption are not at hand, I have assumed that parallel changes are occurring in European and Japanese firms.

uninformed about conditions in foreign markets, whether in other advanced countries or in the developing world. Nor can it be assumed that US firms are exposed to a very different home environment from European and Japanese firms; although the gap between most of the developing countries and the advanced industrialized countries palpably remains, the differences among the advanced industrialized countries are reduced to trivial dimensions. With some key assumptions of the product cycle hypothesis in doubt, what organizing concepts are still available by which one can observe and assess the role of innovation in the operations of the multinational enterprises of different countries?

The Global Network in Operation

To try to answer the question, I have classified multinational companies crudely into three ideal types, and have sought to explore their likely behaviour.

The first type is purely hypothetical, a result of armchair speculation. Picture an MNC with an innovating capability that has developed a powerful capacity for global scanning. Communication is virtually costless between any two points of the globe; information, once received, is digested and interpreted at little or no cost. Ignorance or uncertainty, therefore, is no longer a function of distance; markets, wherever located, have an equal opportunity to stimulate the firm to innovation and production; and factory sites, wherever located, have an equal chance to be weighed for their costs and risks. But some significant economies of scale continue to exist in the development activities as well as in the production activities of the firm.

An enterprise of this sort, we can presume, will from time to time develop an innovation in response to the promise or threat of one of the many markets to which it was exposed. The firm might launch the innovative process in the market that had produced the stimulus; or, if economies of scale were important and an appropriate facility existed elsewhere in the system, in a location well removed from the prospective market. In either case, once the innovation was developed, the global scanner would be in a position to serve any market in which it was aware that demand existed; and would be in a position to detect and serve new demands in other markets as they subsequently arose. Presumably such demands would grow in other countries as they attained the income levels or the factor cost configurations of the country whose needs had first stimulated the invention. For some products, such as consumer goods, the demand in different national markets could be expected to appear in a predictable pecking order, based largely on income levels and labour costs.

The global scanner, therefore, would be in an advantageous position as compared with those firms without such a scanning capability. Firms that were confined to a country which was down the ladder in the pecking order, including most firms headquartered in the developing countries, would be at a disadvantage in relation to the global scanner. As the incomes of their home countries grew, the nonglobal producers might well perceive the opportunity to fill a growing demand; but they would be handicapped by comparison with the enterprises that were already producing in the higher income countries, including the global scanners.

In a world composed of such firms, the product cycle hypothesis would play only a very little role. Although innovating firms might prefer locations in one of the advanced industrialized countries due to the supply of engineers and scientists, the preference for a location in the home market would be weaker. The exports generated by the innovations might come from the country in which the product had initially been introduced; but then again they might not. Whatever the original source of the exports might be, the hold of the exporting country would be tenuous, as the global scanner continuously recalculated the parameters that determined the optimal production location.

The hypothetical global scanner, of course, is not to be found in the real world. The acquisition of information is seldom altogether costless; and the digestion and interpretation of information always entails cost. The typical patterns of behaviour that one observes in the real world reflect that fact.

One typical pattern, which provides the basis for a second model, consists of firms that develop and produce a line of standardized products which they think responds to a homogeneous world demand rather than to the distinctive needs of individual markets. Some firms have been able to take this approach from the very first, because of the nature of their products; the oil, chemical, and crude metals industries, for instance, were always in a position to develop and purvey a standardized line of products to world markets. But the trend has been moving beyond such products to well-elaborated manufactures: to aircraft, computers, pharmaceuticals, and automobiles, for instance. The trends of the automobile industry in that direction are particularly striking.[14]

By standardizing their product on a world basis, firms can hope for two kinds of benefit: they can reduce or avoid the costs of processing and interpreting the information that bears on the distinctive needs of individual markets; and they can capture the scale economies of production and marketing on a global scale. Whether those advantages outweigh the disadvantages of being unresponsive to the needs of individual markets is an empirical question the answer to which may well vary by product lines and other factors; those firms that decide in the affirmative for some or all of their product lines cannot be said to be engaged in an irrational response.

Firms in this category, innovating for a global market, are obliged to play their innovational gambles for relatively heavy stakes. Accordingly, they can be expected to maintain the central core of their innovational activities close to headquarters, where complex face-to-face consultation among key personnel will be possible; in this respect, such firms are likely to perform consistently with the product cycle pattern. To be sure, with increased ease of communication and transportation, various routine aspects of the development work, not involving the most critical choices in the development process, can be spun off to more distant

[14] See A. J. Harman, 'Innovations, Technology, and the Pure Theory of International Trade', unpublished Ph.D. thesis, MIT, September 1968, pp. 131–134; J. M. Callahan, 'GM Adopting Worldwide Purchasing Coordination', *Chilton's Automotive Industries*, July 1978, pp. 47–49; 'Ford's Fiesta Makes a Big Splash', *Business Week*, August 22, 1977, pp. 38–39; and 'SKF Reintegrates Internationally', *Multinational Business*, The Economist Intelligence Unit, No. 4, 1976, pp. 1–7.

locations. To reduce their development costs and to respond to the pressures of various governments in whose territories they hope to do business, firms in this category are commonly prepared to establish some carefully selected development activities at distant points; but integration at the centre is still needed.[15]

Firms in this category also have a strong need to integrate their global production facilities. Seeking to exploit scale economies, they are likely to establish various component plants in both advanced industrialized countries and developing countries, and to crosshaul between plants for the assembly of final products. That pattern will be at variance with product cycle expectations.

It need not be anticipated, however, that all firms with a capacity for global scanning will commit themselves unequivocally to the development of standard global products such as the IBM 370, the Boeing 757, or the GM world car. General Motors, after all, continues to respond to certain distinctive national characteristics in some of its product lines, in spite of its commitment to a world sourcing strategy. Other automobile firms, including Renault and Chrysler, seem prepared to respond to national factors for even a larger proportion of their output, foregoing the advantages of a world product and long production runs. In computers, a number of IBM's rivals survive by their willingness and ability to adapt to the requirements of local markets, including the requirements of national governments, to a degree that would be incompatible with the standardization of their products and the global rationalization of their facilities.[16] Many European and Japanese firms still find it useful to treat the US market as a distinctive entity, justifying distinctive products and strategies.[17]

Accordingly, we can picture firms that make different decisions on the benefits of global optimization, according to the characteristics of each product line. And we can picture markets in which different firms have settled on somewhat different strategies for closely competing products. If past history is any guide, such differences can persist in a given product market over extended periods of time.[18]

A third type of innovating MNC that merits some speculative consideration is the firm whose choices of innovations and production sites remain myopically oriented to the home market while leaving all analysis of foreign markets to its individual foreign producing subsidiaries. Firms in this category simply put out their home-based innovations for production by their foreign subsidiaries; or, perhaps even more commonly, such firms allow the initiative for such decisions to

[15] Compare the observations of Sanjaya Lall, 'The International Allocation of Research Activity by U.S. Multinationals', in this issue.

[16] This point is being developed in detail by Yves Doz at the Harvard Business School.

[17] For evidence on Japanese firms in this category, see Terutomo Ozawa, *Japan's Technological Challenge to the West, 1950–1974* (Cambridge: MIT Press, 1974), pp. 97–98.

[18] This proposition is of course consistent with the theory of strategic groups; see R. E. Caves and M. E. Porter, 'From Entry Barriers to Mobility Barriers: Conjectural Decisions and Contrived Deterrence to New Competition', *Quarterly Journal of Economics*, vol. XCI, no. 2, 1977, pp. 241–261. It is consistent also with the long established observation that different geographical locations offer different combinations of benefits and costs such that widely separated locations applying different production techniques may be competitive for sustained periods. See Max Hall, *Made in New York* (Cambridge: Harvard University Press, 1959).

come from the subsidiaries themselves.[19] Drawing from a shopping list of products generated by the headquarters unit, subsidiaries choose those that seem appropriate for intensive exploitation in their local markets. As long as the proposed production in the subsidiary seems to have no considerable impact on the facilities of the firm located in other countries, the managers at headquarters are disposed to give the local managers their head.

Firms that pursue a policy of this sort can justify their approach readily enough: One possibility is that the firm perceives the cost of interpreting the information needed for pursuing a more centralized policy in production and marketing as exceeding the likely benefits. Another possibility is that the firm has found it impossible to fashion an organization that has the capability for absorbing and being influenced by signals that originate in the subsidiaries.[20]

Where this pattern of operation exists, the hypothesized behaviour of the product cycle may still be visible. But the phase of the product cycle in which the parent is responsible for serving foreign markets will be foreshortened and the oligopolistic strength of the innovating firm will be relatively weak, given the existence of firms in other markets that face similar demands and factor cost conditions.

Cases in this category will of course deviate from the pattern that a global scanner would generate. First, as long as the subsidiary is the initiator, the geographical spread of products will be affected by the risk-taking propensities and drives of individual subsidiary managers and by the resource slack of individual subsidiaries rather than by a consistent set of decision rules and allocations from the centre.[21] Second, in cases in which the initiative for transfer comes from the subsidiary rather than the parent, the possibility of producing in some third country where neither the parent nor the subsidiary is located is unlikely to be considered.

All this leads to a simple conclusion. As we search for a hypothesis that would replace the product cycle concept as an explicator of the trading and investing behaviour of the innovating multinational company, a simple variant such as that of the global scanner will not take us very far. Global scanning is not costless, even when a network of foreign subsidiaries is already in place; costs of collecting and interpreting the information, as the firm perceives those costs, may not be commensurate with its expected benefits. In assessing the benefits, flexibility may be a problem: either the flexibility that firms have lost from decisions in the past, or the flexibility they are fearful of losing in an uncertain future.

[19] For illustrations, see 'IBM World Trade Corporation' and 'YKK (Yoshida Kogyo KK)', both in Stanley M. Davis, *Managing and Organizing Multinational Corporations* (New York: Pergamon Press, 1979). Also, from Intercollegiate Case Clearing House, see *Corning Glass Works (A), (B), and (C)* (numbers 9–477–024, 9–477–073, and 9–477–074); *International Calculators (Australia) Pty. Limited* (9–572–641); *Veedol France* (ICH 10 M 31); *The International Harvester Company (B)* (9–512–009); *Princess Housewares Gmb H (A)* (ICH 13 M 117); *General Foods Corporation—International Division (D2)* (ICH 13 G 214); *AB Thorsten (A)* (9–414–035); and *Sanpix Industries* (9–278–673).

[20] For indications of the formidable difficulties associated with developing such an organizational capability, see Allen, *Managing the Flow of Technology, op. cit.*

[21] This, of course, is a familiar phenomenon, long observed by business historians and organizational behaviourists. More recently the concept has been elevated to the status of theory in Harvey Leibenstein's formulation of his X-inefficiency concept; see his *Beyond Economic Man: A New Foundation for Microeconomics* (Cambridge: Harvard University Press, 1976).

So the day of the global scanner as I defined it a few pages back is not yet here. Nevertheless, even if the global scanner is not yet the dominant model, nor perhaps ever will be, the power of the product cycle hypothesis is certainly weakened.

The Product Cycle Reconsidered

The evidence is fairly persuasive that the product cycle hypothesis had strong predictive power in the first two or three decades after World War II, especially in explaining the composition of US trade and in projecting the likely patterns of foreign direct investment by US firms. But certain conditions of that period are gone. For one thing, the leading MNCs have now developed global networks of subsidiaries; for another, the US market is no longer unique among national markets either in size or factor cost configuration. It seems plausible to assume that the product cycle will be less useful in explaining the relationship of the US economy to other advanced industrialized countries, and will lose some of its power in explaining the relationship of advanced industrialized countries to developing countries. But strong traces of the sequence are likely to remain.[22]

One such trace is likely to be provided by the innovating activities of smaller firms, firms that have not yet acquired a capacity for global scanning through a network of foreign manufacturing subsidiaries already in place. The assumptions of the product cycle hypothesis may still apply to such firms, as they move from home-based innovation to the possibility of exports and ultimately of overseas investment.

Moreover, even firms with a well-developed scanning capability and a willingness to use it may be found behaving according to the expectations of the product cycle hypothesis. As noted earlier, the specifications of new products are usually in such a state of flux that it is infeasible for a time to fix on a least-cost location. Some firms therefore are unlikely to make intensive use of their scanning capability when siting their first production facility. To be sure, such innovators cannot expect to retain their innovational lead for very long, in view of the fact that the innovators of many countries now confront such similar home conditions. But a shadow of the hypothesized behaviour may well remain.

Moreover, the product cycle may gain some support as a predictive device from other developments.

One such development is the improved position of European and Japanese firms as innovators. As noted earlier, the innovations of these firms, when compared with those of US firms, have tended to place greater emphasis on material-saving and capital-saving objectives, while placing lesser relative emphasis on labour-saving measures and on new mass consumer wants. The costs of materials and capital have risen rapidly over the past few years, both in relative and absolute terms. Accordingly, it may be that the long-time emphasis of the

[22] But see I. H. Giddy, 'The Demise of the Product Cycle Model in International Business Theory', *Columbia Journal of World Business*, vol. xiii, no. 1, Spring 1978, pp. 90–97.

Europeans and Japanese firms will generate an increasing demand for their innovations. The world's increased use of European and Japanese small-car technology and of Japanese steel technology are cases in point, fitting nicely within the structure of the product cycle hypothesis.

However, the product cycle hypothesis would also predict that the European-Japanese advantage on this front will only be temporary. As US firms confront factor-cost conditions in their home market that are similar to those of Europe and Japan, one would expect a stream of innovations from the Americans similar to those of their overseas competitors; General Motors, for instance, is now seen as a potential threat to European and Japanese car makers for the 1980's.

A less equivocal case for the continued usefulness of the product cycle concept is found in analysing the situation of the less-developed countries. Although income, market size, and factor cost patterns have converged among the more advanced industrialized countries, a wide gap still separates such countries from many developing areas. Accordingly, despite the fact that so many MNCs have created producing networks all over the globe, the subsidiaries of such firms located in the developing countries have yet to acquire all of the products that their parents and affiliates produce in richer and larger markets. Most of the developing countries, therefore, are still in process of absorbing the innovations of other countries introduced earlier, according to patterns that remain reasonably consistent with product cycle expectations.

The performance of firms in some developing countries, moreover, follows the expectations of the product cycle in a very different sense. Firms operating in the more rapidly industrializing group—in countries such as Mexico, Brazil, India, and Korea—are demonstrating a considerable capability for producing innovations that respond to the special conditions of their own economies.[23] Once having responded to those special conditions with a new product or process or with a significant adaptation of an existing product or process, firms of that sort are in a position to initiate their own cycle of exportation and eventual direct investment; their target, according to the hypothesis, would be the markets of the other developing countries that were lagging a bit behind them in the industrialized pecking order.

Indications that some such process was going on in a limited way in the developing countries were already being reported in the 1960's in occasional illustrations and anecdotal materials; but those early cases for the most part involved the subsidiaries of multinational enterprises, which were making modest adaptations of products and processes originally received from the foreign

[23] See, for example, Julio Fidel, et al., 'The Argentine Cigarette Industry: Technological Profile and Behavior', IDB/ECLA Research Programme in Science and Technology, Buenos Aires, September 1978, pp. 92–94; C. J. Dahlman, 'From Technological Dependence to Technological Development: The Case of the USIMINAS Steel Plant in Brazil', IDB/ECLA Research Programme in Science and Technology, Buenos Aires, October 1978; and Jorge Katz *et al.*, 'Productivity, Technology and Domestic Efforts in Research and Development', IDB/ECLA Research Programme in Science and Technology, Buenos Aires, July 1978. For evidence of the increasing capacity of some developing countries to sell plants and engineering services, see Sanjaya Lall, 'Developing Countries as Exporters of Industrial Technology', *Research Policy*, forthcoming, vol. 9, no. 1, January 1980.

parents.[24] Innovations such as these sometimes gave the subsidiaries a basis for exporting more effectively to neighbouring countries that were lower on the development scale.

In the 1970's, however, the anecdotal materials began to involve firms that were headquartered in developing countries.[25] Firms were reported developing products and processes of special importance to other developing countries, to be followed eventually by the creation of producing subsidiaries in those countries.[26] Of course, the direct investments of the firms of developing countries in other developing countries have not all been of the product cycle variety. The foreign subsidiaries of firms headquartered in developing countries often maintain their position through oligopolistic strengths other than a technological lead.[27]

Accordingly, the product cycle concept continues to explain and predict a certain category of foreign direct investments. Although it no longer can be relied on to provide as powerful an explanation of the behaviour of US firms as in decades past, it is likely to continue to provide a guide to the motivations and response of some enterprises in all countries of the world.

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[24] W. A. Yeoman, 'Selection of Production Processes for the Manufacturing Subsidiaries of U.S.-Based Multinational Corporations', D.B.A. thesis, Harvard University, April 1968, chap. 5; Jorge Katz and Eduardo Ablin, 'Technology and Industrial Exports: A Micro-Economic Analysis of Argentina's Recent Experience', IDB/ECLA Research Programme in Science and Technology, Buenos Aires, August 1978; and by the same authors, 'From Infant Industry to Technology Exports: The Argentine Experience in the International Sale of Industrial Plants and Engineering Works', IDB/ECLA Research Programme in Science and Technology, Buenos Aires, October 1978.

[25] See for instance L. T. Wells, Jr., 'The Internationalization of Firms from Developing Countries', in Tamir Agmon and C. P. Kindleberger, *Multinationals from Small Countries* (Cambridge: MIT Press, 1977), pp. 133–166; by the same author, 'Foreign Investment from the Third World: The Experience of Chinese Firms from Hong Kong', *Columbia Journal of World Business*, Spring 1978, pp. 39–49; and A. J. Prasad, 'Export of Technology from India', unpublished Ph.D. thesis, Columbia University, 1978, pp. 123–156

[26] Extensive data on this tendency are being developed by L. T. Wells, Jr., for eventual publication.

[27] Such firms also have been known, for instance, to develop special skills in the maintenance and repair of second hand machinery, and a supply of scarce spare parts for such machinery. See Wells, 'Hong Kong', and Prasad, 'India', p. 147.