THE MOTIVATION FOR FOREIGN DIRECT INVESTMENT*

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I. Introduction

Several theories have been advanced in recent years purporting to explain the phenomenon of foreign direct investment. This study subjects a number of these theories to limited empirical testing, using fairly elaborate investment data on a single country, Brazil. The theories are discussed in more detail in Section II. The specific hypotheses tested and the methodology used are described in Section III; Section IV and V discuss data and measurement specification; Section VI outlines results of the study.

II. Theories of Direct Investment

The research in this study is most closely related to several recent theories advanced to explain foreign direct investment flows. Yair Aharoni's theory derives from work on the behavioral theory of the firm by Cyert and March.[1] Of particular interest in our study is Aharoni's idea of search patterns undertaken by international firms prior to making foreign investment decisions. His study suggests that firms are limited in the number of investment opportunities considered at any given time. In his terminology, an "initiating force" usually is required for particular projects to come to the attention of decision-makers, followed by a complex review process. The existence of an initiating force is a most important element of Aharoni's theory, because the review process is strictly limited to investment opportunities within the firm's identified set of alternatives.

After potential investment projects come to the attention of corporate decision-makers, profitability considerations become more important. According to Stephen Hymer, foreign investment is undertaken mostly by certain types of monopolistically competitive companies.[2] These firms will not invest unless through some monopoly advantage they can (1) earn higher profits abroad than at home, and (2) make higher

1. See Yair Aharoni, *The Foreign Investment Decision Process* (Boston: Harvard Graduate School of Business Administration, 1960), and R. M. Cyert and J. G. March, *A Behavioral Theory of the Firm* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963).

2. Stephen H. Hymer, "The International Operations of National Firms: A Study of Direct Investment" (unpublished doctoral dissertation, M.I.T., 1966).

profits than host country firms in the same industry. This monopoly advantage can take numerous forms, including technology and patents, easier access to capital markets, lower cost sources of raw materials, and even superior management.

Raymond Vernon's product cycle theory provides further insight into the direct investment process.[3] This theory, which might be considered a subset of Hymer's monopoly hypothesis, suggests that overseas investment is an outgrowth of the stages of development and marketing of new products. Comparatively heavy research and development expenditures in the United States, in part due to unique characteristics of our domestic markets, foster the relatively early appearance of new and differentiated products. Later exports of the products are followed by direct investment, as firms discover cost advantages of manufacturing overseas. Recent empirical research has demonstrated that R&D expenditures are related to trade and investment flows.[4]

Robert Aliber's thesis is that the pattern of direct foreign investment can be explained by the fact that "source-country" firms capitalize a stream of expected earnings from a foreign direct investment at a discount rate lower than firms in the host country.[5] As a result, equivalent earnings streams are valued higher by the foreign investor and, in cases where investment occurs, sufficiently higher to overcome the extra costs of doing business abroad. Moreover, as capital intensity increases in the production process, so also does the advantage accruing to the foreign investor. In Aliber's view, therefore, investment is more likely in industries characterized by comparatively high capital intensity. Clearly, this hypothesis runs counter to another, more traditional economic rationale for investment, which states that firms invest in less-developed countries to take advantage of lower labor costs. In this latter view, relatively labor intensive companies might be expected to invest overseas.

III. Hypothesis and Methodology

This study employed a two-stage linear discriminant model to examine the following general hypothesis: foreign direct investment is contin-

3. Raymond Vernon, "International Investment and International Trade in the Product Cycle," *Quarterly Journal of Economics*, LXXX (May, 1966), 190-207.

4. See especially Robert E. Baldwin, "Determinants of the Commodity Structure of U.S. Trade," *American Economic Review*, LXI (March, 1971), 126-146, W. Gruber, D. Mehta, and Raymond Vernon, "The Research and Development Factor in International Trade and International Investment of U.S. Industry," *Journal of Political Economy*, LXXV (February, 1967), 20-37, and D. B. Keesing, "The Impact of Research and Development on U.S. Trade," *Journal of Political Economy*, LXXV (February, 1967), 33 ff.

5. Robert Z. Aliber, "A Theory of Direct Foreign Investment," in *The International Corporation, A Symposium*, ed. by Charles P. Kindleberger (Cambridge: The M.I.T. Press, 1970), 17-34.

gent upon "search" activity being undertaken by firms and, after the search is initiated, upon expected economic profitability. That is, the model conformed to the sequential decision process outlined by Aharoni in that it posited an initiating force stimulating investment search activity. In the first stage of the analysis, variables believed to be important in motivating industries to search for investment opportunities were used to discriminate between Brazilian industries in which U.S. investment either did or did not occur. Some, but not all, non-investing industries were identified by the discriminant procedure as industries where the stimulus to search did not exist. The second stage analysis took the remaining industries and used essentially economic variables relating to expected profitability to segregate investing from non-investing industries.

The two-stage discriminant procedure was selected for several reasons. Most importantly, the hypothesis suggests that *both* search and profitability are necessary conditions for investment. To represent this decision process in a single estimating equation would require multiplying two sets of variables together. Multiplication, however, introduces significant collinearity among the independent variables. This problem is avoided by analyzing the investment decision sequentially, first using search variables, in a way to be defined, and then employing economic variables.

The fact that discriminant analysis is employed at each stage rather than, say, linear regression is due to the particular nature of the investment data. The data indicate the industry pattern of investment, and our interest was simply to determine whether or not investment occurred in an industry. The dependent variable of a linear regression, therefore, would be zero or one, i.e., one when investment was made and zero otherwise. Use of such a dependent variable introduces heteroscedasticity in the error term of a regression equation.[6] Discriminant analysis, on the other hand, is a multivariate statistical procedure designed to determine which independent variables best classify a set of data into two or more mutually exclusive and exhaustive categories, and it is therefore more appropriate.

IV. The Investment Data

The analysis used data relating to U.S. direct investment in Brazil during the period 1956-61. There were several reasons for focusing on this country. First, Brazil is a large country where foreign direct investment has been an important component of total industrial investment. Second,

6. See J. Johnston, *Econometric Methods* (New York: McGraw-Hill Book Company, 1963), pp. 227-228.

a major change in tariffs occurred in 1957 and therefore it was possible to investigate the effects of this change on direct investment decisions. Finally, disaggregated investment data were availble for the period.

The investment data list all direct investments made in Brazil during 1956-61 under a special regulation permitting foreign investment in the form of imported equipment.[7] This privilege was attractive because of Brazil's multiple exchange rate system in force at the time. The automatic privilege of investing in kind was extended only to investors establishing new plants (and sometimes major expansions of existing plants) in industries thought to be particularly desirable for Brazil's development.[8] The investment data used in this study, therefore, cover most (though probably not all) investment made by firms to establish new plants in Brazil.

Individual investments have been classified according to a 214 industry breakdown. These industries are, in general, equivalent to the four-digit classification of manufacturing industries in the 1957 Standard Industrial Classification. Not all four-digit SIC industries are used, however, and some of the 214 industry groups are combinations of more than one four-digit industry.[9]

A basic shift occurred in the composition of investments between 1956-57 and 1960-61. During 1956-57, most investments were made in industries producing consumer products. In 1958 and later, however, the pattern of investment shifted from consumer goods industries to intermediate products and capital goods. Investments in non-electrical machinery and transport equipment increased as a proportion of the total, and investments in electrical machinery shifted from electronic components and appliances to heavy electrical equipment.

This shift in industry composition made possible the analysis of various factors inducing the change. For this reason, the 1958-61 investment pattern of U.S. industries in Brazil was used as the dependent variable in the discriminant analysis. The purpose of the statistical analysis was to determine which independent variables discriminate between investing and noninvesting U.S. industries in 1958-61.

Of the 214 industries, investment occurred in 54 industries. In the non-investment group, however, were 81 industries in which foreign investment was not permitted under the instruction. The statistical analysis

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7. The regulation was instruction 113 of the Superintendent of Money and Credit. The data is derived from: Government of Brazil. Superintendencia da Moeda e do Credito, "Investments in Brazil Under Instruction 113," *Boletim* (1956-62). Complete data used in this study is available on punched cards at cost from the authors.

8. See Joel Bergsman, *Brazil: Industrialization and Trade Policies* (New York: Oxford University Press, 1970), pp. 73-78.

9. Manipulation of the four-digit SIC classifications was necessary so that industries may be constructed for which equivalent export data are available.

relating to causal factors clearly would be inapplicable to such industries, and accordingly a strong motivation existed to drop them from the analysis. When these industries are excluded, 79 industries remain in the non-investment group.

V. Specification of Independent Variables

A. Stage One Analysis

The particular variables which were hypothesized to induce search were: 1) the relative size of the market, 2) previous investment in the industry, and 3) a change to a higher tariff barrier. Specific measures and data sources for these variables are described below:

1) Relative importance of the market: measured by the ratio of U.S. industry exports to Brazil to total industry exports (E_{iB}/E_i), from U.S. Census data for 1959.[10] This measure was intended *not* as a profitability indicator but rather, as in Aharoni's theory, to denote the likelihood that the market would come to the attention of some organizational unit.

2) Prior investment: this is a dummy (i.e., zero-one) variable (I_{t-1}) indicating the pattern of U.S. direct investment in Brazil in the period of 1956-57 and is obtained from the basic investment data described above.

3) Tariff changes: Brazilian tariff data on over 400 products are available from Paul Clark, who adjusted specific and *ad valorem* duties to reflect the effect of multiple exchange rates.[11] Each of the adjusted tariffs, then, has been assigned to one of the original 214 industries. When more than one product was assigned to some industries, the arithmetic average was computed and assigned as the industry tariff. The tariff changes (ΔT) were computed over the period 1955-1959).

The estimated discriminant function incorporates these independent variables and determines the ability of each to discriminate between investing and non-investing industries. It should be pointed out that the particular search variables used were by no means intended to be exhaustive, and Aharoni's work suggests that many other stimuli in fact exist. The inten-

10. U.S. Bureau of Census, *Report No. FT-410, United States Exports of Domestic and Foreign Merchandise* (Washington, D.C.: G.P.O., 1959), and *U.S. Commodity Exparte and Imports as Related to Output, 1961 and 1963* (Washington, D.C.: G.P.O., 1963).

11. Paul Clark and Richard Weisskoff, "Import Demands and Import Policies in Brazil" (unpublished research report for office of Program and Policy Coordination, Agency for International Development, 1966). This work contains only summaries of the basic data. The detailed figures were obtained privately from Clark.

tion here, however, was to concentrate on a relatively few important and comparatively easily measured variables in hope that their power to discriminate would at least demonstrate the importance of the "initiating force" concept in the investment decision process.

B. Stage Two Analysis

The second stage discriminant procedure employed investment data only from industries found to have "searched" in the first stage. Analysis concentrated on various economic variables derived from the investment theories of Hymer, Vernon, and Aliber. This analysis incorporated two measures of monopolistic advantage: (1) the extent of industry vertical intergration (Hymer) and (2) the relative intensity of industry research and development activities (Vernon). Specific measures and data sources for these variables are:

1) Vertical integration: Michael Gort has developed an index of vertical integration for two-digit SIC industries from data obtained from a sample of 111 U.S. firms.[12] His measure is the ratio of employment in auxiliary activities to total employment. Gort's index is used in the following way to construct a measure for the component four-digit industries.

I_{ij} — vertical integration in four-digit industry i, a component of two-digit industry j.

I_j — Gort's measure of integration in two-digit industry j.

VA_{ij} — value added in 1957

VS_{ij} — value of shipments in 1957

$$I_{ij} = \left(\frac{VA_{ij} / VS_{ij}}{\Sigma VA_{ij} / \Sigma VS_{ij}} \right) I_j$$

2) Research and development: the most disaggregated data obtainable were employment of engineers and scientists in three-digit industries.[13] The ratio of this employment to total employment was computed for each three-digit industry and used as the measure of R&D intensity of the component four-digit industries.

In addition, profitability would tend to be higher when tariffs are higher,

12. Michael Gort, *Diversification and Integration in American Industry* (New York: Princeton University Press, 1962).

13. U.S. Bureau of the Census, *1960 Census of Population* (Washington, D.C.: G.P.O., 1961).

provided that the market size is sufficiently large to economically justify an investment. Accordingly, a composite variable was derived to combine these two effects:

> 3) Tariff and market size: the measure of market size is the ratio of the industry's exports to Brazil from the U.S. (i.e., E_{iB}) to the industry's optimum plant size in the U.S. (P_i). The measure of optimum plant size is average plant size in the U.S. in 1957. Average plant size is the value of the industry's shipments in 1957, divided by the number of establishments.[14] This figure was multiplied by the tariff level (1+T), discussed earlier, to obtain the composite variable, $E_{iB}/P_i\ (1+T_i)$.

Finally, capital intensity for an industry clearly was also related to profitability. However, this variable as a determinant of investment was somewhat difficult to deal with on an empirical level. On the one hand, traditional economic theory would suggest that investing industries would see cost advantages in less-developed countries through lower labor costs, with the advantage being greater for industries where labor content in the final product is large. The motivation to invest, therefore, would increase as measured capital intensity decreased. On the other hand, Aliber's hypothesis would indicate that *increasing* capital intensity would tend to make investment more probable.

This study attempted to separate Aliber's hypothesis from the traditional theory by including capital intensity in the discriminant test in two ways. First, the variable was treated as a single independent variable, similar to vertical integration and R&D intensity. In this way, capital intensity was considered as another "monopolistic" advantage, as Aliber would indicate, and investing industries would tend to be *more* capital intensive. Therefore, the anticipated coefficient on this variable, like those on I and on R&D, would be positive.

> 4) Capital intensity: measured as the ratio of the gross book value to total employment of firms in the four-digit SIC industries comprising the 214 industries utilized in this study.[15]

The traditional theory was tested in a different manner. We hypothesized that industries which have a monopolistic advantage in being either vertically integrated or heavily involved in R&D activities would invest

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14. Data derived from U.S. Bureau of the Census, *1957 Census of Manufactures* (Washington: G.P.O., 1961).

15. The data for both measures were taken from U.S. Bureau of the Census, *1963 Census of Manufactures* (Washington: G.P.O., 1966). The 1957 *Census* recorded no information on book value.

to lower labor costs. We would expect such investing industries to be more labor intensive (i.e., less capital intensive). To achieve this differentiation, two composite variables were formed.

5) Capital intensity/vertical integration: formed by multiplying the capital intensity variable by a dummy variable indicating vertical integration. The dummy equals one when the industry is integrated and zero otherwise. The decision as to which industries are integrated and which are not was made from a frequency distribution of the calculated vertical integration index. Since the distribution has a single mode, approximately half of the industries are classified as being vertically integrated.[16]

6) Capital intensity/R&D: formed by multiplying the capital intensity variable by a dummy variable indicating R&D intensity. High R&D activity was specified as one, low as zero. A frequency distribution of the calculated measure of R&D activity was examined to determine which industries should be classified as strong in R&D. Unlike the earlier case, however, the distribution is bi-modal, indicating a natural division into R&D and non-R&D industries. Forty-nine industries were in the R&D mode.

Anticipated coefficients on both of these variables would be negative.

VI. Results

1. Search variables affecting investment

The first stage of the discriminant analysis had two purposes: a) to identify variables that explain the industry pattern of search for investment opportunities; and b) to identify industries where search did not occur. Three variables were hypothesized as affecting search: a) the relative importance of the market from an organizational point of view (E_B/E); b) threats to that market from changes in tariffs ($\triangle T$); and c) prior investment by U.S. firms in the industry (I_{t-1}). Of these three variables, changes in tariffs did not discriminate significantly between investment and non-investment industries. The other two variables each provided a statistically significant discrimination when used individually. However, in a multi-variable discriminant function, only the coefficient

16. It should be recognized that industries around the mode, and specified zero or one, might in fact be quite similar. For this reason, the variable might be less sensitive than desired.

of prior investment was statistically different from zero. The variable measuring relative market importance did improve the discrimination somewhat, however, and it is useful to include it is the first stage analysis of search. The computed first stage discriminant function is, therefore:

$$1)\ D_1 = 0.81\left(\frac{E_B}{E}\right) + .019^* I_{t-1}$$

$$F = 24.581^*$$

This function was used to separate the total set of 143 industries into those where search did and did not occur. A value of D_1 was calculated for each of the 143 industries, and the industries ranked according to this value. Presumably, the smaller the value of D_1, the smaller the probability that there was search for investment opportunities by the industry. Of course, there must have been search by industries which actually made investments. Consequently, the industries which did not search for investment opportunities can only be those non-investment industries that rank below the lowest ranking investment industries.

When the ranking actually was done according to the discriminant function, there were several large blocks of non-investment industries at the bottom of the list, between which were interspersed a few investment industries. Search may have occurred in these low-ranking investment industries for reasons not caught in the discriminant function. Consequently, they were eliminated from the second stage analysis along with the low-ranking non-investing industries. Fifty-five industries were assumed in this ranking not to have searched for investment opportunities. Of these, 47 were non-investment and 8 were investment industries.

2. Profit variables affecting investment

Variables influencing the profitability of investment in Brazil were used to discriminate between the remaining 46 investment and 42 non-investment industries where search was presumed to have occurred. These variables included: a) a composite variable measuring market size relative to efficient plant size, adjusted for tariffs $\left(\frac{E_B}{P}\right)(1 + T)$; b) variables such as capital intensity (K), vertical integration (V), and R&D activity (R) that give foreign firms a monopoly advantage relative to host country firms; and c) two composite variables obtained by multiplying the measure of industry capital intensity by two dummy variables indi-

cating vertical integration (D_V) and R&D activity (D_R).

The discriminant function calculated using these six variables is:

$$2)\ D_2 = .004\left(\frac{E_B}{P}\right)(1+T) + .011*K - .004V + .031*R + .002(K \bullet D_V) - .022*(K \bullet D_R)$$

$$F = 2.046$$

*Statistically significant at the 5% level of confidence.

This function is not statistically significant at the 5 percent level, although coefficients of some variables are significant. If only these variables are included in a discriminant function, the result is statistically significant at the 5 percent level.

$$3)\ D_2 = .030*R + .011*K - .021*(K\text{-}D_R).$$

$$F = 3.742*$$

*Statistically significant at the 5% level of confidence.

Interpretation of this discriminant function reveals some interesting characteristics of the industries in which U.S. direct investments were made during 1958-61. The factors that discriminate between investment and non-investment industries are research and development, capital intensity, and the composite variable formed by multiplying the R&D dummy variable by capital intensity. Consider first the industries that are not classified as being intensive in research and development. The R&D dummy (D_R) is zero for these industries, and the last term of the discriminant function (3) drops out. The discriminant function becomes, then:

$$D_2 = .030R + .011K \text{ (non-R\&D industries)}$$

Therefore, in the non-R&D industries, the probability of direct investment is larger the more capital intensive are production processes. Moreover, even though these industries engage in relatively little research and development, the positive coefficient on the variable R indicates that the more R&D that is done, the more likely is direct investment.

In research and development industries the situation is somewhat different. The dummy variable (D_R) takes on the value of one, and the discriminant function is:

$$\begin{aligned} D_2 &= .030R + .011K - .021\ (1.K) \\ &= .030R + K\ (.011 - .021) \\ &= .030R - .010K \qquad \text{(R\&D industries)} \end{aligned}$$

Consequently, contrary to the situation in the non-R&D industries, the more capital intensive the production processes in the R&D industries, the *less* likely it is that the industry will invest abroad. Thus, it would appear that R&D industries make direct investments in order to exploit cheap labor.

These results provide support for the hypotheses advanced by Hymer, Aliber, and Vernon. They indicate, in support of Hymer, that foreign investment tends to occur when the industry has some advantage relative to foreign firms. The particular advantage might be access to capital, as suggested by Aliber. Consequently, in the absence of other advantages, investment is more probable the more capital intensive is production. However, when foreign firms have an advantage relative to host country firms as a result of R&D activity, they invest to exploit cheap labor, as suggested by Vernon.

In addition to these positive results, it is interesting to note that tariffs and market size seem to have no effect on the pattern of direct investment in Brazil. Neither of these variables, either individually or in combination, significantly improve the discrimination between investment and non-investment industries that is possible with the function specified above. Consequently, contrary to what would be expected, it would appear that tariffs and market size have not had a significant influence on direct investment.

However, in the case of tariffs, this finding might be due simply to the measure of tariffs used in the study—i.e., nominal tariffs adjusted for multiple exchange rates. This measure is inadequate partly because the Brazilian Government has been particularly ingenious in devising special tariffs and subsidies not included in published tariffs. Moreover, the nominal tariff might not be a good measure of the incentive to invest in an industry because it doesn't take into account the effect of tariffs on raw materials and intermediate products used in the industry's production process. That is, *nominal* tariffs might not be correlated with *effective* tariffs.

However, Joel Bergsman's study of import substitution in Brazil supports the finding of this study that tariffs were not an important determinant of the pattern of direct investment. Bergsman shows that a considerable amount of import substitution took place after 1949 in a number of industries where *effective* protection was relatively low.[17] Much foreign direct investment occurred in those industries, which included machinery, metallurgy, and other capital goods. Bergsman concludes that such investments were profitable even in the absence of substantial effective protection, because the Brazilian market was large

17. Joel Bergsman, *Brazil Industrialization*, pp. 102-110.

enough to support efficient production.

Considering this conclusion, it is surprising that the market size variable does not contribute to discrimination in the second stage of this study. The seeming unimportance of the market size variable, however, may be a result of the statistical procedure used. The variable used to measure market size in the second stage is strongly correlated ($r = .74$ over the 214 industries) with the variable used to measure the relative importance of the Brazilian market in the first stage (exports to Brazil divided by the industry's total exports). The effect of market size, therefore, is taken into account in the first stage discrimination.

In fact, in one sense the two variables used in the first stage discriminant function incorporate all information contained in variables used in the second stage. The first stage discriminant function classifies 77.5 percent of the 143 industries into the correct investment or non-investment group. But only 73.5 percent of the industries are classified correctly into investment and non-investment industries by the two-stage procedure. Thus, it might be concluded that the second stage profit variables do a poorer job of discriminating among the 88 industries in which search is presumed to occur than would the search variables applied to the same industries. Aharoni's belief in the importance of an "initiating force," therefore, finds support here.

This finding, of course, does not mean that profit factors really do not affect investment decisions. Rather, it means that a substantial amount of association exists between search and profit variables. This association has already been demonstrated in the case of the market size variable. The prior investment variable also could be reflecting lagged profit factors, as well as organizational inducements to search for investment opportunities.

The independent effects of the profit variables can be demonstrated by using them to discriminate among the total set of 143 industries. The result of this discrimination is similar to that obtained in the second stage analysis. Capital intensity, research and development, and the composite variable obtained by multiplying capital intensity by the dummy variable indicating the strength of research and development were statistically significant at the 5 percent level. In addition, the size of the Brazilian market relative to an efficient plant size (adjusted for the tariff rate) was significant at the 10 percent level of confidence. The following discriminant function, including these variables, was significant at the 5 percent level:

$$4) \quad D = .001K + .013R - .007\,(K.D_R)$$

This function, like that calculated in the second stage analysis, emphasizes what is probably the most important finding of this study. U.S. firms invest in less-developed countries like Brazil when they have some

kind of monopoly advantage. The monopoly advantage might be due to research and development activity or preferential access to capital, among others. Firms not having an R&D advantage are more likely to invest, the more capital intensive are their production processes, since preferential access to capital provides a greater advantage to capital intensive firms. On the other hand, firms with an R&D advantage don't have to rely on preferential access to capital to maintain their competitive position vis-a-vis host country firms. Research and development-oriented foreign firms, therefore, can invest in less-developed countries to exploit cheap labor. The possibility of this exploitation, of course, is more important when the production process is labor intensive. Consequently, firms with a research and development advantage are more likely to invest in a less-developed country, the more labor intensive are their production processes.

The conclusion that R&D-intensive firms make direct investments in less-developed countries to exploit cheap labor is good news to countries with unemployment problems. It suggests that at least some foreign direct investment could help absorb the unemployed and thus contribute to the country's social welfare, as well as its economic development. Moreover, it provides policy makers in the less-developed countries with a method of identifying foreign firms that would make desirable investments and that might be interested in what less-developed countries have to offer. Consequently, it provides at least some basis for government officials to formulate policies with respect to foreign direct investment.