NBER WORKING PAPER SERIES

# CHARACTERISTICS OF U.S. MANUFACTURING COMPANIES INVESTING ABROAD AND THEIR CHOICE OF PRODUCTION LOCATIONS

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Working Paper No. 1104

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
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April 1983

The research reported here is part of the NBER's program in International Studies. This paper was prepared as part of the study of Multinational Firms and Host-Country Technology (NSF Grant No. 8017543 A01). An earlier version of some of these results was reported in a paper by Robert E. Lipsey and Irving B. Kravis on "Technological Factors in the Overseas Activities of U.S. Firms" at the December 1981 meeting of the American Economic Association. We are indebted to Nancy Ng and Jenny Van Le for statistical assistance, to the Bureau of Economic Analysis of the U.S. Department of Commerce for the use of unpublished data on U.S. foreign investment, to Arnold Gilbert of the BEA for calculations on those data, and to the City University of New York for a grant of computer time. Any opinions expressed are those of the authors and do not necessarily represent those of the National Science Foundation or the National Bureau of Economic Research.

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## ABSTRACT

The purpose of this paper is to examine the relations among characteristics of U.S. firms, their tendency to invest abroad, and their choice of production locations. The larger the firm, and the higher its profitability, capital intensity, technological intensity, and the skill level of its labor force, the higher the probability that it was a foreign investor. Some of these factors were largely associated with the industry the firm was in but size, R&D, and profitability were characteristics of investing firms within individual industries.

Despite its importance in determining the probability that a firm would invest abroad, size of firm appeared to have no relation to the importance of foreign investment; among firms that invested at all, large firms did not produce a higher proportion of their output abroad than small firms. The concentration of manufacturing abroad in a small number of companies is largely a reflection of the concentration within the United States. The influence of size, we conclude, reflects economies of scale not in production but in investing.

We found no evidence that, in general, low-wage U.S. firms tended to invest in low-wage countries or that R&D-intensive firms tended to operate more in countries with highly sophisticated or educated labor. In fact, investors in developing countries, and particularly those in some Southeast Asian countries, tended to be more R&D intensive than investors in developed countries. There was some indication that in industries other than machinery R&D-intensive firms were more inclined than others to license technology, while in the machinery industries, R&D-intensive firms tended to license less: to exploit their technological capital in foreign markets by producing there rather than by licensing.

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## Introduction

One common thread that runs through most explanations of the role of multinational firms is that their distinctive characteristic is possession of some technological advantage over other firms. This could be the possession of a patented or difficult to imitate process or product but it might also be knowledge about production or marketing or servicing a complex product. It could be a particular quality of product or its suitability in particular uses or the firm's ability to assist buyers in using the product or to persuade buyers to purchase the product. The advantage is usually difficult to identify and measure, because it rarely takes the form simply of measurably higher output for the same amount of identifiable inputs. The difficulty of demonstrating the existence of or measuring the extent of this mysterious factor of production, which we can broadly identify as "technology," is one reason why it tends to be exchanged in internal markets--that is, within a firm--rather than traded among firms. By the same token, this difficulty of measurement makes it hard to learn whether technological advantages are the basis for direct investment or to know what results would flow from limitations on investment.

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Who Invests Abroad?

A parent firm's distinctive characteristics are presumably what enable it to produce in a host country in competition with local firms that may have advantages of being at home: the favor of the government, knowledge of the language and customs of the country, consumer goodwill, and so on. The attributes of the multinational firm are composed of several elements: those associated with the country that is the home base of the firm, those associated with the industry, and those specific to the firm (Kravis and Lipsey, 1982). The home country attributes must be those that are absorbed by the company, embodied in mobile factors of production, such as the management or scientific or marketing staff, and carried over to production abroad. The industry attributes are those common to firms in an industry regardless of national origin, and the firm attributes are those that distinguish the company from others in its own country and industry, such as leadership in innovation or in quality of product. The same characteristics may appear in each category; for example, a high level of R&D is a characteristic of U.S. firms in general, as compared to those from other countries, but firms in the pharmaceutical industry have high levels of R&D relative to those in other industries in the United States and in other countries, and some firms within each country's pharmaceutical industry have much higher levels of R&D investment than the industry average.

In this paper we deal mainly with what we describe as industry and firm characteristics. There may be some country characteristics mixed in, but we cannot distinguish them in a study relying on one country's data.

We do point out some similarities to, and differences from, Swedish investors, the only other national group studied extensively. Even with respect to Sweden and the United States, however, there has not yet been a careful comparative study.

The accepted notion of what characteristics distinguish multinational parent firms from others, as summarized in Hufbauer's (1975) survey, is that they are a mixture of technological-rent and industrial-organization factors, not completely independent of each other. Multinational firms are set apart from others by, among other characteristics, their large size, high profitability, and heavy expenditures on R&D and advertising. Hufbauer quotes Horst (1972) as having established that within industries only size distinguishes multinational firms from others in their industries, at least among U.S.-based firms. The implication is that all the other characteristics are industry attributes. Thus size of firm is a rival to technological characteristics as an explanation of foreign investment decisions among parents within an industry.

Comparing the attributes of investing firms with those of other firms is a more complex problem than might appear at first glance. While we know a good deal about U.S. firms investing abroad, from the direct investment surveys of the Bureau of Economic Analysis (U.S. Department of Commerce, 1975 and 1981), there are no comparable data, using the same industry classifications, parent firm definitions, and firm attributes, for noninvestors. Data sources with information for large numbers of individual firms that include both investors and noninvestors, such as Moody's Industrials or the Standard and Poor's Compustat tapes, do not

identify all foreign direct investors and do not distinguish between domestic and foreign activities of individual firms. We use both of these sources of data to characterize firms we identify as investors or noninvestors.

In Table 1, we compare U.S. parents of majority-owned manufacturing affiliates with their industries with respect to several measures of R&D intensity and average compensation (which we take in comparisons within the U.S. to be a measure of average skill level of the labor force). The parent data refer to the consolidated domestic operations of manufacturing industry parents of affiliates in all industries. For comparability, we restricted our industry data to those which excluded foreign operations, although this limited the kinds of comparisons we could make. We were unable, for example, to include any industry profitability measures because these included profits from foreign operations. It was not possible to obtain comparability between parent and industry data in industry classification, unfortunately. The parent data are classified by major industry of the enterprise, as are the industry data in the section of the table referring to R&D expenditures and personnel. The industry data in the section on employee compensation are classified by establishment. They thus more accurately represent industry characteristics but are less comparable to the parent data.

A comparison of the absolute numbers reported by the various sources points up some of the difficulties in this comparison. One is that the investors made up a large part of the universe of manufacturing enterprises, 84.4 per cent of employment and 87.6 per cent of the R&D

TABLE 1

Characteristics of U.S. Manufacturing Parent Firms and Their Industries, 1977

| | Total Manufac-turing | Food & Related Products | Chemicals | Metals | Non-Electrical Machinery | Electrical Machinery | Motor Vehicles & Parts |
|---|---|---|---|---|---|---|---|
| Research and Development | | | | | | | |
| R&D Expenditures as % of Sales | | | | | | | |
| Parents | 3.5 | .49 | 3.1 | 1.0 | 5.8 | 6.0 | 3.2 |
| Industry | 3.5 | .43 | 3.6 | .88 | 5.1 | 6.2 | 3.1 |
| Industry minus parents | 3.5 | | | | | | |
| Company-Financed R&D as % of Sales | | | | | | | |
| Parents | 2.4 | .49 | 3.0 | .82 | 4.4 | 3.8 | 2.8 |
| Industry | 2.2 | NA | 3.3 | .81 | 4.4 | 3.4 | 2.7 |
| Industry minus parents | 1.2 | | | | | | |
| R&D Expenditures per Employee ($ thousand) | | | | | | | |
| Parents | 2.2 | .40 | 2.5 | .65 | 3.0 | 2.9 | 2.7 |
| Industry[a] | 2.2 | .43 | 2.9 | .55 | 2.7 | 2.8 | 2.7 |
| Industry minus parents | 1.9 | | | | | | |
| R&D Scientists and Engineers as % of All Employees | | | | | | | |
| Parents | 3.0 | .90 | 4.7 | .99 | 4.3 | 4.0 | 2.2 |
| Industry[b] | 2.9 | .75 | 4.2 | .92 | 3.8 | 4.1 | 2.4 |
| Industry minus parents | 2.3 | | | | | | |
| Employee Compensation | | | | | | | |
| Total Compensation per Employee ($ thousand) | | | | | | | |
| Parents | 18.6 | 13.6 | 19.4 | 20.2 | 19.4 | 16.4 | 26.4 |
| Industry | 15.7 | 14.6 | 19.0 | 18.4 | 17.6 | 15.7 | 23.6 |
| Industry minus parents | 11.4 | | | | | | |
| Payroll per Employee ($ thousand) | | | | | | | |
| Parents | 15.1 | 11.4 | 15.8 | 16.0 | 16.0 | 13.7 | 20.3 |
| Industry | 14.2 | 12.2 | 15.7 | 14.9 | 14.7 | 13.1 | 18.3 |
| Industry minus parents | 9.9 | | | | | | |
| Payroll per Production Worker ($ thousand) | | | | | | | |
| Parents | 13.6 | 10.2 | 13.1 | 15.1 | 13.4 | 11.5 | 19.8 |
| Industry | 11.4 | 10.9 | 13.7 | 13.7 | 12.9 | 10.9 | 17.4 |
| Industry minus parents | 9.3 | | | | | | |

Notes to TABLE 1

All parent data are from U.S. Department of Commerce (1981) Tables III.R1, III.S2, III.S3, and III.U1. Industry data on R&D expenditures and employment are from U.S. National Science Foundation (1980) and industry data on other variables are from U.S. Bureau of the Census (1981), Section 1, General Summary, Tables 1 and 2. All parent data and industry data in section on R&D refer to the consolidated U.S. operations of enterprises. Industry data in section on employee compensation refer to establishments in the United States.

[a] Employment as of March 1977.

[b] Number of scientists and engineers average of January 1977 and January 1978.

scientists and engineers. The characteristics of parents could not, therefore, diverge much from those of enterprises in their industries. Parents accounted for a much smaller share of manufacturing establishment employment--only 60 per cent. If comparability were perfect we could subtract the parent values from those for enterprises in their industries to obtain estimates for noninvestors, and we did make such a calculation for total manufacturing. However, it is clear that at least for the industry groups there are differences in classification or measurement, since parent numbers exceed the industry numbers in three of the six industries.

We measured skill intensity by levels of employee compensation, assuming that the more skilled workers command higher salaries. In every industry but food products, the parent companies paid higher than average levels of total compensation per employee. Average payroll per production worker (total compensation was not available) shows the parent companies higher in all but two industries: food products, again, and chemicals. The magnitude of the difference in compensation per employee between parent and industry for total manufacturing is larger than that for any individual industry. This would suggest that the difference results not only from individual industry differences, but also from a different industry mix--the parent firms must have been concentrated in higher paying industries, as well as paying above average wages for their industry. Thus the multinational firms appear to be relatively skill-intensive within relatively skill-intensive industries.

We cannot, on the other hand, draw any strong conclusions from these

data about the R&D intensity of the multinationals. One gets the general impression that the parents were, overall, slightly more R&D intensive, and they appeared more R&D intensive in twice as many comparisons as they appeared less so. However, the ratios are often extremely close, or equal to each other. Among the four measures in Table 1 there is none that points consistently one way or the other. For only three industries is there any general agreement among them: in both the metal manufactures and nonelectrical machinery industries, the parents' R&D levels were higher than average, while in the chemical industry, they were lower. For the rest of the industries, as well for total manufactures, the parents' R&D intensity was very similar to that of their industries. One would have to conclude from this set of data, for most industries, and for manufacturing in general, that there were no major differences between multinational parents and their industries in R&D intensity.

Calculations for noninvestors, that is industry minus parents, were performed only for total manufacturing, because we did not think the industry classifications were comparable. They show consistently that parents were higher-wage companies and, by three measures out of four, more research-intensive as well. The lack of any difference for the rate of total R&D expenditures to sales may reflect the fact that there were some very R&D-intensive industries with major government financing of R&D, such as aircraft and missiles, that invest very little abroad. We cannot say whether these differences in R&D intensity are to be attributed to intra-industry differences or to industry mix. There are also some differences in definition between the parent and industry definitions of R&D

expenditures, the importance of which we do not know. One of these is the inclusion in the parent data of company-financed R&D performed outside the company.

Another measure sometimes used as a proxy for skill levels of the labor force is the proportion of nonproduction workers. The data showed the parent companies to have had much higher levels than their industries--almost 50 per cent higher for manufacturing as a whole and over 50 per cent in some industries. However, we did not consider this difference believable for two reasons. One was that parents were such a large part of their industries that the ratios would have to be close if they were measured properly. The other was that the data showed parents having much higher proportions of nonproduction workers even in industries in which parents' average compensation levels were lower.

Another way of studying the characteristics of investing firms is by using information on individual companies from standard sources of company financial data within which we attempted to distinguish foreign direct investors. One advantage over the calculations of Table 1 is that the characteristics for investors and noninvestors are from the same source and are therefore comparable. Another is that the companies can be compared with their industries at the 4-digit SIC level rather than at the very broad industry groups of Table 1. The comparison with the more detailed industries should tend to raise the importance of industry differences and reduce the influence of company divergences from their industries.

The comparisons of firms with their industries are done in two ways. For most items, the industry measures, referred to as enterprise data, are

from the same sources as the firm data and are unweighted averages of the measures for the firms in the sample. For a few items, referred to as establishment data, the industry measures are calculated separately for each firm by weighting industry characteristics derived from the Census of Manufactures by the proportion of the firm's domestic (U.S.) employment that is in each industry. These are thus measures of the characteristics each firm would have shown if in each industry in which it operated it was exactly like the average firm. The establishment data are better than our enterprise data in two respects. One is that they apply only to establishments in the industry, rather than to all establishments, whatever their industry, of every firm classified in that industry. The second is that the individual firms are assigned the attributes of all the industries in which they operate rather than only those of the principal industry for each firm.

The data suffer from a number of disadvantages. One is that we can only characterize firms here by the attributes of their worldwide operations, assuming for this purpose that these attributes determined investment decisions and were not simply a reflection of them. Thus an investing firm paying high wages in the United States may appear here as one paying lower wages in the aggregate if foreign operations in low-wage countries were important in the total. However, since the bulk of foreign operations were in comparatively high wage countries and since they were not a very large part of total employment for most companies, although they were for some, we suspect that the inclusion of foreign operations does not produce very different results from those we would have arrived at from an

analysis in which characterizations of firms were based on domestic (U.S.) attributes.

Another drawback of these data is that to avoid incomparabilities in definitions of characteristics between firms and their industries we do not calculate differences between firms and industries or ratios of firms to industries using the establishment-based industry characteristics, but only using "industry" averages for the firms in our data set. Since the firms usually cover several industries, these "industry" averages may tend to blur the distinctions among more precisely defined industries such as could be calculated from establishment data. For that reason we do show a few establishment-based industry characteristics of firms for comparison. As was pointed out in connection with Table 1, the investors tended to dominate most of the industries. That problem is exacerbated in the company data by the incompleteness of the sample, which probably omits more small noninvesting firms than investors. The industry averages are thus biased to resemble the larger firms.

Table 2 compares U.S. firms that invest abroad with those that did not have any such operations, not even sales subsidiaries. Columns (1) and (2) compare the two sets of firms directly, without regard to their industry affiliation. In columns (3) and (4) we compare the industry characteristics of the two groups by attributing to each firm the average characteristics of the industry or industries to which it belonged. In effect this comparison assumes that there are such things as attributes that are common to firms in an industry regardless of their foreign investment or other individual characteristics. The industry

TABLE 2

Comparative Characteristics of U.S. Manufacturing Firms and Their Industries, by Status as Foreign Investors, 1972[a]

| | Firms | | Industries | | Difference between Firms and Industries | | Firms Relative to Industries | |
|---|---|---|---|---|---|---|---|---|
| | Non-investors (1) | Investors (2) | Non-investors (3) | Investors (4) | Non-investors (5) | Investors (6) | Non-investors (7) | Investors (8) |
| **Size** | | | | | | | | |
| 1. Assets ($ million) | 66.0 | 560.6 | 227.9 | 519.2 | -161.9 | 41.3 | .50 | 1.13 |
| 2. Sales ($ million) | 100.7 | 645.0 | 322.5 | 588.4 | -221.9 | 56.7 | .52 | 1.12 |
| 3. Employment (thousands) | 3.0 | 17.6 | 9.7 | 15.9 | -6.7 | 1.7 | .52 | 1.12 |
| **Rate of Growth, 1967-72 (%)** | | | | | | | | |
| 4. Assets | 12.4 | 12.6 | 12.7 | 12.6 | -.21 | .05 | b/ | b/ |
| 5. Sales | 11.3 | 12.2 | 11.9 | 12.0 | -.63 | .15 | b/ | b/ |
| 6. Employment | 5.7 | 6.9 | 6.2 | 6.8 | -.50 | .10 | b/ | b/ |
| **Profitability** | | | | | | | | |
| 7. Net income/Sales (%) | 2.6 | 4.3 | 3.4 | 4.1 | -.81 | .21 | b/ | b/ |
| 8. Net income/Assets (%) | 3.7 | 5.5 | 4.6 | 5.2 | -.95 | .24 | b/ | b/ |
| **Capital Intensity** | | | | | | | | |
| 9. Noncompensation VA per employee ($000) | 4.0 | 4.5 | 4.0 | 4.5 | .02 | 0 | .97 | 1.01 |
| 10. Nonwage VA per employee ($000)[c] | NA | NA | 6.3 | 7.1 | NA | NA | NA | NA |
| 11. Net fixed assets per employee ($000) | 9.3 | 11.7 | 9.8 | 11.6 | -.54 | .14 | .95 | 1.01 |
| 12. Total assets per employee ($000) | 25.3 | 30.7 | 26.4 | 30.4 | -1.12 | .29 | .96 | 1.01 |
| **R&D Intensity** | | | | | | | | |
| 13. R&D expenditures per employee ($000) | .48 | .70 | .57 | .68 | -.10 | .02 | .78 | 1.04 |
| 14. R&D expenditures/Sales (%) | 1.6 | 2.3 | 1.90 | 2.20 | -.35 | .06 | .75 | 1.04 |
| 15. R&D scientists & engineers/Employment (%)[c] | NA | NA | 1.31 | 1.65 | NA | NA | NA | NA |
| 16. Scientists & engineers/Employment (%)[c] | NA | NA | 3.10 | 4.02 | NA | NA | NA | NA |
| **Skill Intensity** | | | | | | | | |
| 17. Compensation per employee ($000) | 10.1 | 9.3 | 10.1 | 9.3 | .03 | 0 | 1.00 | 1.00 |
| 18. Wages and salaries per employee ($000)[c] | NA | NA | 5.7 | 5.9 | NA | NA | NA | NA |

Notes to TABLE 2

Col. (1) and (2): NBER company data for manufacturing firms, mainly based on publicly available financial information, were matched with our listing of investors and noninvestors, as identified for a period around 1971-72, and with our tabulation of the industry distribution of company employment in the United States. For a description of the data sets see Lipsey (1978).

Numbers of observations range from 204 for Compensation per employee and 650-770 for R&D intensity, Noncompensation VA per employee, and Rate of growth of employment to 900-1,000 for the other variables.

Col. (3) and (4): Enterprise data (Rows 1-9, 11-14, and 17) are derived from our own data and therefore include information only for those companies that were included in that set. Each firm is therefore assigned the characteristics of the average of all the firms in the same 4-digit SIC industry in our data set rather than the characteristics of the industry as a whole. For this purpose, each firm is included only in its principal industry.

The establishment data (Rows 10, 15, 16, and 18) take advantage of the information for whole industries collected on an establishment basis for the Census of Manufactures and similar surveys. For each firm, the attributes of its industries are weighted up by the employment distribution for the firm. Thus, the figure for Scientists and engineers/Employment shows the ratio each firm would have had if in each of the industries in which it operated it used the same proportion as the average for the industry.

Numbers of observations are as in Col. (1) and (2) for enterprise data and over 1,250 for establishment data.

Col. (5) and (6): Unweighted averages of differences of each firm from its industry average.

Col. (7) and (8): Unweighted averages of ratios of each firm to its industry average.

[a] Characteristics are unweighted averages of those for firms in each category.

[b] Not calculated because of presence of negative values.

[c] Establishment data.

characteristics are calculated in two ways, from enterprise data and from establishment data, as explained above, and we consider the latter more reliable. Unfortunately, they are also more difficult to compare directly with the data for firms in columns (1) and (2), because they are from different sources, and we therefore do not make direct comparisons. In columns (5) through (8) we compare each firm to its own industry, using only the industry data on an enterprise basis. We do not directly compare investors with noninvestors since the industries may be quite different.

Among the variables related to the technology of firms the most direct measures of input into technology are those of R&D intensity. They show that investors spent more heavily than did noninvestors. The differences in R&D input shown here are much larger than those in Table 1. Another variable we take to represent an aspect of technology is the physical capital intensity of production, as measured by various ratios of nonhuman capital input to employment. The investors were more capital intensive, by every measure. A counterpart to the nonhuman capital intensity is the human capital or skill intensity. We have, on the firm level, only average compensation per employee as a measure, and even that is poorly covered in the sample. The noninvestors appear to have been higher-wage, presumably higher-skill, firms. Since the total compensation figures are based on only about a fifth of the firms and since the data in Table 1 point to the opposite result--that investors paid high-compensation per worker--we have to describe the issue of skill levels as not settled.

Investors were more profitable than noninvestors, and by a large margin. This is a variable that is difficult to classify with respect to

its relation to technological factors. It could represent the exercise of market power derived from size, rather than from technological leadership. On the other hand, it could represent higher than normal profits, true rents, on technological investment, in which case it would be a technological output measure, reflecting the success of R&D investment.

Rates of growth, another possible reflection of technological success, but also of many other factors, differed little between investors and noninvestors except in the case of employment growth.

The largest difference between investors and noninvestors was in size, which can be, as we said earlier, an alternative to technological factors as an explanation of investment. The investors were, on the average, six to nine times as large as the noninvestors by the three size measures.[1] As in the case of profitability, there is some ambiguity about the reason for the relationship. The size of investors may reflect economies of scale in investing, as Caves suggests.[2] Large size may open up the possibility of economies achieved by splitting up a product line or stages of production into parts suitable for different economic environments, as in the division between wafer production in developed countries and assembly in developing countries by semiconductor companies. It might, on the other hand, represent mainly the market power of the large investor, or its desire to exercise that power more effectively in foreign countries.

These differences between investors and noninvestors may reflect simply the industry composition of the two groups or, on the other hand, differences between investing or noninvesting firms and their industries. We try in various ways to make that distinction in Columns 3 through 8 of

of Table 2.

The large differences in R&D intensity between investors and noninvestors are mirrored in the four measures for the industries of the two groups. That is, the investors were clearly from more R&D-intensive industries. The two measures for which we have firm as well as industry data suggest that about half of the difference was associated with the industry composition and about half with firm differences from their industries, with perhaps some indication that the latter source of differences was larger.

The technology input measure that shows the largest difference between investors and noninvestors that is associated with industry composition is the ratio of total scientists and engineers to total employment. This may measure not R&D input but the technological complexity of the industry or the pace of technical change, which determines the manpower required for imitation. Unfortunately we do not have a corresponding measure for individual firms.[3]

We find that investors were more physically capital intensive than noninvestors but in this case the bulk of the difference reflects the industry composition of the two groups. Relative to their industries the noninvestors were slightly (4-8 per cent) less capital intensive.

The surprising higher compensation per worker we found for noninvesting firms turns out to be entirely an industry characteristic. There was no difference between the two groups relative to their industries. However, the two industry measures of compensation per worker disagree. The enterprise measure, more comprehensive in the types of compensation

covered, says that it is the lower-skill industries that tended more to invest abroad. The establishment measure, covering only wages and salaries per worker but not other forms of compensation, but based on observations for many more firms, suggests that the investors came from industries of slightly higher skill levels.[4]

The higher profitability of investing firms, while it partly reflects the fact that they came from more profitable industries, mainly reflects the characteristics of the individual firms. That is, the investors were more profitable than the average firms in their industries. On the other hand, the higher rates of growth in employment of investing firms were largely an industry characteristic.

Size is partly an industry variable. The investors were from industries in which average firm size was high.[5] In addition, investors were, within their industries, about twice as large as noninvestors.[6]

The industry differences in average size of firm could reflect the extent of scale economies in production, a characteristic of the industries' technologies. However, the presence of scale economies in production is usually considered an obstacle to production abroad. In the case of Swedish foreign investors, scale economies, as an industry variable, were negatively related to foreign investment propensities (Swedenborg, 1979, pp. 128-130).

Since most large firms had some foreign activity, either manufacturing or marketing, it is of interest to look at the characteristics of those that did not. Of the 2,300 manufacturing firms in our company data, only a little over ten per cent had no foreign subsidiaries. The proportions

differ greatly among the industries, ranging from 0 to over a quarter among two-digit SIC classes (Table 3).

TABLE 3

Firms with No Foreign Investment as Per Cent of All Firms, by Industry

| SIC | Title | % Noninvestors |
|---|---|---|
| 31 | Leather and leather products | 26.1 |
| 23 | Apparel and other finished products from fabrics | 25.7 |
| 33 | Primary metals | 21.8 |
| 37 | Transportation equipment | 18.6 |
| 30 | Rubber and plastic products | 18.5 |
| 20 | Food and kindred products | 17.6 |
| 27 | Printing, publishing and allied industries | 17.2 |
| 32 | Stone, clay, glass, and concrete products | 16.9 |
| 22 | Textile mill products | 16.4 |
| 24 | Lumber and wood products | 15.4 |
| 25 | Furniture and fixtures | 14.8 |
| 26 | Paper and allied products | 13.3 |
| 36 | Electrical machinery and equipment | 13.2 |
| 21 | Tobacco manufactures | 9.1 |
| 39 | Miscellaneous manufactures | 7.9 |
| 34 | Fabricated metal products | 7.3 |
| 38 | Professional, scientific and controlling instruments | 6.8 |
| 37 | Chemicals and allied products | 4.2 |
| 38 | Machinery, except electrical | 4.0 |

The industries in which the United States does not enjoy a comparative advantage in trade and that have had severe problems with import competition, such as leather and products, apparel, primary metals, and transportation equipment were also the ones with the highest proportions of noninvestors. The industries that had very few firms that did not invest abroad, such as instruments, chemicals, and nonelectrical machinery, were those in which the U.S. comparative advantage is concentrated. The industries with the

highest skill levels and R&D intensity were also concentrated at the bottom of the list with very few noninvesting firms, while the low-skill and low R&D-intensity industries were mostly among those with higher numbers of noninvestors. There is no clear relationship to physical capital intensity. Chemicals and petroleum refining were in the group in which almost all firms invested abroad, but primary metals, also physical-capital intensive, had a high proportion of noninvestors. Leather and products and apparel, both labor-intensive, had many noninvestors, but machinery, also fairly labor-intensive, had very few.

One industry characteristic we thought might distinguish firms likely to invest abroad was the cost of transporting the product, conceived broadly to include any factors that required production close to consumers. An industry in which U.S. firms possessed the technological advantages needed to sell abroad but in which exporting was difficult because the product was bulky or needed extensive attention at the consumption location would be likely to produce extensively abroad. We attempted to measure the difficulty of long-distance marketing from data on the U.S. market, hoping that it would be associated with industries in which establishments shipped their product relativey short distances. The logic of the hypothesis requires a division between firms with and without foreign manufacturing rather than those with and without any foreign subsidiaries, but we did not have the manufacturing information. The effect is probably to blur our results since firms which centralize production and only export from the United States may nevertheless establish foreign sales affiliates and therefore appear in our data as foreign investors.

| | Investors | Noninvestors |
|---|---|---|
| Mean distance shipped | 514.0 | 472.2 |
| Radius within which 80% of tonnage is shipped | 810.7 | 733.2 |

Source: Industry data from Weiss (1972).

The data give no confirmation at all to the role of this variable. The investors shipped over a longer distance on the average, rather than a shorter one, by both measures. Unless the results are dominated by the operations of trading subsidiaries, we can drop this variable from consideration as an important determinant of investment.

Foreign investment has also been associated with the degree of concentration in an industry. We can test that relationship in our data by comparing the average concentration ratios among the industries of the two groups of firms. The differences are not large but they are consistent

| Concentration Measure | Investors | Noninvestors |
|---|---|---|
| % of Value of Shipments | | |
| Top 4 | 35.0 | 30.6 |
| 8 | 47.5 | 42.4 |
| 12 | 62.7 | 57.8 |
| % of Employment | | |
| Top 4 | 30.7 | 26.8 |
| 8 | 42.4 | 37.7 |
| 12 | 57.5 | 52.5 |
| % of Payroll | | |
| Top 4 | 32.8 | 28.5 |
| 8 | 44.8 | 39.8 |
| 12 | 60.0 | 55.0 |
| % of Value Added | | |
| Top 4 | 35.3 | 30.5 |
| 8 | 47.6 | 42.2 |
| 12 | 62.7 | 57.4 |

Source: Concentration Ratios in Manufacturing Industry, 1963, U.S. Department of Commerce, 1966.

from one measure to another. The investing firms were from industries with higher levels of concentration than those of the noninvesting firms, as has been suspected.

All these analyses up to this point of the probability that a firm would be a foreign investor have been univariate. They have ignored the possibility that the apparent influence of one variable may reflect that of another correlated with it or the possibility that several variables in combination explain the probabilities. A way of investigating this issue is with a multivariate logit analysis in which the dependent variable is the probability that a firm will be an investor or a multinational firm, or the per cent of a group of firms that will be investors or multinational firms, and the independent variables are the ones listed in Tables 1 and 2. We can also add industry dummy variables and, for the pharmaceutical industry, certain measures of a company's innovativeness developed in an earlier study.

For our own measure of the probability of being any type of foreign investor, the logit analysis pointed to only one variable, the size of the firm. Neither the other characteristics of industries or firms or industry dummies improved on this variable. Because of the high proportion of investors by this definition overall and in most industries we thought the logit equation might not provide a good fit and we experimented with the much more restrictive definition of a multinational firm used in the Harvard studies (Vaupel and Curhan, 1973, p. 2), principally that the firm should have equity interests of 25 per cent or more in manufacturing firms located in six or more countries outside the United States. This criterion was met by fewer than 200 firms.

The main variable determining multinationality in this sense was again

size, but profitability, as measured by the ratio of net income to sales (and with possible relationships to technology and/or monopolistic power, as mentioned earlier), was also significant. Some industry dummy variables were significant, positive for chemicals and foods, negative for primary metals. The measure distinguishing "innovative" pharmaceutical companies from others and those purporting to measure the innovativeness of these companies (Cohen, Katz, and Beck, 1975) did not help to distinguish multinational manufacturing investors from others within that industry.

To summarize, we have strong evidence supporting earlier findings that size of firm is of great importance in determining the probability that a firm will invest abroad. Profitability and technological intensity also seem to encourage foreign investment.

Most of the industry and firm characteristics worked together, as can be seen in the following table which shows the per cent of differences between investors and noninvestors that is explained by differences in the characteristics of the industries they are in:

| | Per Cent of Differences between Investors and Noninvestors Explained by Industry Composition |
|---|---|
| Size | |
| Assets | 59 |
| Sales | 49 |
| Employment | 42 |
| Rate of Growth, 1967-72 | |
| Assets | -30 |
| Sales | 13 |
| Employment | 50 |
| Profitability | |
| Net income/Sales | 40 |
| Net income/Assets | 34 |
| Capital Intensity | |
| Noncompensation VA per employee | 96 |
| Net fixed assets per employee | 72 |
| Total assets per employee | 74 |
| R&D Intensity | |
| R&D expenditures per employee | 40 |
| R&D expenditures/Sales | 41 |
| Skill Intensity | |
| Compensation per employee | 96 |

Source: Table 2, Col. 4 minus Col. 3 as per cent of Col. 2 minus Col. 1.

High skill levels, if they served at all to distinguish investors from noninvestors, were almost entirely an industry determinant of the probability of being an investor rather than an influence on the firm's behavior relative to its industry. The same was true to a smaller extent of physical capital intensity. Depending on the size measure used, we find that 40 to 60 per cent of the difference in size between investors and noninvestors could be attributed to industry, and the rest to the deviation of companies from their industry average. While most of the industry and firm characteristics worked together there was one exception, the rate of growth of assets, in which they pulled in opposite directions: the

investors were from slightly slower-growing industries but they were the faster-growing companies within those industries. However, the differences involved were too small to deserve much attention. On the other hand, the investors were from industries growing faster in employment than those of the noninvestors and were the faster growing employers in those industries.

The two characteristics for which the behavior of firms relative to their industries was more important than the behavior of industries were technological intensity and profitability. In both cases the deviation of investing firms from their industry averages accounted for about 60 per cent or more of the overall difference between investor and noninvestor firms. Thus, aside from industry differences and that of size of firm within industries, we found, in contrast to earlier studies, two variables that influence the selection of foreign investors within industries. One is the extent of input into R&D, which is a technological input, and the other is profitability, which might reflect input into technology, the other sources.

One way of attempting to explain the results of our comparisons of investors and noninvestors is by referring to theories that treat technology as a changing, rather than a fixed, characteristic of commodities. Among these are the "availability" hypothesis of Kravis (1956) and the product cycle hypothesis (Vernon, 1966, and Gruber, Vernon, and Mehta, (1967). To do this we must stretch these theories to associate the life cycle of firms with the life cycle of commodities.

The noninvestors, according to this interpretation, are comparatively new firms producing new or innovative products in the early stages of the product cycle. Such products tend to be manufactured in the United States by U.S.-based firms because at that stage of their lives they are still

being experimented with, modified, and adapted to markets and need the high skill levels and particularly the skill at innovation of the U.S. labor force. The investors are larger, more mature firms producing older products that have moved into the large-scale production stage. These products are possibly capital intensive, and now adaptable to production abroad with less skilled labor. In fact, since the production process has become more routine and does not need the skill of U.S. technical labor, the U.S. firms must produce abroad where unskilled labor is cheaper or face losing the market for the product.

We do find the noninvestors to have been small relative to investors within and among industries and less capital intensive, both as might be expected from the life-cycle notion. However, several of the results do not seem to be in accord with the theory: investors were more R&D or technology intensive, by every measure, both within and among industries, were the faster growing firms within their industries, and did not differ substantially from noninvestors in average wage levels, presumably an indication of skill level. Some of these calculations point to another explanation of investment. Not every industry manufacturing older products can transfer its production abroad because production abroad requires some advantage over local firms such as that conferred by high technological intensity. In an industry without such advantages, or for a firm with no technological advantages, production moves from the United States not to foreign affiliates of U.S. firms but to non-U.S. producers. That possibility would explain our finding that overseas investors tend to be from R&D-intensive industries and to be R&D-intensive firms within industries.

Size of Firm and the Propensity to Invest Abroad

The distinction between the probability of being a foreign investor and the extent of foreign investment, or propensity to invest or produce abroad, was made in Hufbauer's (1975) survey. He pointed out that the evidence available for the United States was on the influence of size on the likelihood that a firm would be a foreign investor but not on the extent of such investment. The distinction was tested in a study of Swedish firms (Swedenborg, 1979) which confirmed Horst's finding as to the probability of being a foreign investor but "contradict the common notion that large firms invest relatively more abroad than small firms do, due to advantages of firm size or oligopoly considerations." In fact, the elasticity of foreign sales with respect to domestic sales size was reduced below one in an equation relating foreign affiliate sales not only to domestic sales but also to R&D intensity, physical-capital intensity, labor skill (or human capital intensity), and age of foreign operations.

We have not made as thorough an analysis of the U.S. data but a preliminary look at the 1970 cross-section suggests the same conclusion. In all manufacturing industries combined the foreign investment propensities, as measured by median ratios of manufacturing affiliate net sales to parent domestic sales, did not increase with firm size among those firms that were investors, as can be seen below. The relationship was erratic, with the highest foreign sales ratios in the class of firms with only $50 to $100 million in domestic sales, and lower median ratios of affiliate to parent sales at the larger parent firm sizes than at the two smallest ones shown.

| Parent Domestic Sales ($ million) | Median Ratio: Foreign Affiliate Sales / Parent Sales |
|---|---|
| 50 to <100 | .35 |
| 100 to <250 | .21 |
| 250 to <500 | .09 |
| 500 to <1,000 | .12 |
| 1,000 to <2,500 | .16 |
| 2,500 to <5,000 | .15 |

Source: Unpublished data of the U.S. Department of Commerce.

Table 4 shows the results of a set of linear regression equations across all manufacturing industries, all excluding transportation equipment, and within 5 broad industry groups, the best breakdown we could get with this limited number of observations. Two measures of foreign and domestic size are used: fixed assets and employment.

The equations for all manufacturing firms in the sample have a small negative constant term, and those for all firms except transport equipment have a positive one. None is significant, however, and we can interpret the results as indicating that the equations go through the origin; there was essentially no relationship between parent size and propensities to invest abroad. That is, the foreign operations of large parents bore the same proportion to their domestic operations as did those of small parents.

When we divide the sample into five industries we get mixed results. Only two constant terms are statistically significant at the 5 per cent level, a positive one for parent employment in metals and a negative one for parent employment in metals and a negative one for parent fixed assets in nonelectrical machinery. The former suggests a negative size effect on the propensity to invest abroad and the latter a positive one.

It is possible to run a greater variety of equations with data from

TABLE 4

Equations Relating Size of Foreign Affiliates to Domestic Size of Parent Companies

Manufacturing Industry Parents, 1970

Linear Equations

| Eq. No. | Industry | Size Measure | Constant Term | Coefficient Domestic Size | $\bar{r}^2$ |
|---|---|---|---|---|---|
| 5- 1 | Total Manufactures | Fixed Assets | -1.05 (0.09)[a] | .27 (18.39) | .60 |
| 5- 2 | " | Employment | -1.33 (1.06) | .43 (19.14) | .62 |
| 5- 3 | Total exc. Transportation Equipment | Fixed Assets | 6.87 (0.65) | .23 (14.50) | .51 |
| 5- 4 | " | Employment | 0.59 (0.47) | .36 (12.09) | .42 |
| 5- 5 | Chemicals | Fixed Assets | -7.12 (0.49) | .28 (9.60) | .70 |
| 5- 6 | " | Employment | 1.37 (0.80) | .34 (5.36) | .41 |
| 5- 7 | Metals | Fixed Assets | 27.30 (0.82) | .16 (4.04) | .36 |
| 5- 8 | " | Employment | 4.86 (3.85) | .04 (1.44) | .04 |
| 5- 9 | Nonelectrical Machinery | Fixed Assets | -48.65 (4.85) | 0.68 (37.50) | .98 |
| 5-10 | " | Employment | -2.52 (1.25) | .60 (11.54) | .82 |
| 5-11 | Nonelectrical Machinery | Fixed Assets | 14.15 (0.64) | 0.16 (8.37) | .73 |
| 5-12 | " | Employment | -0.47 (0.06) | 0.40 (4.28) | .41 |
| 5-13 | Transportation Equipment | Fixed Assets | -9.86 0.21 | 0.35 (9.24) | .79 |
| 5-14 | " | Employment | -8.13 (1.30) | 0.50 (9.77) | .80 |

[a] Figures in parentheses are t-statistics.

Source: Unpublished data of the U.S. Department of Commerce.

the National Bureau's collection for individual companies. The better ones for each size variable and each form are shown in Table 5. They show more evidence for a decline than for a rise in the propensity to invest abroad as size of firm increases. All the significant coefficients for the squared size term in arithmetic equations are negative. Of the coefficients for log of size in the logarithmic equations, all significant at the 5 per cent level, three are below one and two are above.

The equations for individual industries in Table 6 also give little support for the idea that size of firm is related to foreign investment propensities. For the industry with the largest number of observations, machinery, the best equation includes a significant negative term for the square of the size variable and the other two arithmetic equations have insignificant squared terms. The log equations, which fit the data less well, include two size coefficients below one and one very slightly above. The chemical industry results are similarly unfavorable to a positive relation of size to propensity. The arithmetic equations again fit much better than the log equations and all include negative squared terms for size. The log equations produce two coefficients for the log of size that are above one, but only slightly, and one substantially below one. For the other two industries, foods, and metals and mining (partly outside the coverage of our industries), we have only 10 to 13 observations for each equation. The arithmetic equations, again the better ones, include no significant squared terms. The log equations, which do not fit as well, do have some coefficients for log of size substantially above one. The only significant evidence we have for a positive relationship between size and the propensity to invest abroad is for the oil industry, which is outside the range of our study. In that case the log equation is the better one

TABLE 5

Equations Relating Size of Foreign Affiliates to Domestic Size of Parent Companies, 1970-1974

NBER Data

All Manufacturing

| Eq. No. | No. of Observations | Parent and Affiliate Size Variable | Coefficients: Size | Coefficients: $(Size)^2$ | Coefficients: Log Size | Constant Term | $\bar{R}^2$ |
|---|---|---|---|---|---|---|---|
| 6-1 | 135 | Employment | .59 (9.60)[a] | -.0004 (3.26) | | -4.38 (2.18) | .68 |
| 6-2 | 135 | " | .49 (11.77) | -.0002 (2.40) | | - | .73 |
| 6-3 | 135 | " | | | 1.14 (9.72) | -2.06 (5.70) | .41 |
| 6-4 | 118 | Sales | .45 (6.01) | -.00001 (3.37) | | - | .32 |
| 6-5 | 118 | " | | | .99 (11.86) | -1.87 (3.45) | .54 |
| 6-6 | 87 | Sales minus Exports | | | .96 (9.55) | -1.64 (2.58) | .51 |
| 6-7 | 87 | Sales | | | .97 (9.56) | -1.79 (2.74) | .51 |
| 6-8 | 112 | Gross Fixed Assets | .41 (2.11) | .00006 (1.32) | | - | .46 |
| 6-9 | 112 | " | | | 1.02 (12.89) | -1.90 (4.10) | .60 |

- = Constant suppressed in fitting equation.

[a] Figures in parentheses are t-statistics.

Source: NBER company data. 1972 data were used when available. If 1972 figures for the dependent or independent variable were missing for an observation, adjacent years were used for parent and affiliate measures of that variable in the following order of preference: 1971, 1973, 1970, and 1974.

TABLE 6

Equations Relating Size of Foreign Affiliates to Domestic Size of Parent Companies, 1970-1974

NBER Data

Five Industries

| Eq. No. | No. of Obser-vations | Parent and Affiliate Size Variable | Coefficients: Size | Coefficients: $(Size)^2$ | Coefficients: Log Size | Constant Term | $\bar{R}^2$ |
|---|---|---|---|---|---|---|---|
| Foods | | | | | | | |
| 7- 1 | 11 | Employment | .58 (1.72)[a] | -.0065 (.59) | | - | .69 |
| 7- 2 | 11 | " | | | 1.38 (2.98) | -2.56 (1.95) | .44 |
| 7- 3 | 10 | Gross Fixed Assets | .21 (1.58) | .00003 (.16) | | - | .73 |
| 7- 4 | 10 | " | | | 1.07 (2.14) | -2.14 (.74) | .28 |
| Metals and Mining | | | | | | | |
| 7- 5 | 13 | Employment | .11 (1.22) | -.0001 (.04) | | - | .57 |
| 7- 6 | 13 | " | | | 1.23 (2.92) | -3.42 (2.68) | .39 |
| 7- 7 | 12 | Sales | .09 (2.59) | .00001 (1.12) | | - | .89 |
| 7- 8 | 12 | " | | | 1.26 (5.47) | -4.19 (2.79) | .72 |
| 7- 9 | 11 | Gross Fixed Assets | .05 (.63) | .00004 (1.14) | | - | .78 |
| 7-10 | 11 | " | | | .69 (3.07) | -.18 (.13) | .46 |
| Machinery | | | | | | | |
| 7-11 | 54 | Employment | .58 (8.71) | -.0004 (2.81) | | - | .82 |
| 7-12 | 54 | " | | | 1.01 (6.85) | -1.73 (3.75) | .46 |
| 7-13 | 52 | Sales | .19 (4.49) | -.000001 (.90) | | - | .67 |
| 7-14 | 52 | " | | | .82 (7.30) | .90 (1.28) | .51 |
| 7-15 | 46 | Gross Fixed Assets | .30 (1.73) | .00002 (.58) | | - | .63 |
| 7-16 | 46 | " | | | .92 (6.88) | -1.67 (2.30) | .51 |

(cont.)

TABLE 6 (concl.)

| Eq. No. | No. of Observations | Parent and Affiliate Size Variable | Coefficients | | | Constant Term | $\bar{R}^2$ |
|---|---|---|---|---|---|---|---|
| | | | Size | $(Size)^2$ | Log Size | | |
| Chemicals | | | | | | | |
| 7-17 | 16 | Employment | .94 (6.36) | -.0069 (3.33) | | - | .84 |
| 7-18 | 16 | " | | | .53 (2.66) | 1.06 (1.69) | .29 |
| 7-19 | 13 | Sales | .58 (4.75) | -.00008 (2.07) | | - | .83 |
| 7-20 | 13 | " | | | 1.03 (3.05) | -1.31 (.58) | .41 |
| 7-21 | 16 | Gross Fixed Assets | .58 (6.41) | -.00008 (2.93) | | - | .93 |
| 7-22 | 16 | " | | | 1.03 (4.34) | -1.26 (.88) | .62 |
| Oil | | | | | | | |
| 7-23 | 10 | Employment | 1.89 (1.21) | -.03 (.83) | | - | .29 |
| 7-24 | 10 | " | | | 2.38 (3.65) | -6.10 (2.85) | .58 |

- = Constant suppressed in fitting equation.

[a] Figures in parentheses are t-statistics.

Source: NBER company data. 1972 data were used when available. If 1972 figures for the dependent or independent variable were missing for an observation, adjacent years were used for parent and affiliate measures of that variable in the following order of preference: 1971, 1973, 1970, and 1974.

and the coefficient for log of size is well above two. However, there are only 10 observations for this equation.

Our general conclusion on the influence of size of firm is to support the belief that it is an important influence, but only as a threshold effect: an effect on the decision to invest abroad but not, once foreign investment has been established, on the fraction of the firm's resources devoted to foreign activity. It reflects economies of scale, not in production, but in foreign investing, and such economies of scale account for the higher frequency of foreign investors among larger firms. However, they seem to be in the nature of indivisibilities which have little or no influence once a firm has surmounted the initial barrier to becoming a foreign investor.

The Location of Investment

Another question we can ask is whether the technological characteristics of industries and firms influence their choices among locations for investment. We pursue this issue first by comparing the parents that located in two very different types of host countries, Sweden on the one hand, a high-wage, high-skill, developed country, and Brazil and Mexico on the other, two rapidly industrializing developing countries, but with far lower wages and skill levels than Sweden. Those countries are compared here not only because of the contrast in environments they provide but also because reasonably complete lists of U.S. investors are available that permit us to use our own company data for analysis (Table 7).

Investors in Sweden were far more R&D-intensive firms than those in Brazil or Mexico, as measured by the ratios of R&D expenditures to sales and employment. They were from R&D-intensive and technology-intensive

TABLE 7

Comparative Characteristics of U.S. Firms and Their Industries, by Status as Investors in Manufacturing in Sweden, Mexico, and Brazil, 1972[a]

| | Firms | | Industries of Firms | | Difference between Firms and Industries | | Firms Relative to Industries | |
|---|---|---|---|---|---|---|---|---|
| | Investors in | | Investors in | | Investors in | | Investors in | |
| | Sweden, but not Mexico or Brazil | Brazil or Mexico, but not Sweden | Sweden, but not Mexico or Brazil | Brazil or Mexico, but not Sweden | Sweden, but not Mexico or Brazil | Mexico or Brazil, but not Sweden | Sweden, but not Mexico or Brazil | Mexico or Brazil, but not Sweden |
| **Size** | | | | | | | | |
| 1. Assets ($ million) | 671.5 | 1,000.8 | 657.0 | 732.7 | 145.3 | 268.2 | 1.56 | 1.77 |
| 2. Sales ($ million) | 764.7 | 1,168.2 | 691.7 | 844.5 | 73.0 | 323.4 | 1.59 | 1.80 |
| 3. Employment (thousands) | 20.6 | 28.9 | 16.7 | 21.0 | 3.9 | 7.9 | 1.57 | 1.81 |
| **Rate of Growth, 1967-72 (%)** | | | | | | | | |
| 4. Assets | 13.7 | 11.8 | 12.7 | 11.6 | .94 | .29 | b/ | b/ |
| 5. Sales | 12.9 | 12.0 | 12.2 | 11.3 | .71 | .75 | b/ | b/ |
| 6. Employment | 7.5 | 7.3 | 6.9 | 6.1 | .54 | 1.21 | b/ | b/ |
| **Profitability** | | | | | | | | |
| 7. Net income/Sales (%) | 5.7 | 4.2 | 4.7 | 4.0 | 1.01 | .20 | b/ | b/ |
| 8. Net income/Assets (%) | 7.1 | 5.3 | 6.0 | 5.0 | 1.12 | .32 | b/ | b/ |
| **Capital Intensity** | | | | | | | | |
| 9. Noncompensation VA per employee ($000) | 5.2 | 5.0 | 4.9 | 5.0 | .32 | -.03 | 1.08 | .99 |
| 10. Nonwage VA per employee ($000)[c] | NA | NA | 8.0 | 8.4 | NA | NA | NA | NA |
| 11. Net fixed assets per employee ($000) | 12.5 | 16.2 | 11.6 | 15.4 | .86 | .80 | 1.04 | 1.04 |
| 12. Total assets per employee ($000) | 32.0 | 35.5 | 30.7 | 36.4 | 1.36 | -.89 | 1.02 | .96 |
| **R&D Intensity** | | | | | | | | |
| 13. R&D expenditures per employee ($000) | 1.17 | .59 | .93 | .62 | .24 | -.03 | 1.25 | 1.00 |
| 14. R&D expenditures/Sales (%) | 3.5 | 1.7 | 2.8 | 1.7 | .66 | -.04 | 1.24 | 1.02 |
| 15. R&D scientists & engineers/Employment (%)[c] | NA | NA | 2.0 | 1.6 | NA | NA | NA | NA |
| 16. Scientists & engineers/Employment (%)[c] | NA | NA | 4.8 | 4.2 | NA | NA | NA | NA |
| **Skill Intensity** | | | | | | | | |
| 17. Compensation per employee ($000) | 9.3 | 9.3 | 9.5 | 9.0 | -.19 | .30 | .98 | 1.03 |
| 18. Wages and salaries per employee ($000)[c] | NA | NA | 6.2 | 6.1 | NA | NA | NA | NA |

Notes to TABLE 7

[a] Characteristics are unweighted averages of those for firms in each category.

[b] Not calculated because of presence of negative values.

[c] Establishment data.

For sources and definitions, see Notes to Table 2.

The list of U.S. investors in Sweden was supplied by an agency of the Swedish government. The list of investors in Mexico and Brazil was from Newfarmer and Mueller (1975).

industries, by the same measures as well as by measures of employment. They were in addition, by a large margin, the more R&D-intensive firms within their industries.

Since Sweden is a high-wage country, at least for unskilled labor, we might expect it to attract the most capital-intensive U.S. firms. In fact, the parents of Mexican and Brazilian affiliates were more capital intensive and were from more capital-intensive industries than those investing in Sweden. Within industries, however, we could not observe any consistent relationship to capital intensity.

Sweden's comparative advantage is often associated with skill intensity, but our measure, compensation per employee, suggests that skill intensity did not distinguish investors in Sweden from those investing in Mexico or Brazil. The investors in Sweden came from industries of somewhat higher skill levels but within their industries they were lower wage-firms. In other words, firms which, within their industries, were the lower-wage firms, presumably those with a lower-skill labor force, tended to establish affiliates in one of the highest-wage countries with a highly skilled labor force, as if they were seeking characteristics in their affiliates opposite to those of the parent operations in the United States.[7]

Among the other firm characteristics we have information for, investors in Sweden were smaller and they were from industries characterized by relatively small firms, probably a reflection of the concentration on machinery investment[8] and the absence of U.S. auto companies. They were also relatively small firms in their industries. There are thus indications that economies of scale in production were a characteristic that did not favor locating in Sweden.

The firms investing in Sweden were from industries of faster growing

and more profitable firms and they were also, within their industries, the firms with these characteristics. Both of these may be related to the high level of R&D intensity among investors in Sweden.

The sharpest distinction we found between firms investing in Sweden and those investing in Mexico or Brazil was the extent of expenditure on R&D. The higher R&D levels of the firms investing in Sweden were clearly not related to size since the Swedish firms tended to be smaller, and we thus have further evidence of the importance of this technology input variable in explaining within-industry differences in investment.

A more systematic view of the selection of parents for investing in different locations can be gained from the latest survey of U.S. direct investment (U.S. Department of Commerce, 1981). One indication of the selection of parents is the distribution, by industry, of parents investing in various areas of the world. Table 8 gives one measure of that distribution, the share of each major industry in the total of parent-firm assets. There is no indication here that physical-capital-intensive U.S. industries, defined as those with high levels of plant and equipment per worker, consistently concentrated their investment in high income countries and labor-intensive U.S. industries in low-income, presumably low-labor-cost countries. The most capital-intensive industry, chemicals, represented a higher proportion of investment in developing countries than in developed countries, while the nonelectrical machinery industry, which is labor-intensive, was concentrated in developed countries. On the other hand, electrical machinery and transportation equipment, both labor-intensive, tended to be more heavily represented in low-income countries. Similarly, R&D-intensive industries did not consistently choose locations with highly educated populations. Electrical machinery and chemicals, two

TABLE 8

Aggregate Assets of Parents in Each Industry Group as Per Cent of All Parents Investing in a Country, 1977

Unweighted Averages of Countries, by Area

| | All Manufacturing | Foods | Chemicals | Metals | Machinery | | Transportation Equipment | Other Manufacturing |
|---|---|---|---|---|---|---|---|---|
| | | | | | Non-Electrical | Electrical | | |
| Developed Countries | 100.0 | 7.6 | 22.1 | 7.6 | 13.2 | 7.3 | 24.2 | 18.0 |
| Canada | 100.0 | 7.3 | 17.8 | 9.3 | 12.0 | 6.8 | 25.2 | 21.5 |
| Europe | 100.0 | 7.7 | 23.6 | 8.0 | 13.7 | 7.3 | 20.6 | 19.1 |
| Developing Countries | 100.0 | 6.1 | 27.2 | 7.0 | 7.2 | 9.0 | 29.0 | 14.5 |
| Latin America | 100.0 | 7.5 | 25.3 | 8.7 | 8.7 | 5.9 | 26.9 | 17.0 |
| Asia | 100.0 | 5.0 | 28.8 | 5.5 | 6.0 | 11.7 | 30.8 | 12.3 |

Source: Unpublished data of the U.S. Department of Commerce.

Note: A given parent may appear in several countries, but in only one industry.

R&D-intensive industries, were more heavily represented in developing than in developed countries.

Two measures of the capital intensity of parents investing in different areas of the world are given in Table 9. Fixed assets per employee represents physical-capital intensity and total assets per employee represents some mixture of physical capital, including inventories, and financial capital. We show average capital intensities of parents investing in different areas, for all manufacturing and for several industry groups, using weighted and unweighted averages within countries.

One fairly consistent feature of the table is that unweighted averages of net property, plant, and equipment per worker of investors in Canada are lower than weighted averages, overall and in all industries except foods. Furthermore, the unweighted averages for investors in Canada are consistently below those for investors in Europe and even those for investors in developing countries, even though Canadian wages were higher than European wages and much higher than developing country wages. Weighted averages for investors in Canada also tend to be relatively low, but not as consistently or by so much. Since the difference between the weighted and unweighted averages is in the weight given to the larger parents, it tells us something about the relation of parent size, capital intensity, and investment location. High physical capital intensity was associated with large parent size. Canada apparently attracted a larger number of small parents with low physical capital intensity that were less likely to invest in the developing countries or in Europe. Their presence reduced the average capital intensities of U.S. investors in Canada, particularly the unweighted averages, by large amounts. In other words, small U.S. parents, which tended to be relatively labor intensive in their

TABLE 9

Capital Intensity of Parent Companies by Location of Investment, 1977
Unweighted Averages of Countries Within Areas

Unit: Thousands of Dollars

| | All Manufacturing | Foods | Chemicals | Metals | Machinery | | Transportation Equipment | Other Manufacturing |
|---|---|---|---|---|---|---|---|---|
| | | | | | Non-Electrical | Electrical | | |
| **A. UNWEIGHTED AVERAGES WITHIN COUNTRIES[a]** | | | | | | | | |
| Assets per Employee | | | | | | | | |
| Developed Countries | 68.3 | 62.9 | 88.4 | 60.7 | 49.1 | 42.0 | 52.7 | 52.1 |
| Canada | 52.4 | 66.6 | 80.5 | 45.7 | 45.0 | 48.1 | 41.5 | 46.6 |
| Europe | 66.2 | 63.3 | 89.9 | 64.3 | 49.2 | 41.1 | 52.5 | 53.9 |
| Developing Countries | 65.7 | 65.5 | 92.0 | 62.6 | 48.6 | 42.9 | 54.2 | 53.6 |
| Latin America | 64.9 | 57.1 | 87.2 | 59.0 | 53.2 | 46.5 | 53.5 | 52.0 |
| Asia | 66.4 | 73.9 | 96.1 | 65.5 | 44.7 | 39.9 | 54.8 | 54.8 |
| Net Property, Plant and Equipment per Employee | | | | | | | | |
| Developed Countries | 17.5 | 21.7 | 25.6 | 18.3 | 10.3 | 10.3 | 13.3 | 16.5 |
| Canada | 13.6 | 18.1 | 24.5 | 12.0 | 9.6 | 8.6 | 10.4 | 12.3 |
| Europe | 18.2 | 23.0 | 25.8 | 19.7 | 10.3 | 10.4 | 13.4 | 17.7 |
| Developing Countries | 19.9 | 23.1 | 29.1 | 23.4 | 11.0 | 10.7 | 11.7 | 17.3 |
| Latin America | 19.4 | 24.0 | 26.1 | 21.3 | 12.2 | 11.3 | 13.0 | 16.6 |
| Asia | 20.2 | 22.2 | 31.6 | 25.1 | 10.1 | 10.2 | 10.6 | 17.9 |
| **B. WEIGHTED AVERAGES WITHIN COUNTRIES[b]** | | | | | | | | |
| Assets per Employee | | | | | | | | |
| Developed Countries | 60.4 | 52.3 | 81.7 | 65.5 | 56.2 | 39.1 | 62.6 | 55.0 |
| Canada | 55.5 | 43.4 | 79.6 | 55.6 | 54.9 | 37.6 | 60.5 | 50.5 |
| Europe | 61.0 | 54.1 | 82.3 | 67.8 | 56.4 | 39.8 | 61.4 | 56.9 |
| Developing Countries | 63.3 | 51.7 | 86.8 | 75.4 | 52.1 | 40.9 | 68.6 | 54.8 |
| Latin America | 62.8 | 49.6 | 81.0 | 64.6 | 57.5 | 44.1 | 66.9 | 57.6 |
| Asia | 63.8 | 53.7 | 91.6 | 84.4 | 47.7 | 38.3 | 69.9 | 52.5 |
| Net Property, Plant and Equipment per Employee | | | | | | | | |
| Developed Countries | 17.6 | 16.4 | 29.0 | 24.3 | 13.3 | 9.9 | 14.1 | 17.8 |
| Canada | 16.3 | 13.1 | 29.6 | 19.1 | 13.9 | 9.0 | 12.2 | 18.0 |
| Europe | 18.1 | 17.0 | 29.2 | 25.4 | 13.2 | 10.1 | 14.5 | 18.3 |
| Developing Countries | 18.3 | 16.4 | 31.6 | 26.0 | 12.2 | 9.9 | 12.4 | 19.4 |
| Latin America | 18.8 | 16.3 | 29.1 | 26.4 | 13.0 | 10.7 | 13.3 | 20.1 |
| Asia | 18.0 | 16.4 | 33.7 | 25.6 | 11.5 | 9.2 | 11.5 | 18.8 |

Source: Unpublished data of the U.S. Department of Commerce.

[a]Unweighted averages across countries of unweighted within-country averages.

[b]Unweighted averages across countries of weighted within-country averages.

industries, were more likely to invest in Canada than in developing countries despite their labor intensity. The reason was presumably that because they were small they did not wish to take the risks or costs of investment in developing countries.

The direction of differences between unweighted and weighted parent firm capital intensities is often consistent within industries. In foods and electrical machinery almost all the unweighted averages are higher for both total assets and fixed assets per employee. For metals, nonelectrical machinery, transportation equipment, and "other manufacturing," the weighted averages are higher. For chemicals, unweighted averages of total assets per employee are higher while unweighted averages of fixed assets per employee are lower than weighted. The implication seems to be that large parent firms were more capital intensive in metals, nonelectrical machinery, transportation equipment, and the miscellaneous group but were more labor intensive in foods and electrical machinery and, as measured by total assets per worker, in chemicals.

Most of the figures show slightly higher capital intensity among investors in developing countries than among those in developed countries. The differences are small and not very consistent from industry to industry. Although the capital intensities derived from weighted averages within countries are often quite different from those derived from unweighted averages, they tell essentially the same story about the capital intensity of investors in developed and developing countries.

The relation among parent capital intensity, host-country labor cost, and parents' selection of countries for investment was examined by regressions across host countries of parent capital intensity on average compensation per worker in affiliates.[9] The results agree with our

impression from Tables 8 and 9: none of the coefficients is statistically significant and more are negative than positive. If there is any relation between the two variables it is more likely negative than positive, but the evidence for any relationship is very weak.

Another set of parent company characteristics we can examine is related to the technical level of the companies. These characteristics include the average skill level of employees, as measured by average compensation per worker, and three variables related to technological intensity. These are R&D expenditures as a per cent of sales and two measures of technology sales: the importance relative to sales of license fees received from firms not controlled by the parent and of sales under license by foreign firms not controlled by the parent.

Investors in developing countries were parents with slightly higher average compensation than those investing in developed countries among manufacturing companies in general, but there was no consistent relation within industries (Table 10). The only fairly consistent difference is that investors in Canada seem to have been among the lower-skilled companies in their industries relative to other investors, despite the comparatively high level of education of the Canadian labor force. This result may reflect the size of investors in Canada mentioned earlier (see also Kravis and Lipsey, 1982) rather than any selection on the basis of labor force quality.

Regressions across countries within industries of parent average wage (assumed to represent parent firm skill levels) against average quality of each country's labor force (Kravis and Lipsey, 1982) produce no significant

TABLE 10

Measures of Technological Intensity of Parent Companies, by Location of Investment, 1977

Unweighted Averages Within Countries and Among Countries Within Areas

Unit: Thousands of Dollars and Per Cent

| Parent Company Characteristics and Areas of Investment | All Manufacturing | Foods | Chemicals | Metals | Machinery | | Transportation Equipment | Other Manufacturing |
|---|---|---|---|---|---|---|---|---|
| | | | | | Non-Electrical | Electrical | | |
| **Average Compensation per Employee** | | | | | | | | |
| Developed Countries | 17.6 | 16.1 | 19.5 | 18.8 | 17.7 | 16.3 | 19.6 | 16.0 |
| Canada | 16.3 | 14.5 | 18.2 | 16.6 | 17.9 | 15.6 | 17.4 | 15.1 |
| Europe | 17.7 | 16.2 | 19.5 | 19.0 | 17.6 | 16.3 | 19.4 | 16.1 |
| Developing Countries | 17.8 | 15.7 | 19.4 | 18.1 | 17.4 | 16.5 | 21.9 | 16.2 |
| Latin America | 17.9 | 15.7 | 19.1 | 19.5 | 18.6 | 17.3 | 20.8 | 16.2 |
| Asia | 17.7 | 15.6 | 19.6 | 16.8 | 16.3 | 15.9 | 22.8 | 16.2 |
| **R&D Expenditures as % of Sales** | | | | | | | | |
| Developed Countries | 2.36 | .71 | 3.51 | 1.09 | 2.69 | 2.90 | 2.20 | 2.02 |
| Canada | 1.40 | .50 | 2.50 | .70 | 1.90 | 1.80 | 1.40 | 1.10 |
| Europe | 2.41 | .68 | 3.55 | 1.03 | 2.80 | 3.02 | 2.14 | 2.12 |
| Developing Countries | 2.66 | .72 | 3.59 | 1.10 | 3.55 | 3.65 | 2.21 | 2.15 |
| Latin America | 2.42 | .76 | 3.56 | 1.06 | 2.56 | 3.00 | 2.18 | 2.10 |
| Asia | 2.87 | .68 | 3.62 | 1.13 | 4.37 | 4.18 | 2.23 | 2.20 |
| **Fees and Royalties Received from Uncontrolled Foreign Persons as % of Sales** | | | | | | | | |
| Developed Countries | .15 | .04 | .20 | .16 | .17 | .17 | .15 | .12 |
| Canada | .14 | .03 | .28 | .12 | .23 | .07 | .10 | .10 |
| Europe | .15 | .05 | .20 | .15 | .17 | .20 | .16 | .11 |
| Developing Countries | .16 | .03 | .18 | .13 | .17 | .17 | .07 | .20 |
| Latin America | .17 | .05 | .27 | .15 | .19 | .11 | .10 | .14 |
| Asia | .15 | .01 | .11 | .12 | .15 | .22 | .04 | .25 |
| **Uncontrolled Product Sales as % of Sales** | | | | | | | | |
| Developed Countries | 2.11 | .69 | 1.78 | 1.84 | 2.83 | 3.66 | .63 | 2.58 |
| Canada | 1.90 | .90 | 2.50 | 2.80 | 2.70 | 2.20 | .50 | 1.30 |
| Europe | 2.13 | .76 | 1.67 | 1.59 | 3.01 | 4.12 | .61 | 2.48 |
| Developing Countries | 2.38 | .72 | 1.73 | 1.59 | 2.92 | 1.55 | .57 | 5.64 |
| Latin America | 2.40 | 1.32 | 2.10 | 2.16 | 3.72 | 1.54 | .78 | 3.60 |
| Asia | 2.37 | .12 | 1.42 | 1.12 | 2.25 | 1.55 | .40 | 7.33 |

Source: Unpublished data of the U.S. Department of Commerce.

coefficients. The coefficients larger than their standard errors, for three of the seven industries, are all negative. That is, if there was any faintly visible relationship, lower-skill firms within their industries in the United States tended to operate in countries with higher labor quality.

Our measure of parent R&D intensity, R&D expenditures as a per cent of sales, reveals a surprising relationship. Investors in developing countries were more R&D-intensive than investors in developed countries in manufacturing as a whole and in every industry. Some of the differences were very small but some were substantial. With respect to this measure as was true of others, investors in Canada were different: in this case less R&D intensive than those investing in any other area, and by a large margin in several cases. However, even investors in Europe were less R&D intensive than investors in developing countries in every industry. In the two machinery industries, the margin was quite large. There was little difference in R&D intensity between investors in Europe and investors in Latin America, but the machinery parent companies investing in the developing Asian countries were particularly R&D intensive.

The figures for individual countries (not shown in our tables) confirm that investors in Canada were among the least research intensive, even if they were not the lowest. Our earlier finding from the individual company data for 1972 that investors in Sweden were particularly R&D intensive is supported here only for the nonelectrical machinery industry. That was, however, by far, the main area of U.S. investment in Sweden. In other industries we do not find investors in Sweden particularly R&D intensive even relative to those investing in Brazil and Mexico. Investors in

individual developing Asian countries were not only much more R&D intensive than others in the machinery industries but slightly more R&D intensive in all the other industries except foods.

Regressions across countries within industries in which we related parent R&D intensity to average host-country labor quality again failed to reveal any selection of parents, or of investment locations by parents, on this basis. Only one of the coefficients was even as large as its own standard error.

The apparent affinity of R&D-intensive parents for low-income countries may be related to other characteristics of the parents. Larger parents may tend to have higher R&D intensities and may also be more able to bear the costs of investing in developing countries. The latter point has been documented in this paper and elsewhere (for example, Kravis and Lipsey, 1982). The developed countries thus attract both larger and smaller U.S. parents while the developing countries attract mainly the large ones.

The particularly high R&D intensity of machinery industry investors in developing Asian countries must reflect to some degree the policies of the semiconductor and computer companies, which are particularly R&D-intensive. U.S. parents' investment in developing countries of Asia (except the Middle East) and the Pacific is heavily concentrated in "Electronic Components and Accessories" within electrical machinery and "Office and Computing Machines," within nonelectrical machinery. The ability of the semiconductor companies to split their stages of production between labor-intensive operations, carried out in developing countries, and skill- and

technology-intensive operations carried on in developed countries is partly responsible for this apparently paradoxical choice of host countries by R&D intensive parents (see Finan, 1975).

We include two measures of technology sales in Table 10. One is the ratio to parent sales of fees and royalties received by the parent from foreign entities other than its own affiliates. The other is product sales by uncontrolled foreign entities under license from the parent. We interpret them as representing a mixture of two elements: the technological level of the parent, which permits it to have some technology to sell to others, and the tendency to exploit that technology outside the United States by sales of the technology itself rather than by production of the goods embodying it. A firm or industry with little technology to sell would presumably show low ratios to total sales of fees and royalties and uncontrolled product sales under license. The food industry might be an example of this situation, since it has low ratios of both R&D and technology sales to total sales. A firm or industry at a fairly high technological level might still show low ratios of technology sales to total sales if it chose to exploit its technological capital by producing abroad rather than by sales of the technology itself. This might be the case for the motor vehicle industry which is only slightly below average in R&D expenditure but far below average in the importance of uncontrolled product sales under license.

Differences in technology sales levels between investors in developed and developing countries were not very large or consistent among industries. Within industries two major differences stand out. Electrical

machinery companies investing in developed countries reported larger sales by uncontrolled companies under license (but not larger income from such sales) than those investing in developing countries while the latter spent more heavily on R&D. In the other manufacturing group, investors in developing countries, and especially those investing in Asia, reported both relatively high sales by uncontrolled companies under license and high income from fees and royalties from such sales, while they were no more research-intensive than were investors in Europe. Investors in Canada were, overall, the lowest in sales under license, income from such sales, and R&D intensity, but the picture is very different in some industries. Chemical and metals industry investors in Canada were the least R&D-intensive group but reported the highest ratios of fees and royalties received and of sales under license, while "other manufacturing" investors in Canada were low in all three respects.

Along the same lines we ran a set of regressions across host countries, including and excluding Canada, relating two characteristics of parents investing in them, from the unpublished U.S. Department of Commerce data for 1977. The dependent variable was the importance to the parents of technology sales, as measured by the ratio of sales by uncontrolled foreign entities under license from the parents (TS), and the independent variable was the ratio of parent R&D expenditures to parent sales (RD). None of the equations for manufacturing as a whole, foods, chemicals, electrical machinery, or transportation equipment, explained any of the variation in technology sales. Equations for the other industries, excluding Canada, based on 24 observations, are as follows (equations including Canada were

similar):

$$\text{TS (Metals)} = \underset{(.22)}{.162} + \underset{(2.11)}{1.367}\ \text{RD} \qquad \bar{r}^2 = .13 \qquad (1)$$

$$\text{TS (Nonelectrical machinery)} = \underset{(5.63)}{4.705} - \underset{(2.41)}{.587}\ \text{RD} \qquad \bar{r}^2 = .17 \qquad (2)$$

$$\text{TS (Other manufacturing)} = \underset{(.74)}{-2.123} + \underset{(2.22)}{2.903}\ \text{RD} \qquad \bar{r}^2 = .15 \qquad (3)$$

The relationships seem to vary among the industries. In metals and in "other manufacturing industries," the more R&D intensive the firms investing in a country, the greater the importance of sales by uncontrolled firms under their licenses. In the nonelectrical machinery industry, on the other hand, higher R&D intensity was negatively related to sales by others under license. The equation for electrical machinery also had a negative coefficient but explained very little of the variation in technology sales. It may be characteristic of machinery industries that they exploit their technological capital in foreign markets by production rather than by licensing. However, this is a question that should be examined at the individual firm level rather than, as here, by looking at differences among parents investing in groups of contries.

## Conclusions

The strongest influence on the likelihood that a U.S. manufacturing firm will be a foreign investor is the size of the firm, as has been noted by others. Profitability, capital intensity, technological intensity, the skill level of the labor force, and the rate of growth of the firm, are also all positively related to the probability of being an investor.

We separated these relationships between effects common to firms in an industry and those related to differences between a firm and the industry

average. About half of the firm size effect can be attributed to the industry of the parent firm and capital intensity is mostly an industry effect. Aside from industry differences and that of size of firm within an industry we found, in contrast to some earlier studies, two characteristics that influenced the selection of firms within industries. One is the extent of input into R&D, which is a technological input, and the other is profitability, which might reflect the output from technological input or market power derived from other sources.

The selection of firms and industries as foreign investors tends to bring to foreign countries the attributes of the more technically oriented, faster-growing, and more profitable of U.S. manufacturing firms within their industries, as well as the larger firms. It also brings to foreign countries U.S. firms from industries that are capital intensive and technologically oriented.

While a number of studies have examined the factors determining the probability of a firm's being a foreign investor, few have attempted to explain the propensity to invest abroad--that is, the determinants of the size of foreign investment or activity relative to domestic. The results of our test of the effects of size of firm on investment propensities were somewhat surprising in view of the conclusive evidence that size is the major determinant of the probability of foreign investment. For manufacturing as a whole and for major industry groups within manufacturing we could find little or no evidence from two independent sources of company data of any relationship between the domestic size of a parent company and the propensity to invest abroad. Thus the frequently mentioned concentration of manufacturing abroad in a small number of companies appears to be nothing but a reflection of the concentration among

manufacturing firms in the United States.

Our conclusion about the influence of size of firm is to support the belief that it is important, but only as a threshold effect. It affects the decision to invest abroad or to invest in a particular area but not, once manufacturing has been established, the fraction of the firm's resources that are devoted to foreign operations. The influence of size, we conclude, reflects economies of scale, not in production, but in foreign investing, and such economies of scale account for the higher frequency of foreign investment among larger firms. However, these economies of scale seem to result from indivisibilities that have little or no influence once a firm has surmounted the initial barrier to becoming a foreign investor.

We could find only a few, and rather weak relationships between the characteristics of parent firms and the locations of their foreign operations, as measured by the likelihood that they would invest in particular locations. Investors in low-income countries were not predominantly U.S. companies that paid low wages or were labor intensive in their U.S. operations. Relatively R&D-intensive or skill-intensive U.S. companies or those from relatively R&D-intensive or skill-intensive industries were not more likely to invest in developed countries. In fact the average firm investing in developing countries was slightly more R&D intensive than the average investor in developed countries. Investors in developing Asian countries in particular were relatively R&D intensive for their industries. Thus the characteristics of parent firms that led to foreign investment also led to investment in the developing countries, with perhaps a greater emphasis on size and technological intensity.

Other parent-firm characteristics we investigated were income from technology sales and the importance of sales by uncontrolled foreign

licenses relative to the parents' sales. Two types of relationship were noticed: in the electrical machinery industry, investors in developing countries spent more on R&D relative to their sales than investors in developed countries but reported smaller sales by uncontrolled firms under license, and in the machinery industries R&D-intensive companies tended to license less. In other words, these companies apparently tended to exploit their technological capital in foreign markets by production rather than by licensing. On the other hand, in metals and in "other manufacturing industries" there was a positive relation between R&D intensity and licensing.

## Footnotes

1 Since size is such a major difference between the investors and the noninvestors, one might suppose that it alone might account for some of the differences in other characteristics between the two groups, if those characteristics, such as profitability, are related to size. In fact, size does not seem to be a strong influence on most of the other variables in equations across all firms. Where it was, we tested the effect of size on the differences between investors and noninvestors. For example, we substituted, for the profitability measure (Pr), defined as Net Income/Sales, the residuals from an equation relating profitability to size, such as

$$Pr = a + b \text{ (Sales)}$$
$$Pr = a + b \text{ (log Sales)}$$
$$\log Pr = a + b \text{ (log Sales)}$$

and then compared investors and noninvestors with respect to $PR - \hat{PR}$, the latter being the "expected" profitability from one of the equations. The conclusions were not altered by that calculation; the other variables' influence was not simply a reflection of their relation to size. However, taking account of size did reduce the margin substantially, from the 1.7 percentage points shown in the table to only .6 percentage points, using an arithmetic equation, or from over 35 per cent to less than 10 per cent using a log equation.

2 "...direct investment entails higher (relatively fixed) costs of search and investigation than do exporting or licensing, and thus is more likely the game of the firm big enough to amortize these search costs over a large direct investment outlay" (Caves, 1974).

3 The same R&D variable has a fairly weak effect on the propensity of Swedish firms to produce abroad (Swedenborg, 1979). That fact suggests that the role of R&D input may be a characteristic of U.S. multinationals rather than of multinationals in general. However, the variables that affect the propensity to invest (the ratio of foreign to home-country investment) are not necessarily the same as those that affect the probability of investing (the proportion of firms in a group that do any foreign investing at all) as we shall see below, and there are also other differences between the Swedish and U.S. analyses. We therefore cannot make a strong statement on this question.

4 Although we are dealing with characteristics associated with any investment abroad rather than with the proportion of production carried out abroad (propensity to invest) it is of some interest to compare these

characteristics with those that determined the propensity to invest of Swedish parent firms (Swedenborg, 1979). Aside from size, discussed later, the labor skill level was positively related and physical-capital intensity negatively related to the Swedish foreign investment propensities. Those facts suggest that multinational firms from different countries may not carry the same set of advantages.

5 Table 2 probably exaggerates the difference associated with industry composition because, in the enterprise data, investors are much more fully covered than noninvestors and dominate our industry averages. However, an industry size measure from establishment data (not shown here), not subject to this problem, gives the same results: investors are from industries in which the median size of establishment is larger.

6 This difference is undoubtedly underestimated here because the noninvestors missing from our data must consist mainly of small firms.

7 That strange result is not a peculiarity of this pair of countries. In another paper (Kravis and Lipsey, 1982) we found, across a broader set of countries, that high-wage, presumably high-skill companies showed some tendency to locate not in high-wage host countries, for example, but in low-wage countries, and low-wage parents located in high-wage countries. The most capital-intensive parents located in low-wage countries and the least capital intensive in high-wage countries.

8 44 per cent of U.S. manufacturing investment in Sweden, measured by the U.S. direct investment position, was in nonelectrical machinery, the highest share for any host country, although Japan was close (U.S. Department of Commerce, 1981, Table I.W3). U.S. machinery industry parents were, on the average, 25 per cent smaller, as measured by total assets, than U.S. manufacturing parents in general (ibid, Table C).

9 In these regressions, differences among host countries in compensation per worker are presumed to reflect differences in costs of equivalent labor to a substantial degree, although we know that differences in labor quality are also included. That interpretation contrasts with the one we apply to average wage differences among industries or companies within the United States, which we consider as measuring differences in labor quality. The underlying assumption is that labor is fairly mobile among companies and industries within the United States but not among countries. To test the consequences of treating inter-country differences in average wages as measures of the price of labor we ran the regressions substituting for average wage in 1977 the same wage corrected for differences in labor quality measured for an earlier period (see Kravis and Lipsey, 1982, for a discussion of the correction). The results were essentially the same.

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