FIRM SIZE AND
FOREIGN DIRECT INVESTMENT

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ABSTRACT

This paper examines the importance of firm size in explaining foreign direct investment with data from American and Swedish firms. The results suggest that firm size only has a threshold effect on foreign investment, an effect on the decision to invest abroad. Once, however, a firm has jumped the initial barriers to foreign production, size has no effect on the fraction of the firm's resources devoted to foreign activity. Among firms that invest in foreign production large firms do not appear to have any particular advantage over small investing firms.

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Introduction

The standard literature on multinationals emphasizes the importance of firm size in explaining foreign direct investment. A typical statement is that of Caves, that "the relation between direct investment and firm size with other factors held constant, has been established statistically" (1974, p. 280). Some authors take the conclusion a step further to suggest that large firm size produces not only large foreign operations but also faster growth abroad. For example, Lall and Streeten write that "success breeds success in big business" and that Gibrat's Law is not applicable to the growth of multinationals (1977, p. 28). In other words, large size, which incorporates the firm's ownership-specific advantages, produces a cumulative and dynamic effect on the expansion of MNCs (see also Hood and Young, 1979, Chapter 2).

These descriptions of the role of firm size are often ambiguous. As Hufbauer (1975) and Swedenborg (1979) have pointed out, they do not make a

clear distinction between the probability or likelihood that a firm would be a foreign investor and the extent of such investment or, as Swedenborg describes it, its propensity to operate abroad, the share of its production that it carries on outside its home country. The study by Horst (1972), the basis for most of the statements about the importance of firm size, dealt only with the probability that a firm would be a foreign investor, or more specifically, the probability that it would meet the criteria for being a multinational firm by the definition used in the Harvard Studies (Vernon, 1971), including that of having a certain number of overseas operations.

In this paper we examine the relationship between parent size and the propensity to invest abroad with data for American multinationals that have become available in the last few years. We compare our results with the relationship for Swedish multinationals and with earlier analyses of smaller samples of U.S. firms.

Who invests abroad?

The accepted notion of what characteristics distinguish multinational parent firms from others is that they are a mixture of technological-rent and industrial-organization factors, not completely independent of each other. Multinational firms have been found to be set apart from others by, among other characteristics, their large size, high profitability, and heavy expenditures on R&D and advertising. Horst (1972) concluded that among U.S.-based firms only size distinguished multinational firms from others in their industries. The implication is that all the other charac-

teristics are industry attributes.

Several later studies have confirmed Horst's results for both U.S. and European multinationals. For instance, Lipsey, Kravis and O'Connor (1983), comparing U.S. firms that invest abroad with those that did not have any such operations, found that firm size was the most important determinant of the probability that a firm would invest abroad. Aside from industry effects and that of size of firm within industries, they also found, in contrast to earlier studies, two variables that influenced the selection of foreign investors within industries. One was the extent of input to R & D, and the other was profitability. The latter might reflect the output from investment in technology or in other assets such as advertising that are not capitalized.

In her study of Swedish multinationals, Swedenborg (1979) also confirmed Horst's finding as to relation of firm size to the probability of being a foreign investor. She showed, however, that Swedish firms on the average were smaller than U.S. firms when they ventured abroad for the first time, and suggested that it was the firm's size relative to its home market rather than its absolute size that determined when it went abroad.

Thus, the evidence of the influence of size on the likelihood or probability of foreign investment is quite strong. The size effect may differ between industries, as well as between countries, but there is little doubt that it exists. However, that evidence tells us nothing about what determines the extent of foreign production among firms that do produce abroad. That is, it does not tell us whether, among such firms, larger ones produce a higher proportion of their output abroad.

Size of firms and the propensity to produce abroad

The only publicly available data separating the domestic and foreign operations of individual U.S. firms are those reported to the Securities and Exchange Commission since the late 1970s. We have taken from Standard and Poor's Compustat tapes a sample consisting of 183 U.S. manufacturing firms that reported foreign operation in 1982, and sufficient additional information to construct the other variables required by our equations.

There are several ways to test for the influence of size on the propensity to operate abroad. Equation 1 relates the log of foreign sales to the log of domestic sales and Equation 2 adds several reputed determinants of foreign investment to the size variable (standard errors in parentheses):

(1) $\text{Log FS} = \begin{array}{c} .97 \\ (.05) \end{array} \text{log DS} - \begin{array}{c} .86 \\ (.33) \end{array}$ $\qquad \bar{R}^2 = .70 \quad \text{No. Obs.} = 183$

(2) $\text{Log FS} = \begin{array}{c} .99 \\ (.04) \end{array} \text{log DS} + \begin{array}{c} .20 \\ (.10) \end{array} \text{log KL} + \begin{array}{c} 8.65 \\ (1.72) \end{array} \text{RD} + \begin{array}{c} 3.23 \\ (1.42) \end{array} \text{AD} - \begin{array}{c} 2.04 \\ (.43) \end{array}$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad \bar{R}^2 = .74 \quad \text{No. Obs.} = 183$

where FS = Foreign Sales ($million)

DS = Domestic Sales ($million)

KL = Capital/labor ratio ($thousand)
measured by the assets per employee for
the consolidated firm

RD = R&D expenditures as per cent of sales for
the consolidated firm

AD = Advertising expenditures as per cent of sales
for the consolidated firm.

Equations 3 and 4 are the corresponding equations using domestic and foreign assets (DA, FA) as measures of size and foreign activity:

(3)   Log FA = 1.01   log DA   -1.23 $\bar{R}^2$ = .73   No. Obs. = 183
            (.05)   (.31)

(4)   Log FA = 1.02   log DA + .03log KL + 6.11 RD + 3.72 AD - 1.67
            (.05)   (.10)   (1.70)   (1.39)   (.40)

                                          $\bar{R}^2$ = .75   No. Obs. = 183

A coefficient of one for domestic sales or domestic assets implies that, across firms, a doubling of domestic size is associated with a doubling of foreign operations, but no more or less than that. In all these cases the coefficient of domestic size does not differ significantly from one. Although these are cross-section rather than time series data, the coefficients could be interpreted as implying that among these firms, growth in the domestic market would typically be associated with growth at the same rate in foreign markets.

The addition of the firm's capital intensity, R&D intensity and advertising intensity to the equations did not affect the size coefficient significantly. The directions of their influences on foreign investment propensities are as expected, but there is no indication that size acted as a proxy for any of them. Results for three industry groups, reported in Appendix Tables 1 and 2, were essentially the same as regards the size effect, although there were some differences in the influence of the other variables.

A more direct test of the relation of firm size to the propensity to operate abroad is to relate the propensity itself, as measured by the ratio of foreign to domestic sales (denoted RATIO), to the domestic size of the firm. Equations 5 and 6 give these relationships in log of size with and without additional variables.

(5) RATIO = $-.043$ log DS + .47 $\bar{R}^2$ = .01   No. Obs. = 183
           (.023)   (.03)

(6) RATIO = $-.041$ log DS + .10 log KL + 3.26 RD + 1.18 AD + .25
           (.023)   (.05)   (.88)   (.73)   (.22)

                                            $\bar{R}^2$ = .09   No. Obs. = 183

In no case is there a positive significant coefficient for domestic firm size. In fact, these equations show more evidence for a decline rather than for a rise in the propensity to invest abroad as size of firm increases. We also related the ratio of foreign to domestic sales to size itself, in arithmetic form, and, to test for nonlinearity, a squared size term. Both coefficients turned out to be zero (Appendix Table 3). All in all, the data indicate clearly that the size of the firm has no positive influence on the propensity to operate abroad, once a firm has jumped the initial barriers to foreign production.

We also ran a set of parallel equations for 109 Swedish multinationals (virtually all there were) using data from the IUI 1978 survey of Swedish investment abroad (Swedenborg, 1982). As can be seen from equations 7 and 8, and others parallel to the U.S. equations (Appendix Table 4), the regressions provided results similar to those for U.S. firms (even the test for nonlinearity).

(7) RATIO = .04 log DS − .08 $\bar{R}^2$ = .02 No. Obs. = 109
          (.03)   (.34)

(8) RATIO = .02   log DS + .00 log KL + 2.82 RD + .03 $\bar{R}^2$ = .06 No. Obs. = 109
          (.03)   (.06)   (1.31)   (.34)

This confirms the findings for Swedish firms in 1974 (Swedenborg, 1979). However, in that study the coefficient for domestic sales size,

close to unity when no other variables were included in the equation, 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 the oldest foreign operation, the last two of which were variables we could not match in the U.S. data.

Conclusion

We conclude that while size of firm is the major determinant of the probability of foreign direct investment, it is important only as a threshold effect. Once the firm has jumped the initial barriers to foreign production, size has no effect on the fraction of the firm's resources devoted to foreign activity. Therefore, among firms that invest in foreign production, large firms do not appear to have any particular advantage over small firms. Nothing in our results supports the fears sometimes expressed that the advantages of large firm size must lead to increasing con- centration within the foreign production of multinationals or their world- wide operations. Outside of a fringe of small firms, concentration in foreign production must be little different from that in domestic produc- tion.

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Appendix Table 1

Regression Equations for the Determinants
of Foreign Activity (Foreign Sales in logs) of U.S. Multinationals, 1982
Three Industry Groups

Industry (Number of Observations)		Domestic Sales (Million $) (Log)	Capital Labor Ratio (Thousand $) (Log)	R&D as % of Sales	Advertising as % of Sales	Intercept	$\bar{R}^2$
Chemicals (44)	a.	1.03 (.09)	---	---	---	-.97 (.64)	.74
	b.	1.04 (.09)	-.27 (.18)	9.67 (3.45)	-3.25 (1.96)	.18 (.84)	.78
Non-Electrical Machinery (32)	a.	1.15 (.18)	---	---	---	-2.10 (1.14)	.56
	b.	1.15 (.17)	.11 (.25)	20.77 (9.31)	13.22 (10.74)	-2.97 (1.39)	.62
Electrical Machinery (43)	a.	.99 (.09)	---	---	---	-1.13 (.61)	.75
	b.	.98 (.10)	.26 (.41)	-.24 (3.58)	-3.81 (8.05)	-1.88 (1.33)	.74

Standard errors in parentheses

Appendix Table 2

Regression Equations for the Determinants
of Foreign Activity (Foreign Assets in logs) of U.S. Multinationals, 1982
Three Industry Groups

Industry (Number of Observations)		Domestic Assets (Million $) (Log)	Capital Labor Ratio (Thousand $) (Log)	R&D as % of Sales	Advertising as % of Sales	Intercept	$\bar{R}^2$
Chemicals (42)	a.	.96 (.08)	---	---	---	-.58 (.58)	.75
	b.	.97 (.08)	-.38 (.18)	10.21 (3.35)	-3.21 (1.89)	.60 (.78)	.81
Non-Electrical Machinery (32)	a.	1.10 (.16)	---	---	---	-1.88 (1.03)	.58
	b.	1.17 (.15)	-.13 (.24)	22.48 (8.32)	16.15 (9.57)	-2.37 (1.07)	.69
Electrical Machinery (42)	a.	1.04 (.07)	---	---	---	-1.50 (.49)	.83
	b.	1.02 (.08)	.27 (.34)	1.66 (2.75)	2.72 (6.14)	-2.44 (1.02)	.82

Standard errors in parentheses

Appendix Table 3

Regression Equations for the Determinants of U.S.
Multinationals' Propensity to Operate Abroad in 1982
Total Manufacturing
(183 Observations)

Propensity and Domestic Size Measure		Domestic Size ($1,000)	Squared Domestic Size	KL	RD	AD	Intercept	$\bar{R}^2$
Sales ($1,000)	a.	-.003 (.006)	--	--	--	--	.47 (.03)	.00
	b.	-.006 (.014)	.0001 (.0004)	--	--	--	.47 (.04)	-.01
	c.	-.002 (.006)	--	.001 (.001)	3.52 (.89)	1.08 (.74)	.27 (.06)	.07
Assets ($1,000)	a.	.004 (.007)	--	--	--	--	.40 (.03)	.00
	b.	.001 (.015)	.0002 (.0007)	--	--	--	.41 (.03)	-.01
	c.	.005 (.007)	--	.000 (.001)	1.58 (.71)	1.39 (.59)	.31 (.05)	.03

Standard errors in parentheses.

Appendix Table 4

Regression Equations for the Determinants
of Foreign Activity (Foreign Sales in Logs) of Swedish MNCs, 1978
Total Manufacturing
(109 Observations)

Equation	Domestic Sales (1,000 SEK) (Log)	Capital Labor Ratio (1,000 SEK) (Log)	R & D as % of Sales	Intercept	$\bar{R}^2$
1.	1.05 (.06)	--	--	-2.22 (.79)	.72
2.	1.06 (.07)	-.15 (.14)	6.03 (3.07)	-1.87 (.79)	.73

Standard errors in parentheses.