RISK REDUCTION BY INTERNATIONAL DIVERSIFICATION

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Abstract. It is possible for multinational firms to reduce the risk of their profits by engaging in foreign operations (F/T). Empirical tests show that the (F/T) variable is inversely related to risk after allowing for size, industry classification, and other factors. This implies that international diversification offers to a multinational firm significant risk reduction advantages that are not available to a nonmultinational.

INTRODUCTION

■ The objective of this paper is to report empirical tests of the opportunities available to a multinational firm for reducing the risk of its profits. Interest in this risk dimension, as well as in the traditional level of profits, has developed due to the application of portfolio theory in an international context.[1]

The first such application of the theory of portfolio selection under conditions of uncertainty, as developed by Tobin (1958) and Markowitz (1959), was by Herbert Grubel (1968). He demonstrated that it was possible for individual asset holders to reduce risk by holding an efficiently diversified portfolio of international assets. His analysis considered financial capital flows, as did work by Levy and Sarnat (1970), Miller and Whitman (1970), and Grubel and Fadner (1971). It can be extended in a new direction by consideration of direct investment, as attempted by Cohen (1972) and Severn (1974).

The characteristic of direct investment is that the investor retains control over the investment. For example, the parent firm of a multinational corporation may both invest in a foreign subsidiary and control the operations of that subsidiary. Recent work in the field of international investment has shown that direct investment is motivated by the existence of market imperfections: Kindleberger (1969), Johnson (1970), Caves (1971), Knickerbocker (1973). [For an interpretation of these studies see Parry (1973) and Rugman (1975).] These studies show that the motivation of direct investment occurs at the firm level owing to an imperfect international market.

The foreign operations of multinational firms allow the firm to maximize its overall level of profits. It is demonstrated in this paper that the multinational firm also enjoys the additional advantage of less risk in its profits than does a similarly sized firm selling most of its goods in one national market alone. More specifically, stability of earnings through time is an increasing function of the ratio of foreign to total operations. The advantage of risk reduction exists due to the possibility of diversification of sales in various national economies, provided that the fluctuations of these economies are not perfectly positively correlated.

In this paper the theory of portfolio analysis is used to justify variance as a suitable proxy measure of risk. No distinction is attempted between systematic and unsystematic risk since it is empirically difficult and even theoretically inappropriate to use the Capital Asset Pricing Model (CAPM) in an analysis of direct investment. The CAPM, developed by Sharpe (1964) and Lintner (1965), would be suitable if financial capital flows were being examined as in the work by Solnik (1974 a,b) and Lessard (1974). To use the CAPM it is necessary to have a perfect international capital market and an international risk free asset. These are inappropriate assumptions to make when testing direct investment, and the use of a CAPM would be inconsistent with the argument that direct investment is motivated at the firm level by market imperfections.

Although a foreign *investment* variable is desirable when portfolio theory is used to determine the actions of individual asset holders in an international context, a foreign *operations* variable is suitable when the activities of multinational firms are being analyzed. Foreign *operations* must be used instead of direct *investment* because of data limitations; there are no published data on foreign investment of firms—this information is available only at the industry level.

SPECIFICATION OF EQUATION FOR TESTING

Using earnings stability as a measure of risk and foreign operations as a measure of foreign investment generates an empirical hypothesis that states: "The instability of United States corporation earnings through time is a decreasing function of the ratio of foreign to total operations *ceteris paribus*." Alternatively, the risk of profits (as measured by variance) is related inversely to the ratio of

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foreign to total operations. Other factors influence the risk of profits; the more relevant of these are specified in the equation. One independent variable is size, while another is a dummy variable representing industry classification.

The equation specified for testing is:

$Var\ (E/K)_i = f[\ (F/T)_i,\ SIZE_i,\ DUM_i\ ]$

Where:

Var is variance.

(E/K) is the rate of return on capital, using annual data, where E is defined as net income (profits) and K is defined as net worth of the corporation.

(F/T) is the ratio of foreign to total operations, where F is defined as exports by home firms plus sales by overseas subsidiaries.

SIZE is a variable representing the size of a firm, as measured by either sales, assets, employees, or a size index.

DUM is an industry dummy variable.

i is a subscript denoting individual firms.

It is hypothesized that size is inversely related to variance, since, as the size of a firm increases, the firm is able to diversify its total operations in order to reduce risk. Since it is not possible to test product diversification itself, the industry classification of the firm is used instead, as a dummy variable. The sign of the industry dummy variable depends on the omitted dummy in the specific formulation of the particular equation tested.[2]

DATA SOURCES

The only published source on foreign operations at the firm level available to the author was that of Bruck and Lees (1968), who calculated the extent of foreign operations in 1965 as ranked by *Fortune*. The data were gathered from company reports and by interviews. The ratio of foreign to total operations is examined for several firm characteristics such as sales, profits, assets, and number of employees. These alternative measures of (F/T) were found by the author to be highly positively correlated. The (F/T) for sales was recorded whenever it was available; other (F/T)s were used in the few cases when it was not. A data bank was coded with the following information for each firm: rank of firm in 1965; (E/K) for each year from 1960-1969; (F/T) for 1965; sales, assets, and net profits in $ millions for 1965; employees in thousands for 1965; SIC code for 1965; sales and assets for 1960 and 1969 in $ millions; and earnings per share.

All these dȃta, other than (F/T), were taken from the *Fortune* directory of the top five hundred American companies, mostly from the July 15, 1966 issue which reported the 1965 data. The size variables are from consolidated data, as defined in the survey. The figures for (E/K) over ten years were obtained by searching in annual issues of the *Fortune 500*. For many of the smaller firms, however, data on several (E/K)s were missing. Therefore, when the variance of (E/K) was calculated for each firm, an adjustment was made for this difference in the number of observations. Of the original *500* firms listed for 1965, 41 were affected by name changes and 56 were involved in mergers. Some of the same firms were involved in both name changes and mergers. Other researchers have used (E/K) as a measure of the rate of return for a firm; their studies are discussed elsewhere (see Rugman 1974, Chapter 4). In the (F/T) figures taken from the Bruck and Lees study of 1968, five firms were foreign owned with, consequently, no appropriate data for (F/T). These five firms were omitted from all calculations. The data for dummy variables, namely, their SIC code for industry classification, are taken from the Bruck and Lees study (1968).

Alternative measures of size are used in the regressions, namely sales, assets, and employees. These measures are correlated, and the appropriate use of any variable will depend upon the specific empirical test projected. In order to check for any bias in this procedure, a fourth measure of size was constructed; that is, an index of size based on equal weights for each of the three measures. It was found, subsequently, that the results using the size index were similar to other regression results, and, therefore, the size index is not reported here.

EMPIRICAL RESULTS

A series of tests was carried out using least squares regression analysis.[3] In the reporting of regression results, the subscript i in the equations will be dropped. It is to be understood that all such equations refer to individual firms, and the interpretation of the results is based on this assumption. The functional form specified is logarithmic since it was thought that this type of function would best capture the wide range in absolute numerical values of the observations in several of the variables. The use of this functional form helps to avoid heteroscedasticity in the size variables.

To generate industry dummies, the firms were coded into 18 industry groups plus one miscellaneous category, making 19 in all. These classifications report the standard three-digit SIC code number. Since only 18 operations are available with the MASSAGER program, these industries were reduced to 12 dummies, as shown in Table 1.

Table 1

INDUSTRY DUMMIES

Dummy No.	*SIC Code*	*Industry Name*	*No. of Firms*
1	37	Transportation Eqpt.	46
2	36	Electrical Machinery	43
3	35	Non-Electrical Machinery	55
4	34	Fabricated Metals	18
5	33	Primary Metals	49
6	28	Chemicals	56
7	20 + 21	Food: Tobacco	78
8	22 + 23	Textiles: Apparel	26
9	24 + 26 + 27	Lumber: Paper: Printing	39
10	29 + 30	Petroleum: Rubber	38
11	31 + 32	Leather: Glass	23
12	38 + 39	Instruments: Miscellaneous	28

When the regressions were run, each industry dummy was omitted in turn. One such dummy has to be omitted in order to act as a standard of comparison for all other industry groups. By this procedure, it was found that SIC group 37 was the most risky group. The interpretation of results is no different when alternative industry groups are omitted. For simplicity in presentation, results are reported with SIC 37 as the omitted dummy variable.

In the equations reported in Table 2, the problem of zero (F/T)s was overcome by adding 0.25 to each observation of (F/T). The number of observations is 492, with eight omitted due to data limitations. Size variables have been included in equations 2, 3, and 4, where the size variables used are:

Sales in equation 2
Employees in equation 3
Assets in equation 4

The value of R^2 adjusted for degrees of freedom was as follows:

0.10 in equation 1
0.12 in equation 2
0.12 in equation 3
0.13 in equation 4

The mean value of the dependent variable, In variance (E/K), was about 0.69 in each of the four equations.

INTERPRETATION OF RESULTS

In equation 1 (F/T) satisfies the 1% level of significance as shown by the *t* value of -3.49 (which is greater than the required value of -2.33 for a one-tail test). The explanatory power of the equation is about 10% as indicated by the multiple correlation coefficient when adjusted for degrees of freedom. A low R^2 is to be expected in regressions which include the variance of a profit variable rather than the levels of profit rates. The former is more likely to be strongly affected by random disturbances to firm profit rates than the latter [see Harry Bloch (1974).] The value of the (F/T) coefficient is about 0.1 which implies that an average increase in (F/T) for a firm of 10 percentage points would reduce its variance by 10 percentage points; and, with a mean of about .7, the risk would be reduced by about one-seventh. In equation 1 the industry dummies are all inversely related to variance which shows that they are all less risky than those firms in SIC group 37.

When a size variable is added in equation 2, the (F/T) variable satisfies the 1% level, as does the size variable. With SIC 37 as the omitted industry dummy variable, all the industry groups are, again, related inversely to variance. For the first seven industry dummies reported, this stability satisfies the 5% level. There is evidence of multicollinearity between the (F/T) and the sales variables as demonstrated by a correlation of 0.25 between (F/T) and sales that is greater than the value of the adjusted R^2.

Table 2

ln Variance (E/K) 1960-1969 is a function of the following independent variables:—

	Constant	ln (F/T)	ln (Size)	(SIC 20 & 21)	(SIC 31 & 32)	(SIC 24 & 26 & 27)	(SIC 22 & 23)	(SIC 28)	(SIC 33)	(SIC 38 & 39)	(SIC 36)	(SIC 35)	(SIC 29 & 30)	(SIC 34)
(1)	1.056	-0.109		-0.495	-0.494	-0.375	-0.344	-0.319	-0.260	-0.230	-0.187	-0.111	-0.105	-0.028
	15.72*	-3.49*		-5.94*	-4.27*	-3.66*	-3.05*	-3.52*	-2.82*	-2.13x	-1.95x	-1.21	-0.95	-0.22
(2)	1.489	-0.078	-0.169	-0.512	-0.536	-0.422	-0.382	-0.358	-0.284	-0.276	-0.216	-0.177	-0.038	-0.079
	9.06*	-2.36*	-2.88*	-6.18*	-4.63*	-4.09*	-3.39*	-3.94*	-3.10*	-2.54*	-2.26x	-1.88x	-0.33	-0.62
(3)	1.285	-0.068	-0.194	-0.558	-0.526	-0.436	-0.365	-0.384	-0.301	-0.288	-0.203	-0.174	-0.090	-0.079
	13.96*	-2.06x	-3.59*	-6.63*	-4.59*	-4.240*	-3.28*	-4.21*	-3.28*	-2.66*	-2.13x	-1.88x	-0.82	-0.63
(4)	1.639	-0.049	-0.252	-0.541	-0.521	-0.101	-0.387	-0.347	-0.249	-0.250	-0.226	-0.196	-0.007	-0.097
	11.74*	-1.48′	-4.73*	-6.59*	-4.60*	-4.00*	-3.51*	-3.91*	-2.76*	-2.36*	-2.40*	-2.14x	-0.07	-0.78

t values are reported below each coefficient where the significance test is satisfied at:—

* 1% level, x 5% level, ′ 10% level.

In equations 3 and 4 there is a similar pattern of results when employees and assets are used as alternative measures of size. The explanatory power of the equations, as indicated by the multiple correlation coefficient adjusted for degrees of freedom, is between 12% and 14%. When employees are used instead of sales, (F/T) is significant at the 5% level, whereas when assets are used, (F/T) is significant only at the 10% level. In both equations the size variable itself satisfies the 1% level of significance. In the equations there is again multicollinearity between (F/T) and the respective measure of size. The industry dummies perform consistently in each equation. In equations 3 and 4, for seven of the industry groups, the more stable earnings as compared with SIC 37 are significant at the 1% level, while for another two this stability is significant at the 5% level. There is no multicollinearity between any of the industry dummies, since they are orthogonal by construction. The results as reported and interpreted here, in general, support the hypothesis as it is outlined above. The sales variable in equation 2 gives the best results because, with this proxy for size, the crucial (F/T) variable satisfies the 1% significance level.

CONCLUSION AND IMPLICATIONS

This paper is an extension of previous work; therefore, its contribution should not be overstated. It does not aim to offer a full explanation of direct investment; but, instead, to suggest and confirm that one variable, the ratio of foreign to total activities (F/T), is worthy of consideration; and that firms with a higher (F/T) ratio are able to reduce the variance of their earnings, where variance is a proxy for risk. The empirical results show that the (F/T) variable is statistically significant and inversely related to variance of profits. This significance remains when other important variables, such as size and dummies for industry classification, are specified as independent variables.

There is a possible downward bias in the results, owing to the selection of U.S. corporations for the analysis. The U.S. market is already large and well diversified, especially on regional grounds. If the test had been made using corporations of European or Japanese origin, the estimated gains from diversification would probably have been higher due to the smaller geographic and economic size of the markets in such countries.

Another possible bias in the results is due to the modifications required in data on assets of the firm. One of the opportunities available to a multinational enterprise is that it may be able to disguise the source of its profits from various subsidiaries. It can do this by means of transfer pricing, retained earnings, depreciation, and other devices. Similarly, the data on net profits may be inaccurate. Multinational enterprises may attempt to avoid reporting all of the profits on their foreign operations. This could permit the firm to minimize its tax bill, and it might engage in such a policy until the probability of detection offsets potential gains from tax evasion. The policy decision depends on relative tax rates, laws, and other variables which need not be analyzed here. Neither of these problems will undercut the basic results in this study. For example, if the multinational firms report an artificially low level of profits, and yet this study shows that their risk in profits is reduced through international diversification, then the correct level of profits, when it is reported, would tend to reinforce the benefits available to multinational firms.

Several policy implications arise from the fact that the foreign operations reduce risk. First, the individual risk-averting investor can purchase shares in multinational corporations in order to achieve the benefits of international diversification in an indirect manner. He will do this if there are barriers to free trade in capital, as, for example, when the cost of acquiring shares in foreign economies was prohibitive due to the tax payments required under the Interest Equalization Tax imposed from 1963 to 1974. The stockholders of a multinational firm can benefit from the more stable earnings in such a firm and thereby enjoy the benefits of international diversification in an indirect manner.

Secondly, foreign governments might attempt to measure the gains from diversification that are reaped by multinational firms selling in their own economies. It may then be possible for national governments to impose an "optimum" tax, such that, at the margin, the multinational firm still benefits from foreign investment and sales by subsidiaries in the host economy, but that any excess profits in the form of more stable earnings have been eliminated.

Finally, a look into the future may reveal increasing world economic integration. The pace of this interdependence may be speeded up by the operations of multinational firms themselves, as they sell similar products, and introduce similar preferences in world markets. Increased economic integration will also tend to increase the correlation between fluctuations in the domestic economy and fluctuations in foreign economies. As the integration of economies proceeds, market imperfections will become less important as a determinant of direct investment. In the long run, a world market may develop in which knowledge, research, and technology can be freely bought and sold so that direct ownership of these techniques is no longer required. Then the benefits of international diversification via the multinational firm will eventually fade away.

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FOOTNOTES

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2. Clearly other variables influence the variance of (E/K) besides these variables specified. One such omitted independent variable is the expected rate of return, E(E/K). In the portfolio theory model, higher expected returns would be positively associated with risk. As E(E/K) is not in theory causally related to risk, the E(E/K) variable is not included as an independent variable. The treatment of expectations is also constrained by lack of data. A firm engages in foreign operations in order to reduce the expected variability in its (E/K) ratio, but it is not possible to test this theoretical argument directly due to the familiar research problem that only *ex post* data are available. Here actual rates of return are used as proxies for expected rates of return. It is conventionally assumed that the equations using such *ex post* data are suitable proxies for the *ex ante* theory specified in terms of expectations.

3. Several problems arose in the actual programming and operating of the computer. The canned program used to generate regressions was MASSAGER and one of the difficulties in its use is the treatment of zero values of variables. The MASSAGER program cannot take the log. of zero, and there are 97 firms of the *500* with a zero (F/T) percentage. To overcome this problem the value of 0.25 was added to each and every value of (F/T). This device does not affect the raw data since the original data of (F/T) from Bruck and Lees were themselves rounded to the nearest percentage point. Hence any firm with a (F/T) of less than 0.5 is reported as zero. By taking 0.25 as an estimate of the mean of the true (F/T) for these firms, the program can be used correctly, and any computing bias in the results can be avoided.