MANAGERIAL AND DECISION ECONOMICS, VOL. 10, 89–100 (1989)

The Mode of Corporate Diversification: Internal Ventures versus Acquisitions

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This study investigates empirically the underlying motives for selecting the mode of corporate diversification and attempts to match the form of capital investments with a corresponding theoretical rationale for diversification. The empirical results seem to support both the transaction-costs rationale for diversification and the motive that arises from a firm's prior experience with each form of capital investment. However, the empirical findings are inconsistent with the explanation that is based on the owner–manager conflict of interest.

INTRODUCTION

Corporate diversification has received considerable attention in the literature. Economists have dealt with its effects on the structure of industries and on profitability of firms, and have developed various measures of diversification (see, for example, Arnould, 1969; Caves *et al.*, 1980; Gort, 1962; Jacquemin and Berry, 1979; Lemelin, 1982). Finance theorists have pointed out the futility of conglomerate diversification if markets are perfect (Levy and Sarnat, 1970) and have suggested various market imperfections to explain conglomerate diversification (Higgins and Schall, 1975; Lewellen, 1971). Strategic management researchers have examined the role of diversification in determining profits and riskiness of firms and have investigated the ramifications of various types of diversification (Bettis, 1981; Bettis and Hall, 1982; Bettis and Mahajan, 1985; Christensen and Montgomery, 1981; Palepu, 1985; Rumelt, 1974).

Several motives for diversification have been suggested. One is the transaction cost theory (Coase, 1937; Williamson, 1975), which states that diversification facilitates the use of excess resources, thus enhancing efficiency (Teece, 1982). Diversification may be a desirable alternative to selling off excess capacity when there is some failure in the market such as high transaction costs due to variations in asset specificity or the ability to redeploy the firm's assets.

Recently, Amihud and Lev (1981) advanced the risk reduction motive of managers as a rationale for unrelated diversification. Managers who have a large and non-tradable human capital investment in their firms may find it advantageous to diversify this investment through conglomerate diversification. Consequently, as long as the firm-specific risk is reduced, they may engage in mergers and acquisitions even when such investments do not create synergies or are negative net present-value projects for shareholders. Thus another motive for conglomerate diversification is the agency conflict between managers and shareholders, in which managers are motivated to reduce the probability of bankruptcy to enhance their job security and preserve their firm-specific human capital investment.

With a few exceptions (Salter and Weinhold, 1979; Yip, 1982), the relationship of the mode of diversification to the type of diversification has received little attention in the literature. At issue here is whether a firm chooses to make its capital investments through internal expansion into other businesses or through external acquisitions; a firm can, of course, diversify into other lines of buisness through both modes. However, it is possible that some firms are more likely to choose diversification through the development of internal new ventures, while others may select to diversify through acquisitions.

The purpose of this study is to investigate empirically the underlying motives for selecting the mode of corporate diversification, attempting to match the form of capital investments with the rationale for diversification. We examine three alternative explanations for the decision to diversify and the associated modes of diversification that firms choose. The first is based on the transaction cost rationale. If it is correct, and if we make two additional assumptions, then it can be expected that diversified firms are characterized by a larger proportion of future capital investments carried out through acquisitions than non-

0143-6570/89/020089-12$06.00

diversified ones. The empirical results are consistent with this explanation. The second explanation is based on the manager–owner conflict of interest in which it is expected that manager-controlled firms are characterized by a larger proportion of investments carried out through acquisitions; however, empirical results do not support this. The third explanation is based on the experience a firm has accumulated in prior capital investments. According to this explanation, the larger the proportion of prior capital investments that have been carried out as acquisitions, the higher the proportion of future capital investments that will be made through acquisitions. This third explanation is supported by the data.

The organization of the study is as follows. Each of the next three sections includes a potential explanation, the research design and data that examines it, and the statistical results. The last section summarizes and concludes the study.

TRANSACTION COSTS AND THE MODE OF DIVERSIFICATION

Hypothesis

By drawing on Williamson (1975), Teece (1982) discussed the role of various market failures as motives for diversification, particularly the excess capacities or resources that a firm cannot efficiently deploy internally. While one solution may be to sell or lease these resources to other firms, high transaction costs may prevent such action. Therefore a firm may decide to diversify in order to better deploy its excess resources.Teece (1982, p. 58) also briefly examines the mode of such diversification and, in particular, whether it should be done through *de novo* entries into other lines of business or through acquisitions. He suggests:

> If an enterprise has excess or slack internal resources, and market failure considerations dictate internal utilization, then the choice of *de novo* entry or acquisition will depend upon the amount of slack, the time period over which it is available, and the complementary resources which can be accessed through acquisition. Thus, if the slack appears gradually over a long period of time, *de novo* entry can be tailored as incremental approach to diversification. If, on other hand, slack resources are expected to emerge suddenly—due, for instance, to a sudden surge in technological innovation or due to an adverse change in demand which suddenly throws internal resources into unemployment—then merger or acquisition is likely to be the most favored route.

While these arguments are intuitively appealing, Teece (1982) does not support them empirically. Indeed, empirical investigation of this subject is difficult, since we cannot actually observe the extent of excess resources within a firm, the associated transaction costs of deploying them externally, and the fluctuations in their levels. Consequently, we must resort to indirect measures for the empirical test.

We focus on prior diversification as a surrogate for the variables of interest. Presumably, a diversified firm has found it necessary to diversify into other lines of business because it had accumulated substantial excess resources that could not have been efficiently deployed internally. Furthermore, its decision to diversify indicates that high transaction costs prevented the firm from selling these excess resources in the marketplace. Thus to the extent that the same conditions will persist in the future, we expect that the new excess resources will also be utilized by entering new markets. According to Teece (1982), such entries are more likely to be through acquisitions if the accumulation of prior excess resources has not occurred gradually over the years. Consequently, past capital investment decisions may be studied to make inferences about the future form of capital investment.

The above discussion leads, therefore, to the following hypothesis:

> H1: Diversified firms are more likely to engage in future acquisitions than non-diversified ones. Similarly, non-diversified firms are more likely to engage in future internal expansion than diversified ones.

Empirical Test

Data The COMPUSTAT Industrial File was used to retrieve most of the financial information utilized in this section and the COMPUSTAT Business Segment File was used to retrieve segment data about firms. According to the Financial Accounting Standards Board (FASB), Standard No. 14 (1976), firms are required to disclose sales, operating income and identifiable assets information in their annual reports about each business segment. The COMPUSTAT Segment File includes all three data items for each segment, along with one or two Standard Industrial Classification (SIC) codes, and the segment's name.

Sample We first ranked all firms represented on the COMPUSTAT tape in descending order of sales in 1984. We then eliminated financial sector firms and regulated utilities, which are subject to special accounting regulations that may distort the cross-sectional analysis, as well as firms that did not have at least six years of segment data for the period 1977–84. The first 400 firms that remained on the list provided data for the study.

We selected large firms to maximize the availability of segment data and deleted others because of missing data; however, most of the statistical analyses were based on at least 300 firms.

The Diversification Measure

In the context of our study, diversification is defined by the number of SIC industries in which the firm operates. Economic theory does not provide a single basis for measuring corporate diversification. Indeed, studies in the industrial organization and strategic management literature offer many measures, ranging from simple product counts, specialization ratio measures, and output-share measures using a variety of weighing schemes, to continuous and categorical measures of relatedness between the firm's activities (Arnould, 1969; Berry, 1975; Caves *et al.*, 1980; Pitts and Hopkins, 1982).

Traditional diversification measures relied on SIC codes to count the extent of the firm's operations in different industries. The general form of these SIC measures is:

$$D = 1 - \Sigma_j s_j w_j$$

where s_j is the proportion of total firm sales in the *j*th SIC industry and w_j is an assigned weight. Among the variety of approaches for assigning weights, the Berry–Herfindahl index has been used most frequently. It weights each business share by itself, so that:

$$D = 1 - \Sigma_j s_j^2$$

In this study we utilize a slightly modified Berry–Herfindahl measure of the form:

$$SIC4 = 1 - (\Sigma_j s_j^2)/(\Sigma_j s_j)^2$$

where $SIC4$ denotes four-digit industry groups. The denominator of this measure, which was also adopted by Montgomery (1982, p 300), may deviate from unity when total firm sales differ from the sum of the segments. This may be the case when some of the firm's sales cannot be identified with any SIC industry group.

In what follows, we show that the Berry–Herfindahl measure of diversification, which essentially counts the extent of a firm's operations in different four-digit SIC industries, equals 0 when the firm is active in a single SIC industry and has a maximum value of 1. Further, when the shares of total sales in any business segment are chosen to maximize the extent of diversification, then the diversification index increases monotonically as the number of SIC industries in which the firm is active (i.e. n) increases and, at the limit (i.e. when $n \to \infty$), the diversification measure approaches unity. It should be noted, however, that while D (and $SIC4$, which is identical to D, since its denominator equals unity in the absence of data problems) is bounded by 1 (above) and by 0 (below), it does not converge to 1 or even increase monotonically for every choice of s_j. For the latter to hold, the selection of s_j is restricted, as discussed below.[1]

By inspection, we may establish that when $n = 1$, $s_j = 1$, and so $D = 0$. That is, when the firm is in a single SIC industry the share of its sales in this industry equals 1 and thus $D = 0$.

To show that the maximum value of D is 1, we formulate and solve the following constrained maximization problem:

$$\underset{s_j}{\text{Max}} \left(1 - \sum_{j=1}^{n} s_j^2\right)$$
$$\text{s.t.} \qquad \Sigma s_j = 1$$

The solution (see Section A of the Appendix) suggests that the share of any segment, *j*, which will maximize the diversification index, D, equals $1/n$. Thus the maximal value of D is:

$$\bar{D} \equiv \text{Max}\, D = 1 - \sum_{j=1}^{n} (1/n)^2 = 1 - 1/n$$

It now can be shown that if the firm selects $s_j = 1/n$ then, as the number of segments, n, increases, $\bar{D}$ approaches 1 monotonically. This holds, since

$$\partial\bar{D}/\partial n = 1/n^2 > 0 \text{ and } \lim_{n \to \infty} (1 - (1/n)) \to 1 \text{ since } 1/n \to 0$$

This result has been obtained by restricting each s_j to equal $1/n$, a value which has been shown to maximize D. Clearly, this choice of s_j need not necessarily hold, as the objective of the firm may not be to maximize the extent of corporate diversification. Indeed, one can show (see Section B of the Appendix) that when total firm sales increase with an increase in the number of business segments, and by constraining the magnitude of s_j, the results on the monotonicity and limit of D may be upheld.

Measures of Acquisitions and Capital Expenditures

To measure the investment decisions of a firm we used data from the Statement of Changes in Financial Position (SCFP). As specified in the Accounting Principles Board (APB) Opinion No. 19 (American Institute of Certified Public Accountants, 1971), firms should disclose separately their expenditures on property, plant and equipment (PPE) from their acquisitions of subsidiaries or new investments in unconsolidated subsidiaries. Thus capital expenditures are those taken from the SCFP and divided by total uses of funds, which is necessary for the cross-sectional tests employed in this study. The acquisitions are those reported on the SCFP divided by total uses of funds. Note that both the capital expenditures and acquisitions measures are not contemporaneous with the diversification measure but lead it one year. For example, the 1977 diversification measure is matched with the capital expenditures and acquisitions during 1978.

Results

Prior to the tests of Hypothesis 1, we would like to establish the appropriateness of the diversification measure in assessing the magnitude of excess capacities, the severity of transaction costs and, in particular, the evolution of excess resources as manifested by prior decisions to invest internally through capital expenditures or externally through acquisitions. Table 1 presents correlation results between the measure of diversification and *prior* acquisitions and capital expenditures. As the table clearly indicates, diversified

Table 1. Pearson Correlations Between Diversification and Capital Investments (Year 1977)

	Diversification[a]
Capital expenditures[b]	
Three-year averages	−0.1436
Significance	(0.003)
Five-year averages	−0.1232
Significance	(0.009)
Acquisitions[c]	
Three-year averages	0.1289
Significance	(0.007)
Five-year averages	0.1550
Significance	(0.002)

[a] Diversification is measured by *SIC4*.
[b] Capital expenditures from Statement of Changes in Financial Position (SCFP) divided by total uses of funds, averaged over three- and five-year periods ending in 1977.
[c] Acquisition from SCFP divided by total uses of funds, averaged over three- and five-year periods ending in 1977.

firms tend to invest a larger proportion of their funds through acquisitions than non-diversified ones. The converse is true for capital expenditures.

These results seem to indicate that if the transaction-costs explanation is valid it is reasonable to assume that the extent of total diversification is a good surrogate for prior assessments of excess resources, the existence of transaction costs and the evolution of excess resources throughout time. If the occurrence of excess resources and the corresponding transaction costs are persistent over time, we can use the diversification measure to predict *future* modes of capital investments, as suggested by the first hypothesis.

Table 2 reports the results of OLS regression models where the dependent variables are the modes of capital investments and the independent variable is the measure of prior diversification. As can be seen from the table, prior diversification is a statistically significant variable in explaining the forms of future

Table 2. Tests of the Transaction-costs Theory

		Intercept	*SIC4*	R^2
1977				
	Model			
	1	0.584	−0.109	0.018
		(22.98)	(−2.37)	(0.018)
	2	0.017	0.093	0.015
		(0.67)	(2.03)	(0.043)
1983				
	Model			
	1	0.503	−0.156	0.022
		(15.08)	(−2.65)	(0.008)
	2	0.012	0.105	0.013
		(0.37)	(1.89)	(0.060)

(1) $CAP_{t+1} = a_0 + a_1 SIC4_t$.
(2) $ACQ_{t+1} = C_0 + C_1 SIC4_t$.
t-statistics in parentheses, except for R^2, where the significance level is provided in parenthesis.
CAP_t is capital expenditures divided by total uses in year *t*.
ACQ_t is acquisition divided by total uses in year *t*.
SIC4 is a measure of total diversification.

capital investments. Furthermore, recall that H1 predicts that diversified firms are more likely to diversify through acquisition than their non-diversified counterparts, because of the larger amount of excess resources that may suddenly become available. Indeed, we find that diversified firms tend to invest a larger proportion of their funds through external capital expansions than non-diversified ones.

Thus the transaction-costs explanation seems to be supported by the data, provided that two important assumptions are made:

(1) That prior diversification is a suitable measure for the magnitude of excess resources and their evolution over time; and
(2) that the evolution of excess resources and the transaction costs of deploying them externally are stable over time.

THE AGENCY CONFLICT AND THE MODE OF DIVERSIFICATION

The separation of ownership from control in modern corporations poses some interesting agency problems. From Berle and Means (1932) to Jensen and Meckling (1976), it has been recognized that managers and directors of corporations with diffuse ownership structures have incentives to make decisions which enhance their personal wealth rather than that of the shareholders. Several mechanisms exist to prevent such conflicts, such as hierarchical/mutual monitoring (Alchian and Demsetz, 1972), executive compensation contracts (Smith and Watts, 1985) and decision systems (Fama and Jensen, 1983). However, these preventive mechanisms are necessarily incomplete and, therefore, cannot eliminate entirely the divergence of interest between managers and shareholders. For example, Demsetz (1983, p. 381) argued that 'shirking is reduced to its optimal level by various pressures from within and outside the firm, but shirking nonetheless exists'. Jensen and Meckling (1976) emphasized the role of the efficient capital market in remedying the residual conflict, and used this information to value their claims. Consequently, market prices reflect agency costs associated with the residual conflict of interest between owners and managers.

The residual conflict depends, among other things, on managers' ability to control the firm. Jensen and Ruback (1983, p. 41) defined corporate control as 'the rights to determine the management of corporate resources, and these rights are vested in the corporation's board of directors'. Thus the extent to which managers can influence the selection and decisions of the board of directors will determine their ability to control the firm. Since directors are elected by holders of voting stock, managers' ability to control the firm depends on the distribution of the firms voting stock among its shareholders. This concept of management control has been summarized by Larner (1970, p. 3):

Its essential meaning is that managers—the corporate officers whose assigned task is to implement the policies adopted by the board of directors—rather than stockholders (through the directors they elect) effectively decide the broad policies the corporation will pursue. Management's power to determine corporate policy is based not on the ownership of a significant proportion of the corporation's voting securities, but rather on its ability to solicit proxies for its slate of candidates with the use of the corporation's prestige and funds. This ability, together with the wide dispersion of the company's stock among small holdings, enables the management to nominate and elect a board of directors.

Of course, the distribution of voting stock among shareholders varies from firm to firm. There are firms in which one individual or a group of individuals hold a large proportion of the corporate voting stock. In other firms there may be a wide distribution of voting stock among shareholders, implying greater management control. Rather than inferring the degree of managerial control from the distribution of voting stock in each firm we focus on two extreme types of firms—those in which a large portion of voting stock is held by a single shareholder and those in which no such stockholder exists. Consistent with prior studies, the first group is denoted owner-controlled (OC) while the second is denoted management-controlled (MC). It is expected that in MC firms there is a strong residual conflict between managers and shareholders, while in OC ones the intensity of this conflict will be small.

Amihud and Lev (1981) provide empirical results that are consistent with the managers–owners conflict of interest. They show that MC firms are more diversified and engage in more mergers and acquisitions than OC firms. The difference in the intensity of the managers–owners conflict between MC and OC firms also may lead to different forms of capital investments. The managers of MC firms may decide to diversify their firm-specific risk through acquisitions rather than capital expenditures because acquisitions facilitate rapid entries into different lines of business. Presumably, the firm may consider *de novo* entry by building a new business. However, it may not have prior experience in the new market and, therefore, may require a long time and transference of skilled managers away from the firm's core businesses. Alternatively, an acquisition will save time and will utilize more effectively the acquired firm's familiarity with its technological and economic environment, thus providing a more rapid reduction in risk, which is the motive for conglomerate diversification in manager-controlled firms. We can, therefore, postulate the following hypothesis:

H2: Manager-controlled firms invest a greater proportion of their funds in acquisitions and a smaller proportion in internal ventures than owner-controlled firms.

Data

This section uses the same data as the prior one, with one exception: the classification of firms as MC or OC depends on their ownership structure. To classify firms we obtained ownership data from Value Line Investment Service, which records the percentage of a firm's shares that are held by insiders or major shareholders. If a single investor held over 20% of the outstanding stocks, or if any single investor controlled such percentage of the stock through direct holdings or holdings in trusts, the firm is classified as an OC one. If no such investor holds above 5% of the firm's outstanding stock, the firm is classified as an MC one. This classification is performed for 1977 and again for 1983. Since the firms in our sample are large, the sample is expected to contain substantially more MC firms than OC ones.

RESULTS

To test Hypothesis 2, which predicts that management-controlled (MC) firms would invest a greater proportion of their funds in acquisitions than owner-controlled (OC) ones, we first compare the mean proportions of funds invested in acquisitions and capital expenditures of MC and OC firms, using a standard two-sample t-test for the equality of means between the two groups. The results are reported in Table 3 for the measures of capital expenditures and acquisitions in 1977 and 1983, for which we have collected ownership data.

The number of MC firms is about four to five times that of OC firms, a finding we expected, given the large size of our sample firms. The two groups seem to have identical means, and thus the null hypothesis corresponding to H2, which states that MC firms have identical mean capital expenditures to OC ones, cannot be rejected by the data. Thus the principal–agent conflict of interest does not seem to provide a good explanation for the decision to invest in acquisitions or internal ventures.

To test this finding further, we use the General Linear Model (GLM) to determine the effects of the ownership structure on the particular form of capital investment, holding prior diversification constant. The advantage of using the GLM is that it provides maximum likelihood estimates of the coefficients when one or more of the independent variables is dichotomous, as in the case of ownership data. Thus the dependent variables used in the GLM are the proportions of funds invested in acquisitions or internal ventures. The two independent variables are the prior diversification measure, $SIC4$, and the dichotomous variable which obtains the value of 1 for MC firms and 0 for OC firms. The results of the GLM are reported in Table 4.

The table reveals that the ownership variable is not statistically significant in any of the years and for any of the two capital investment variables. These results

Table 3. T-tests for the Equality of Mean Internal Investment and Acquisitions of Owner- and Manager-controlled Firms

	No. of firms	Mean 1978	No. of firms	Mean 1984
Capital expenditures[a]				
Mean MC[b] firms	151	0.540	145	0.432
Mean OC[b] firms	51	0.530	44	0.437
t-statistic		0.34		−0.10
Significance level		0.737		0.919
Acquisitions[a]				
Mean MC firms	134	0.058	130	0.054
Mean OC firms	43	0.072	40	0.092
t-statistic		−0.41		−1.01
Significance level		0.679		0.315

[a] See Table 1 for definition of capital expenditures and acquisitions
[b] MC—Management-controlled firms.
OC—Owner-controlled firms.

Table 4. Tests of the Manager–owner Conflict Theory

		Intercept	*SIC4*	Ownership	R^2
1977					
	Model				
	1	0.588	−0.120	0.014	0.024
		(17.20)	(−2.47)	(0.051)	(0.045)
	2	0.016	0.113	−0.011	0.022
		(0.043)	(2.19)	(−0.037)	(0.088)
1983					
	Model				
	1	0.522	−0.167	−0.004	0.028
		(12.06)	(−2.74)	(−0.14)	(0.024)
	2	0.013	0.138	−0.025	0.024
		(0.31)	(2.21)	(−0.82)	(0.068)

(1) $CAP_{t+1} = b_0 + b_1 SIC4 + b_2\ Owner_t$.
(2) $ACQ_{t+1} = d_0 + d_1 SIC4_t + d_2\ Owner_t$.
t-statistics in parentheses, except for R^2, where the significance level is provided in parentheses.
Owner$_t$ equals 1 for MC firms and 0 for OC firms.
See definitions of other variables in Table 2.

are consistent with the results reported in Table 3. Note that the estimated coefficients are almost identical in Tables 4 and 2. Thus the classification of firms into OC and MC groups does not explain the mode of capital investments followed by firms, nor does it affect the statistical significance of prior diversification in explaining the modes of capital investments. Although the managers–owners conflict of interest has received wide support in the financial economic literature, it fails to provide an adequate explanation for the form of capital investments undertaken by firms.

MANAGERIAL EXPERIENCE AND THE MODE OF DIVERSIFICATION

It is plausible that past forms of capital investments affect future capital investments directly, without an intervening variable of diversification, such as in the explanation based on firms' experience of following one form of capital investment rather than the other. In this section we present and discuss a decision-theoretic, intertemporal model that portrays the trade-offs between capital expenditures internal to the firm (adding a new production line in an existing plant, replacing old machinery) and capital expenditures related to the acquisition of other businesses. The model is designed to highlight benefits and costs of the two investment alternatives. It shows that the greater the proportion of assets purchased through these acquisitions, the more desirable it becomes to expand through acquisitions than through capital expenditures.

Let $R(K_1(t), K_2(t))$ be the firm's net cash flows earned from two types of fixed assets: $K_1(t)$ are the cumulative assets of the firm at time period t which were purchased through capital expenditures and $K_2(t)$ are the cumulative assets of the firm obtained through acquisitions of other businesses. Let R'_{K_i}, R''_{K_i}, $i=1,2$, denote the first and second partial derivatives of the firm's revenues, respectively. Assume that $R'_{K_i}>0$, $R''_{K_i}<0$, $i=1,2$ (i.e. cash flows from each type of capital are increasing at a decreasing rate), and $R''_{K_{ij}} > 0$, $i \neq j$ (i.e. the contribution to marginal cash flows of asset type $j \neq i$ is positive). Assume further that there is an initial stock of each type of assets, K_i^0, and that each group of assets depreciates at a constant proportionate rate $d_i \geqslant 0$, $i = 1,2$. Let $I_i(t)$, $i = 1,2$, be the new investment in each group of assets at time t, and assume that at each point in time the firm's total new investments in both types of assets are bounded by a constant A. The instantaneous change in the levels of each group of cumulative assets $K_i(t)$ is therefore (the dependency of K_i and I_i on t is suppressed hereafter for simplicity):

$$K'_1 = I_1 - d_1 K_1 \qquad (1)$$

$$K'_2 = I_2 - d_2 K_2 \qquad (2)$$

These differential equations suggest that each group of cumulative assets, K_i, may be increased by new investment, I_i, but is depreciated at an exponential rate d_i. Thus the change in cumulative assets in each group during period t equals to the addition of new assets (I_i) minus the expiration of a proportion of cumulative previously obtained assets, $d_i K_i$.

Investment Costs

The general form of the assets-cost function is $C_i(K_i, I_i)$, $i = 1,2$, where C_i is assumed to be twice continuously differentiable. with $C'_{I_i} \geqslant 0$, $C''_{I_i} \geqslant 0$; that is, the assets cost are a non-decreasing convex function of gross investment. Further, it is assumed that $C'_{K_i} < 0$ while $C''_{K_i} > 0$. The latter assumptions reflect the experience effect, that is, the assets costs decline at a diminishing rate as the corresponding levels of assets increase. In order to reflect analytically the trade-offs between the two types of assets, consider the following specific functional forms for C_i:

Capital Expenditures The cost function is characterized by:

$$C_1(K_1, I_1) = c(K_1) I_1 \qquad (3)$$

When $c(K_1) = aK_1^{-b}$, the functional form is the well-known experience curve (Boston Consulting Group, 1972). Note that in many applications of the experience curve cumulative output is a proxy for experience. In our context, however, the net level of assets purchased through capital expenditures is the relevant variable. The coefficient, a, is the cost of the first unit of capital expenditure and b is the constant experience curve elasticity; this implies that the costs of capital expenditure decline by $(1 - 2^{-b})$ each time the cumulative level of assets doubles.

It should be noted that for our purposes it is sufficient to use the more general formulation of the cost function in Eqn (3), which is referred to by Clarke *et al.* (1982) as the case of scaling in C.

Acquisitions This cost function can be formulated as:

$$C_2(K_2, I_2) = F(K_2) + mI_2 \qquad (4)$$

which implies that net cumulative level of assets purchased through acquisitions reduces fixed costs associated with future acquisitions while variable costs remain unchanged. Such functional form is referred to by Clarke *et al.* (1982) as the case of translation in C. We assume that $F(K_2(0))$ equals some positive constant and $F'_{K_2} < 0$, $F''_{K_2} > 0$. The idea behind such a formulation is that the firm realizes fixed cost savings as the level of acquired businesses increases, for it is able to better handle the managerial and control issues caused by these acquisitions. However, it is assumed that there are no learning or scale effects in the variable costs of the acquired businesses, and thus this component of costs (m) is assumed to be proportional to the level of gross investment, I_2.

The reason for choosing these particular functional forms is that most capital expenditure decisions involve assets with which the firm has some experience. For example, more sophisticated equipment is introduced into the production process. The firm may already have had experience with similar technology and may save some costs in integrating the new equipment. Thus it is reasonable to assume that the larger the level of assets obtained through capital expenditures, the less costly it is to introduce such new assets.

However, this argument may not be true for acquisitions; the acquired business may have totally different production processes and operating procedures. Thus in the absence of synergies there are no learning economies that affect the variable costs of acquisitions. The only expected effect is the reduction in the fixed costs associated with acquisitions; therefore the functional forms of the two investment alternatives are different. It should be noted that our results would hold even if the *same* functional form is assumed for both types of investments.

These basic relationships can now be formulated as a problem of optimal control. Assuming that r is the constant interest rate, the problem is to choose I_1 and I_2 so as to:

$$\underset{\text{s.t.}}{\text{Max}} \int_0^\infty e^{-rt}(R(K_1, K_2) - c(K_1)I_1 - (F(K_2) + mI_2))dt \qquad (5)$$

$$K'_1 = I_1 - d_1 K_1 \qquad (6)$$

$$K'_2 = I_2 - d_2 K_2 \qquad (7)$$

$$I_1 + I_2 \leqslant A;\ I_1 \geqslant 0;\ I_2 \geqslant 0 \qquad (8)$$

$$K_1(0) = K_1^0;\ K_2(0) = K_2^0 \qquad (9)$$

The objective function (5) represents discounted cash flows generated by the capital investment policy. The differential equations (6) and (7) represent the time path of the level of assets K_1 and K_2, respectively. Inequality (8) presents the investment constraint of the firm: In each period t the individual investments are non-negative and the sum of the two types of investments does not exceed the predetermined capital-budget limit, A. The initial condition on the levels of each type of assets are stated in Eqn (9).

The solution to the above problem, which is provided in the Appendix (Section C), yields two propositions:

Proposition 1: When the boundary constraints are non-binding, i.e. when an internal solution is obtained, the optimal amount of capital expenditures, I_1^*, is an increasing function of the level of assets acquired through capital expenditure, K_1, and a decreasing function of the level of acquired assets, K_2.

Proposition 2: When the boundary constraints are non-binding, i.e. when an internal solution is obtained, the optimal amount of acquisitions, I_2^*, is an increasing function of the level of assets obtained through acquisitions, K_2, and a decreasing function of the level of assets obtained through capital expenditures, K_1.

The proofs of these propositions are provided in the Appendix. They suggest that the greater the level of assets obtained through acquisitions, the more likely is the firm to make further acquisitions. The rationale is that the firm has developed some 'expertise' in integrating othe businesses within its operations and, therefore, is more likely to engage in further acquisitions. Conversely, firms that have obtained their assets through capital expenditures show that they are better able to exploit the benefits of familar assets and, therefore, are expected to engage in further capital expenditures.

Results

To test the validity of the managerial-experience explanation the following test is performed. For each of the sample firms we calculate the proportion of capital that has been accumulated through acquisitions as compared with that of capital that has been accumulated through internal ventures. This is done by computing the ratio of total acquisitions during the period 1977–83 to the total funds that were used in this period. Similarly, total capital expenditures during 1977–83 is divided by the total uses of funds in this period. These variables serve as the independent variables in regressions, with the proportion of funds invested in acquisitions or capital expenditures in 1984 as the dependent variables. These results are reported in Table 5.

As can be seen in the table, the decision to invest in internal ventures (capital expenditures) is very highly correlated with the proportion of funds that were previously invested in internal ventures. The regression coefficient is positive, as expected, and very highly significant. Similarly, the decision to engage in acquisitions is highly correlated with the proportion of funds that were previously invested in acquisitions in prior years. Here, too, the coefficient is positive and highly significant. Thus the data seem to be consistent with the managerial-experience explanation in which managers decide to invest in a mode similar to one that is familiar through prior investments.

CONCLUSIONS

This study tests the determinants of investment decisions made by firms and, in particular, whether they are carried out through acquisitions or internal venturing. We examined three possible explanations for the type of capital investments that firms undertake which are consistent with the motives for diversification. The first is based on the transaction-cost theory of diversification and suggests that acquisition may be the desired form of diversification when certain conditions are upheld. The empirical test supports this hypothesis, but it relies on two stringent assumptions. The second explanation is based on the manager–owner conflict, and suggests that firms in which the conflict is great will tend to invest a large proportion of their funds in acquisitions. This, however, does not satisfactorily explain the capital investment decisions of our sample firms.

Table 5. Tests of the Managerial-experience Theory for Selecting the Mode of Diversification

		Intercept	*SCAPUSE*	*SACQUSE*	R^2
1983					
	Model				
	1	−0.0001	1.368		0.947
		(−1.05)	(68.60)		(0.000)
	2	0.0009		1.360	0.699
		(1.50)		(24.66)	(0.000)

(1) $CAP_{t+1} = b_0 + b_1\, SCAPUSE_t + \varepsilon$, where $SCAPUSE = TCAP/TUSE$ and $TCAP = \Sigma_t\, CAP$, $t = 1971 \ldots 1983$; *CAP* are the capital expenditures from the Statement of Changes in Financial Positions (SCFP); $TUSE = \Sigma_t\, USE$, where *USE* are the total uses of funds from SCFP; CAP_t is defined in Table 2.
(2) $ACQ_{t+1} = d_0 + d_1\, SACQUSE_t + \varepsilon$, where $SACQUSE = TACQ/TUSE$ and $TACQ = \Sigma_t\, ACQ$, $t = 1971 \ldots 1983$; *ACQ* are the acquisition expenditures from the Statement of Changes in Financial Positions (SCFP); $TUSE = \Sigma_t\, USE$, where *USE* are the total uses of funds from SCFP; ACQ_t is defined in Table 2.
t-statistics are in parentheses, except for R^2, where the significance level is provided in parentheses.

Alternatively, the third explanation is based on the experience a firm has acquired in a particular form of investment. We suggest that a firm which in the past had diversified through acquisitions will tend to continue this method in the future. Conversely, a firm that diversified through internal venturing will continue to do so in the future. The data support this explanation. However, this alternative explanation does not describe how some firms evolve as acquisitions-type ones when others evolve as capital expenditures-type. Further efforts should be directed to the study of the reasons that make some firms engage in internal venturing while others engage in acquisitions.

Acknowledgements

The first author gratefully acknowledges the financial support for this study from the Richard M. Paget Research Chair in Business Policy. The second wishes to acknowledge the financial support from the Dean's Fund for Faculty Research at the Owen Graduate School of Management, Vanderbilt University, where he was when this study was conducted. The third author gratefully acknowledges the financial support of the Summer Resesrch Fund of New York University. We thank an anonymous reviewer for helpful comments.

APPENDIX

Section A

The Lagrange function is:

$$L = 1 - \sum_{j=1,n} s_j^2 - \lambda\left(\sum_{j=1,n} s_j - 1\right)$$

First-order conditions for maximizing L are

$$\partial L/\partial \lambda = \Sigma s_j - 1 = 0$$

$$\partial L/\partial s_1 = 2s_1 - \lambda = 0 \Rightarrow S_1 = \lambda/2$$

$$\vdots$$

$$\partial L/\partial s_j = 2s_j - \lambda = 0 \Rightarrow s_j = \lambda/2$$

$$\vdots$$

$$\partial L/\partial s_n = 2s_n - \lambda = 0 \Rightarrow s_n = \lambda/2$$

Thus

$$s_1 = s_j = s_n = \lambda/2$$

and so

$$\sum_{j=1,n} (\lambda/2) - 1 = 0 \Rightarrow n\lambda/2 = 1$$

or

$$\lambda = 2/n$$

and

$$s_i = 1/n \qquad j = 1 \ldots n$$

Section B

We show that by imposing certain (we feel, reasonable) restrictions on s_j the results on the monotonicity and limit of D are upheld. Let $\mathbf{S}_j$ be the minimum economic scale of business segment, j, regardless of what firm produces it. Let $\bar{S}_j$ be the total amount of industry j sales. If:

$$\Sigma_{j=1,n} S_j(n) \text{ increases with } n, \text{ and } \mathbf{S}_j < S_j(n) < \bar{S}_j$$

where $S_j(n)$ are the sales in segment j of a firm with n business segments, then for any $0 \leq s_j \leq 1$ and $\Sigma_{j=1,n} s_j = 1$:

$$\text{Lim}\, \Sigma s_j^2 \to 0, \text{ as } n \to \infty; \text{ and so } D \to 1 \text{ as } n \to \infty$$

Before proceeding, it may be useful to interpret the constraints on s_j which will assure monotonicity and convergence to 1. First, total firm sales are assumed to increase as the firm becomes active in more business segments. Second, the lower bound on s_j suggests that if a firm decides to be active in business segment j, than there is some minimum scale for its operations. Clearly, it may choose not to participate (in which case, $s_j = 0$). If it does, the constraint suggests that there is some minimum scale of operations which may be mandated by technological, industry or environmental factors which are industry-specific. Third, the upper limit on the sales of segment j of a firm with n segments is the total amount of industry sales. Clearly, there are other constraint sets that will assure monotonicity and convergence. However, these seem the least restrictive.

Note now that:

$$s_j(n) = S_j(n)/(\textstyle\sum_{j=1,n} S_j(n))$$

and since we assumed that $S_j(n) < \bar{S}_j$. we have that

$$s_j(n) = S_j(n)/(\textstyle\sum_{j=1,n} S_j(n)) < \bar{S}_j/(\textstyle\sum_{j=1,n} S_j(n))$$

Since we assumed that as n increases, total firm sales $(\Sigma_{j=1,n} S_j(n))$ also increase, we have that $s_j(n) \to 0$ as $n \to \infty$. Thus, lim $\Sigma s_j^2 \to 0$ as $n \to \infty$ and therefore $D \to 1$ as $n \to \infty$. This establishes the convergence of D to 1.

To assure the monotonicity of D we note that for any j:

$$s_j^2(n) < (\bar{S}_j)^2/(\textstyle\sum_{j-1,n} S_j)^2$$

Now, as n increases, the upper bound on $s_j^2\,(n)$ decreases (the r.h.s. of the inequality decreases). This assures that the highest possible value of the square of each business segment declines with an increase in n, and thus D increases with an increase in the number of segments n.

Section C

To solve the problem identified by Eqns (5)–(9), let $\lambda_i(t)$, $i = 1,2$, denote the current value multiplier associated with eqns (6) and (7), respectively. The current value Hamiltonian is:

$$H = R(K_1, K_2) - c(K_1)I_1 - F(K_2) - mI_2 + \lambda_1(I_1 - \mathrm{d}_1 K_1) + \lambda_2(I_2 - \mathrm{d}_2 K_2) \qquad \text{(A1)}$$

Let μ_i, $i = 1, \ldots, 3$, be the Lagrange multipliers and let L denote the Lagrangian (augmented Hamiltonian). Then:

$$L = H + \mu^1(A - I_1 - I_2) + \mu_2 I_1 + \mu_3 I_2 = 0 \qquad \text{(A2)}$$

with

$$\mu_1 \geqslant 0; \mu_1(A - I_1 - I_2) = 0$$
$$\mu_2 \geqslant 0; \mu_2 I_1 = 0 \qquad \text{(A3a)}$$
$$\mu_3 \geqslant 0; \mu_3 I_2 = 0$$

so that μ_1, μ_2, and μ_3 cannot all be positive, and

when $\mu_1 > 0$, $\mu_2 > 0$ and $\mu_3 = 0$, the $I_1 = 0$ and $A = I_2$ (A3b)

when $\mu_1 > 0$, $\mu_2 = 0$ and $\mu_3 > 0$, then $I_2 = 0$ and $A = I_1$ (A3c)

when $\mu_1 = 0$, $\mu_2 > 0$ and $\mu_3 > 0$, then $I_1 = I_2 = 0$ (A3d)

Kamien and Schwartz (1981) showed that the necessary conditions for optimality of Eqns (5)–(9) are Eqns (6), (7) and

$$\partial L/\partial I_1 = \partial H/\partial I_1 - \mu_1 + \mu_2 = (-c(K_1) + \lambda_1) - \mu_1 + \mu_2 = 0 \qquad \text{(A4a)}$$

so that

if $\mu_1 = 0$ and $\mu_2 > 0$, then $\partial H/\partial I_1 < 0$ and $I_1 = 0$ (A4b)

if $\mu_1 > 0$ and $\mu_2 = 0$, then $\partial H/\partial I_1 > 0$ and $I_1 = A - I_2$ (A4c)

$$\partial L/\partial I_2 = \partial H/\partial I_2 - \mu_1 + \mu_3 = -m + \lambda_2 - \mu_1 + \mu_3 = 0 \qquad \text{(A5a)}$$

so that

if $\mu_1 = 0$ and $\mu_3 > 0$, then $\partial H/\partial I_2 < 0$ and $I_2 = 0$ (A5b)

if $\mu_1 > 0$ and $\mu_3 = 0$, then $\partial H/\partial I_2 > 0$ and $I_2 = A - I_1$ (A5c)

combining the necessary conditions (A3a–d), (A4a–c) and (A5a–c) we observe the following:

If $\mu_1 > 0$, $\mu_2 = 0$ and $\mu_3 > 0$, then from Eqns (A3c) and (A4c):

$$I_2 = 0 \text{ and } I_1 = A \qquad \text{(A6)}$$

if $\mu_1 > 0$, $\mu_2 > 0$ and $\mu_3 = 0$, then from Eqns (A3b) and (A5c):

$$I_1 = 0 \text{ and } I_2 = A \qquad \text{(A7)}$$

if $\mu_1 = 0$, $\mu_2 > 0$ and $\mu_3 > 0$, then from Eqns (A3d), (A4b) and (A5b):

$$I_1 = I_2 = 0 \qquad \text{(A8)}$$

if $\mu_1 = 0$, $\mu_2 = 0$, and $\mu_3 > 0$, then from Eqns (A4a) and (A5b):

$$I_2 = 0, \text{ and } I_1 \text{ is choosen so that } \lambda_1 = c(K_1) \qquad \text{(A9)}$$

if $\mu_1 = 0$, $\mu_2 > 0$, $\mu_3 = 0$, then from Eqns (A4b) and (A5a):

$$I_1 = 0 \text{ and } I_2 \text{ is chosen so that } \lambda_2 = m. \qquad \text{(A10)}$$

Recall that μ_i cannot all be positive, as it violates Eqn (A3a). An interior solution may be obtained for cases in which $\mu_1 \geqslant 0$ and $\mu_2 = \mu_3 = 0$:

$$\lambda_2' = r\lambda_1 - \partial H/\partial K_1 = (r + d_1)\lambda_1 - (R'_{K_1} - c' I_1) \qquad \text{(A11)}$$

$$\lambda_2' = r\lambda_2 - \partial H/\partial K_2 = (r + d_2)\lambda_2 - (R'_{K_2} - F') \qquad \text{(A12)}$$

The differential equation (A11) can be solved to obtain an expression for the marginal value of a unit of internal capital. Integrating Eqn (A11) and noting the transversality condition

$$\lim_{t \to \infty} \lambda_1(t) \to 0. \qquad \text{(A13)}$$

we obtain

$$\lambda_1(t) = \int_t^\infty e^{-(r+d_1)(s-t)}(R'_{K_1} - c' I_1) ds \qquad \text{(A14)}$$

Since the level of assets obtained through capital expenditures depreciates at rate d_1, we observe that at each time $s > t$ it contributes only a fraction $e^{-d_1 s}$ of what a whole unit would add. Further, since $c' < 0$, $\lambda_1(t) \geqslant 0$ for all t. Combining Eqns (A9) and (A14) yields the marginal cost-marginal benefit condition for optimal capital expenditures:

$$c(K_1) = \int_t^\infty e^{-(r+d_1)(s-t)}(R'_{K_1} - c' I_1) ds \qquad \text{(A15)}$$

Note that the term inside the integral of Eqn (A15) is the discounted (to time t) net cash flows generated by an incremental unit of capital expenditures K_1. The left side is the marginal cost of an incremental investment. Thus, condition (A15) states that along the optimal investment path, marginal cash flows attributable to capital expenditures and oppropriately adjusted for depreciation, interest costs and experience effects have to equal marginal costs. We also note that, in addition to satisfying condition (A15), the optimal investment through capital expenditures path has to satisfy the set of inequalities depicted in Eqn (8).

Equation (A11) can be used to obtain an expression for the optimal investment rate in terms of the marginal valuation of capital expenditures λ_1, the marginal cash flows associated with an incremental unit of capital expenditures, R'_{K_1}, the interest rate, r, the depreciation rate of these assets, d_1, and the change in marginal cost of assets obtained through capital expenditures c':

$$I_1^* = (1/c')(R'_{K_1} + \lambda_1' - (r + d_1)\lambda_1) \qquad \text{(A16)}$$

where λ_1 is depicted by Eqn (A14).

Proof of Proposition 1 Recall our assumptions on $R(K_1, K_2)$ and on $c(K_1)$. Also note that when the boundary conditions are not binding, i.e. $\mu_1 = \mu_2 = 0$, Eqn (A4a) reduces to

$$\lambda_1 = c(K_1)$$

when $\mu_3 > 0$. Then, by Eqn (A9), $I_2 = 0$ and $I_1 \leqslant A$ is chosen so that the above equation is satisfied. Also, when $\mu_2=0$, $I_2 \geqslant 0$ and $I_1 \leqslant A-I_2$ has to satisfy $\lambda_1 = c(K_1)$. We can thus substitute $c(K_1)$ for λ_1 in Eqn (A16) to obtain

$$I_1^* = (1/c')(R'_{K_1} + \lambda'_1 - (r+\mathrm{d})c(K_1)). \qquad \text{(A17)}$$

By deriving Eqn (A17) it can be shown that along the optimal capital expenditures path

$$\partial I_1^*/\partial K_1 > 0 \qquad \text{(A18)}$$

and

$$\partial I_1^*/\partial K_2 < 0 \qquad \text{(A19)}$$

QED

We now turn to an investigation of the optimal acquisitions path. By integrating Eqn (A12) we can solve for the marginal valuation of a unit of acquisitions

$$\lambda_2(t) = \int_t^{\infty} \mathrm{e}^{-(r+\mathrm{d}_2)(s-t)}(R'_{K_2} - F')\mathrm{d}s \qquad \text{(A20)}$$

since $F'<0$, $\lambda_2(t) \geqslant 0$ for all t. Combining Eqn (A10) with Eqn (A20) we observe that $I_1=0$ and $I_2 \leqslant A$ has to be chosen so that:

$$m = \lambda_2(t) = \int_t^{\infty} \mathrm{e}^{-(r+\mathrm{d}_2)(s-t)}(R'_{K_2} - F')\mathrm{d}s \qquad \text{(A21)}$$

Since m is a constant that denotes the average variable cost (which equals the marginal cost) of a unit of acquired businesses, condition (A21) suggests that the optimal acquisitions path has to be such that, at the margin, the discounted net change in cash flows adjusted for the decline in fixed cost, F' (which results because of an incremental unit of acquisitions), has to equal the marginal cost of an acquired business. From Eqn (A21) we observe that $\lambda'_2=0$ along the optimal path of acquisitions. Equation (A12) can then be rewritten as:

$$(r+\mathrm{d}_2)m = (R'_{K_2} - F') \qquad \text{(A22)}$$

which means that I_2^* has to be such that the net change in cash flows after adjustment for the decline in fixed cost has to equal a fraction of the marginal investment cost, namely $(r+\mathrm{d}_2)m$.

Proof of Proposition 2 When $\mu_1=\mu_3=0$, i.e. the boundary conditions are non-binding, then $0 \leqslant I_2^* \leqslant A - I_1^*$, where $I_2^*=0$ if $\mu_2>0$ and $I_1^* \geqslant 0$ when $\mu_2=0$. By recalling that $F'_{K_2}<0$ and $F''_{K_2}>0$, we note that condition (A21) can only hold if the level of assets obtained through acquisitions K_2 remains unchanged over time, i.e. $K'_2=0$. From Eqn (1) we thus observe that

$$I_2^* = \mathrm{d}_1 K_2$$

so

$$\mathrm{d}I_2^*/\mathrm{d}K_2 > 0 \qquad \text{(A23)}$$

OED

NOTE

1. We thank an anonymous reviewer for pointing it out to us

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