Tobin's q and the Importance of Focus in Firm Performance

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Using Tobin's q as a measure of performance, we seek to estimate the relative importance of industry, focus, and share effects in determining firm performance. Our methods are analogous to those of Richard Schmalensee and, like him, we find that industry effects account for the majority of the explained variance. However, we also find that firm effects exist in the form of focus effects, that is, narrowly diversified firms do better than widely diversified firms. We interpret this finding as consistent with profit maximization by firms with different factor endowments.

In a thought-provoking paper, Richard Schmalensee (1985) shows that accounting rates of return at the business-unit level are strongly influenced by industry effects, only unimportantly influenced by market-share effects, and not influenced by firm effects. Schmalensee finds the last result somewhat surprising and conjectures (p. 349) that firm effects might exist in the form of focus effects; that is, he suspects that widely diversified (less-focused) firms are unable to transfer their competencies to a host of different markets. The purpose of this paper is to investigate this conjecture.

It is worth noting that characterizing firm effects as focus effects involves a change from looking at individual, random differences to looking at systematic differences across types of firms. In other words, firms may have insignificant individual differences, yet still differ in systematic ways when aggregated according to suitable criteria. A prime candidate for such a criterion is level of firm diversification.

Schmalensee cites managerial literature to the effect that widely diversified firms fail to maximize profits. However, it is not necessarily so. A factor-based theory of diversification (Edith Penrose, 1959; David Teece, 1982) also supports a positive focus effect. According to this theory, diversification is prompted by excess capacity of less-than-perfectly marketable factors. One would expect such factors to return slightly less when used outside the industry first chosen. This does not imply that diversifying firms are not maximizing profits, only that their marginal returns decrease as they diversify farther afield. Like Schmalensee's managerial perspective, this revisionist perspective also predicts a positive focus effect. In contrast, the classical school (which looks at diversification as facilitating collusion) would predict a negative focus effect.

Beyond adding the focus effect, our analysis differs from Schmalensee's in two related ways. Whereas he looked at firms' accounting returns at the industry level, we use Tobin's q as a measure of performance and conduct the analysis at the firm level. In effect we trade more detailed data for a better measure of returns.

Section I develops our research design as it relates to Schmalensee's. Section II outlines our methods. The remainder of the paper describes our results (Section III) and the main implications of the research (Section IV).

I. Research Design

Schmalensee (1985) estimated the model

$$(1) \qquad r_{ij} = \mu + \alpha_i + \beta_j + \gamma S_{ij} + \varepsilon_{ij},$$

where r_{ij} is the accounting rate of return of firm i's operations in industry j, S_{ij} is its

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market share, the α's are firm effects, the β's are industry effects, μ and γ are constants, and the ε's are disturbances. The results from this model are that industry effects (β's) are important, the market-share effect (γ) is significant but unimportant, and firm effects (α's) add no explanatory power (do not exist).

From this, we would expect that a firm's rate of return r_i can be expressed as

$$(2) \qquad r_i = \Sigma_j \beta_j w_{ij} + \gamma \Sigma_j S_{ij} w_{ij} + \varepsilon_i,$$

where w_{ij} is the percentage of firm i's investments which are made in industry j (since these sum up to one, there is no need for an intercept). If there are firm effects associated with narrowly diversified firms, we expect

$$(3) \quad r_i = \Sigma_j \beta_j w_{ij} + \gamma \Sigma_j S_{ij} w_{ij} + \phi D_i + \varepsilon_i,$$

to perform better than (2), if D_i is a measure of the focus (breadth of diversification) of firm i.

II. Methods

There has recently been considerable criticism of the use of accounting measures of performance (George Benston, 1985). In particular, accounting rates of return are distorted by a failure to consider differences in systematic risk, temporary disequilibrium effects, tax laws, and accounting conventions regarding *R&D* and advertising. These properties are likely to vary more across industries than across firms. That is, if a firm wants to compete in a given industry, it is subject to the risk and disequilibrium effects in that industry and the industry-specific needs for investments in fixed capital, advertising, and *R&D*. Accordingly, the use of such measures will strongly bias an estimation of (1) in favor of industry effects.

As a first step toward avoiding these problems, we chose to use Tobin's q, defined as the capital market value of the firm divided by the replacement value of its assets, as our dependent variable. Theoretically, q is a much more appealing measure than accounting returns. By incorporating a capital market measure of firm rents, q implicitly uses the correct risk-adjusted discount rate, imputes equilibrium returns, and minimizes distortions due to tax laws and accounting conventions.

While q in principle should correct for all the biases noted above, in practice its calculation (Eric Lindenberg and Stephen Ross, 1981) leaves intangible assets out of the denominator, thus overstating the relative performance of firms with large investments in intangibles. The capitalized value of these investments is, of course, very difficult to estimate. However, as a partial correction we include, as independent variables, estimates of a firm's current marketing and *R&D* expenditures, divided by the replacement cost of physical assets (also see Michael Salinger, 1984).

In order to estimate a firm's investment per industry, we multiply its sales by the industry average capital-output ratio. This in turn allows us to construct $\overline{w}_{ij}$, the estimated fraction of firm i's assets that are in industry j.

To measure the extent of firm diversification, we use the concentric index of Richard Caves, Michael Porter, and Michael Spence (1980). The index is given by $D_i = \Sigma_j \overline{w}_{ij} \Sigma_l \overline{w}_{il} d_{jl}$, where d_{jl} is a weight whose value depends on the relations between j and l in the standard industrial classification (SIC) system. The weight is zero if j and l have the same 3-digit SIC code, one if they have a different 3-digit code but identical 2-digit codes, and two if they have different 2-digit codes. This index captures the degree of relatedness between industries, while correlating very strongly with the standard Gort-Herfindahl index (Caves et al., 1980, p. 201).

We estimate the following equations:

$$(4) \quad q_i = \sum_{j=20}^{39} \beta_j \tilde{w}_{ij} + \gamma \sum_{l=1}^{n} S_{il} \overline{w}_{il} + \phi D_i + \varepsilon_i$$

$$(5) \quad q_i = \sum_{j=20}^{39} \beta_j \tilde{w}_{ij} + \gamma \sum_{l=1}^{n} S_{il} \overline{w}_{il} + \phi D_i + \psi_1 \sum_{l=1}^{n} A_l M_{il}/K_i + \psi_2 \sum_{l=1}^{n} R_l M_{il}/K_i + \varepsilon_i,$$

where q_i = an estimate of Tobin's q for firm i;

$\tilde{w}_{ij}$ = the estimated fraction of firm i's assets which are in 2-digit industry j;

S_{il} = firm i's market share in industry l;

$\overline{w}_{il}$ = the estimated fraction of firm i's assets which are in $3\frac{1}{2}$-digit industry l;

D_i = firm i's diversification;

A_l = the ratio of marketing expenditures to sales in industry l;

M_{il} = firm i's sales in $3\frac{1}{2}$-digit industry l;

K_i = the replacement value of firm i's physical assets;

R_l is the ratio of $R\&D$ expenditures to sales in industry l.

To interpret (4), note that the β's are industry effects (estimates of industry q's), γ is the share effect, and ϕ is the focus effect. Following Schmalensee (1985), we can estimate the relative importance of these effects by comparing the R^2's from (4) with regressions having only one or two of the effects. (If we drop the β's, we of course need a constant in the regression.) In (5), we include the partial correction for industry-specific intangible assets. This equation can be subjected to the same analysis as (4); the difference in the resulting estimates of industry effects will give us an idea of the magnitude of industry bias due to accounting practices.

Industry effects are estimated at the 2-digit level. Unfortunately, our data do not allow 3-digit industry estimates. Since average profitability across 2-digit industries is more similar than average profitability across 3-digit or 4-digit industries, this will give a downward bias in our estimates of the importance of industry effects. On the other hand, research on stock prices and industry effects indicates that the bias may be quite small. In his seminal paper, Benjamin King (1966) found that differences between 2-digit industries explained 20 percent of the variance in stock prices on a given day. Later, James Farrell (1974) showed that the same 20 percent could be explained by grouping 2-digit industries into 4 "industry-types." On the other hand, Miles Livingston (1977) explained only 23 percent of the variance using more than 100 different industries. In sum, research on stock prices seems to indicate that estimates of the importance of industry effects are quite insensitive to the level of aggregation. Nevertheless, we should expect that our estimate of the importance of industry will be biased downward. We see no reason, however, why this bias should affect our estimate of the focus effect.

Data sources are detailed in the Data Appendix.

III. Results

Figures 1 and 2 summarize the results of least squares estimation of (4) and (5) and restricted models, excluding one or more of the three effects with which we are concerned. Each arrow corresponds to the imposition of a restriction that one of the three effects discussed above is absent. The number next to each arrow is the probability level (P level) at which an F-test rejects that restriction. (This method of presentation conforms to that of Schmalensee and is used to maximize comparability with his results.)

Note that the adjusted R^2's are quite high. Further, the high P levels generated by tests for share effects (arrows pointing to the left) indicate the absence of share effects in this sample, a result which is particularly strong in the more complete models. In contrast, and consistent with our main hypothesis, tests for focus effects (arrows pointing to the right) show strong significance, especially in the more complete models. As in Schmalensee (1985), the strongest results appear for industry effects which are always significant beyond the .2 percent level.

To analyze the results in another way, Table 1 gives the incremental contributions to the adjusted R^2 of each effect, relative to a model with all three effects. That is, the first cell in Table 1 gives the difference between the adjusted R^2 for the model with industry, focus, and share effects, and the adjusted R^2 for the model with only share and focus effects.

Three results are important. First, like Schmalensee, we find that industry effects account for the majority of the explained variance. In fact, the estimate of 19 percent which emerges from the model without correction for intangible assets, is very close to his and also agrees with the stock price

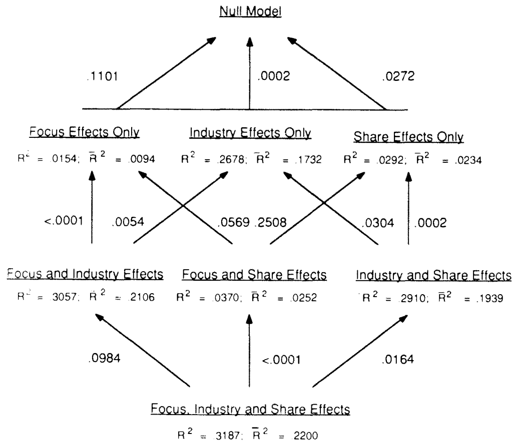

FIGURE 1. MODELS WITHOUT CORRECTION FOR MARKETING AND $R\&D$ INVESTMENTS

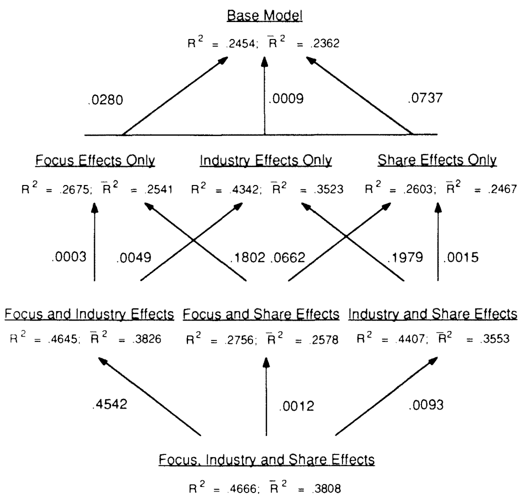

FIGURE 2. MODELS WITH CORRECTION FOR MARKETING AND $R\&D$ INVESTMENTS

research discussed in Section II. The estimate of 12 percent from the more correctly specified model is lower than his, probably because of our coarser industry definitions. Second, focus effects are positive and explain about $2\frac{1}{2}$ percent of the variance. Although Schmalensee did not find pure firm effects, they do appear here in the form of focus effects when firms are represented by their diversification profiles. Third, the importance of industry effects declines by approximately one-third after corrections for industry-related biases.

TABLE 1—ESTIMATED VARIANCE DECOMPOSITION[a]

Effect	Without Correction for Intangible Assets Percentage	With Correction for Intangible Assets Percentage
Industry	19.48	12.30
Focus	2.61	2.65
Share	.94	−.18

[a] Incremental contributions to $\bar{R}^2$, relative to models with all three effects.

Concerning the last point, a referee alerted us to the possibility of a real effect of advertising and $R\&D$ on industry profitability. If such an effect exists and is positive, estimates based on the model (5) are biased against industry effects. This is ultimately a theoretical issue. However, using the depreciation rates of .7 and .9 suggested by Henry Grabowski and Dennis Mueller (1978), the coefficients on advertising and $R\&D$ should be close to 10/3 and 10. Our estimates are generally below these levels, giving some indication that real effects, if they exist, are small.

The absence of share effects is somewhat surprising, but inspection of Figures 1 and 2 shows that this result is quite robust, despite the multicollinearity between share and focus. Recall also that share effects were unimportant (but significant) in Schmalensee's analysis.

It should be further noted that q by definition is positive such that the distribution of the error term cannot be strictly normal. An examination of the residuals does not, however, reveal problems on this front.

IV. Conclusion and Implications

Using Tobin's q as a measure of performance, we have confirmed Schmalensee's finding that industry effects are the major determinants of firm success. There is some evidence that industry-related measurement bias inflates this estimate. In particular, our results indicate that accounting conventions regarding *R&D* and advertising distort estimates of the variation of industry returns. However, after correcting for these biases, the industry effect remains strong.

This brings us to our major result, that firm effects exist in the form of positive focus effects. That is, some differences in performance can be explained by efficiency differences firms experience in transferring competencies to widely varying markets. Interpreted in this way, this finding not only supports the revisionist view, it enriches it, since it also tells us something about the sources of efficiency differences. Further, the fact that we find a positive focus effect contradicts the classical view of diversification as a vehicle for collusion.

DATA APPENDIX

The 1976 values of Tobin's q were generously provided by Eric Lindenberg and Stephen Ross. The method of calculation is described in their (1981) paper in which they publish average values of q for 247 firms in the period 1960–77.

The 1976 estimates of firms' sales and market shares per 4-digit SIC code are from the Trinet/EIS (Economic Information Systems) Establishment Database, made available to us through the Center for the Study of Business Markets at Pennsylvania State University. Trinet/EIS is a subsidiary of Control Data, which provides current sales and market share data on line through Dialog Information Services (file: Trinet Establishment Database).

Data on the replacement value of firms' assets are from 1976 Form 10-K's, filed with the Securities and Exchange Commission. 10-K's are widely available in libraries through the Disclosure Information Group, Bethesda, MD 20816.

Industry data on asset/sales ratios, total marketing expenditures/sales, and company sponsored *R&D*/sales, at the $3\frac{1}{2}$-digit level, are from the *1976 Line of Business Report*, which is published by the Federal Trade Commission and available to the public.

The dataset itself is available from the authors (Wernerfelt and Montgomery, 1987).

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