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FIRM AND INDUSTRY EFFECTS WITHIN STRATEGIC MANAGEMENT: AN EMPIRICAL EXAMINATION

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This study brings out the complementarities between resource-based and industrial organization schools within strategic management through an empirical examination of firm and industry effects. A variance component analysis of 264 single-business companies from 69 industries using 5- and 15-year periods suggests that firm effects are more important than industry effects on firm performance, but not on core strategies such as technology and marketing. The findings also point to the need to study core strategies at lower levels of aggregation to understand the sources of competitive advantage. © 1998 John Wiley & Sons, Ltd.

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INTRODUCTION

Firm effects and industry effects capture the degree of heterogeneity within an industry. They underlie several important concepts in strategic management such as distinctive competence and competitive advantage. Yet two schools with significant influence in strategic management have been at odds with one another regarding the magnitude and persistence of firm effects. The resource-based view argues that firm heterogeneity is significant and persistent, whereas industrial organization suggests that industry effects dominate over time.

Not only is there conflicting theoretical guidance, but there have also been few empirical studies. These empirical studies have focused on the performance variation among firms and industries (Schmalensee, 1985; Rumelt, 1991; Roquebert, Phillips, and Westfall, 1996), and have reported contradictory findings. None of the prior studies has examined the firm effects on strategies though it would help us understand 'why firms differ' (Carroll, 1993; Nelson, 1991).

This study seeks to bring out the complementarities between the resource-based view and industrial organization through an empirical analysis. We estimate the firm and industry effects on core strategies as well as performance using a sample of nondiversified companies over 5-year and 15-year periods. The results show the predominance of firm effects on performance but not on core strategies such as technology and marketing.

DIFFERENT PERSPECTIVES ON FIRM AND INDUSTRY EFFECTS

Firm effects capture the unique firm characteristics which influence the variation in strategies and performance outcomes across industries and firms, and industry effects refer to attributes common to an industry. The dominance of firm effects suggests heterogeneity because of barriers to imi-

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tation (Rumelt, 1991) and the inability of firms to change their resource endowments over time (Carroll, 1993). In contrast, the dominance of industry effects over time shows the similarities in response to industry conditions and the imitation of successful strategies.

The emerging resource-based view of the firm (Wernerfelt, 1984; Barney, 1991; Conner, 1991; Grant, 1991; Mahoney and Pandian, 1992; Peteraf, 1993) focuses on firm effects as the basis for sustainable competitive advantage. In this perspective, unique resource and idiosyncratic processes drive heterogeneity among firms. Such unique resources can provide competitive advantage when protected from imitation and effective isolating mechanisms (Lippman and Rumelt, 1982). Thus, the resource-based view suggests that firm-specific attributes drive both strategies and performance outcomes, which stands in sharp contrast to the predominance of market structure in the industrial organization literature.

The main proponent of industry effects on strategies and performance is industrial organization. Several schools within industrial organization have proposed market structure as the principal explanation for the emergence of common patterns of behavior and similar performance outcomes for firms in the same industry. However, some of its schools differ regarding the dynamics of industry structure. The traditional school (Bain/Mason) views market structure as exogenous and stable (Bain, 1972; Caves, 1980; Porter, 1981), while the Schumpeterian and Chicago schools view market structure as dynamic and constantly evolving. The Schumpeterian school focuses on revolutionary innovations that make rivals' positions obsolete and change industry structure. Similarly, the Chicago school (Stigler, 1968; Demsetz, 1973) believes in the convergence of competitive patterns over the long term when the less successful firms imitate the strategies of more successful ones (Demsetz, 1973). Despite these differences, the literature in industrial organization treats the industry as the unit of analysis, implicitly assuming that firms within an industry are homogeneous.

RELATIVE EFFECTS ON CORE STRATEGIES AND PERFORMANCE

Strategic actions involve the allocation of existing resources and the development of new ones to achieve the long-term goals and objectives of the enterprise (Chandler, 1962:383). These resource allocation patterns (Mintzberg, 1978) underscore the concept of strategic choice (Child, 1972).

Resources can be classified as financial, physical, human, technological, and organizational (Grant, 1991). The proponents of the resource-based view have concentrated on unique resources from which companies may derive sustainable competitive advantage. According to them, only those resources that are valuable, rare, nonsubstitutable, and difficult to imitate would provide competitive advantage and become the source of economic rents (Barney, 1991; Peteraf, 1993). We term these key resources core resources, and the strategies based on them as core strategies. Interestingly, both the resource-based view and industrial organization consider core strategies based on technological and marketing differentiation as determinants of performance (Dierickx and Cool, 1989; Scherer and Ross, 1990). The following sections distinguish between firm- and industry-level drivers of these strategies and performance outcomes.

Firm-level drivers

The resource-based view inherently offers an explanation for the firm effects on strategies and performance outcomes within the same industry. The key dimension of differences in strategies and performance levels among competitors within an industry is the existence of unique firm characteristics capable of producing core resources that are difficult to imitate (Wernerfelt, 1984; Barney, 1986; Peteraf, 1993). These core resources are developed internally (Dierickx and Cool, 1989) through sustained investments in difficult-to-copy attributes (Barney, 1986) by managers committing to irreversible strategic actions (Ghemawat, 1991). When acquired from the market, core resource endowments fully captialize their rents in the market price (Barney, 1986). Similarly, core strategies are characterized by lock-in, lock-out, lags, and inertia (Ghemawat, 1991); and imply unique decision-making conditions due to complexity, uncertainty, and conflict (Amit and Schoemaker, 1993).

These unique strategies and resources, in conjunction with causal ambiguity, create isolating mechanisms that protect the competitive positions of firms against imitation (Lippman and Rumelt, 1982; Reed and DeFillipi, 1990). This heterogen-

eity in turn leads to systematic differences in firm performance within the same industry. Hence:

Hypothesis 1: Core strategies and performance within industries vary systematically with differences in firm-level characteristics.

Industry-level drivers

Industrial organization researchers have argued that strategy and performance are primarily determined by the membership of an industry, and are sustained through entry barriers. In this perspective, the common structural elements of an industry lead its members to share competitive characteristics. In a more dynamic context, as successful firms develop resources producing competitive advantage, other firms are able to reduce competitive gaps by imitating these valuable resources. As a result, convergent patterns of competition can become common industry characteristics over time.

Previous research has studied these convergent patterns for core strategies in technological and marketing differentiation. For instance, in technology development, firms share several characteristics of the industry: direct competitors face similar technological opportunities for innovation (Klevorich *et al.*, 1995; Cohen and Klepper, 1992), use a common protection mechanism for profiting from their technological investments (Levin *et al.*, 1987), and share innovative conditions derived from the underlying technology life cycle (Utterback and Abernathy, 1975).

The behavioral explanation for homogeneity of strategies is more obvious for marketing expenditures. They are easily observable and imitable—competitors' expenditures can be easily duplicated. Marketing expenditures may reach comparable levels among competitors in an industry because of similar conditions which determine product differentiability (Comanor and Wilson, 1974), buyer characteristics (consumer or industrial products), stage in product life cycle, or close rivalry (Kotler, 1994). Firms use advertising to inform individuals about the quality of their products, or to persuade consumers that their brand is better than those offered by rivals. In such cases, advertising rather than price can become the way in which competitors interact with each other (Scherer and Ross, 1990).

Prescriptions from early strategy literature (Andrews, 1971; Ansoff, 1965), based on the industrial organization paradigm, are consistent with the structural determinants of competition discussed above. According to this perspective, companies must develop strengths based on Key Success Factors (KSF) that are stable and externally determined by the industry environment (Vasconcellos and Hambrick, 1989). This approach implies that firms in an industry converge towards competitive parity, thus enhancing their chances of survival (Barney, 1991).

When there is no clear understanding of the means–end relationship, firms should imitate the more observable aspects of successful strategies. Managers pursuing the KSF approach practice strategic benchmarking aimed at decreasing competitive gaps (Colmen, 1993; Bogan and English, 1994). The practitioners collect competitive information for imitation from different sources such as reverse engineering, patent applications, industry journals and magazines, financial statements, consultants, and ex-employees (Winter, 1987). The industrial organization literature prescribes this approach.

Thus, shared industry characteristics such as market structure and imitation of strategies lead to convergence of core strategies and performance among firms in the same industry and differences across industries. Therefore:

Hypothesis 2: Core strategies and performance vary systematically with differences in industry-level characteristics.

COMPLEMENTARITY OF THE SCHOOLS

This study argues that the above two hypotheses underlying resource-based view and the industrial organization schools within strategic management are complementary. Industry-level drivers that promote homogeneity coexist with firm-level drivers that generate heterogeneity, just as various forms of competition coexist within the same industry. Firms invest upfront in resources that permit differentiation from their competitors. However, as industries evolve, imitation reduces the gaps and differences in resources between firms (Demsetz, 1973). The common nature of customers, suppliers, products, technologies, and competitive conditions leads to similarities within

an industry (Barney, 1991). While industrial organization has been primarily concerned with the similarities among firms, the resource-based view has focused on the differences as the basis to develop sustainable competitive advantage (Wernerfelt, 1995).

However, empirical studies within industrial organization and resource-based view have not addressed this complementarity. This has been partially because of the difficulty in operationalizing the theoretical constructs. Researchers within industrial organization have relied on proxies of industry structure such as entry barriers, concentration ratios, and industry dummy variables to predict strategy and performance. They have reported a significant effect on R&D and advertising intensities, as well as performance (see Scherer and Ross, 1990, Chs. 11, 16, and 17 for a review). On the other hand, several resource-based studies (Jacobson, 1988; Hansen and Wernerfelt, 1989; Powell, 1996) have reported evidence supporting the influence of firm factors on performance outcomes despite the difficulties in measuring unobservable firm-specific characteristics (Godfrey and Hill, 1995).

Even those studies that used more sophisticated techniques to overcome the measurement problems of industry structure and firm-specific characteristics reported findings that confirmed the polar perspectives. Both Schmalensee (1985) and Rumelt (1991) used variance component analysis to study differences in performance derived from industry and firm effects. However, their results are in conflict due to methodological differences. Schmalensee found dominance of industry effects as he selected latent variables to capture industry effects and market share for firm-level effects; Rumelt found dominance of firm effects because latent variables were used to capture both the industry and firm-specific effects.[1] In addition, Hill and Deeds (1996) argue that the 3-year time series used by Rumelt is too short to allow equilibrium to be reached, and Powell (1996) questions the validity of the FTC data base used. The above discussion brings out the need for more empirical research to test the complementarity between the industrial organization and resource-based view. In the following section we design and carry out an empirical test which examines this complementarity.

METHODOLOGY

Statistical test and measures

The empirical analysis was conducted using the variance components methodology. Unlike regression techniques using fixed-effects models, variance components assume a random model that does not require direct measurement of the independent variables. Using variance components, the unique firm characteristics are modeled as latent factors, captured using individual latent variables for each firm; while industry attributes are captured using a common latent variable shared by members of the same industry. By assuming that the latent factors are selected randomly from a population of firms and industries, variance components are capable of estimating the portion of the total variance derived from firm- and industry-specific sources. As recommended by Searle, Casella and McCulloch (1992), the variance component tests were estimated using the maximum-likelihood method.

The dependent variables for core strategies were developed for technology and marketing resources. Several researchers have suggested that these intangible resources are a potential source of competitive advantage. Dierickx and Cool (1989) argue that the accumulation process for generating brand loyalty and technological expertise provides uniqueness and reduces imitation because of resource mass efficiencies, resource erosion, resource interrelationships, time-compression diseconomies and causal ambiguity. R&D expenditure captures an enterprise's endowment of unique knowledge possessed by individuals and teams within organizations (Caves, 1982; MacDonald, 1985), and these investments require periods from 4 to 6 years to provide a return (Cohen and Levin, 1989). Similarly, advertising expenditure captures a firm's intangible assets such as brand name and reputation (Stewart, Harris, and Carleton, 1984). Because of the high uncertainty, high asset specificity and high sunk costs associated with R&D and advertising, these expenditures are core strategies financed with equity (Balakrishnan and Fox, 1993), or with internally generated funds (Grabowsky and Mueller, 1978). We used R&D and advertising

[1] In this study we follow Rumelt's methodology regarding the severe limitations of market share to capture firm effects.

intensities as measures of core strategies by dividing the annual expenditures in each variable by sales (Bettis, 1981; Chatterjee and Wernerfelt, 1991).

Like previous studies (Schmalensee, 1985; Rumelt, 1991; Roquebert *et al*., 1996), we used return on assets as the measure of business performance. This variable was constructed by dividing the annual income before extraordinary items by the total assets.

Sample selection

Our sample consists of 264 companies in 69 4-digit SIC industries. For each company, financial data were collected for the period 1978–92. The companies selected in the sample comply with three criteria. First, they are nondiversified companies. Since companies do not disclose resource allocation information at the segment level, a sample of nondiversified firms from manufacturing industries (Balakrishnan and Fox, 1993) was selected from COMPUSTAT. These companies correspond to Rumelt's (1974) single- and dominant-diversification categories for which revenues from the largest company segment (defined at the 4-digit SIC code) are greater than 70 percent of total revenues. This procedure permits the use of the company's consolidated financial statements as a proxy for the information of the most important segment, and allows us to control for multiplicity of industry effects in diversified companies.

Second, industry groups were selected by identifying single-business companies whose portfolio of business was classified as being in the same segment by independent raters. We used 4-digit SIC classifications from COMPUSTAT and Compact Disclosure data bases. This procedure allowed identification of companies whose portfolio of businesses clearly belongs to the same industry segment. Broader 4-digit SIC codes that group other segments, such as those ending in 00, 0, and 99 were eliminated from the sample. Finally, only companies with 1992 sales larger than $100 million were selected.

To assess the validity of the sampling technique to produce a nonbiased set representative of other companies in the same industry, the strategies of single-business firms (sampled) were tested for statistical differences with strategies from the population of firms in that industry for the period 1988–90. The results showed no significant statistical differences. In addition, the SIC classifications for the single-business companies sampled were screened for the period 1987–92. This procedure showed a stable pattern for the main business segment.

RESULTS

Table 1 presents the results of the random effect model using a 5- and a 15-year period (1988–92, 1978–92, respectively). For each variable and period presented in the table, the columns show the variance component estimate derived from firm-level factors, from industry factors, and the random error, respectively. Each estimate is also presented as a fraction of the total variance.

Table 1. Variance components results

Variable	Period	Firm	Industry	Error	Total
R&D Intensity	1988–92	6.61***	13.35***	1.51***	21.47
		30.8%	62.2%	7.0%	100.0%
	1978–92	6.87***	12.64***	3.31***	22.83
		30.1%	55.4%	14.5%	100.0%
Advertising intensity	1988–92	4.10***	11.48***	0.97***	16.55
		24.8%	69.3%	5.9%	100.0%
	1978–92	3.68***	10.41***	1.17***	15.26
		24.1%	68.2%	7.7%	100.0%
ROA	1988–92	29.84***	5.03**	45.96***	80.83
		36.9%	6.2%	56.9%	100.0%
	1978–92	18.55***	4.21*	50.13***	72.88
		25.4%	5.8%	68.8%	100.0%

*$p < 0.05$, **$p < 0.01$; ***$p < 0.001$

As can be seen in Table 1, core strategies on R&D and advertising are principally influenced by industry-level factors. In particular for the 5-year period, 62 percent of the variation in R&D strategy is caused by industry factors, which is about double the size of the firm effect. The results for the longer period are of similar magnitude. For advertising strategy, the influence of industry factors is larger for both periods (68–69 percent), which is also larger in magnitude than the firm effect (24–25 percent). In addition, for both of the core strategy variables the error term is of a small magnitude, between 6 and 15 percent of the total variance. This shows that both industry and firm factors consistently explain the variation of these resource strategies across companies, and over time. Companies in the same industry present a homogeneous pattern in their R&D and advertising investments to develop core resources. The results for ROA are similar to those presented by Rumelt (1991), though our sample is very differently chosen, and the periods are longer. Using a 3-year period, Rumelt found that 46.4 per cent of variation was derived from firm factors and 8.3 percent from industry factors. The results in Table 1 confirm the predominant effects of firm-specific factors on performance. It is interesting to note that there is a clear trend toward reduction in firm effects as the time period of the study is increased. The magnitude of firm effects for a 5-year period is 37 percent, whereas for the 15-year period it is only 25 percent.[2,3]

DISCUSSION

Our results support the complementarity between resource-based and industrial organizations perspectives. The results from core strategies support the strong influence of industry-level drivers on R&D and advertising investments, whereas the results for performance confirm the strong effect of firm-level drivers.

The findings suggest that firms competing in the same industry tend to develop homogeneous competitive strategies for investing in technology and marketing resources. The results are also consistent with institutional theory. Managers try to reduce the strategic gaps with relevant competitors to gain legitimacy in the eyes of institutional investors and other important stakeholders (Meyer and Rowan, 1977; DiMaggio and Powell, 1983). Under causal ambiguity, firms choose to imitate the observable aspects of core strategies. For instance, the uncertainty inherent in the relation between the investments in specialized resources and competitive advantage leads other firms to imitate the behavior of the more successful ones (Alchain, 1950).

These findings also support the resource-based view. Barriers to imitation depend on the degree of observability of a resource (Godfrey and Hill, 1995). Firms dedicate enormous attention to the study of competitive moves on core resources because of their potential impact on performance. However, easily implementable strategies such as the allocation of funds for R&D and advertising cannot provide competitive advantage (Erickson and Jacobson, 1992). The existence of convergent competitive patterns with respect to easy-to-observe variables confirms the competitive value of the difficult-to-observe resources. As Collis and Montgomery (1995) recently observed: sustainable competitive advantage can be gained only by leveraging and combining competitively distinctive resources that exist at lower levels of aggregation.

The results are also consistent with the existence of unique resource endowments for firms in the same industry. Comparable levels of resource

[2] As suggested by an anonymous reviewer, a second sample was constructed by selecting companies competing in more precise industry segments, rather than 4-digit SIC industries. Since competition is an important topic followed by financial analysts, this subsample was selected by screening the General Business Files data base. This data base collects the reports for publicly held companies tracked by financial analysts. The companies identified in the original sample were screened for the competition topic in financial analysts' reports. Industry segments were identified only when financial analysts explicitly considered two or more companies that were selected in the original sample competing in the same segment. A total of 103 single-business companies in 35 segments were identified following this procedure. The results using this subsample presented similar patterns to those indicated in Table 1. Due to the more homogeneous nature of the segments, the variance components results showed a larger portion of the variance derived from industry effects. For R&D intensity the portion of the variance explained by industry effects increased from almost 62 percent (as reported in Table 1) to 90 percent. Advertising intensity presented very similar results to those presented in Table 1.

[3] The variance components modeling was replicated for a modified performance variable. This variable was constructed by modifyng the asset base of ROA by capitalizing the annual R&D and advertising expenditures with rates of 10 and 10/3, respectively (Montgomery and Wernerfelt, 1988). Similar to Table 1, the results on the modified performance variable showed that the firm effects continued to dominate the industry effects. This additional test was also suggested by an anonymous reviewer.

allocation for the development of similar types of resources by two firms in the same industry do not lead to possession of the same resources. This is especially true for idiosyncratic resources such as R&D and advertising.

Our findings support Rumelt's (1991) conclusion that firms' unique resource endowments, and not the participation in a particular industry, are the cause of differences in performance. The higher magnitude of firm effects on performance than on strategy may be explained by the idea of 'multifinality' reported by Lawless, Bergh, and Wilsted (1989): even when firms follow similar strategies, the idiosyncrasy in their resources leads to heterogeneous performance outcomes.

A comparison of the 5- and 15-year periods for all three variables shows a decrease in the industry effects and the reduction in the proportion of variance explained jointly by industry and firm effects. This trend could be the net result of an interaction between long periods of convergence and punctuated reorientations (Tushman and Romanelli, 1985). As predicted by industrial organization, longer periods increase the chances of competition settling down, and allow a long-term equilibrium to be reached within the industry; this explains an increase in industry effects. However, an increasing time period increases the chances of having a Schumpeterian revolution that changes the nature of competition as well; this explains the decrease in the proportion of variance explained by industry effects.

Together, firm and industry effects explain between 74 percent and 94 percent of the total variance in strategy variables. The low level of error (ranging from 6 percent to 15 percent) for core strategies offers support to the concept of strategy as a pattern. Once a strategy is chosen, whether it is deliberate or emergent, and whether it is followed by competitors or unique, strategic positioning tends to be maintained over time.

IMPLICATIONS FOR FUTURE RESEARCH

Our results suggest that models of competitive advantage within the resource-based view could improve their prescription value by measuring resources at lower levels of aggregation. Firm-level proxies like R&D and advertising expenditures do not capture idiosyncratic resources that provide competitive advantage. Although it is irreversible investments in resource development that create idiosyncratic resource stocks that form the basis of competitive advantage (Dierickx and Cool, 1989), these resource development strategies are easy to observe and easy to imitate. Hence, firm-level proxies like R&D and advertising expenditures capture broad classes of resources, not the idiosyncratic firm resources or resource development processes that form the basis of competitive advantage. Thus models of competitive advantage within the resource-based view are applicable only at low levels of analysis, unobservable to the competition. The challenge is to carry out empirical research at an appropriate level of aggregation and develop normative guidance on leveraging the four drivers of competitive advantage within the resource-based view—resources, routines, replication, and rents (Winter, 1995).

Only fine-grained analysis of resource hierarchies at lower levels of aggregation can help managers identify the true sources of competitive advantage. Attempts to generalize the value of unique resource–product–market positions would undermine the basic premises of strategic management. Strategy is about differentiating a firm from its competitors, and the task of the general management is to adjust and renew firm resources as time, competition, and change erode their value (Rumelt, 1987). Hence strategy researchers should focus on differences and not similarities in resources (Hatten and Hatten, 1987; Wernerflet, 1985).

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