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PERFORMANCE DIFFERENCES AMONG STRATEGIC GROUP MEMBERS

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Whether and why members of the same strategic group would experience different performance results has received little attention in previous research. These questions are addressed in this paper. First, conventional theory on the relationship between firm performance and strategic group membership is reviewed. Then a theory is developed as to how historical differences among strategic group members may result in performance differences. An empirical analysis of risk and return relationships is conducted, centered on the nature of environmental change characterizing the industry. The empirical setting throughout is the U.S. pharmaceutical industry over the period 1963–82.

INTRODUCTION

Central to the various studies of strategic groups have been one or more of the following three questions: (1) do strategic groups (stable conduct differences) exist within industries; (2) does the existence of strategic groups affect overall industry performance; and (3) does performance differ among strategic groups? Overall, research has answered the first two questions affirmatively, while research on the third has produced conflicting evidence (Cool and Schendel, 1987).

This paper explores why empirical research has found conflicting results on the third question. Theoretical reasons for the absence of an unequivocal link between strategic group membership and firm performance are reviewed first. One explanation, the incidence of performance differences among strategic group members owed to different asset accumulation, is considered thereafter. This explanation is explored empirically using longitudinal data from the U.S. pharmaceutical industry over the period 1963–82. The research design, empirical tests, and results are discussed in subsequent sections. A final section on implications of the findings for further research on strategy and performance relationships concludes the paper.

STRATEGIC GROUP MEMBERSHIP AS A PREDICTOR OF FIRM PERFORMANCE

Although early work (Hunt, 1972; Newman, 1972; Porter, 1973; Hatten, 1974; and Patton, 1976) contributed substantially to demonstrating the heterogeneity of firm[1] conduct in industries, it was not until 1977 that a well-developed set of theoretical arguments appeared on the causes and implications of strategic group phenomena. Caves and Porter (1977) argued that 'mobility barriers' prevented industries from consolidating into one group of firms which are similar except perhaps for their size. Mobility barriers were described as *structural* forces impeding firms from freely changing their competitive position, and were seen as substantially independent of the firm's actions. In the tradition of Industrial Organization (IO) Economics' views on entry

[1] Since strategic group analysis is concerned with rivalry within an industry, the term 'firm' stands for 'division' or 'strategic business unit' in the case of diversified corporations, or for the firm itself if it is not diversified.

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barriers and industry performance, the argument was developed that mobility barriers provided an explanation of why 'profit rates may differ systematically among the groups making up an industry' (Caves and Porter, 1977: 251). This view was later repeated by Caves (1984: 129): 'the factors delineating strategic groups themselves are directly related to structural barriers to entry, establishing a straightforward explanation why some strategies prove persistently more profitable than others in the same market'.

Caves and Porter (1977: 250–251) also attached a set of *behavioral* (conduct) implications to the mobility barrier notion. They suggested that firms within a strategic group are sensitive to their interdependency and are likely to respond identically to the same stimuli. Because their interdependency is easily perceived, tacit agreements among strategic group members more readily develop which sustain superior performance and deter entry. Even absent strong collusion, group members would at least have incentives to divert their behavior from rivalry to activities that contribute to mobility barriers.

Thus, a model of rivalry based on the strategic group notion was proposed by Caves and Porter. The emphasis on entry barriers, collusion, and market power at the strategic group level reflected traditional IO thinking on the direct relationship between structure, conduct, and performance. However, their model suggested a strong association between strategic group membership and performance, thus by-passing the more customary aggregated industry level/performance relationship typical of IO studies.

The original model was later elaborated and adapted in important ways by Porter (1979). He redirected the focus from *strategic group* performance to that of individual *firm* performance. Summarizing the hierarchy of performance determinants, Porter (1979: 219) stated:

> the structure within an industry consists of its configuration of strategic groups, including their mobility barriers, size and composition, strategic distance, and the market interdependence relative to each other. The firm will have higher profits if it is located in a group with the best combination of high mobility barriers, insulation from intergroup rivalry and substitute products, bargaining power with adjacent industries, the fewest other members, and suitability to the firm's execution ability.

Careful reading of Porter's 1979 contribution shows an important departure from his previous work with Caves. While mobility barriers still occupied a central role, only *indirect* links with *firm performance* were suggested. Rather, mobility barriers were viewed as determining *potential* for profitability, and this potential could be eroded by a host of factors like those listed above. *Firm-specific* characteristics in contrast to strategic group specific factors received more attention in Porter's discussion of determinants of firm performance. Included in these characteristics which could dominate strategic group effects were: different *risk profiles* among group members; *scale* differences among group members; differences in *asset endowment*; and differential *ability to execute* a chosen strategy.

In summary, in their early writings, Caves and Porter argued that a reference to the height of 'entry barriers' characterizing industries is insufficient to explain observed performance differences among industry participants. They suggested that an intermediate analysis based on mobility barriers among strategic groups would significantly enhance the explanatory power of IO models. Later, Porter took the analysis one step further, suggesting that the concept of mobility barriers alone is inadequate to explain performance differences among firms, including firms within the same strategic group. He contended that consideration of market factors, as well as firm-specific factors, would enhance performance predictions over those based on mobility barrier considerations alone.

Clearly, a more qualified theoretical view developed on the performance consequences of strategic group membership. Yet empirical research maintained its focus on the evaluation of direct linkages between strategic group membership and firm performance. That this empirical research produced mixed results should not be surprising given the many (potentially) intervening variables that have been identified since the formulation of the original IO model. If the conflicts noted are to be resolved, then it is likely that a richer, unfortunately more complex, model which includes the moderating factors discussed above needs to be developed.

FIRM PERFORMANCE, RISK AND STRATEGIC GROUP MEMBERSHIP

One of the more interesting moderating factors that deserves greater study is that of the *risk*

profile of individual firms. If it were true that strategic group members have different risk profiles, and if risk and return are related, then one would expect that performance would differ among group members. Were large differences in risk profiles to exist among group members, then an evaluation of performance differences among strategic groups would most likely fail to identify significant performance differences: the large within-group variation would dwarf between-group variation in performance. If this phenomenon is at work, this may provide one explanation of why previous studies did not produce consistent evidence on the incidence of performance differences among strategic groups.

The following discussion develops a rationale for why strategic group members may have different risk profiles. Building on the work of Porter (1979), Rumelt (1981) and McGee and Thomas (1986), the factors of 'asset endowment' and 'execution ability' are examined in more detail and are linked to the 'risk profile' factor. In particular, the major determinants of the risk and return properties of strategic investments are considered first. Since strategic investments are at the heart of strategic group membership, this analysis is a prerequisite to gaining insight into the determinants of performance differences among group members. Following this, the nature of risk–return relationships of strategic investments is considered. A set of hypotheses building on this discussion is developed thereafter.

Risk and return properties of strategic investments

What determines the risk and return properties of strategic investments is still not well understood. As Brealey and Myers (1981) recently pointed out in their review of investment theory: 'Our ignorance is largest when it comes to major strategic decisions [p. 735]. Capital asset pricing provides no mechanical formula for measuring and adjusting for risk in capital budgeting. The best one can do is to combine an understanding of the theory with good judgement and a good nose for hidden clues' [p. 166]. Clearly, strategic investments and their *ex ante* evaluation are affected by high ambiguity. That actual risk exposure (*ex post*) may differ among firms pursuing a similar strategy (strategic group members) may not come as a surprise. What major factors contribute to this is discussed next.

Strategic investments as asset combinations

It can be argued that one condition for effective business strategy is that *current* strategy actions build on *accumulated assets* (resources and skills) to exploit a perceived market opportunity. If a firm's current actions are incongruent with its accumulated 'stock' of assets, then it is likely to be less effective than other firms pursuing a similar strategy but with a good 'fit' between current strategic investments and accumulated assets. Given that accumulated assets constrain the effectiveness of current strategic actions, it can be argued that the 'stock' of accumulated assets or 'competences' constitutes the real source of competitive advantage. Current strategic resource allocations (advertising spending, R&D outlays, etc.) are important to the extent that they alter the stock of assets (brand loyalty, technological expertise, etc.) in a chosen direction. However, the impact of these expenditures, or 'flow' decisions, on competitive advantage and return is mostly indirect. Their impact on competitive advantage derives from their incremental change of the stock of competences or accumulated assets.

Returning to the strategic group context, the previous argument suggests that group members may not realize similar returns to the extent that important differences exist in their stock of assets. Although their flow actions (current strategy) may be similar, return differences can be expected if asset stocks are developed differently. It also follows that risk exposure may differ among group members to the extent that their actions are characterized by a different degree of fit between their (similar) current strategy and their different stocks of assets. Firms with an imbalance between their current strategy and their accumulated assets are likely to have a higher risk exposure in their strategic investment than other strategic group members with a better balance. In short, whenever strategic groups consist of firms with different histories of asset endowment and accumulation, risk and return differences may occur.

Market imperfections and performance differences

One important question to consider is whether the suggested risk and return differences are

likely to be *stable* or merely *temporary*. Building on the previous arguments, one would expect only temporary differences when input markets for assets (factors) and output markets for produced goods and services are competitive and complete. If input markets were perfect and complete, firms could easily and quickly assemble the particular stock of assets necessary to pursue a given investment opportunity. Under the assumption of perfect output markets, firms would be equally positioned to obtain an expected return on investment.

However, as Coase (1937), Arrow (1974), Williamson (1975), Nelson and Winter (1982), Caves (1984) and others have pointed out, *input markets* tend to be imperfect and incomplete. Indeed, critical assets may be tied up; imitation may be difficult if not impossible because knowledge to reproduce the resources and skills may be tacit (Nelson and Winter, 1982; Lippman and Rumelt, 1982); finding substitutes for required assets may not be possible without significant costs, substantial lead times or uncertainty about the outcome (McGee and Thomas, 1986). Thus, to the extent that required assets or competences for a given strategy cannot be easily imitated, substituted or acquired, the resulting competitive advantage and return difference is likely to be of longer duration. Similarly, possible imbalances between current strategy and accumulated assets may also persist, if perhaps at a decreasing rate, producing significant risk differences among group members.

Even if input markets were perfect, imperfections in *output markets* can result in different returns to firms pursuing a similar investment opportunity. If the degree of market power differs among firms competing in the same market (segment), firms with more market power may be able to realize higher returns than other market participants.

In summary, firms that currently pursue a similar strategy (strategic group members) may not necessarily realize similar performance. At least two factors may be responsible: (1) input markets may be imperfect and incomplete, impeding the procurement of required assets; and (2) different competitors in output markets may have varying degrees of market power.

Risk–return relationships of strategic investments

It was argued before that strategic group members may not have complete asset stock similarity; 'latent' differences in the stock of competences may persist due to imperfections in input markets. Under what conditions these latent differences will acquire an *important* role is a final question to consider. Below, the state of *environmental conditions* is presented as a key-moderating factor.

Negative risk–return relationships

As long as industry conditions are relatively stable, group members may have time to adjust their skills and resources so that asset stock discrepancies are minimized. Yet, when important discontinuities occur, or when environmental changes follow each other at a quick pace, these latent asset stock differences may acquire a more important role. When environmental events prompt firms to action, less-endowed group members may try to imitate the actions of their well-endowed group peers. Strategic group shifts may be attempted, sometimes unknowingly. These actions may increase the imbalance between their stock of assets and current strategy, and substantial risk relative to the return potential may be undertaken. Extending the arguments of Bowman (1980, 1982) and Figenbaum and Thomas (1986) on the investment behavior of 'troubled firms', one can argue that environmental change can prompt some firms to take poorly calculated actions and risks, resulting in disproportionately low returns because of inadequate resources and skills and input market imperfections and incompleteness.

While high environmental uncertainty may impel some firms to undertake strategies that do not turn out well, the same events may provide other firms with opportunities that can be exploited at low risk relative to the potential return. If these firms have at their disposal a 'pool of resources' that permits 'strategy adjustment' or that enables them to initiate major 'strategy changes' (Snow and Hambrick, 1980),

high-return investments may be pursued at low risk. This low risk stems not only from *superior assets* and the protection of this position due to imperfect and incomplete input markets, but also from the *inability* of the troubled firms to carry out their strategies in the market place. One can thus argue that in any strategic group 'successful' members exist alongside 'troubled' members. If the strategic actions of troubled and successful group members in times of environmental turbulence are considered together, then one can see that *negative* risk–return relationships may describe the strategic investments of strategic group members.

Positive risk–return relationships

On the other hand, a *positive* risk–return relationship may describe strategic investment outcomes of strategic group members. This case could occur when industry conditions and risks are well understood, and strategic group members recognize their limitations and strengths, and match them well to environmental opportunities. In such cases the 'free lunch' discussed in the case above may not be available to the successful firms at the expense of troubled firms. In low-risk conditions substantial competition from other group members (or group outsiders) may be expected, along with low returns. Higher returns may thus come only at the expense of higher risk exposure. Higher risk exposure occurs because members of other strategic groups, using different strategies, compete for the same market opportunities. Under this set of conditions fewer opportunities exist to realize a high return at low risk. Thus, a positive risk/return condition describes the set of investment opportunities in such cases.

In summary, strategic groups may consist of members who have different capabilities in terms of resources and skills to execute a similar strategy. These differences stem from different historical outcomes, perhaps from using different past strategies. When environmental changes occur very rapidly and unexpectedly, these differences in capability may become very important. Troubled members may have to take what are high risk actions relative to the return potential, making it much easier for successful firms to seize opportunities at low risk relative to the return potential. Hence, what were initially positive risk/return expectations may be disturbed by environmental events and result in a negative risk/return outcome.

The major aspects of the previous discussion are summarized in Figure 1. Types of environmental conditions are contrasted with the degree of congruence between accumulated assets and current strategy of strategic group members. The resulting two-by-two matrix represents different conditions which may give rise to the particular patterns of performance differences among group members, as discussed above.

HYPOTHESES

The previous arguments suggest an analysis of at least four issues: (1) do risk positions differ among strategic group members; (2) do strategic group members realize different performance results; (3) if the answer to the first two questions is affirmative, can performance differences be related to differences in risk position; and (4) do risk/return relationships change over time? The following hypotheses will be tested in the context of the U.S. pharmaceutical industry over the period 1962–83:

- H_1: *Firms belonging to the same strategic group have similar risk positions.*
- H_2: *Firms belonging to the same strategic group realize similar performance levels (returns).*
- H_3: *Performance levels and risk positions are positively related.*
- H_4: *Risk–return relationships are stable over time.*

The research design used in the study is discussed briefly, followed by a presentation and discussion of the results of the hypothesis testing.

RESEARCH DESIGN

The issues involved in the longitudinal identification of strategic groups were discussed extensively elsewhere (Cool and Schendel, 1987). Only

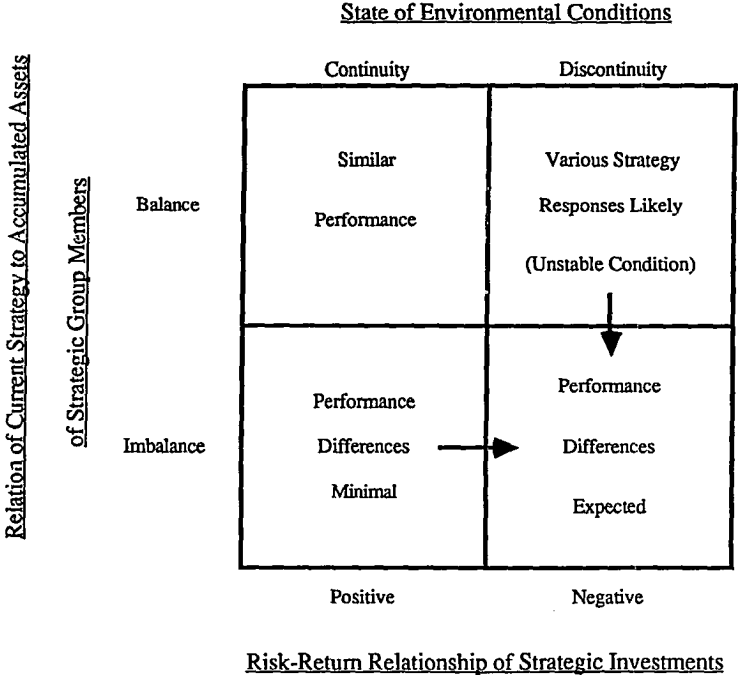

Figure 1. Determinants of performance differences among strategic group members

a brief overview will be presented here to provide proper perspective for the subsequent discussion of the empirical analysis.

Methodology

Building on prior work (Caves, 1984; Cool, 1985; and McGee and Thomas, 1986) the dimensions which define strategic group membership are similarities in those strategic actions intended to alter competitive advantage. Integrating previous definitions and findings on competitive strategy (Ansoff, 1965; Katz, 1970; Hofer and Schendel, 1978; Rumelt, 1979; Day, 1984) the strategic actions of interest are *business scope* and *resource commitments*. Included in the business scope decisions are those involving: (1) the range oi market segments targeted; (2) the types of products and/or services offered in the market segments selected; and (3) the geographic reach of product-market strategy. Resource commitments are defined to include business-level deployments of resources to functional areas that are key to gaining and maintaining a competitive advantage in target product-market segments.

The statistical issues involved in identifying strategic groups, especially longitudinally, are many and varied. To deal with them, a procedure was developed to evaluate whether and how firms reposition themselves over time in a strategic sense. Different strategic group structures in different, distinct time periods were tested for their existence. The procedure used is based on a combination of variance-covariance matrix testing, multivariate analysis of variance, and cluster analysis. The Appendix provides details on the procedure.

Strategy variable selection

The specification of strategy variables is always a function of the industry under study, in this case the U.S. pharmaceutical industry over the period 1963–82. This industry was chosen for several reasons: (1) preliminary research indicated that different firms pursued different strategies;

(2) the 1962 Amendments to the 1938 Food, Drug and Cosmetics Act, as well as later developments, significantly altered the environmental context in which drug firms had to compete; (3) detailed data bases appeared to be available, and (4) this industry had not yet received significant attention in strategic management research. A lengthy, 20-year period was selected to permit evaluation of the temporal stability of any observed strategic groupings.

Selection of strategy variables was based on studies of the drug industry (see Cool, 1985; Comanor, 1986) and discussions with industry executives and other experts. The variables chosen to represent strategy and the measures used for them are given in Table 1. The results of the strategic group identification procedure are presented in Table 2. A detailed description of patterns of strategic group formation is given in Cool and Schendel (1987) and is not repeated here, except when necessary, to place the empirical analysis presented here in perspective.

Measurement of risk and return

Since most pharmaceutial firms are diversified, financial market measures are not suitable to evaluate the performance of pharmaceutical

Table 1. Variables describing strategy in the U.S. pharmaceutical industry

Strategy dimension	Measure
Scope commitments	
Range of market segments	
1. Breadth of scope (FOCUS)	1. (Rx sales in three largest therapeutic categories)/(total domestic Rx sales)
2. Commitment to ambulatory care market (DRUGST)	2. % Drug store sales in total domestic drug sales
Types of products	
3. Commitment to ethical drug market (Rx)	3. % Rx sales in total domestic drug sales
4. Branded generics (BRANGEN)	4. % Branded generic Rx sales in total domestic Rx sales
5. Commodity generics (COMMGEN)	5. % Commodity generic Rx sales in total domestic Rx sales
6. Commitment to the maintenance drug market (MAINT)	6. % Maintenance drug sales in total domestic Rx sales
Geographic scope	
7. Spatial Reach (FOREIGN)	7. % Total firm sales generated abroad
Resource commitments	
Research & development commitments:	
8. Current R&D spending (RDINTEN)	8. (Total firm R&D)/(Worldwide Health Care Sales)
9. R&D capital stock (RDCAPIT)	9. (Cumulative number of NDAs submitted)/(Cumulative number of INDs submitted)
10. R&D orientation (RDORIENT)	10. (Cumulative number of NCEs approved)/(cumulative number of NDAs submitted)
Marketing commitment	
11. Product strategy (PRODSTR)	11. (Cumulative number of NCEs introduced)/(Cumulative number of all products introduced)
12. Promotion to the medical profession (PROFPROM)	12. (Total domestic professional promotion)/(Total domestic Rx sales)
13. Advertising to the consumer (CONSADV)	13. (Total domestic PTY drug advertising)/(Total domestic PTY sales)
14. Distribution strategy (DISTR)	14. % Total domestic drug sales shipped directly to drugstores and hospitals
Size	
15. Scale of drug operations (SIZE)	15. Ln (Total domestic drug sales)

Table 2. Strategic groups in the period 1963–82: group membership and MANOVA test results

Period I: 1963–69, F(WILKS) = 3.105 (p = 0.028)

SG1	SG2	SG3	SG4	SG5	SG6
Abbott	American Home	Johnson & Johnson	Searle	Carter-Wallace	Marion
Lederle	Bristol-Myers	Morton-Norwich	Warner-Lambert	Robins	
Lilly	SmithKline	Pfizer		Rorer	
Merck	Sterling Drug	Richardson-Vicks			
Squibb		Schering-Plough			
		Syntex			

Period II: 1970–74, F(WILKS) = 5.476 (p = 0.005)

SG1	SG2	SG3	SG4	SG5
Abbott	Bristol-Myers	Merck	Robins	Marion
American Home	Carter-Wallace	Pfizer	Rorer	
Lederle	Johnson & Johnson	Schering-Plough		
Lilly	Morton-Norwich	Searle		
Squibb	Richardson-Vicks	Sterling Drug		
Warner-Lambert	SmithKline	Upjohn		
	Syntex			

Period III: 1975–79, F(WILKS) = 6.887 (p = 0.000)

SG1	SG2	SG3	SG4
Abbott	Lilly	Johnson & Johnson	Carter-Wallace
American Home	Merck	Morton-Norwich	Marion
Bristol-Myers	Pfizer	Richardson-Vicks	Rorer
Lederle	Schering-Plough	Robins	
Warner-Lambert	Squibb	Searle	
	Sterling Drug	SmithKline	
	Upjohn	Syntex	

Period IV: 1980–82, F(WILKS) = 2.623 (p = 0.049)

SG1	SG2	SG3	SG4	SG5	SG6
Abbott	Lilly	Johnson & Johnson	Searle	Carter-Wallace	Lederle
American Home	Merck	Schering-Plough	Syntex	Marion	
Bristol-Myers	Upjohn	Squibb		Morton-Norwich	
Pfizer		Sterling Drug		Richardson-Vicks	
SmithKline				Robins	
Warner-Lambert				Rorer	

divisions. Accounting measures had to be used. In particular, a return on sales (ROS) measure was defined for the pharmaceutical operations of each firm. ROS was calculated as the ratio of net income before interest and taxes from pharmaceutical operations, to total pharmaceutical sales. A return on assets (ROA) measure may have been preferable, but since asset bases were not available for all firms over the 20-year period considered, ROA could not be used. The ROS measure when used within a single industry context however, should be useful given that firms are likely to have more similar asset turnover rates than firms from different industries.

The limitations of accounting indicators are well known, and therefore will not be repeated here (e.g. Bernstein, 1974: 455–509). However, one important shortcoming, their bias due to

changes in inflation rates, warrants attention because of the longitudinal nature of this research. Following Winn (1975), a procedure was developed to adjust ROS for inflation effects. Income statement elements were expressed in constant 1982 values, and depreciation charges were restated to alleviate their bias toward understatement. The full procedure is discussed in Cool (1985: 562–565). A new measure, adjusted return on sales (AROS), was then obtained and served as an indicator of return.[2]

Evaluating the risk of the business strategy of each firm raises many measurement issues. Three considerations led us to evaluate total risk rather than systematic risk: (1) the empirical difficulty in estimating beta at the business level in the absence of financial market data; (2) the fact that theoretically and empirically, beta is related to total risk, and (3) management is responsible to a wider group of 'stakeholders' than just shareholders, making total risk a prominent concern. Total risk for each firm (VAROS) was measured by the standard deviation of AROS about the temporal mean for each of the four periods with a stable strategic group structure: 1963–69, 1970–74, 1975–79, and 1980–82. The measurement of risk in terms of standard deviation has been employed in many previous studies (see e.g. Rumelt, 1974; Christensen and Montgomery, 1981; Bettis and Hall, 1982; Hambrick, MacMillan and Day, 1982).

Data sources

The data bases of IMS America constituted the major source of information. Other data bases used include the Paul de Haen *International New Drug Analysis* and *New Product Survey*, reports by Frost and Sullivan, Leading National Advertisers, *Drug Topics, Advertising Age, Chemical Abstracts,* the *Merck Index*, and FDA reports. For the performance variables, the 10–K line of business reporting and annual reports were consulted. A full description of the reliability and use of the data bases can be found in Cool (1985: 325–337).

[2] Thanks are due to Dr Robert Eskew, Professor of Accounting, Purdue University, for his help in specifying a workable procedure to adjust return on sales measures for inflation effects.

EMPIRICAL RESULTS

The results will be presented in the sequence of the hypotheses specified above. The tests on potential risk and performance differences among strategic group incumbents are given first,[3] followed by the estimated results of the risk–return relationships.

Risk differences among strategic group incumbents

If performance differs among strategic group incumbents, and if this difference is related to differences in risk positions, then risk should differ among group members. Since risk was defined in terms of standard deviation, the first hypothesis can be evaluated using a variance–homogeneity test. The underlying Bartlett–Box *F*-test is described in Neter and Wasserman (1974: 509–513). Formally, the following null-hypothesis is tested:

$$H_0: \sigma^2_{1j} = \sigma^2_{2j} = \ldots \sigma^2_{qi}$$

against H_1: not all σ^2_{ij} are equal

where q = the number of firms in strategic group j,

$j = 1, \ldots, s$: the number of strategic groups in the period considered.

The hypothesis was tested for every strategic group in each of the four periods considered. Test results are reported in Table 3. Inspection of this table indicates that nine out of the 18 tests performed led to a rejection of the null-hypothesis at the 5 percent significance level. When a 10 percent level is taken, the number of rejected null-hypotheses increases to 11, or 61 percent of the total number of tests. Clearly, no strong, uniform support for the hypothesis that group members have a similar risk posture exists.

A second observation relates to the test results in terms of different time periods. In the first three periods most hypotheses of similarity of risk are rejected, but, the results for the 1980–82 period do not allow rejection of the null-hypothesis. It appears that over the time period under study the U.S. pharmaceutical industry has restructured itself into groups of firms which constitute *homogeneous risk classes*. As reported

[3] Strategic groups with only one member were excluded from the analysis for obvious reasons.

Table 3. Risk differences among strategic group incumbents

Strategic group	1963–69	1970–74	1975–79	1980–82
SG1	5.2* (0.000)†	4.5 (0.000)	2.3 (0.055)	1.4 (0.225)
SG2	17.2 (0.000)	2.7 (0.021)	9.6 (0.000)	0.6 (0.561)
SG3	5.9 (0.000)	8.2 (0.000)	1.8 (0.096)	1.7 (0.170)
SG4	1.9 (0.171)	1.7 (0.188)	4.1 (0.017)	0.1 (0.764)
SG5	2.1 (0.122)			2.1 (0.098)

* Bartlett–Box *F*-value
† Significance of *F*

in Cool and Schendel (1987), the U.S. drug industry went through a phase of competitive posture changes after the important 1962 Amendments. It was found that many firms 'adjusted' or 'changed' their strategies (Snow and Hambrick, 1980), resulting in evolving strategic group structures. In the early 1980s, this repositioning activity crystallized into a strategic group structure with high asymmetry between the groups. This was interpreted as indicating that many firms had found a new (temporary) balance after going through a phase of experimentation in strategy changes. This activity, which can be viewed as 'learning-by-doing', may have increased the self-awareness of firms of their capabilities and limitations. Under this scenario, groups of firms with more or less equal risk positions could emerge. This evolution may explain the test results for the period 1980–82.[4]

Despite a tendency towards risk homogeneity of strategic groups, the fact remains that for the larger part of the period examined (1963–79), risk positions differed among strategic group incumbents. This finding supports the argument of Porter (1979) and the view proposed earlier in this paper. Whether these risk differences are also associated with performance differences will be examined next.

[4] Although many firms may have found a new balance between their current strategy and accumulated assets, this does not imply that the industry is in equilibrium. Environmental conditions may still work to upset the position of other firms in the industry, evoking further structural changes.

Performance differences among strategic group incumbents

To test the second hypothesis, an analysis of variance (ANOVA) for the performance differences of group members was performed. Since in about half the tests the assumptions of equal variances across the different 'treatments' (i.e. firms) were violated, a 'parametric' ANOVA was not performed. Its non-parametric counterpart, the Kruskal–Wallis one-way analysis of variance, was therefore applied (Siegel, 1956: 184–193). The results of the analysis of variance on the mean performance differences among strategic group incumbents are given in Table 4. Inspection of this table indicates that in almost all cases the null-hypothesis of equality of returns for members of the same strategic group is rejected (5 percent significance level). In addition,

Table 4. Return differences among strategic group incumbents

Strategic group	1963–69	1970–74	1975–79	1980–82
SG1	32.0* (0.000)†	24.4 (0.000)	22.2 (0.000)	16.1 (0.007)
SG2	25.3 (0.000)	19.9 (0.000)	30.3 (0.000)	6.0 (0.051)
SG3	28.2 (0.000)	28.2 (0.000)	28.5 (0.000)	9.5 (0.024)
SG4	9.8 (0.000)	1.3 (0.251)	9.5 (0.000)	0.4 (0.513)
SG5	13.7 (0.000)			9.2 (0.027)

* Kruskal–Wallis *H* statistic value (X^2_{q-1})
† Significance of *H*

the findings are very consistent over time. A pattern towards similarity of profitability over time is not observed. Therefore, it can be concluded with a high level of confidence that the second hypothesis (H_2) of equal return of strategic group incumbents should be rejected.

Independent of the previous analysis of risk differences, this result is very significant for strategic group research. Previous research has not examined the incidence of performance differences among group incumbents, probably because testing sought to demonstrate the performance variation across strategic *groups*, and therefore little attention was devoted to the performance differences at the *firm* level. The discussion of existing theory indicated that many factors may produce performance variation among strategic group members. The results reported here stress the importance of going beyond simplistic notions of strategic group-firm performance inferences. Since the test results are stable over time, the argument has substantial validity.

As suggested earlier in this paper, return differences among group members may be traced to both firm-specific factors (e.g. risk profile, size, asset endowment) and market-related elements (e.g. market interdependence, strategic distance, etc.) Whether return differences are associated with risk differences will be evaluated next.

Risk–return relationships in a strategic group context

Preliminary considerations

Determining whether and to what extent risk differences explain variation in firm performance raises at least two empirical issues beyond the theoretical considerations given above: (1) do risk–return relationships have to be estimated for each strategic group; and (2) should risk–return relationships for different periods be estimated independently of each other? These issues will be addressed in turn.

It might be argued that different risk–return relationships characterize each strategic group. If some strategies are inherently more risky than others a case could be made for presuming that risk and return are related to each other differently across strategic groups. This view is not accepted here for two reasons. Previous work (Cool and Schendel, 1987) tested whether strategic groups are characterized by different levels of risk. It was found that the hypothesis of equal risk for all strategic groups could not be rejected at any reasonable level of significance. Given that this result was obtained over the entire 20-year period studied, it is appropriate to conclude that there exist few empirical reasons to analyze risk–return relationships at the strategic group level.

In addition to the empirical argument, a more basic theoretical case can be made. If total risk position is indeed related to the degree of congruence between current strategy and accumulated assets, as was argued earlier, then risk is predominantly firm-related. Further, as any firm can take actions which lead it far astray of its original strategic commitments, strategic group membership theoretically should not influence the susceptibility to different degrees of risk incurred. The actions that lead to similar degrees of risk may, of course, differ. However, the risk exposure that a set of firms faces by different actions may be similar. In view of these theoretical considerations, and given the observed similarity of risk exposure at the strategic group level, the position is taken here that risk–return relationships should be estimated at the firm level, regardless of group membership.

The second issue raised was whether risk–return relationships for different time periods should be estimated independently. To find the relationship between risk and return one might perform a regression analysis of return (AROS) on risk (VAROS) for each period. Yet since a regression of return on risk excludes other determinants of firm profitability, and given that all firms operate in the same industry, excluded factors may produce correlations between the disturbances of the risk–return relationships of the four periods. Under these conditions the relationships are not unrelated, but only 'seemingly unrelated' (Theil, 1971: 294–302). Zellner (1962) has shown that a joint estimation of all equations using generalized least squares will result in more efficient estimates than when least squares estimation is applied to each equation separately. This estimation is known as the 'seemingly unrelated regressions' (SUR) model. This grouping of equations to estimate the risk–return relationship for all periods was applied here. The steps leading toward the estimation are described below.

First, ordinary least squares (OLS) estimation was performed on the relation of return (AROS) on risk (VAROS) for each period:

$$AROS_i = \alpha_i + \beta_i VAROS_i + \epsilon_i \quad (1)$$

where i = 1, . . ., 4, denoting the four time periods;

$AROS_i$ = an $n \times 1$ vector representing the average profitability of the n firms over period i;

$VAROS_i$ = an $n \times 1$ vector representing the standard deviation of each firm's profitability about its period mean $AROS_i$.

Results indicated that each of the four estimations was affected by heteroskedasticity, a common problem with cross-sectional samples. To alleviate this problem, each variable and the constant term in (1) was divided by $VAROS_i$, a common correction (see, for example, Johnston, 1972: 214–221). If we denote $AROS_i/VAROS_i$ by y_i, $1/VAROS_i$ by x_i, and $\epsilon_i/VAROS_i$ by μ_i, then each equation can be written as:

$$y_i = \alpha_i x_i + \beta_i + \mu_i \quad (2)$$

or more generally:

$$y_i = X_i\beta_i + \mu_i \quad (3)$$

The set of equations to estimate then are:

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \end{bmatrix} = \begin{bmatrix} X_1 & 0 & 0 & 0 \\ 0 & X_2 & 0 & 0 \\ 0 & 0 & X_3 & 0 \\ 0 & 0 & 0 & X_4 \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \end{bmatrix} + \begin{bmatrix} \mu_1 \\ \mu_2 \\ \mu_3 \\ \mu_4 \end{bmatrix} \quad (4)$$

Generalized least squares was applied to (4) in accordance with the 'seemingly unrelated regressions' model. The estimates are given in Table 5. Also given in this table is the adjusted R^2 for each of the equations (2) estimated separately, to give an approximation of the goodness of fit of the regressions.

Table 5. The relationship between risk and return (t-statistics in parenthesis)

Period	SUR estimates $\hat{\alpha}_i$	SUR estimates $\hat{\beta}_i$	OLS[1] R^2a
1963–69	0.179 (17.230)*	8.559 (2.210)*	0.87
1970–74	0.173 (129.83)*	2.581 (3.387)*	0.99
1975–79	0.203 (17.433)*	−0.809 (−0.435)	0.92
1980–82	0.212 (7.535)*	−4.531 (−1.179)†	0.65

* Significant at $p = 0.05$ level.
† Significant at $p = 0.15$ level.

[1] R^2-adjusted from the relations [2] estimated independently using OLS.

Discussion

The theoretical arguments presented above about the relationship between risk and return postulated that negative as well as positive relationships may occur. Specifically, when environmental changes follow each other at a quick pace, or when important discontinuities occur, negative risk–return investment outcomes may be observed.

During the 1963–82 period the U.S. pharmaceutical industry faced several important changes (Cool, 1985). The 1962 Amendments profoundly influenced the conditions for research and development of drug firms. Other important events since this landmark legislation significantly increased the complexity and uncertainty of the environment of the U.S. pharmaceutical industry. A partial list of events includes: the increasing number of patent expirations, the growing importance of generic drug prescribing, the 1968 Drug Efficacy Study Implementation (DESI), the decline of New Chemical Entity discoveries, the repeal of State Anti-Substitution Laws, the Maximum Allowable Cost (MAC) program, and the increasing entry of non-U.S. firms into the U.S. market. Given this large number of important environmental changes, it can be expected that some firms take on higher risk strategies that are not always in line with their distinctive resources and skills. According to the arguments developed above, negative risk–return relationships can be expected.

Performance levels, risk position and stability

The regression analysis allows a test of hypotheses H_3 and H_4. Stated in null-form, it was postulated that risk and return are positively related, and that the relationship does not change. The estimates in Table 5 provide results on H_3. In particular, the $\hat{\beta}_i$ coefficients give estimates of the relationship between risk and return. An interesting pattern is observable. In the first period (1963–69), there is a highly positive and

significant relation between risk and return. While this relation is still positive in the second period (1970–74), the coefficient is smaller. During the second decade studied, a different, negative relationship emerges. While the negative coefficient for the third period (1975–79) is not significant, the coefficient in the fourth period (1980–82) becomes more negative and significant. A systematic change from highly positive to less significant to highly negative emerges.

These findings are not surprising given the environmental events which occurred in the U.S. drug industry. Moreover, the findings are in line with proposed theory about the relation between environmental changes and risk–return relationships. Why the shift from positive to negative coefficients occurs only in the third time period cannot be explained unequivocally with the present analysis. On a subjective level it can be argued that a lag exists between environmental changes and firm responses. Building on the Snow and Hambrick (1980) distinction between strategy 'adjustments' and strategy 'changes', firms may first try to 'adjust' their strategy incrementally when first facing environmental change. When the impact of environmental changes becomes more evident and other firms start 'changing' their strategies, the organizational momentum to 'change' strategy will increase. It is not possible usually for the firm to respond coincidentally with environmental changes, so lagging response behavior is to be expected. This lagging response behavior is especially to be expected in the pharmaceutical industry because of the long times needed to alter strategy.

These findings, important as exploratory findings, demonstrate that risk and return may be related in a negative as well as in a positive manner. When longitudinal studies are made, alternating risk/return relations can be observed, confirming the earlier arguments concerning the dynamics between environmental change and strategy.

To test whether the risk–return relationships change statistically over time, hypothesis H_4, the significance of differences in the $\hat{\beta}_i$ estimates, was evaluated. Table 6 reports the *t*-statistics of the comparison of each pair of $\hat{\beta}_i$, along with the significance of the observed *t*-values. These results by and large confirm the findings of the previous analysis. The risk coefficients from the first and second period are significantly different, but only

Table 6. Difference between the risk coefficients $\hat{\beta}_i$: *t*-statistics[1]

	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_3$
$\hat{\beta}_2$	1.532**		
$\hat{\beta}_3$	2.970*	1.803*	
$\hat{\beta}_4$	2.166*	1.826*	0.832

[1] The *t*-statistics are computed as $(\hat{\beta}_i - \hat{\beta}_j)/s(\hat{\beta}_i - \hat{\beta}_j)$ for $i \neq j$, where $s(\hat{\beta}_i - \hat{\beta}_j) = [s^2(\hat{\beta}_i) + s^2(\hat{\beta}_j) - 2 \text{ cov } (\hat{\beta}_i, \hat{\beta}_j)]^{1/2}$
* Significant at $p = 0.05$ level.
** Significant at $p = 0.10$ level.

at the 10 percent level of significance. However, pairs from the first, third and fourth periods are significantly different at the 5 percent level of significance. These results indicate that the observed difference between negative and positive estimates is not attributable to chance. A clearly different pattern appears to govern the relationship between risk and return in the first period and the last two periods.

A similar pattern emerges in the comparison of estimates from the second, third and fourth periods. The positive and negative relationships observed show marked statistical differences. Thus it can be concluded that the first two periods and the last two periods are characterized by different risk–return relationships.

Finally, the *t*-values in Table 6 do not support the argument that a different negative relationship exists for the last two time periods. While the coefficients are apparently different in size, a test of differences is not significant. Both periods appear to be governed by a similar, negative, risk/return relationship.

In summary, the findings in Tables 5 and 6 indicate that over the 20-year period studied, different risk–return relationships characterize the strategic investments of firms in the U.S. pharmaceutical industry. The first 12 years are marked by a positive relationship, while the next 8 years indicate a negative relationship. These findings are in line with predicted behavior based on the theoretical arguments presented above, and as expected for the U.S. pharmaceutical industry over the period 1963–82.

DISCUSSION AND CONCLUSIONS

Most empirical research on strategic groups has been anchored on the assumption that firm

performance and strategic group membership are closely related. The brief review of existing theory indicated that this assumption is unwarranted in view of the many mediating factors that link performance and strategic group membership. The empirical evidence reported here that performance differs among strategic group members lends further weight to a more moderate view of the strategic group/performance relationship. Both theory and evidence suggest that strategic group membership is best seen as one element that can have a differential performance impact. Based on this stance and the empirical findings presented, some implications for future research are evident.

First, if risk and return are as closely related as the empirical evidence suggests, how can strategic group analysis enhance management of a firm's risk position? It was argued that risk stems primarily from a discontinuity between past and current strategy, and not *per se* from the type of strategy currently pursued. Strategic management of any firm could be enhanced if a framework existed that permitted them to systematically compare required competences for strategic actions with existing competences. Here, strategic group analysis can play an important role. Such analysis could enable a firm to compare itself with higher-performing, more successful group members, and assess why performance differences occur, even when similar strategies are pursued. An assessment of weak or missing competences can suggest what actions to take. Recommendations could be made in terms of 'adjusting' asset bases if the current strategy is to be maintained, or in terms of 'changing' current strategy if the discrepancy in competences is too large. If a change in current strategy is mandated, the strategy options evidenced by alternative strategic groups could also be evaluated in the same systematic way. Hence, strategic group analysis provides an instructive diagnostic framework for evaluating the need to adjust or change competences, if possible, or to change current strategy. Throughout such analyses, however, recognition must be made of the lag in response behavior to truly assess whether success can be gained by continuing a given thrust.

Second, the postulate that negative risk–return relationships may describe investment outcomes rests on the assumption that both 'troubled' and 'successful' firms populate the same strategic group. Firms were combined in this study and aggregate risk–return relations were estimated. A further step would be to disaggregate the sample into 'successful' and 'troubled' firms and examine their investment behavior in detail, either quantitatively as done here, or qualitatively using case studies, or both. Further insight into investment behavior of strategic group members could be gained from such work.

Third, it was suggested that environmental changes or discontinuities may prompt firms to alter their strategic behavior, especially when environmental changes follow each other in quick succession. Evidence supporting this argument was found in terms of risk–return relationships. How environmental changes impinge on firm actions was not studied explicitly. If environmental changes have this critical impact on firm's strategies and performance, then this relationship warrants further research attention. Specifically, the determination of the specific types of environmental changes that trigger miscalculations or lead to lagging response would be worthy of further study and could provide important insights into the environment–strategy–performance relationship.

Fourth, the fact that negative risk–return relationships may persist over a long period of time suggests that industries may go through sustained phases of disequilibrium. The dynamics of how firms evolve and how firms cope with such evolution has not received significant research attention in the strategic management field. Nelson and Winter (1982) have recently proposed an 'evolutionary theory of economic change' based on disequilibrium scenarios and constrained firm behavior. These issues warrant more attention in the strategic management field, particularly to explain observed patterns of strategic group evolution.

Fifth, if firm performance is indeed influenced by a host of firm-specific and market-specific factors, as described by Porter (1979), then strategy researchers should attempt to model firm performance relationships in more complex ways. The framework based on the strategic group model is well articulated, and could be tested. Detailed data bases are needed, however, and longitudinal designs are necessary to assess the validity of findings. If strategy research is to progress, more work will have to be performed on the systematic development of these types of

data bases. The present research has attempted to move research in this direction.

Finally, the present findings on the performance differences among strategic group members also contain implications for other mid-range research on strategy types. The development of typologies and taxonomies has recently received much attention in strategic management research. Similar to strategic group analysis, inferences are often made about the performance implications of various postulated or uncovered strategy types. Hardly any attention is given to the question of whether or why performance would differ among firms pursuing any given strategy type. This question clearly warrants research attention to establish the validity of claimed findings on performance implications of these strategy types.

APPENDIX: METHODOLOGY FOR IDENTIFYING STRATEGIC GROUP STRUCTURE AND MEMBERSHIP

Identifying strategic groups and tracing the evolution of an industry's strategic group structure over time call for the application of a procedure capable of exacting the differences in business strategies between industry participants at any point in time, and of gauging intertemporal changes in these strategies.

The following procedure was used to longitudinally determine an industry's strategic group structure. Let

$$x_{it} = [X_{i1t}, X_{i2t}, \ldots, X_{imt}]$$

denote the vector of observations at time t on the set of variables describing the strategic scope and resource commitments of firm i in the industry considered, where

$i = 1, \ldots, n$	the number of sampled firms;
$j = 1, \ldots, m$	the number of variables describing business strategy;
$t = 1, \ldots, T$	the number of time periods for which strategy observations are made.

Then, for any period t, an n by m matrix can be constructed describing the strategic position of the sampled firms. One way to determine whether firms change their relative position in the industry over time is to calculate from the matrix of observations the m by m variance–covariance matrix S_t for each period t, and to test whether successive covariance matrices differ statistically. The rationale of this method is that when firms alter their commitments along the identified strategy variables, the covariances between these variables should reflect this repositioning. By determining at what point in time the covariance structure has changed from previous periods in a statistically significant way, it is possible to construct distinct periods of time *within* which the configuration of strategic positions of firms is more stable than *between* periods. In other words, the statistical pooling procedure makes it possible to identify *transition points* separating subperiods with distinct strategic group structures.

Empirically, the test procedure proceeds in the following way. When the stability of the strategic group structure is to be evaluated over T periods, then the procedure starts with testing the hypothesis of equality of the covariance matrices of the first two periods:

$$H_0: \Sigma_1 = \Sigma_2$$

against

$$H_1: \text{both are not equal.}$$

When, for a chosen significance level, both matrices are statistically equal, the data on both periods is pooled and the test procedure is repeated for data over the first three periods. The following test is then performed:

$$H_0: \Sigma_{12} = \Sigma_3$$

against

$$H_1: \text{both are not equal}$$

where Σ_{12} denotes the covariance matrix of the data pooled over the first two periods. Since the pooling of data over the first two periods might impede the detection of patterns of change occurring over the last two periods, an additional test needs to be performed, viz. $\Sigma_1 = \Sigma_{23}$. When both tests point to an acceptance of H_0, then the data over the first three periods are pooled and the test procedure is continued. In general, the following test procedure is performed for period t:

$$H_0: \Sigma_{12\ldots t-1} = \Sigma_t$$
$$H_0: \Sigma_{12\ldots t-2} = \Sigma_{t-1t}$$

H_0: $\Sigma_1 = \Sigma_{23\ldots t}$

against

H_1: not all Σ equal (for each H_0)

where $\Sigma_{12\ldots t-1}$ denotes the population covariance matrix for the period spanning subperiods 1 through $t-1$. The test statistic used for evaluating the equality of covariance matrices is a generalization of the Bartlett test for the homogeneity of m variances. For a description, see e.g., Timm (1975: 250–260) and Morrison (1967: 152–153).

Potentially, the determination of transition points is affected by the composition of the sample used in the pooling procedure. In order to verify the robustness of the results (sensitivity of pooling results to sample composition), a complementary analysis is needed. One approach, followed here, is to determine the transition points on the basis of a sample of q firms where $q<n$, and to repeat the analysis on samples where in each step one firm is added till the total sample of n is obtained.

The above procedure permits identification of subperiods with relatively stable strategic group structures. Within each period cluster analysis can be applied to determine to what strategic group each firm belongs. For a given subperiod the following sequence of steps was followed. If the subperiod spanned k years, then the strategy variables X_{jji} were averaged over the k years for each sampled firm. Upon standardization of the data, the 'error sum of squares' cluster algorithm (Anderberg, 1973: 142–149) was applied to uncover the strategic group structure. Large increases in the criterion value were postulated to signify inappropriate grouping, suggesting where to stop the aggregation of firms into successive clusters. This heuristic decision rule was supplemented with a multivariate analysis of variance (MANOVA) on the centroids defined over the averaged strategy variables for each strategic group. This was done to determine whether statistically different clusters were obtained. That cluster structure was selected where MANOVA-testing pointed to significant differences in the cluster centroids and where subsequent levels of aggregation results in non-significant differences between the cluster means.

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