PATTERNS OF COMPETITION, STRATEGIC GROUP FORMATION AND PERFORMANCE: THE CASE OF THE US PHARMACEUTICAL INDUSTRY, 1963-1982

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ABSTRACT

This paper addresses theoretical and empirical issues regarding the strategic group concept. First, a literature review is presented. The observation of diverging theoretical views and empirical findings indicates the need to define the concept clearly, to re-examine the performance consequences of strategic group membership, and to determine whether strategic groups are stable versus random phenomena in industries. Second, a procedure to study longitudinally the incidence of strategic groupings is presented. This is subsequently applied to the US pharmaceutical industry in the period 1963-1982. The empirical analysis demonstrates how the strategic group concept can be used to understand competitive dynamics, and how these patterns of competition interact with the performance consequences of strategic group membership. Finally, a framework to study patterns of competition and structural evolution in industries is put forward. This framework builds on the strategic group concept and includes elements of environmental change, resource rigidities and market feedback mechanisms.

Since its introduction in 1972 by Hunt, the strategic group concept has received increasing attention in the strategic management and industrial economics literature. Its application to many industries has illustrated that the concept provides some insight into the nature of strategy-performance associations and into the analysis of competition in general. Yet, many ambiguities still surround the concept. Prominent among these are the issues pertaining to the definition of the concept, the lack of consistent evidence about the performance consequences of strategic group membership, and the absence of empirical analyses of the dynamic aspects of strategic group structures.

This paper purports to elaborate the theoretical foundations of the strategic group concept, to develop a general procedure for longitudinally identifying strategic groups in industries, and to provide evidence on the performance consequences of strategic group membership in the context of the US pharmaceutical industry in the period 1963-1982. First a short review of the literature is presented. Next, the framework, hypotheses, variable and sample selection, and data bases for the present research are described. Finally, the results of the longitudinal study of the incidence and performance aspects of strategic groups are analysed.

LITERATURE PERTAINING TO STRATEGIC GROUPS

A detailed discussion of the rapidly growing body of strategic group research is beyond the scope of this paper and is reviewed

elsewhere (Cool, 1985: 11-70). Three central issues will be reviewed here: the theoretical foundation of the concept, the findings of previous research on the performance consequences of strategic group membership, and evidence on the stability of strategic group structures and membership.

Theoretical Foundation of the Strategic Group Concept

The concept of strategic groups developed separately and from two different angles during the early seventies. This period marked the beginning of a more widespread concern with strategy issues in the Business Policy discipline and translated, inter alia, into research on the modelling of strategy-performance relationships (Schendel and Hatten, 1972). This work, in turn, led to empirical research on heterogeneity in firm conduct in the US brewing industry (Hatten and Schendel, 1976; Schendel and Patton, 1978). Postulating that firm performance is primarily influenced by strategic conduct and industry structure, they estimated the following function for each sampled firm:

firm performance = f (strategic conduct; industry structure) [1]

On the basis of similarity of firm performance relationship (see [1]), clusters of firms were constructed, later called "strategic groups". One of the major conclusions of this work was that, within the same industry, similar actions result in different pay-offs for firms belonging to different groupings, a finding corroborated by later research (Frazier and Howell, 1983; Primeaux, 1983a; 1983b).

Whereas the previous work focused on the determinants of firm performance, other studies came to the strategic group notion from the industrial organisation (IO) economics concern of explaining industry performance. In the Mason (1939) - Bain (1956) tradition, industry performance was thought to depend primarily on the industry's structural characteristics. Hunt (1972) departed from this "structuralist" perspective to explain the intense rivalry observed in the highly concentrated U.S. home appliance industry in the sixties. He observed stable conduct differences such as product diversification policies and distribution arrangements and suggested that these differences or "asymmetries" prevented the development of an industry-wide oligopolistic consensus. He coined the term "strategic groups" to refer to firms displaying similar conduct along these key strategic dimensions. This theme was more formally developed by Newman (1973) in his study of strategic groups in the US chemical process industries. Defining strategic groups by their degree of vertical integration within the market in question, he demonstrated that the existence of strategic groups impairs expected (tacit) collusion among firms, reducing the explanatory power of the "structuralist" structure-performance model of IO.

Porter (1976) and Caves and Porter (1977) suggested that industry-wide inferences of market power cannot be made when strategic groups characterise competition. Since "mobility barriers", i.e. group-specific entry barriers, differentially protect strategic groups, entry conditions and the scope for collusive agreements differ between strategic groups. From this, it

is inferred that industry participants have sustained performance differences (Porter, 1979: 226-227).

In subsequent strategic group research, the orientation towards firm or industry performance has remained pronounced. IO research has typically been carried out on cross-sectional samples, identifying strategic groups either on the basis of one variable, such as size (Porter, 1979; Caves and Pugel, 1980), advertising intensity (Oster, 1982), geographic origin (Donsimoni and Leoz-Arguelles, 1981), or with a small set of variables, including advertising and R&D intensity, vertical integration, and size (Tassey, 1983; Hergert, 1983). Strategic management research, on the other hand, has typically been confined to single industry studies, tailoring strategic group identification variables to the context of the industry examined (Ramsler, 1982; Frazier and Howell, 1983; Harrigan, 1983; Dess and Davis, 1984).

Starting with conservative a priori beliefs about the significance of differences in strategic conduct variables between firms in an industry, IO researchers appear to have opted for the selection of a minimal set of variables, applied to a broad array of industries, for defining strategic group membership. Strategic management researchers, on the other hand, espouse the a priori belief that strategy matters, and generally used a broad set of variables, typically tailored to one particular industry setting. These two different approaches have led to an amalgam of firm groupings, all referred to as strategic groups. If the wide variety in applied statistical methodologies is also considered, the

diversity in strategic group analyses becomes even more apparent, significantly hindering the formulation of general conclusions from previous research. In part, this confusion is attributable to the difference in research traditions between the two disciplines. It is also due, however, to the predominant empirical basis of this literature, and the lack of attention to the theoretical definition of the strategic group concept.

Since Hunt coined the term "strategic group" in 1972, little theoretical work has been performed to establish what is really "strategic" about a strategic group. Porter (1980: 127-128) identified a list of key strategic dimensions along which firms could position themselves differently. Such an approach gives little indication, however, as to what the key similarities are of strategic group members, nor does it offer sufficient guidance for empirical research. The lack of a clear definition of the notion of a strategic group is conspicuous and needs to be addressed. If a cumulative stream of research is to be built, the strategic group concept needs to be defined. In addition, a systematic procedure to operationalise the concept needs to be established.

Performance Consequences of Strategic Group Membership

A central theme in the literature on strategic groups is that group membership has performance consequences. However, empirical findings regarding this differential performance hypothesis are scant and often conflicting. Porter (1979), comparing the performance of his "leader" and "follower" strategic groups, found

some evidence that leader groups outperform followers. Yet, this difference was statistically insignificant. Neither did Caves and Pugel (1980) find larger firms to be more profitable than smaller firms. Oster (1982), on the other hand, found that high advertisers outperformed low advertisers in those industries where advertising spending has lasting effects. Frazier and Howell (1983) found no difference in performance between their strategic groups in the medical supply and equipment business, while Dess and Davis observed that their "generic" strategic groups in the paint and allied products industry differed on some performance measures while not on others.

Existing evidence obviously does not provide uniform support for the differential performance hypothesis. Whether this is attributable to the wide variety of strategic group identification procedures or is a true reflection of strategic group performance, cannot be concluded. Clearly, the very concept of a "strategic group needs to be clarified and proper procedures for identifying these groups must be established. Unless these tasks are accomplished, empirical research on performance differences is unlikely to give unequivocal answers to the question whether strategic group membership has performance consequences.

Stability of Strategic Group Structures and Membership

A final issue considered here is the stability of strategic groups and strategic group membership. The majority of previous studies have been limited to the identification of strategic groups

at one point in time (static analyses). The observed groupings are taken as evidence that strategic groups generically characterise competition in the industries studied. To establish the general validity of this proposition, static analyses need to be expanded to longitudinal analyses to establish whether these groupings indeed are stable elements of industry structure rather than mere random phenomena. Unless some degree of stability is observed, the very concept of a strategic group is meaningless. A fortiori, as long as the validity of the construct is not established, research on performance differences among strategic groups is premature.

RESEARCH FRAMEWORK AND HYPOTHESES

Defining the Strategic Group Concept

If observed groupings do stem from differences in the strategies pursued by individual firms, then the concept of strategy should provide the basis for narrowing down the concept of a strategic group. Following Ansoff (1965), Uyterhoeven et al. (1977), Hofer and Schendel (1978), and others, it is postulated here that business strategy minimally[1] consists of two sets of activities: those dealing with business scope[2] commitments and those dealing with resource commitments intended to achieve the chosen scope commitments. Included in the scope commitments are those decisions regarding (1) the range of market segments that are targeted, (2) the types of products and/or services offered in the selected markets segments, and (3) the spatial reach of strategic

actions, referred to as geographic scope[3]. Following the literature on resource analysis on the basis of the value-added concept (see e.g., Porter, 1985), resource commitments are defined to include business-level deployments to those functional areas that are key to obtaining and maintaining a competitive advantage in targeted market segments. The distinctive combination of scope and resource commitments defines business strategy and underlies the pursuit of sustainable competitive advantage (see also Thompson, 1967; Rumelt, 1979; Abell, 1980; Hofer and Schendel, 1978; Miles, 1982).

Based on the concept of strategy discussed above, a more precise definition of the strategic group concept can be given. A strategic group is defined as:

> "A group of firms competing within an industry on the basis of similar combinations of scope and resource commitments".

Note that excluding either scope or resource commitment activities in the operationalisation of the strategic group concept, as most previous studies have done (see references in Cool, 1985: 86-93), may lead to incomplete specifications and hence less reliable empirical results.

The previous definition is, arguably, still general. It specifies, however, the major components that minimally need to be considered to empirically determine strategic groups. Since the pertinent scope and resource commitments are necessarily industry-specific, the actual determination of those variables that define strategic groups will also be industry-specific. Employing the same

variables to identify strategic groups in many different industries, a common practice in IO-based studies, necessarily entails trade-offs and might compromise accurate identification of strategic groups.

Measuring Performance

Further complicating the debate about strategic groups and their performance differences is the issue of how to empirically measure performance. The deficiencies of accounting indicators to determine economic rates of return are well documented (Bernstein, 1974: 466-509; Winn, 1975; Schwartzman, 1975; Stauffer, 1975; Fisher and McGowan, 1983; Salamon, 1985). Yet, measures such as return on equity and return on total firm assets have been employed in previous studies to evaluate strategic group performance differences. Other confounding effects are introduced by taking total firm performance indicators to assess business strategy performance, a practice which is particularly troublesome given the increasing diversification of firms (Montgomery, 1979). A further limitation of previous analyses, with the exception of Oster (1982) and Dess and Davis (1984), is the exclusive reliance on single performance indicators to draw inferences about intra-industry performance differences. Performance is clearly a multi-dimensional concept, necessitating a consideration of multiple performance indicators. Finally, even if multiple, unbiased measures of performance can be obtained, their simple comparison across strategic groups may not be justifiable if realised performance is affected by different levels of risk-taking. While different

strategies might result in different levels of performance, these strategies may entail different risk postures. This calls for the consideration of risk-adjusted performance indicators, an argument supported by finance theory and applied before in various areas of strategic management research (Rumelt, 1974; Christensen and Montgomery, 1981; Bettis and Hall, 1982; Bowman, 1980, 1982; Hambrick et al, 1982).

Hypotheses

As argued before, valid inferences about the relationship between strategic group membership and performance can only be made when the relationship is studied longitudinally. The present study examines this relationship by testing hypotheses with respect to three dimensions of performance: levels of economic performance, levels of risk exposure, and levels of risk-adjusted performance. Formally, the following hypotheses are tested:

H1: Strategic groups demonstrate the same level of economic performance, P_i , $i = 1, \ldots, n$

against the alternative hypothesis that levels of economic performance differ between strategic groups. Several performance indicators will be considered to reflect the multi-dimensional nature of performance.

The second hypothesis relates to the risk postures of strategic groups. It was suggested that different strategies may entail different levels of risk-taking, rendering the simple comparison of

performance levels inadequate. The extent of different risk-postures of strategic groups will be tested with the following null-hypothesis:

H2: Strategic groups are characterised by similar levels of risk against the alternative hypothesis that risk postures differ.

Finally, to complete the performance comparison from a risk-return perspective, risk-adjusted performance will be compared across the strategic groups with the following hypothesis:

H3: Strategic groups demonstrate the same level of risk-adjusted economic performance

against the alternative hypothesis that strategic groups have different risk-adjusted performance.

METHODOLOGY, VARIABLE AND SAMPLE SELECTION, AND DATA BASES

Methodology

Identifying strategic groups and tracing the evolution of an industry's strategic group structure over time are prerequisites to testing the previous hypotheses. These prerequisites 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

$$\mathbf{x}_{it} = [X_{i1t}, X_{i2t}, \ldots, X_{imt}]$$

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, ..., n	the number of sampled firms
j = 1, ..., m	the number of variables describing business strategy
t = 1, ..., 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 $\mathbf{S}_t$ 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 <u>within</u> which the configuration of strategic positions of firms is more stable than <u>between</u> periods. In other words, the statistical pooling procedure makes it possible to identify <u>transition points</u> 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:

$$H_o : \Sigma_1 = \Sigma_2$$
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:

$$H_o : \Sigma_{12} = \Sigma_3$$
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_o, then the data over the first three periods is pooled and the test procedure is continued. In general, the following test procedure is performed for period t:

$$\begin{aligned} H_o &: \Sigma_{12\ldots t-1} = \Sigma_t \\ H_o &: \Sigma_{12\ldots t-2} = \Sigma_{t-1t} \\ &\vdots \\ H_o &: \Sigma_1 = \Sigma_{23\ldots t} \end{aligned} \qquad [2]$$

against $$H_1 : \text{not all } \Sigma \text{ are equal (for each } H_o)$$

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 generalisation 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_{ijt} were averaged over the k years for each sampled firm. Upon standardisation 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 resulted in non-significant differences between the cluster means.

Variable Selection and Measurement

Two major sets of variables need to be discussed: strategy variables (pertaining to the scope and resource commitment decisions), and performance measurement variables. The specification of strategy variables depends on the industry examined which in this study is the US pharmaceutical industry in the period 1963-1982. This industry was selected for the following reasons: (1) preliminary analysis showed that drug firms appeared to pursue different strategies; (2) the 1962 Amendments to the 1938 Food, Drug and Cosmetics Act significantly altered the context in which drug firms had to compete; (3) detailed data bases appeared to be present, and finally, (4) this industry had not yet received significant attention in strategic management research. A long-term period (20 years) was chosen to evaluate temporal stability (or the lack of it) of observed groupings.

The actual selection of the strategy variables was performed in two stages. In a first stage, a detailed study of the drug industry (Cool, 1985: 195-298) and discussions with industry executives and experts were conducted. This stage subsequently guided the selection of the strategy variables from a large set of available indicators of strategic scope and resource commitments (see Table 1).

Insert Table 1 about here

Scope commitments in the US drug industry were described along three major sets of dimensions: (1) the range of market segments

Table 1: Variables describing strategy in the US pharmaceutical industry

STRATEGY DIMENSION	MEASURE	DATA SOURCE
	SCOPE COMMITMENTS	
Range of Market Segments		
1. Breadth of Scope (FOCUS)	(RX sales in 3 largest therapeutic categories) /(total domestic RX sales)	IMS, US Drug Stores and Hospitals Audits
2. Commitment to the Ambulatory Care Market (DRUGST)	% Drug stores sales in total domestic drug sales	IMS, US Drug Stores and Hospitals Audits Drug Topics, "Annual Reports on Consumer Spending"
Types of Products		
3. Commitment to the Ethical Drug Market (RX)	% RX sales in total domestic drug sales	IMS, US Drug Stores and Hospitals Audits Drug Topics, Annual Report on Consumer Spending
4. Commitment to the Generic Drug Market		
(i) Branded Generics (BRANGEN)	% branded generic RX sales in total domestic RX sales	PMA, Frost & Sullivan, Merck Index, Chemical Abstracts
(ii) Commodity Generics (COMMGEN)	% commodity generic RX sales in total domestic RX sales	
6. Commitment to the Maintenance Drug Market (MAINT)	% maintenance drug sales in total domestic RX sales	IMS, US Drug Stores and Hospitals Audits
Geographic Scope		
7. Spatial Reach (FOREIGN)	% total firm sales generated abroad	Annual Reports, 10-K reports

Table 1 (cont'd): Variables describing strategy in the US pharmaceutical industry

STRATEGY DIMENSION	MEASURE	DATA SOURCE
	RESOURCE COMMITMENTS	
Research and Development Commitments		
8. Current R&D Spending (RDINTEN)	(total firm R&D)/(worldwide health care sales)	Annual Reports
9. R&D Capital Stock (RDCAPIT)	(cumulative no. of NDAs submitted)/(cumulative no. of INDs submitted)	FDA
10. R&D Orientation (RDORIENT)	(cumulative no. of NCEs approved)/(cumulative no. of NDAs submitted)	FDA, Paul de Haen, New Drug Analysis
Marketing Commitments		
11. Product Strategy (PRODSTR)	(cumulative no. of NCEs introduced)/(cumulative no. of all products introduced)	Paul de Haen, New Drug Analysis/New Product Survey
12. Promotion Strategy		
(i) Promotion to the medical profession (PROFPROM)	(total domestic professional promotion)/(total domestic RX sales)	IMS, National Journal Audit, National Mail Audit, National Detailing Audit
(ii) Advertising to the consumer (CONSADV)	(total domestic PTY drug adv.)/(total domestic RX sales)	Leading National Advertisers, Advertising Age
14. Distribution Strategy (DISTR)	% of total domestic drug sales shipped directly to drug stores and hospitals	IMS, US Drug Stores and Hospitals Audits
Size		
15. Scale of Drug Operations (SIZE)	LN(total domestic drug sales)	IMS, US Drug Stores and Hospitals Audits Drug Topics, "Annual Reports on Consumer Spending"

that are targeted, (2) the types of products to compete in selected market segments, and (3) geographic scope. Decisions about the range of market segments were measured by establishing to what extent firms compete in a smaller or larger number of "therapeutic categories[4]" (FOCUS), and to what degree firms target the hospital versus the ambulatory care (physician based) market (DRUGST). The second set of variables concerning the types of products chosen in the pharmaceutical industry relate to the relative emphasis on (1) prescription versus non-prescription drugs (RX), (2) branded drugs with patent[5] protection versus branded drugs without patent protection, i.e., branded generics (BRANGEN), (3) off-patent drugs which are branded versus those that are unbranded, i.e., commodity generics (COMMGEN), and (4) drugs for maintenance use (chronic) versus drugs for acute use (MAINT). Finally, the spatial reach of market actions was determined by assessing the reliance on non-US markets for overall sales[6] (FOREIGN).

The selection of indicators of resource commitments was based on an analysis of the key resource requirements for establishing a competitive advantage in the pharmaceutical industry. These were determined as distinctive competences in research and development (R&D) and marketing. To measure R&D resource commitments, three variables were defined (see Table 1). The R&D-to-sales ratio measures the intensity of current R&D spending (RDINTEN). The second measure, the ratio of the cumulative number of New Drug Applications (NDAs) to the cumulative number of Investigational New Drugs (INDs), both submitted to the US Food and Drug Administration, is a proxy for accumulated R&D competence in developing a potential

drug from its initial discovery stage to a stage closer to marketing approval[7]. This reflects the R&D capital stock (RDCAPIT) resulting from past commitments to R&D. Finally, the third measure, the ratio of the cumulative number of New Chemical Entities (NCEs) approved to the cumulative number of NDAs filed, was included as an indicator of R&D orientation (RDORIENT) towards genuinely new drugs as opposed to mere modification or combination products.

With respect to marketing commitments, three areas were considered: promotion outlays, product strategy and distribution strategy. Promotional efforts were divided into promotion to the medical and paramedical professions for prescription drugs[8], (PROFPROM), and direct media advertising to the consumer for non-prescription drugs (CONSADV). Product strategy pertains to the marketing orientation towards new versus modification-combination drugs and is measured by the ratio of the cumulative number of NCEs introduced to the cumulative number of all drugs introduced[9], (PRODSTR).

Resource deployments in the area of distribution depend on whether wholesalers are used as agents, whether a private distribution network is set up, or whether some combination of both is used. The commitment to either distribution strategy was measured by computing the percentage of total domestic drug shipments distributed directly to drug stores and hospitals (DISTR).

Finally, a variable measuring firm size in the drug industry was defined in order to complement the relative measures of R&D

intensity and promotion strategy (SIZE). Since size influences the ability to allocate different amounts of resources, an absolute measure had to be considered to complement the relative measures.

Insert Figure 1 about here

Regarding the performance measures, three different sets are constructed, reflecting the different dimensions discussed before (see Figure 1). The indicators of economic performance are overall drug market share (MS), weighted segment share (WSS) and inflation-adjusted return on sales (AROS). Market share MS is defined as the firm's share of prescription drug sales of total domestic market volume. Weighted segment share WSS is constructed as follows:

$$WSS_i = \Sigma_j W_j SS_j$$

where $W_j = s_j/S_i$; $SS_j = s_j/S_j$

and

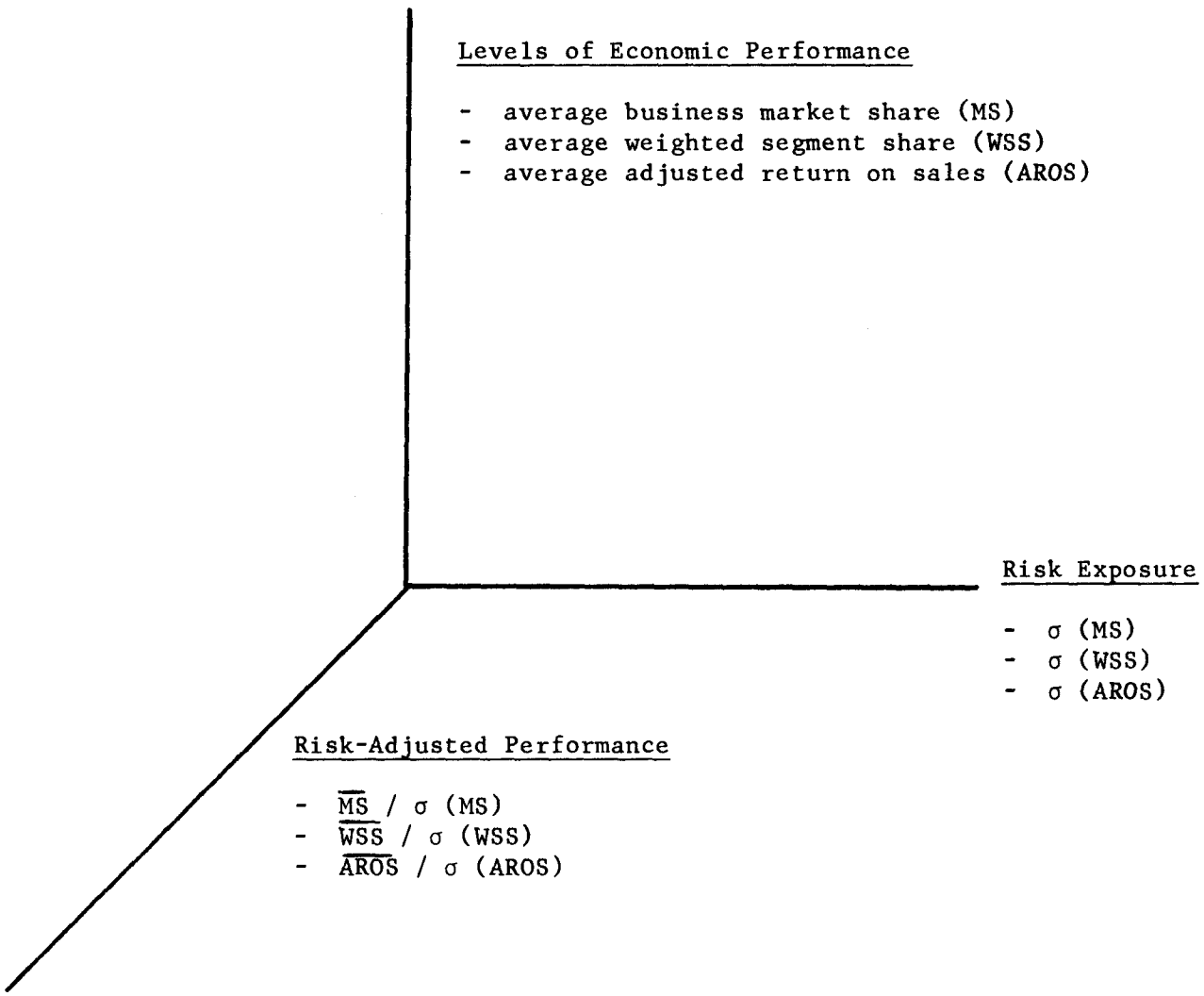
s_j = drug sales of firm i in therapeutic category j

S_i = total prescription drug sales of firm i

S_j = total market volume of therapeutic category j

This variable measures to what extent firms dominate the market segments they compete in. This indicator was found to be very closely related to profitability by Bond and Lean (1977) and Schwartzman (1976). Finally, an attempt was made to construct a profitability measure for the pharmaceutical operations of the firms competing in the drug industry. Since most firms are diversified, and since the asset or investment base for the drug operations are not available for a large sample of firms and a long period of time, this study had to rely on a return on sales measure. This was

Figure 1: Performance Dimensions and Indicators



defined as net income before interest and taxes for the pharmaceutical operations, over total drug sales. The measure was adjusted for inflationary changes by restating depreciation charges, a correction necessary in longitudinal analyses. For each of the three performance indicators, the temporal mean over each period with a stable strategic group structure was computed to define a representative performance indicator for each firm.

Risk measures were obtained by calculating the standard deviation about the temporal mean for each of the above performance indicators in each period of stable strategic group structure. These measures reflect the temporal instability of market share and profitability, a common indicator or risk (see e.g., Cocks, 1975; Bowman, 1980).

Finally, risk-adjusted measures of performance were obtained by dividing average firm performance on each of the defined indicators by the respective standard deviation.

The scope of this paper prevents a more detailed discussion of the variable selection and measurement. A full description can be found in Cool (1985: 270-325).

Data Bases

Since existing databases such as PIMS or COMPUSTAT either do not permit identification of the data units or do not contain information that is detailed enough to measure strategy dimensions,

a separate database was compiled. Table 1 indicates the sources of information employed. The data bases of IMS America constituted the major source of information on sales and marketing expenditures. Other databases consulted include the Paul de Haen New Drug Analysis and New Product Survey, FDA data on INDs and NDAs, annual reports and 10-K statements, reports by Frost & Sullivan, Leading National Advertisers, Drug Topics, Advertising Age, Chemical Abstracts and the Merck Index[10]. For the performance variables, the IMS databases and 10-K line of business reporting provided the majority of the data[11]. A full description of the reliability and use of the databases can be found in Cool (1985: 325-337).

Sample Selection

Several criteria guided the sample selection. First, non-US firms were excluded because of data availability problems. Second, firms needed to exist as separate legal entities over most of the 1963-1982 period to avoid biases resulting from a changing sample composition. Third, all firms participating exclusively in the commodity generic drug segments were excluded. They operate on a completely different basis and have realised their growth only from the second half of the seventies onwards. Fourth, firms were required to have significant commitments to the ethical drug industry. Thus, exclusive non-prescription firms were not retained. In total, twenty-two firms were sampled (see Table 2). Special care was taken to account for acquisitions, mergers and divestments because these activities may reflect changes in strategy.

Insert Table 2 about here

Table 2: Sampled Drug Firms

Firm Name	Divisions
1. Abbott Laboratories	Abbott Laboratories
	Ross Laboratories (1964-)[1]
2. American Cyanamid	Lederle
3. American Home Products	Ayerst
	Campbell
	Ives
	Whitehall
	Wyeth
4. Bristol-Myers	Bristol Laboratories
	Bristol-Myers: - Clinton (65-)
	- Grove (63-)
	- Hillside (65-)
	Dalton (1968-)
	Mead-Johnson (1968-)
	Westwood (1969)
5. Carter-Wallace	Carter Products
	Denver Chemical (1975-)
	Mallinckrodt (ethical div.) (1979-)
	Wallace Laboratories
	Wampole Laboratories
6. Johnson & Johnson	Arbrook (1965-)
	R. W. Johnson
	Janssen Pharmaceutical U. S. (1978-)
	Johnson & Johnson
	McNeil Laboratories
	Ortho Pharmaceutical Corp.
7. Eli Lilly and Company	E. Lilly
	Dista (1974-)
8. Marion Laboratories	Marion Laboratories
	IPC (1970-)
9. Merck & Co.	Calgon Consumer Products (1974-1976)
	Merck & Co.
	Merck, Sharp and Dohme
	Quinton (-1973)[2]
10. Morton-Norwich[3]	Chloraseptic Co.
	Eaton Laboratories
11. Pfizer	Baker Laboratories (1965-)
	Leeming-Pacquin
	Phipharmecs (1974-)
	Pfizer
	Roerig
12. Richardson-Vicks[4]	Merrell (-1970) } Merrell-National (1971-)
	National (-1970) }
	Lakeside (1975-)
	Vick Chemicals
13. A. H. Robins	Chapstick (-1969) → Miller-Morton (1970-)
	Elkins-Sinn (1976-)
	Robins

Table 2 (cont'd)

14. Rorer Group	William H. Rorer, Inc.
	Dermik (1974-)
15. Schering-Plough[5]	Pharmaco (1968-)
	Plough (1971-)
	Schering
	Scholl (1981-)
	White Laboratories
16. G. D. Searle	Searle
17. Smithkline-Beckman	Allergan (1981-)
	Herbert (1981-)
	Menley & James
	Smithkline and French
18. E. R. Squibb and Sons	Squibb
19. Sterling Drug	Breon
	Drew
	Glenbrook
	Lehn & Fink (1968-)
	Winthrop
20. Syntex	Syntex
	Borden (Pharmaceutical div.) (1971-)
21. The Upjohn Company	Upjohn
22. Warner-Lambert	Lactona
	Lambert
	Parke, Davis (1970-)
	Personal Products Division-W.L. (1976-)
	Standard Laboratories
	Texas Pharmacal (1967-)
	Warner-Chilcott

Notes:

1. (19xx-) indicates the year of acquisition or establishment.
2. (-19xx) indicates the year of consolidation or divestment.
3. Morton Norwich was formed by the merger of Morton Salt and Norwich Pharmacal in 1968. In 1982, Morton-Norwich sold the Eaton and Chloraseptic divisions to Procter and Gamble.
4. Merrell-National was sold to Dow Chemical in 1981.
5. W... called Schering before the merger with Plough in 1971.

STRATEGIC GROUPS IN THE US PHARMACEUTICAL INDUSTRY, 1963-1982

Identification of Transition Points

Annual data were compiled for the various strategy variables, and the general procedure for determining transition points in the industry's strategic group structure was followed. The test procedure was initially conducted on 19 randomly selected firms out of the total of 22. The procedure was subsequently repeated on a sample of 20, 21 and 22 firms to establish whether a changing sample composition would alter the selection of transition years. A significance level of one percent ($\alpha = 0.01$) was consistently applied across all tests. Test results on the equality of the variance-covariance matrices are summarised in Table 3. This table shows that the test results are quite robust with respect to different sample sizes. Across the four sample sizes, similar transition points emerged over the two decades. The identified periods of inferred stable strategic group structure are respectively 1963-1969, 1970-1974, 1975-1979 and 1980-1982. For the last period, no significant F-value was found, implying that the group structure occurring since 1980 had not yet changed by 1982[12].

Insert Table 3 about here

Whether these changes are produced by exogenous shocks in the environment, are triggered by autonomous firm actions, or are a combination of both, cannot be established from the analysis. However, a study of the environment of the US pharmaceutical industry (Cool, 1985: 209-270) indicates that major changes have

Table 3: Identification of periods of stable strategic group structure

SAMPLE SIZE	PERIODS	No. YEARS	F^1 (df_1, df_2)	Prob.
n = 19	1963-1969	7	1.53(105,4441)	.0009
	1970-1974	5	1.56(105,39080)	.0005
	1975-1979	5	1.66(105,18278)	.0001
	1980-1982	3	no test significant	
n = 20	1963-1969	7	1.44(105,49335)	.0038
	1970-1974	5	1.63(105,43379)	.0001
	1975-1979	5	1.70(105,20313)	.0000
	1980-1982	3	no test significant	
n = 21	1963-1969	7	4.62(105,89232)	.0000
	1970-1974	5	1.57(105,47902)	.0004
	1975-1979	5	1.67(105,22454)	.0001
	1980-1982	3	no test significant	
n = 22	1963-1969	7	1.39(105,21434)	.0077
	1970-1974	5	1.42(105,14202)	.0050
	1975-1979	5	1.40(105,26748)	.0091
	1980-1982	3	no test significant	

1. Value of the F-statistic when a year is added to the periods specified in the same row.

taken place over the twenty year period, potentially contributing to the observed strategic group changes. The 1962 Amendments, requiring firms to prove that newly developed drugs were effective as well as safe, provided a first major exogenous change. One effect of this legal change was that firms had to be more selective in their R&D commitments and product strategy, and be more explicit about their R&D competences. In all likelihood, this also affected the range of attainable scope actions for firms. Since product-market changes take a long time to materialise in the pharmaceutical industry, it is not surprising that the effects of this legal change were observable after several years only.

During the late sixties and early seventies, other environmental changes took place. Among those are the increasing importance of generic prescriptions following the patent expirations of many major drugs; the 1968 enactment of the Drug Efficacy Study Implementation (DESI) program to examine the efficacy of drugs marketed in the pre-1962 period, leading to the withdrawal of a significant number of drugs; the 1972 OTC Review evaluating the efficacy of over-the-counter drugs; the expanded use of Abreviated New Drug Applications (ANDAs) making the marketing of rival products for drugs coming off-patent easier; and the general decline in the development of New Chemical Entities. This set of changes has undoubtedly also influenced the conduct of firms in the first half of the seventies. The observation of a different strategic group structure in the second half of the seventies may reflect this.

Finally, the repealing of State Anti-Substitution Laws and the institutionalisation of the Maximum Allowable cost (MAC) Program in 1975 both encouraged greater price competition in the US drug industry. Coupled with the increasing participation of non-US drug firms in the development and marketing of new drugs, these changes may also have contributed to the emergence of a yet different strategic group structure in the early eighties.

The brief overview of environmental changes does not claim to provide evidence of causal relationships between these changes and patterns of strategic group formation. A formal analysis is needed to examine these links. The overview illustrates, however, that a meaningful interpretation may be attached to the statistical finding that periods with a distinct strategic group structure occurred in the 1963-1982 period.

How firms have exactly repositioned themselves vis-à-vis each other cannot yet be determined from the previous analysis. To ascertain those competitive realignments, a cluster analysis was performed to determine the strategic groups in each of the four identified periods.

Identification and Description of Strategic Groups

In accordance with the decision criteria set above, strategic groups were identified in each period by means of the error sum of squares cluster algorithm. The strategic groups identified by this procedure, along with the MANOVA F-values are reported in Table 4.

Insert Tables 4 and 5 about here

The observed patterns of strategic group formation are summarised in two ways. Table 5 lists the cluster centroids relative to the industry averages for all strategic groups in each period. Figure 2 depicts the changes in group composition and membership. Pertinent numerical data and extensive descriptions of all strategic groups are given in Cool (1985: 342-387). A brief overview of the patterns of strategic group formation follows next. This overview serves two purposes. First it illustrates the usefulness of the strategic group concept to analyse the dynamics of competition in industries. Second, this descriptive study will prove to be necessary to interpret the performance consequences of strategic group membership.

Insert Figure 2 about here

In the sixties, six strategic groups characterised competition in the US drug industry. The first group ($SG1_I$) consisted of large, R&D-intensive prescription drug firms competing in many market segments with a broad range of products. The second group ($SG2_I$) also included large firms but differed from the first strategic group on several dimensions. Firms were advertising intensive rather than R&D intensive. They participated in the non-prescription as well as in the prescription drug market. In the prescription drug market, they competed in fewer market segments and had a less comprehensive product range. The third strategic group ($SG3_I$) was composed of medium-sized firms pursuing a predominantly "me-too" strategy as indicated by their emphasis on me-too drug development rather than original drug research, and by their heavy

Table 4: Strategic groups in the period 1963-1982: Group membership and MANOVA test results

PERIOD	GROUP	STRATEGIC GROUP MEMBERSHIP COMPOSITION	F(WILKS)
Period I (1963-1969)	SG1	Abbott, Lederle, Lilly, Merck, Squibb, Upjohn	3.105 (p=.028)
	SG2	American Home, Bristol-Myers, SmithKline, Sterling Drug	
	SG3	Johnson & Johnson, Morton-Norwich, Pfizer, Richardson-Vicks, Schering-Plough, Syntex	
	SG4	Searle, Warner-Lambert	
	SG5	Carter-Wallace, Robins, Rorer	
	SG6	Marion	
Period II (1970-1974)	SG1	Abbott, Lederle, American Home, Lilly, Squibb, Warner-Lambert	5.476 (p=.005)
	SG2	Bristol-Myers, Carter-Wallace, Johnson & Johnson, Morton-Norwich, Richardson-Vicks, SmithKline, Syntex	
	SG3	Merck, Pfizer, Schering-Plough, Searle, Sterling Drug, Upjohn	
	SG4	Robins, Rorer	
	SG5	Marion	
Period III (1975-1979)	SG1	Abbott, Lederle, American Home, Bristol-Myers, Warner-Lambert	6.887 (p=.000)
	SG2	Lilly, Merck, Pfizer, Schering-Plough, Squibb, Sterling, Upjohn	
	SG3	Johnson & Johnson, Morton-Norwich, Richardson-Vicks Robins, Searle, SmithKline, Syntex	
	SG4	Carter-Wallace. Marion, Rorer	
Period IV (1980-1982)	SG1	Abbott, American Home, Bristol-Myers, Pfizer SmithKline, Warner-Lambert	2.623 (p=.049)
	SG2	Lilly, Merck, Upjohn	
	SG3	Johnson & Johnson, Schering-Plough, Squibb, Sterling Drug	
	SG4	Searle, Syntex	
	SG5	Carter-Wallace, Morton-Norwich, Richardson-Vicks, Robins, Marion, Rorer	
	SG6	Lederle	

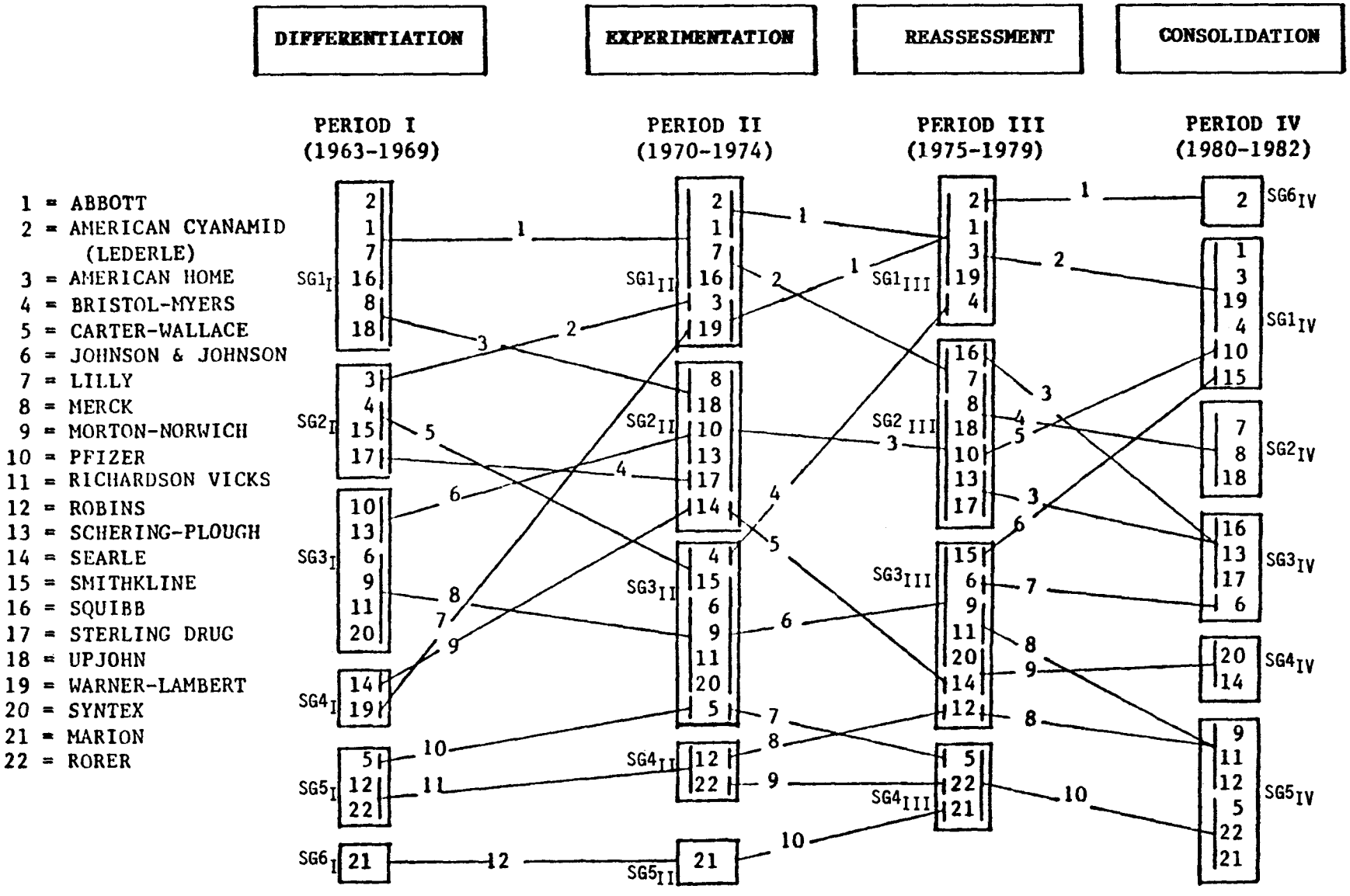
Table 5: Strategic Scope and Resource Commitment Attributes of Each Strategic Group[1]

PERIOD		FOCUS	DRUGST	BRANGEN	COMMGEN	MAINT	RX	FOREIGN	RDINTEN	RDCAPIT	RDORIENT	PRODSTR	PROFPROM	CONSADV	DISTR	SIZE
PERIOD I	SG1	-	-	- -	+ + + +	-	+ +	0	+ + +	+ + +	- - -	+	- - - -	- - - -	+ + + +	+
	SG2	+	-	+	-	- -	- - -	-	- - -	-	- -	+ + + +	-	+ + + +	- -	+ +
	SG3	+	+	- - - -	- - -	- - -	- -	+ + +	+ +	+ + +	- - - -	- - - -	+ + +	+ +	- -	-
	SG4	0	+	+ + + +	- - - -	+ + + +	0	+	-	- - - -	+ + + +	+ + + +	- - -	+ + + +	- - - -	0
	SG5	+	+	+ + + +	- - - -	+ + + +	+ +	- - - -	- - - -	- - - -	- -	- - -	+ + +	- -	- - - -	- -
PERIOD II	SG1	- -	-	+ +	+ + + +	- -	+	-	0	+ + + +	- -	- - -	- -	- - -	+ + + +	+
	SG2	+	-	- - - -	- - - -	0	0	+ + +	+	- -	+ + +	+ + + +	- -	+ + +	+ + +	+
	SG3	+	+	-	- - - -	+	- -	-	+ +	- -	- - - -	- - - -	+ + +	+	- - - -	-
	SG4	+	+	+ + + +	- - - -	+ + +	+ + +	- - - -	- - - -	- - - -	+ + + +	- - - -	+ +	- - -	- - - -	- -
PERIOD III	SG1	- -	-	+ +	+ + + +	+ +	-	-	- -	+ + + +	- - -	- - - -	-	+ + + +	+ + + +	+ +
	SG2	+	-	- - - -	- - -	- -	+	+ +	+	- -	+ + + +	+ + + +	- - -	- -	+ + + +	+
	SG3	+	+	+	- - - -	-	-	+	+ + +	- - -	- -	- - -	+	+ +	- - - -	-
	SG4	+	+	+ + + +	- - - -	+ + +	+ +	- - - -	- - - -	+	- - -	- - - -	+ + + +	- - - -	- - - -	- - -
PERIOD IV	SG1	- -	-	-	+ + +	+ +	+	+	- - -	+ + +	- -	- -	- -	+ + + +	+ +	+ +
	SG2	+	- - -	- - -	- -	-	+ + +	+	+ + + +	- - -	+ + + +	+ + + +	- - - -	- - - -	+ + + +	+
	SG3	0	+	+	-	- - - -	-	+ +	+ + +	0	+ + +	+ + + +	- - -	+ + + +	+ + + +	0
	SG4	+ + +	+	- - -	- - - -	+ + + +	+ +	+ +	+ + + +	- - - -	-	- -	- -	- - - -	- - - -	-
	SG5	+	+	+ + + +	+ +	-	- -	- - -	- - -	0	- - - -	- - - -	+ + +	- - -	- - - -	- -

1. Because of data disclosure restrictions by IMS, groups with only one member are not described.

Legend: Each strategy variable was compared with its industry average in each period. A zero (0) indicates a same level as the industry average. The plus (+) and minus (-) signs indicate a higher or lower level than the industry average. One sign indicates a difference of up to 10 percent from the industry average, two signs a difference of up to 20 percent, three signs a difference of up to 30 percent, and four signs a difference of more than 30 percent.

Figure 2: Strategic group formation in the US pharmaceutical industry, 1963-1982



commitments to professional promotion and consumer advertising. This contrasts with the first two strategic groups where original drug research was the dominant R&D orientation. $SG3_I$-firms were competing in both the non-prescription and prescription drug markets; in the latter, they competed only in a few market segments with a narrow product range. The fourth strategic group ($SG4_I$) also consisted of medium-sized firms. While showing a strong marketing commitment, they lacked the R&D emphasis and R&D competences of firms of the previous group. $SG4_I$ was also present in the prescription and non-prescription drug markets and competed only in a few market segments with a narrow product range. The fifth strategic group ($SG5_I$) combined small prescription drug firms with a narrow product range, a selective participation in market segments, and me-too drug development. Standing out was their heavy emphasis on professional promotion. Strategic group six ($SG6_I$) consisted only of one member, Marion Laboratories. Primarily because of its very small size, very focused product line, very narrow scope range and negligable R&D effort, Marion did not fit into any of the previous strategic groups.

As Figure 2 and Table 5 show, this strategic group structure went through various changes in subsequent periods. Comparing the sixties with the first half of the seventies, the following patterns are observable. The number of strategic groups decreased from six to five, reflecting some reduction in strategic asymmetry between firms. While strategic groups $SG3_I$ and $SG3_{II}$ on the one hand, and $SG5_I$ and $SG4_{II}$ on the other hand manifested fairly similar strategy commitments, groups $SG2_I$ and $SG4_I$ did not have counterparts in the

period 1970-1974. In addition, the strategic profile of $SG1_I$ changed to expand the range of product-market commitments to the non-prescription drug market, while showing a decrease in R&D intensity. Finally, various firms from different strategic groups in the sixties altered their initial strategic postures, converging to a new strategic group, $SG2_{II}$.

The previous results indicate that while some firms maintained their strategy over the first decade, many firms altered their strategic scope and resource commitments to various degrees. It appears that about half of the latter firms opted to pursue a strategy more similar to existing firms while the other half chose the alternative path of developing a new posture ($SG2_{II}$).

From the first to the second half of the seventies, even more firms altered their strategic actions, entailing a further reduction in the number of strategic groups to four. The first strategic group ($SG1_{III}$) became even more oriented towards the non-prescription drug market, and supported this shift by increasing consumer advertising. R&D intensity decreased and original drug development received less emphasis. On average, more market segments were also targeted by $SG1_{III}$ firms. The second strategic group ($SG2_{III}$), on the other hand, became more oriented towards the prescription market, maintained its R&D concentration on original drug development while decreasing the relative emphasis on marketing. In contrast to these evolutions, the third strategic group ($SG3_{III}$) witnessed hardly any strategy changes, as was the case in the previous period. Finally, some ambiguous patterns of

change were associated with the fourth strategic group ($SG4_{III}$). While firms on average targeted more the non-prescription drug market, a de-emphasis of consumer advertising was observed, along with an increase in professional promotion. On the other hand, a marked shift took place towards the development of combination-modification drugs.

Over the last two periods, firms appear to have either continued their initial strategic moves or reversed their posture, leading again to more pronounced strategic asymmetry. Six strategic groups with well defined strategic profiles emerged. The strategic group $SG1_{III}$ basically maintained its earlier profile and saw on the one hand an increased group membership ($SG1_{IV}$), while on the other hand witnessing the development of a new strategic group consisting of only one member ($SG6_{IV}$). Diverging group formation patterns characterised $SG2_{III}$, which basically split into two strategic groups. Some firms ($SG2_{IV}$) altered their scope commitments resulting in a similar scope definition as the group $SG1_{I}$ from period I. Their resource commitments were also similar to those of the first period with the qualification that original drug research was emphasised even more. The second set of firms from $SG2_{III}$ further expanded their product range and supported this with predominant me-too drug development and intensive advertising support ($SG3_{IV}$).

The strategic group showing the most dramatic changes was $SG3_{III}$. After a period of stability, its members relocated to four different strategic groups (see Figure 2). One resulting strategic

group ($SG4_{IV}$) comprised R&D-based firms competing in a small number of market segments with a narrow product range. The other strategic group containing many members of $SG3_{III}$, is $SG5_{IV}$ which had to a large extent the same strategic profile as $SG4_{III}$ of the third period.

Overall, the pharmaceutical industry appears to have gone through profound structural changes in the 1963-1982 period. The strategic group structure in each period reflects different overall patterns of strategic repositioning. The sixties can be marked as a period of differentiation where a clear strategic group structure with high asymmetry is observable. The first half of the seventies appears as a period of experimentation. Many firms are trying out new strategies, probably in response to new environmental conditions. In the next period, a reassessment appears to take place where firms either pursue their strategy changes or assess the feasibility of their new commitments. Finally, in the last period, a consolidation is observed as firms either reinforce their initial strategy changes, reverse their commitments, or pursue yet another different strategy.

Discussion of Empirical Findings

The previous discussion cannot capture the full range of strategic changes that have occurred in the US drug industry over the 1963-1982 period. The longitudinal analysis does, however, further the understanding of the dynamics of competition in industries and permits us to make some observations on the

contributions of strategic group analysis and the nature of patterns of strategic group formation. A first observation relates to the limitations of static analyses. Inferences on the nature of competition from static analyses of strategic groups are valid only when industries are in equilibrium. Under this condition, strategic groups portray long-term strategic asymmetries. The previous review indicates important changes in the strategic group structure of the US drug industry, demonstrating that the validity of inferences drawn from point-in-time studies may be rather limited. In the 1975-1979 period, for example, only four strategic groups could be identified which might lead to the conclusion that many firms compete on similar bases, or that strategic asymmetry is limited. While not incorrect, this interpretation misses the more important point that the industry is undergoing a structural transformation and that substantial strategic asymmetry is imminent, potentially leading to more intense competition. Only longitudinal analyses can reveal such insights. To make inferences about future states of competition and alternative strategic postures, one of the more attractive and useful applications of the concept, longitudinal analyses appear essential.

Second, longitudinal strategic group analyses also shed light on the relative difficulty of implementing a genuine shift in strategic posture. Strategic repositioning does not appear to be a matter of mere "choice". The analysis of the drug industry attests to the difficulty of implementing sustained group shifts. Figure 2 shows that while many firms attempted to significantly alter their strategic commitments, some could or did not sustain it. In several

instances, reversals of earlier scope and resource commitments were observed. Apparently, the development of new competences necessary to successfully compete in a new mode, i.e. to perform a group shift or form a new strategic group, appears to be significantly constrained by past commitments.

To change scope and resource commitments, drug firms have engaged in internal development, mergers and acquisitions, or combinations of both. This is observable to some extent from Table 3. Which route to strategic posture change has proven to be the most effective cannot be established from the multivariate analysis. This question opens up a new avenue for strategic group research. It also indicates an interesting area for integrating findings from research on mergers and acquistions.

This concludes the brief overview of the patterns of strategic group formation observed in the US drug industry. The descriptive analysis has illustrated that the general procedure to identify strategic groups can be employed to longitudinally trace patterns of competition in industries and can provide insight into the process of strategic repositioning.

PERFORMANCE CONSEQUENCES OF STRATEGIC GROUP MEMBERSHIP

As indicated above, several performance indicators (market share, weighted segment share, inflation-adjusted return on sales) were defined and for each, three performance dimensions (levels of

performance, risk, risk-adjusted performance) were considered. Since the strategic group structure was shown to differ over time, an analysis was performed for each period of stable strategic group structure.

Incidence of Performance Level Differences Between Strategic Groups

A one-way Analysis of Variance was performed to test whether average performance levels differ among strategic groups (hypothesis H1). Results are summarised in Table 6.

Insert Table 6 about here

With regard to the market share measure MS, the results show significant differences at the 95 percent confidence level between the strategic groups in all periods. Since this difference is observed over the two decades examined, this finding provides strong evidence for the existence of inter-strategic group performance differences on this indicator. The second performance indicator, weighted segment share WSS, shows a less unequivocal pattern. In the first and fourth periods, typified as periods with high strategic asymmetry and distinct strategic groups, the WSS indicator attests to highly significant inter-strategic group differences in performance (the type-one error α is in both cases less than five percent). In the intermediate periods, on the other hand, no such differences were observable. It should be recalled that these periods were earlier characterised as periods of structural transformation evolving towards a new strategic group pattern. It is interesting that in the second period where most dramatic

Table 6: Comparison of Performance Between Strategic Groups
(ANOVA F-Value and Significance of F)

PERIOD	ECONOMIC PERFORMANCE			RISK-EXPOSURE			RISK-ADJUSTED PERFORMANCE		
	MS	WSS	AROS	MS	WSS	AROS	MS	WSS	AROS
1963-1969	6.8(.002)	6.7(.002)	0.4(.797)	1.9(.158)	2.4(.098)	0.8(.524)	0.03(.998)	1.1(.400)	1.2(.337)
1970-1974	4.3(.019)	1.7(.198)	0.7(.562)	4.3(.020)	0.1(.962)	0.1(.996)	3.8(.031)	1.1(.392)	0.6(.650)
1975-1979	4.2(.020)	2.9(.067)	1.0(.398)	1.1(.370)	1.3(.320)	0.9(.469)	2.1(.138)	0.6(.598)	1.4(.273)
1980-1982	9.6(.001)	4.2(.018)	2.4(.094)	0.8(.524)	0.5(.705)	2.0(.154)	0.8(.560)	1.3(.298)	0.9(.474)

strategic group changes were observed, the significance of the difference was lowest. This finding suggests that along with the observed decrease in strategic asymmetry, the performance differences became less pronounced too. In the third period, however, where the strategic group structure of the fourth period was being formed, the significance of the differences in WSS between the strategic groups increased. Overall, the results on the WSS indicator demonstrate that strategic groups had a statistically different ($\alpha < 0.05$) performance in two out of four periods. The finding that performance is not statistically different in periods with a lower strategic asymmetry suggests that this structural characteristic needs to be explicitly taken into account in strategy-performance studies. Possibly, the conflicting results of previous strategic group studies may have been affected by this structural phenomenon.

The remaining performance indicator, AROS, follows yet a different pattern. In the last period, profitability differences seem to be present ($\alpha = 0.094$). The results for the other periods, however, do not allow us to conclude that performance differs among strategic groups.

The previous findings suggest that some support exists for the position that strategic group membership has performance consequences. Regarding the AROS measure, it was indicated before that any accounting indicator of performance is subject to considerable estimation error, especially when a divisional measure needs to be obtained over a long period of time. Accounting

measures of profitability should not be taken as the sole or even as the most important indicator of performance, especially when more reliable proxies of business performance can be constructed. We argued that one such measure for the drug industry is the weighted segment share WSS, indicating to what extent firms dominate the market segments they compete in. Since segment dominance was found to be associated with higher prices for similar products and lower promotion intensity (Bond and Lean, 1977) and since production costs are unlikely to differ substantially between manufacturers, the WSS indicator can be viewed as closely reflecting true profitability differences. This indicator may be more reliable than the total business market share (MS) measure since a positive relationship between business market share and performance is not universally established (Woo, 1979).

On balance, the previous considerations appear to support the choice of the WSS indicator as the most reliable indicator of performance levels in the drug industry. Hence, the test results tend to support the argument that strategic group membership has performance consequences, especially in times of pronounced strategic asymmetry.

Incidence of Risk Differences between Strategic Groups

The test results regarding the differences in risk characteristics between strategic groups (hypothesis H2) are summarised in Table 6. As indicated before, risk postures were inferred by measuring the standard error about the period mean on

each indicator of economic performance for every firm. The sets of standard errors for each strategic group were treated as observations on a variable measuring strategic group risk, and a one-way ANOVA between strategic groups was subsequently performed.

It was suggested before that strategic groups may display different risk characteristics. This hypothesis is however not borne out by the test results given in Table 6. Only for one indicator (MS) in one period (1970-1974) is a difference with a 95 percent confidence observed. In all other cases, the test results support the view that different strategic groups are characterised by similar risk profiles, contradicting the findings of Oster (1980). Possibly, the procedure to identify strategic groups in Oster's study, which uses only one variable (advertising intensity), may have introduced some confounding effects.

The absence of finding of significant differences in risk profiles necessitates a reappraisal of the prevailing belief that different strategic postures entail different risk exposures. Defining risk as the uncertainty about the outcome of a given combination of strategic scope and resource commitments, the present findings lead us to believe that risk may be more tied to the degree of match between past commitments and currently pursued strategic actions, rather than to a certain configuration of strategic scope and resource commitments alone. In other words, risk is not merely an abstract phenomenon tied to a certain set of actions, but is ultimately firm-related. Within a given strategic group, firms may face different degrees of risk. Thus, while differences in risk

exposure between strategic groups may not be significant, differences within a given strategic group may be significant. When a firm attempts to reorient its scope and resource commitments in ways incompatible with previous commitments, it is likely to have a larger risk exposure than other strategic group incumbents with a more harmonious correspondence or transition between past and present strategic commitments. The present findings cannot substantiate these hypotheses. They are examined in some detail in Cool (1985b).

Incidence of Risk-Adjusted Performance Differences Among Strategic Groups

It was hypothesised above (hypothesis H3) that strategic groups would have similar risk-adjusted performance. Here, risk-adjusted performance was measured by the ratio of mean performance over the standard error of the performance indicator. To the extent that risk exposure differs among members of the same strategic groups, it may not be possible to reject the null hypothesis. The large within-group variance in risk exposure would dwarf inter-group differences in the ratio measuring risk-adjusted performance.

Similar to the previous tests, a one-way ANOVA was performed to ascertain the inter-strategic group differences in average risk-adjusted performance. The results are given in Table 6. No significant differences appear to exist among strategic groups in any period. The absence of findings of significant differences between groups is postulated to stem from within-group differences

in risk exposure rather than from the existence of a positive risk-return relationship. Such risk-return relationships presume the inequality of risk exposure among strategic groups. More research is however needed to verify this hypothesis.

DISCUSSION AND CONCLUSIONS

Despite the fact that strategic groups have been studied since the early seventies, little empirical attention had been given to the central question of whether strategic groups really are structural phenomena in industries. Yet, strategic group analysis is meaningless as long as it has not been determined whether these groupings are more than random events. A great need therefore exists to perform longitudinal analyses.

The findings presented here constitute a first substantiation that strategic groups are relatively stable phenomena. During the twenty-year period that was studied, only four subperiods with a distinct strategic group structure could be identified. These periods ranged in duration from five to seven years[14]. Distinguishing the various strategic group structures from each other were the number of strategic groups in each period, the varying degree of strategic asymmetry between the groups, and the nature of the strategic commitment changes in each period.

Even though strategic group structures were observed to be relatively stable, the observation that they change begs the

question of what forces precisely triggered these changes. Evidence was presented, suggesting that major environmental changes prompted firms to alter their scope and resource commitments. The analysis of inter-strategic group performance differences also suggests a second source of instability in industries. Firms may have been prompted to imitate the strategic commitments of rivals by the observation that these have a higher performance. These attempts at imitation, in the absence of fast-responding feedback mechanisms about the effectiveness of these actions, may have further destabilised strategic group structures. The combination of exogenous discontinuities (environment) and endogenous imitation activities probably functioned as powerful forces in upsetting structural equilibria.

Yet, structural transformation did not appear to come about quickly. The relative length of each period with a distinct strategic group structure reflects this. Substantial rigidities seemed to affect the transformation process. Based on the findings reported here as well as in other studies, the following hypotheses about rigidities in structural evolution processes can be formed. A major source of rigidity appears to be the relative difficulty of changing past scope and resource commitments. The larger the incongruity is between past and intended strategic commitments, the more dramatic the requirements are to build new capabilities. To the extent the input market for required resources is imperfect (i.e. required assets are not freely traded), the less feasible it is and the longer it takes to build new capabilities. In addition, risk exposure is likely to increase as strategic actions are pursued

while the needed capabilities have not been fully developed. The observation that risk exposure differed among members of the same strategic group may reflect this phenomenon.

Another source of rigidities is suggested by the work of Lippman and Rumelt (1983). They agree that it may not be possible to specify fully the set of inputs and the input-output transformation function underlying given strategies. Even if the input market for resources were perfect, uncertainty about the way these resources are combined to yield competitive advantage prevents fast imitation. To the extent input markets are imperfect and uncertainty characterises input-output functions, imitation of observed sets of strategic commitments poses formidable problems.

Further affecting the imitation process is the feedback mechanism by which responses from the output markets are translated into organisational actions. If fast feedback about the effectiveness of new scope and resource commitments can be obtained, corrective actions can be taken quickly. Consequently, a disturbed structural equilibrium may move faster to a new equilibrium. In the absence of fast responses, or a slow organisational processing of these responses, sustained periods of disequilibrium may occur. In the pharmaceutical industry, slow feedback mechanisms appear to be present. Probably, this rigidity in market feedback processes or in the organisational processing of these responses, has contributed to the rather long period where "experimentation" and "reassessment" were the dominant modes of strategic action.

Combining the various elements of exogenous discontinuities, endogenous imitation, input market rigidities and feedback rigidities, a dynamic framework of competition, strategy and performance can be built. Central in this framework is the strategic group concept enabling a tracing of changes in competition, strategy and performance in a systematic way. The framework opens up many opportunities for research in the areas of entry strategies, generic strategies, strategy implementation, organisational learning, and population-ecology selection processes, among others. Also public policy applications are in the realm of dynamic strategic group analyses. One such application is the study of competition from a dynamic point of view, going beyond mere static analyses which have often been criticised as being inadequate (see e.g. Cocks, 1975).

Notwithstanding the potential value of strategic group analysis, more research needs to be done in the area of explicitly linking the concepts of sustainable competitive advantage, strategic scope and resource commitments and (currently omitted) elements affecting the effectiveness of organisational actions. This calls for fundamental research on the origins of sustainable competitive advantage and applied longitudinal research on strategic groups on a wide variety of industries. Unless this task is systematically pursued, new insights into the dynamics of competition, strategy and performance are unlikely to develop.

NOTES

1. It is recognised that strategy formation invariably includes organisational aspects. These were not considered here to simplify the analysis. The definition of strategy in this paper therefore limits itself to the "economic" aspects.

2. Scope commitments are in the literature also described as domain commitments (Miles, 1982). Only the term "scope" will be used here.

3. This scope description parallels Abell's (1980) "business definition" approach in which he uses "customer groups", "customer functions" and "technology" as defining dimensions.

4. The definition of the market segments is described in the Appendix.

5. Product patents rather than process patents are considered here since product patents offer the most protection.

6. Owing to a lack of reliable data on the split between US and non-US drug sales, the ratio of total company sales was taken as a proxy value.

7. Cumulative rather than annual data was employed to smooth out short-term fluctuations as well as to account for the lags between IND and NDA filing, and to record inter-firm differences in the total amount of INDs and NDAs filed. IND-filing became mandatory from 1963 onwards. In this year, firms also had to submit INDs for drugs under development during the period preceding the 1962 Amendments. To reduce the bias resulting from this retrospective filing of INDs in 1963, the average of the number of INDs submitted in the 1964-1966 period was taken as an estimate of the 1963 number of INDs.

8. Promotion expenses for prescription drugs include outlays for detailing, journal advertising and direct mailing to the medical and paramedical profession.

9. New dosage and package forms were excluded from the total number of new drugs introduced.

10. Access to these databases permitted the construction of the variables selected. For most variables, the data had to be transformed to obtain the desired measures. For example, patent data from Frost and Sullivan, Chemical Abstracts and the Merck Index had to be combined with sales data of IMS to gauge the incidence of branded generics; certain criteria had to be devised to ascertain the commitment to maintenance versus acute drugs. In addition, since the format of the databases often changed over the twenty-year period, the databases had to be made consistent first.

11. Since the line-of-business reporting is for most companies only available from 1966 onwards and has been subject to frequent changes, the computation of a divisional ROS measure poses significant problems. An attempt was made to obtain "best" estimates which was believed to be far more useful than overall company figures.

12. Given a certain sample size, many tests had to be performed according to [2] to establish whether a transition point was reached. Significant F-values were never found in isolation. Each time, several significant F-values were observed, pointing to the existence of a transition point.

13. When the relationship between risk and performance is negative or non-linear, the ratio measuring risk-adjusted performance would indicate differences between the strategic groups.

14. The last period (1980-1982) is not considered because no statistical evidence was found in support of the hypothesis that a new strategic group structure already existed.

Appendix: Definition of Therapeutic Categories

Eleven therapeutic categories were defined. They include the following subclassifications:

1. Cardiovasculars

   - anticoagulants
   - cardiovascular therapy
   - cholesterol reducers and isotropics
   - diuretics
   - hemostatics
   - sclerosing agents

2. Nutritional Products

   - nutrients and supplements
   - vitamins

3. Pain Control

   - analgesics
   - anesthetics
   - antiarthritics
   - muscle relaxants

4. Internal Medicine

   - antacids and antiflatulents
   - antidiarrheals
   - antinauseants
   - anti-obesity preparations
   - antispasmodic and antisecretory agents
   - bile therapy
   - contraceptives
   - diabetes therapy
   - enzymes
   - hematinics
   - hormones
   - laxatives
   - parasympathetic drugs
   - thryoid therapy
   - digestants

5. Mental Health

   - anticonvulsants
   - anti-parkinsonism drugs
   - psychotherapeutic drugs
   - sedatives

6. Topical Products

- dermatologicals
- feminine hygiene preparations
- hemorrhoidal preparations
- ophthalmic preparations
- OTIC preparations

7. Anti-infectives

- amebacides and trichomonacides
- anthelmintics
- systemic anti-infectives
- antimalarials
- tuberculosis therapy
- scabicides and pediculocides
- anti-virals

8. Respiratory

- antihistamines
- bronchial therapy
- cough and cold preparations
- respiratory stimulants

9. IV Fluids

- hospitals solutions

10. Cancer Therapy

- cancer therapy products

11. Other

- biologicals
- diagnostic aids

Note: The present IMS classification of drugs on which the previous aggregation is based only became effective in 1976. From 1966 to 1975, another classification was employed by IMS, and before that period no classification occurred at all. To provide a consistent aggregation over time, an analysis was made with respect to each drug. When a categorisation in the 1966-1975 period did not correspond with the categorisation in the most recent period, the latter categorisation was assumed to apply over the entire 20-year period.

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