Strategic Management Journal
Strat. Mgmt. J., **24**: 861–879 (2003)
Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/smj.350

INDUSTRY, CORPORATE, AND SEGMENT EFFECTS AND BUSINESS PERFORMANCE: A NON-PARAMETRIC APPROACH

TIMOTHY W. RUEFLI[1]* and ROBERT R. WIGGINS[2]
[1] *McCombs School of Business and IC[2] Institute, University of Texas at Austin, Austin, Texas, U.S.A.*
[2] *Fogelman College of Business and Economics, University of Memphis, Memphis, Tennessee, U.S.A.*

The literature investigating the degree to which firm performance is associated with industry or corporate factors has recently been subject to criticism on the grounds of both methodological shortcomings and incomplete interpretation of results. Our research goes beyond these critiques to raise more basic issues concerning the assumptions underlying variance decomposition, the methodology dominating the antecedent literature. Performance data and categorizations from a sample consistent with those employed in the recent literature are analyzed via a new non-parametric methodology. Results here indicate that corporate factors were over an order of magnitude better predictors of business unit profit position than were industry factors—which were found not to have been significant predictors. Further, underlying performance relationships were seen to have shifted over time. A key implication of these results for researchers is that they provide additional evidence that managers can have a strategic influence on business performance. Copyright © 2003 John Wiley & Sons, Ltd.

INTRODUCTION

The relative importance of industry and corporate relationships on business performance holds significant implications for industrial organization (IO) economic theory and strategic management research. In the last two decades over a dozen empirical studies beginning in the IO economics literature but concentrated in the strategic management literature have addressed aspects of this issue and have reported findings that differ, sometimes substantially, in their interpretation of the order of importance of the two factors. Recently, Brush, Bromiley, and Hendrickx (1999) and Bowman and Helfat (2001) have provided rich critiques of both the methodologies and the interpretations of findings in the antecedent literature.

Our analysis will go beyond both of the above-mentioned critiques to examine a key assumption underlying the dominant methodology employed in the literature and show that accepting this assumption means that researchers employing the methodology cannot from their results distinguish with any certainty between a factor that has little association with differences in profitability and one that has a substantial effect but is being successfully controlled by managers. Our analysis will place extant empirical results in a position in which the received interpretation of the relative importance of industry or corporate factors is questionable. Then, to provide a counterpoint to previous empirical studies, we will report an analysis that employs non-parametric methods to investigate the relative importance of industry, corporate, and business segment factors to firm performance. To accomplish this we will first identify occurrences of both

Key words: industry and corporate effects; business performance; non-parametric effect
*Correspondence to: Timothy W. Ruefli, McCombs School of Business, University of Texas at Austin, CBA 5.202, Austin, TX 78712-1175, U.S.A.

Copyright © 2003 John Wiley & Sons, Ltd.
Received 12 September 2000
Final revision received 16 April 2003

significant heterogeneity and homogeneity of performance for each factor over time via a novel non-parametric approach and will relate industry, corporate, and business unit factors to performance using information theoretic methods. We will then interpret these relationships for their implications for strategic management research and our understanding of management practice.

ANTECEDENT LITERATURE

Bowman and Helfat (2001), in their recent critical investigation of the existing literature on the topic of the relative importance of business, corporate, and industry factors, have provided an excellent review of the relevant aspects of 11 extant empirical studies[1] and these details are summarized in their Table 1 (Bowman and Helfat, 2001: 7–10), and will not be replicated here. Rather, we will concentrate on Bowman and Helfat's conclusions and, via a different and more fundamental thread in the literature, on the methodological underpinnings that lead to their arguments. In this regard, one of the most striking aspects of Bowman and Helfat's Table 1, beyond the differing levels of importance found for the three factors, is that all of the studies listed employ a variance decomposition methodology. As Bowman and Helfat (2001: 15) note, 'The variance decomposition studies in Table 1 use two main statistical techniques to decompose the variance of profitability or market share: sequential analysis of variance (often using regression methods) and variance components analysis.' Eight of the 11 studies listed employed sequential analysis of variance, while six of the 11 (some studies employed multiple methodologies) employed variance components analysis (VCA)—sometimes referred to in the literature as coefficients of variance—a technique that was originally developed for applications in biology.

The use of variance decomposition methodologies to address the issue of the importance of organization-level factors affecting performance began with Schmalensee (1985). Classical IO theory explains firm performance in terms of the structure–conduct–performance (SCP) model, which says that exogenous industry effects such as barriers to entry and concentration (Rumelt, 1991: 167; Schmalensee, 1985: 342) are the dominant influences on performance. Such a model, for example, underlies the cross-sectional work reviewed by Scherer (1980).

Schmalensee (1985: 342) identified what he termed a revisionist IO model in which market share within an industry (a business effect) is held to have a major impact on performance. This is the model first employed by Ravenscraft (1983). Schmalensee (1985: 342–343) also identified what he termed a managerial tradition in which, in addition to industry and business unit effects, corporate effects also might matter. Schmalensee (1985) employed the structure of this model in his study, as did Wernerfelt and Montgomery (1988), and Schmalensee implemented it via analysis of variance and VCA.

When research on the influence of industry, corporate, and business unit levels on performance was continued in the strategic management literature, the use of variance decomposition methodology was carried over. The focus of these research efforts was on employing variations on the variance decomposition methodology on somewhat differing samples to more completely examine the results of the IO economics research and antecedent strategic management research. The outcome of these aforementioned studies was a set of differing findings with varying interpretations, coupled with claims of more appropriate implementation of variance decomposition methodologies and use of more complete or appropriate samples (Brush *et al.*, 1999: 519–520; McGahan and Porter, 1997: 16; Rumelt, 1991: 167–168).

Brush and Bromiley (1997) critique Rumelt's use of VCA (and, by implication, that of other studies) and contrast it to the use of VCA in the context of genetics. They note that in estimating, for example, genetic effects on size of offspring or on milk production, geneticists employ a variety of formulae to provide a detailed context for interpreting the estimated variance components—a context they note is lacking in the use of VCA by strategic management researchers in this area. Brush and Bromiley (1997) go on to demonstrate, via a simulation exercise, that there are complications in interpreting the results of VCA, complications not taken into account by Rumelt (1991). As Brush and Bromiley note, 'We have shown that Rumelt's results concerning the relative

[1] Other studies, such as Hansen and Wernerfelt (1989), which analyzed industry and organizational effects, and Powell (1996), which analyzed industry effects only, contain analysis and findings that have a bearing on the topic here, but because of their differing levels of analysis are not discussed in detail.

Copyright © 2003 John Wiley & Sons, Ltd.

importance of corporate and business unit effects cannot be interpreted simply' (Brush and Bromiley, 1997: 834). In particular, Brush and Bromiley (1997: 825) focus on the small corporate effect claimed by Rumelt: 'While Rumelt (1991) states this formally in terms of the magnitude of his estimated corporate component, he suggests, and it has been interpreted by others, that corporate strategy may be relatively unimportant for explaining firm performance.' Brush *et al*. (1999: 519) cite Hoskisson, Hill, and Kim (1993), Ghemawat and Ricart I Costa (1993), and Carroll (1993) as having suggested that Rumelt's results mean that corporate strategy just doesn't matter. Analogously, McGahan and Porter (1997: 16) indicate that the small corporate effect has been interpreted as support for the resource-based perspective.

In their more recent critique Bowman and Helfat (2001) raise a broader set of questions regarding the original interpretations of results in the antecedent studies. As a result of their analysis, they conclude that the results of variance decomposition are affected by: (1) the percentage of single-business firms in the sample (with higher percentages yielding lower corporate effects), (2) by whether a broad or narrow definition of industry is employed, (3) by the order of variable entry in hierarchical regression, (4) by the inclusion or exclusion of interaction effects (corp./year; corp./industry), and (5) the degree to which stable or transitory corporate effects (Bowman and Helfat, 2001: 19) are examined. (To these conclusions we can add Brush and Bromiley's, 1997, findings that in a VCA the components must be adjusted for the number of industries and the number of corporations.) In their discussion Bowman and Helfat revisit prior studies to show that corporate effects are non-negligible (except in Schmalensee, 1985) and go on to relate the findings in this literature to the results of the leadership literature.

A key empirical study that Bowman and Helfat (2001) do not examine is Brush *et al*. (1999). In this study Brush *et al*. (1999) use a continuous variable technique in a simultaneous equation model to produce revised estimates of industry, corporate, and business unit effects on performance. They conclude:

> However, when we measure importance using incremental adjusted R's rather than R^2's, a different picture emerges. Using this metric on our results, corporate and industry effects remain smaller than business segment effects, but appear half to four tenths the size of business effects respectively. Rather than inconsequential, corporation and industry effects remain important. (Brush *et al*., 1999: 541)

These findings are significant because the sample employed covers a subset of McGahan and Porter's (1997) time period but corrects for methodological problems not treated in that study.

McGahan and Porter (2002b) reconcile the results of previous studies with a new study that examines differences in methods and datasets. In particular, they employ a large dataset and avoid both the assumption of independence of effects on a particular business that is inherent in the CoV method, and the omission of covariance between effects inherent in the nested ANOVA approach, by using a simultaneous ANOVA implemented via regression analysis. This also allows them to address Brush and Bromiley's (1997) concerns about the sensitivity of results to outliers. McGahan and Porter (2002b) find that business segment effects are the most important, followed by corporate parent effects and then industry effects—with all being significant. They also show that with a more restrictive screening of their dataset they can reconcile their results with those of Roquebert, Phillips, and Westfall (1996). Most recently, Hawawini, Subramanian, and Verdin (2003) in a study that looked at only industry and firm (corporate plus business) factors, found that 'on average industry factors have little impact on performance' (Hawawini *et al*., 2003: 11) and after removing the top and bottom two performers from each industry, refine that to conclude: 'industry structure matters only for firms that do not manage to be the leader or the loser, i.e., for firms with average managerial capabilities and performance' (2003: 14).

There is another set of studies by McGahan and Porter (1999a, 1999b, 2002a), not discussed elsewhere in the literature on relative importance of industry, corporate parent, and business segment effects, that employs a significantly different measure of importance: the persistence of effects of changes in profitability at the various levels. Drawing on the earlier work of Mueller (1986), Cubbin and Geroski (1987), and Waring (1996) that examined the persistence of profitability[2] at the

[2] For a more detailed review of the persistence literature, see Wiggins and Ruefli (2002).

Copyright © 2003 John Wiley & Sons, Ltd.

firm level, McGahan and Porter (1999b, 2002a) hypothesized that from the industry view of industrial organization industry effects should be more persistent, but from the firm-efficiency view both segment and corporate effects should be more persistent. Employing an OLS analysis (with corrections) they find that 'incremental industry effects persist longer than incremental business-segment and corporate-parent effects' (McGahan and Porter, 1999b: 152). While not important to their tests of hypotheses, corporate parent persistence was larger than business segment persistence. McGahan and Porter note that these findings are in agreement with structure–conduct–performance (SCP) theory. Employing the same dataset as their other studies cited here, but with a different screening due to a wider variety of performance measures, McGahan and Porter (1999a) found that the results for the high importance of industry effects on the stability of performance extended across both return on replacement assets and Tobin's q. Corporate focus was small or zero and not significant. These results are important because they treat the same general problem of importance of organizational levels—but with a different methodology and a different set of measures. It is worth noting that findings of McGahan and Porter (1999a, 1999b, 2002a) show that the degree of importance of an effect on performance is not necessarily the same as the degree of importance on the *persistence* of performance. This is evidence that there are complexities to the problem of estimating industry, corporate parent, and business segment effects that have not been elsewhere treated.

METHODOLOGICAL CONSIDERATIONS

Emblematic of a key thread that runs through all of the empirical studies and the two critiques is the notion of assessing the relative importance of the factors being examined for their impact on performance—based on amount of variance explained. This approach to estimating the importance of each of the organizational factors, first initiated by Schmalensee (1985), also formed a focus of the strategic management research. This latter literature can be viewed as a series of successive improvements in samples employed with increasing methodological sophistication.

Our contention here is that while sample selection and refinements of statistical techniques are important operational issues, efforts to improve the validity of, or to resolve conflicts between, findings by refining methods are for naught if the results of those methods are constrained in their interpretation by the deeper contextual assumptions inherent in the methodology. Brush and Bromiley (1997), in their discussion of VCA, cite some of the earliest instances of applications of VCA in genetics in general and in the breeding of cows for milk production in particular. As Brush and Bromiley (1997: 827) note, 'In short, quantitative geneticists use variance components but in the context of carefully designed experiments.' Thus there is an even more fundamental set of circumstances that must be satisfied for the interpretations of the variance components in these methods to be valid—and that is that the circumstances which characterize the research context operate under the assumption of *ceteris paribus*.[3] In the case of breeding cattle reported by Brush and Bromiley (1997), the assumption is that there are no feedback or learning loops that would generate behavior not accounted for in the genetic formulas. Thus in moving methodologies from the realm of determining the effects of breeding on milk production to that of examining the influences on organizational performance, care must be taken that the assumptions underlying the methods also carry over.

However, once the context for research moved from economics into the strategic management arena, where the basic premises of the field include the possibility of managerial efficacy, then the condition of *ceteris paribus* cannot be assumed to hold and thus variance decomposition may be an inappropriate methodology to employ—even though it is commonly done. The primary reason for this is that while IO economic theory presupposes a *ceteris paribus* worldview in regard to firm performance, strategic management theory presumes a *mutatis mutandis*[4] model.

The strategic management literature contains numerous assertions to the effect that managers can affect, either proactively or reactively, the competitive environment at industry, corporate, and business unit levels. To cite just a few examples, at

[3] 'With all other factors or things remaining the same' (*American Heritage® Dictionary of the English Language*, 4th edn).

[4] 'The necessary changes having been made' (*American Heritage® Dictionary of the English Language*, 4th edn).

Copyright © 2003 John Wiley & Sons, Ltd.

the industry level, Porter (1980: 187) has a subsection on how firms can influence industry structure, while D'Aveni (1994), Hamel and Prahalad (1994), and Brown and Eisenhardt (1998) talk about managers transforming industries. More anecdotally, managers introducing new technologies, diversifying into or withdrawing from an industry, and even pricing can have an effect on the relative performance of the industry and its constituent businesses. At the corporate level, Porter discusses, among other things, firms entering new businesses (Porter, 1980: 339) and vertical integration (1980: 300) to affect performance. General Electric's practice of requiring that its corporate units be either first or second in their business segment (and enforcing it via divestiture) is an excellent example of managerial policies that influence corporate-level effects. At the business unit level Porter (1980) postulates firm position within its industry as a key determinant of performance and discusses three among many possible ways for managers to influence performance: altering buyer power (1980: 26), limiting entry through pricing (1980: 14) and capacity expansion (1980: 324). While the managerial activities described have effects that are not limited solely to the level mentioned, each represents a possible deviation from an assumption of *ceteris paribus*, and thus a compromise of the conditions required for valid application and interpretation of variance decomposition techniques.

Recognizing the context in which industry and corporate-level factors affect performance as one in which learning and feedback loops are important renders discussion of the operational details of the use of techniques such as VCA analysis, as historically applied, moot. To see this, consider the case of the very small corporate variance component noted by Rumelt (1991). Derived from a variance decomposition methodology and interpreted in a *ceteris paribus* context, this small value has been interpreted by Rumelt (1991: 182) to mean that 'corporations exhibit little or no (differential) ability to affect business-unit returns.' However, in a *mutatis mutandis* context a small corporate effect statistic based on variance can be interpreted to mean that, rather then being unimportant, the corporate factor was deemed so important by managers that, over time, they focused a significant portion of their managerial efforts on exploiting it and trying to control it.

In this process managers might have been aided by researchers and consultants investigating diversification, mergers and acquisitions, and internal capital allocation practices. Knowledge dissemination and imitation of practices might have been so successful that managers obtained as much as was competitively possible of the possible contribution to profit as they could out of their corporate management activities. Other managers in competing firms would notice this and copy the corporate management techniques. If competitive pressures over time reduced the viable lower and upper limits on returns due to corporate activities, then the variance of these returns might have been very low—but not because of the unimportance of corporate effects, but rather, because of their importance. At the same time, similar forces would act to restrict those aspects of the corporate factor that are modified to those that are, or at least are thought to be, effective—thus also reducing the variance of the independent variable.

Thus in a VCA analysis of this environment, the corporate-level factor would yield small variance coefficients—not because it was not important, but because it had been deemed by managers to be more important—and, perhaps, more manageable. Similarly, under an assumption of *mutatis mutandis*, a large industry variance component might indicate, not importance of the industry factor, but rather a paucity of management techniques, or the incentives for individual managers to apply them, directed at improving industry performance that were efficacious across industries. Meyer (1994) and Meyer and Gupta (1994) place the situation in a wider sociological context and note that 'firms imitate one another's performance measures' (Meyer, 1994: 561) and over time, 'performance measures tend to lose informativeness' (Meyer, 1994: 571). The implication is that rather than devote more effort to refining samples and adjusting previously employed variance decomposition methods, this area of strategic management research would be better served by stepping back, selecting fresh methodologies to employ, and then, if necessary, attempting to revisit the relationships between levels of organization and performance. The next sections will present some first steps in doing just that.

EMPIRICAL STUDY

Empirical evidence of the validity of the logic of the foregoing critique of accepting an assumption

Copyright © 2003 John Wiley & Sons, Ltd.

of *ceteris paribus* may be gained by employing a distinctly different methodological approach that allows for a *mutatis mutandis* context. We thus selected a sample that has been analyzed in the literature but eschewed the traditional variance decomposition approach. Rather we selected a set of methods that generated, via a novel longitudinal clustering technique, statistically significantly different ordinal performance ranks for industries, corporations, and businesses. These intermediate results were then analyzed via ordinal regression to generate contingencies that indicate in an information theoretic sense the degree to which knowledge of industry or corporate performance category rank predicts business performance rank.

Note that the theories being tested here are the same theories tested in the prior studies in the literature (see, for example, Rumelt 1991: 168–170; Bowman and Helfat 2001: 1–6; McGahan and Porter 1997: 15–17): the classic IO economics SCP theory that says that industry is the prime determinant of performance and strategic management theories that say that corporate factors are also significant determinants. Since the majority of empirical results to date support the SCP theory, our hypothesis is:

> *Hypothesis 1: Industry effects dominate corporate effects in determining business performance.*

Since the studies by McGahan and Porter (1999a, 1999b, 2002a) indicated that there may be a difference in the importance of a factor on performance and its importance on persistence of performance we will also test:

> *Hypothesis 2: Industry effects dominate corporate effects and business segment effects in determining persistence of superior performance.*

In selecting new methodologies, attention was paid to March and Sutton's (1997: 699) observation: 'This competitive shaping of practice and various forms of institutionalized diffusion ... reduce the variation in powerfully effective practices and obscure their effects, leaving any analysis the unenviable task of detecting weak signals in a performance world of substantial noise.' With that potentially dismal prospect in mind, we opted for non-parametric statistical techniques that generated variable categories that sacrificed detail for statistically significant differences. Thus we opted for tripartite, ordinal categorizations of performance rather than the continuous performance variables that have characterized prior research in the area. In so doing we took a more coarse-grained approach that sacrificed absolute differences for relative performance—and in the process removed some to the effects of time.

We also departed from the customary practice of using the amount of variance explained as a measure of importance of a factor. Instead, taking advantage of the capabilities of a non-parametric approach, we employ as a measure of importance the much rougher information theoretic concept of the ability of a factor to correctly categorize business segment performance into one of three ordinal ranks. We did so in the same fashion that an epidemiologist might study the incidence and characteristics of a disease (and, in fact, in the second stage of our analysis we draw on a statistical technique, ordinal regression, which was first employed in epidemiology). That is, we attempt to look anew, and in categorical terms, at the performance space of publicly listed business units, corporations, and industries with the help of some recently developed non-parametric techniques. In this process we uncovered some of the complexities that must be dealt with in any program of research in this area and can *en passant* shed some contrasting light on some of the results yielded by previous studies.

DATA

Given the limitations of the methods employed in much of the antecedent literature, the intent here is to introduce a fundamentally different methodology while striving for comparability/contrast in results insofar as is possible. Preceding articles have established a compelling rationale for selecting the sample to be analyzed and within the limits imposed by our methodology that was followed here. Employing the logic of Brush *et al.* (1999: 527–528) we used a COMPUSTAT sample that, because of our 5-year window analysis (see below), is only 1 year off the sample used by Brush *et al.* (1999) and extends McGahan and Porter (1999a, 1999b, 2002a, 2002b) by only 2 years and Roquebert *et al.* (1996) by 5 years. We also used ROA as our performance measure—as

Copyright © 2003 John Wiley & Sons, Ltd.

was done in nine of the 12 most comparable prior studies. Supporting this choice is Hawawini *et al*. (2003: 9), which employed both economic measures and ROA and found no difference in their results across these measures. Following Brush *et al*. (1999: 528) COMPUSTAT business segment unit data, operating profit and assets, at the four-digit SIC level were aggregated to the three-digit level (to yield a sample size comparable to prior studies) and used in a ratio to give business unit ROA. Operating profit and assets for business units that were part of corporations were aggregated to the corporate level then formed into a ratio to give corporate ROA. Because many entrants and exits from the COMPUSTAT sample are occasioned by database policies and not economic events, transitions into and out of the sample were deleted from our sample. The Iterative Kolmogorov–Smirnov technique (described below and in Ruefli and Wiggins, 2000) imposed an additional constraint on the sample: business units must have had five consecutive years of data in the period 1980–96. The descriptive statistics and correlations of all study variables are shown in Table 1.

METHODOLOGY

The research methodology reported here departs from most of its antecedents by employing a set of non-parametric techniques that simultaneously allowed for a *mutatis mutandis* context, employed a coarser-grained analysis of performance, permitted a much lower level of assumptions, as well as enabled a more direct examination of the entities being analyzed and the results obtained. Non-parametric techniques were employed throughout the analysis, thus avoiding the imposition of restrictive assumptions about the functional form of the relationships involved. With regard to our rigor in differentiating levels of economic performance, as noted, variance decomposition studies utilized absolute differences in continuous performance variables, while the study here, to focus on rougher, but more meaningful differences in performance, first developed clear, ordinal categories of performance. Antecedent studies that identified performance categories (e.g., McGahan and Porter, 1999b) have commonly dichotomized performance and defined superior (inferior) performance in terms of performance that is above (below) the mean or the median for an industry or other sample. This is a handy dichotomization, but carries the substantial risk of differentially classifying entities with statistically indistinguishable performance. That is, given two entities, one may be classified as a superior performer and the other as an inferior performer when there is, in fact, no statistically significant difference between their performance levels.

To arrive at statistically significant performance categories at each level of analysis—industry, corporate, and business unit—the longitudinal performance data for all entities at a particular level were first identified with successive 5-year windows of analysis. Five years was chosen because it ameliorated the problem of year-to-year differences noted by Rumelt (1991: 168) and it approximated the period commonly associated with a phase of the business cycle (McGahan and Porter, 1999b: 22; Rumelt, 1991: 167). The distribution of performance levels over the 5 years for each entity being analyzed was then compared with the distribution of performance levels of each of the other entities being analyzed at that level via an iterative application of the Kolmogorov–Smirnov two-sample method (Ruefli and Wiggins, 2000).

Table 1. Sample descriptive statistics: means, standard deviations, minimums, maximums, and bivariate correlations for all study variables[a]

	Variable	Mean	S.D.	Min.	Max.	1	2	3	4	5
1	Segment	0.0288	0.63	−1	1	1.000				
2	LagSegment	0.0331	0.62	−1	1	0.846***	1.000			
3	Corporation	0.0310	0.65	−1	1	0.733***	0.669***	1.000		
4	Industry	0.0428	0.60	−1	1	0.086***	0.084***	0.123***	1.000	
5	Period	7.75	3.44	2	13	−0.009*	0.002	−0.010*	−0.047***	1.000

[a] Sample contained 56,688 business-unit-periods.
Significant at the ***0.001 level; **0.01 level; *0.05 level.

Copyright © 2003 John Wiley & Sons, Ltd.

The details of the Iterative Kolmogorov–Smirnov (IKS) technique are given in Ruefli and Wiggins (2000). For the purposes here it is sufficient to know that the technique clustered the entities being analyzed in each period into statistically significantly different performance strata. In each case there was a single modal stratum that contained on average 58 percent of the entities being clustered. Those strata with performance below the modal level were combined into a single stratum of inferior performers, while those strata with performance above the modal level were combined into a single superior performance stratum. To validate the stratification supersets, discriminant function analysis was employed in a confirmatory mode. All of the discriminant functions were significant ($p < 0.05$), demonstrating the validity of the superset performance strata. This yielded three strata ranked in ordinal fashion (superior performers, modal performers, and inferior performers). Three sets of IKS analyses were run, one for each factor. The result of each analysis was the stratification of each level—business units, corporations, and industries—into the three statistically significantly different performance ranks. The corporations were further subdivided into single business and diversified entities.

Following the stratification at each level, subsequent analysis via ordinal regression analysis established information theoretic relationships between the business unit and corporate levels and the business unit and industry levels, as well as between business units in the current period and business units in the prior period (lagged business units). To examine the relationships among the levels of performance, we combined the results of all of the IKS stratifications (superior, modal, inferior) at all levels, so that for each time period we coded the business unit relative performance stratum, the corporate-level relative performance stratum for the corporation the business unit belonged to, and the industry-level relative performance stratum for the primary industry in which the business unit operated. This yielded 70,268 total observations (business unit periods). After lagging the business unit performance strata, and thereby losing the first period for all business units, we were left with 56,688 observations for our second set of analyses (comparable to McGahan and Porter's (1997) sample size of 58,132). For our primary analysis we used all business units; for our secondary analysis, we eliminated all business units for companies reporting only one business unit (single-business firms). This last was done in cognizance of one of Bowman and Helfat's (2001: 14) findings: '*Thus, inclusion of single-business firms masks the corporate effect: the larger the proportion of single-business firms in a sample, the smaller is the estimated corporate effect. Conversely, when a study excludes single-business firms, the estimate corporate effect rises*' (emphasis theirs). This left 24,252 business unit periods for the second set of analyses.

Since the stratifications result in naturally ordered categories (Argresti, 1984) from inferior performance to modal performance to superior performance, we estimated an ordinal regression model with business unit performance stratum as the dependent variable, lagged business-level, corporate-level, and industry-level performance strata as factors, and time period as a covariate. Ordinal regression has been used in epidemiological research because of its ability to distinguish the probabilities associated with less desirable and more desirable outcomes (Armstrong and Sloan, 1989). In our analysis, inferior performance is the least desirable and superior performance the most desirable outcome for the business unit. Ordinal regression is a generalized linear model of the form $link(y_j) = \theta_j - [\beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k]$ where y_j is the cumulative probability for the jth category, θ_j is the threshold for the jth category, $\beta_1 \ldots \beta_k$ are the regression coefficients, $x_1 \ldots x_k$ are the predictor variables, and k is the number of predictors (McCullagh, 1980).

This is in effect a form of contingency analysis. For example, as Schmalensee (1985: 349) notes, 'The absence of firm effects ... merely means that knowing a firm's profitability in market A tells nothing about its likely profitability in randomly selected market B.' Conversely, we note in the terms of our methodology that if knowing an industry's profitability stratum rank predicts (in a significantly better than random fashion) the profitability stratum ranks of its constituent business units, then a significant industry effect exists. Thus the statistics we developed were analogous to those contingent effects to which Schmalensee refers and, in terms of ordinal regression results, we can restate our hypothesis as:

> *Hypothesis 2b: Industry effects are more accurate predictors of business performance than are corporate effects.*

Copyright © 2003 John Wiley & Sons, Ltd.

Note also that our approach did not require us to make assumptions such as that of independence of individual effects (see, for example, Chang and Singh, 2000: 747).

For comparability with the persistence effects reported by McGahan and Porter (1999b), we additionally used Cox regression to estimate models of the hazard of exiting the superior performance strata and compared the hazard rates across industries, corporations, and business segments to determine the relative persistence of profitability. Higher hazard rates would be associated with lesser persistence, and vice versa.

RESULTS

As a first step the distribution of performance at each level—business segment, corporate, and industry—was examined in comparison with the other levels. To test for significant differences, in each year 1980–96 a traditional two-sample Kolmogorov–Smirnov test (Conover, 1980: 344–356) was applied to the ROA distributions for the organization levels taken in pairs. In each year examined, the differences between each pair of distributions were significant at the 0.01 level. This indicates that there is a statistically significant pair-wise difference between the performance distributions at industry, corporate, and business segment levels and these effects persisted over time.

Business unit

The IKS analysis of the business unit sample stratified the entities into the three ordered and statistically significantly different categories: superior performers, modal performers, and inferior performers. Table 2 presents the percentage of business units in each stratum for the 5-year period ending in the indicated year. For the entire sample the percentage of business units in the modal level averaged about 60 percent and declined (but not monotonically) over time, while the fraction in the superior stratum stayed in the 20 percent range, and the inferior performers increased. Business units that were not part of diversified corporations showed a substantial increase over time in the fraction that are in the superior-performing stratum. Table 3 shows that the increase in the fraction of single business units that were in the superior stratum increased, while the fraction of superior performing business units that were parts of multi-business firms declined. The row labeled 'All' in each case gives the overall fraction of units of each type and here it can be seen that there was a relative decline in the fraction of business units that are part of a diversified corporation—indicating the trend towards less diversification in the period studied. Bergh (1995: 221) notes that sell-offs from diversified corporations 'increased more than 1000 percent during the 1980s to account for one part of the trend. The rest of the trend can be attributed to a net increase in the number of new single-business firms entering the sample as well as a reduction

Table 2. Business unit fractions in each stratum

		5-year period ending:												
		84	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**
All	Superior	0.20	0.23	0.22	0.20	0.19	0.22	0.20	0.21	0.21	0.21	0.20	0.21	0.21
	Modal	0.63	0.59	0.60	0.61	0.62	0.57	0.60	0.60	0.62	0.61	0.61	0.60	0.57
	Inferior	0.17	0.19	0.18	0.19	0.20	0.21	0.20	0.19	0.17	0.18	0.19	0.19	0.22
	$N =$	5506	5231	5206	5138	5025	5226	5452	5651	5715	5803	5964	5954	5755
		84	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**
Single	Superior	0.09	0.11	0.12	0.11	0.11	0.15	0.14	0.15	0.15	0.15	0.15	0.16	0.16
	Modal	0.67	0.61	0.63	0.63	0.62	0.56	0.59	0.58	0.62	0.62	0.60	0.59	0.57
	Inferior	0.24	0.27	0.25	0.26	0.27	0.29	0.27	0.26	0.24	0.23	0.25	0.25	0.27
	$N =$	1410	1425	1614	1708	1741	1981	2131	2205	2158	2264	2439	2606	2651
		84	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**
Diversified	Superior	0.23	0.27	0.27	0.24	0.23	0.27	0.23	0.24	0.24	0.25	0.24	0.25	0.26
	Modal	0.62	0.57	0.58	0.60	0.62	0.57	0.61	0.61	0.62	0.61	0.61	0.60	0.57
	Inferior	0.15	0.16	0.16	0.15	0.16	0.16	0.15	0.15	0.13	0.14	0.15	0.14	0.17
	$N =$	4096	3806	3592	3430	3284	3245	3321	3446	3557	3539	3525	3348	3104

Copyright © 2003 John Wiley & Sons, Ltd.

Table 3. Corporations, fraction of stratum

		5-year period ending:												
		84	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**
All	Superior	0.17	0.19	0.19	0.19	0.17	0.19	0.18	0.17	0.20	0.19	0.19	0.20	0.21
	Modal	0.63	0.59	0.59	0.57	0.57	0.56	0.57	0.56	0.55	0.58	0.57	0.53	0.54
	Inferior	0.20	0.22	0.22	0.24	0.26	0.26	0.26	0.27	0.25	0.23	0.24	0.27	0.25
	$N =$	3898	3824	4019	4089	4089	4351	4527	4632	4563	4640	4832	4927	4792
		84	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**
Single	Superior	0.24	0.24	0.30	0.34	0.32	0.38	0.41	0.44	0.44	0.44	0.48	0.51	0.52
	Modal	0.38	0.38	0.41	0.42	0.42	0.44	0.45	0.46	0.46	0.48	0.49	0.52	0.55
	Inferior	0.51	0.52	0.51	0.52	0.53	0.57	0.58	0.58	0.56	0.58	0.61	0.62	0.67
	$N =$	1494	1475	1655	1745	1766	2012	2161	2250	2187	2297	2485	2671	2734
		84	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**
Diversified	Superior	0.76	0.76	0.70	0.66	0.68	0.62	0.59	0.56	0.56	0.56	0.52	0.49	0.48
	Modal	0.62	0.62	0.59	0.58	0.58	0.56	0.55	0.54	0.54	0.52	0.51	0.48	0.45
	Inferior	0.49	0.48	0.49	0.48	0.47	0.43	0.42	0.42	0.44	0.42	0.39	0.38	0.33
	$N =$	2404	2349	2364	2344	2323	2339	2366	2382	2376	2343	2347	2256	2058

in the number of corporate acquisitions of single-business firms and a decrease in the number of subsidiaries created.[5]

Of the 1797 business segments with 13 periods of data, only 51 (8%) were consistent superior performers, and of those 23 percent were single businesses and 77 percent were part of a multi-business corporation. Of the business segments with 13 periods of data, 46 (3%) were consistent inferior performers, and of those 30 percent were single businesses and 70 percent were part of a multi-business corporation. Note that this implies that approximately 89 percent of those business units with continuing presence in the study were largely modal performers. While most traditional persistence studies have been at the corporate level, Jacobsen (1988) used SBU-level data and found no evidence of persistence. The foregoing results clearly indicate persistence exists, but for a minority of business segments—thus providing a possible explanation for why Jacobsen, using a central tendency methodology, did not identify them.

Corporate

When the IKS methodology was applied to the corporate-level longitudinal ROA data, the results indicated the existence of significant differences between performance strata in each period examined. Table 3 indicates that in each period well over 50 percent of the corporations were in the modal performance group, but that percentage declined over time. The percentage in the superior and inferior stratum increased somewhat over time, indicating a possible bifurcation in the corporate management capabilities that increased with time. Note that this supports Bowen and Wiersema's (1999) call for consideration of parameters that change over time.

The lower part of Table 3 shows that in the period ending in 1984 single-business corporations made up only 24 percent of the superior performers and 51 percent of the inferior performers, while diversified firms made up 76 percent of the superior performers and 49 percent of the inferior performers. However, by the last period in the study, single-business corporations had increased their proportion to more than 50 percent in all three performance strata. The increase in both superior and inferior-performing single-business firms indicates that there was a possible bifurcation in the efficacy of business-level strategies in this period.

The next logical step was to check to see how many firms were stable in their superior performance. There were 151 firms that stayed in the superior performance stratum for all 13 periods examined. That is an average of only 3.5 percent of the firms over time—indicating that sustained, truly superior performance was a relatively rare

[5] March and Sutton (1997: 699) observed that 'The basic idea is that any feature of organizational practice that might provide major competitive advantage is ordinarily adopted by all competitors.' Reduced diversification and a focus on single-business strategies during the period studied may well be an example of this.

Copyright © 2003 John Wiley & Sons, Ltd.

phenomenon. Of these superior performers, 27 percent were single -business firms and 73 percent were diversified. On the other hand, there were only 46 firms (about 1%) that exhibited persistent inferior performance over the study period, and of these 28 percent were single-business firms while 72 percent were diversified firms. There were 2738 firms (an average of 63% over time) that exhibited performance in the modal stratum over the entire 13 periods. Of these, 60 percent were single-business firms. These results agree in general with the findings of Mueller (1986), Geroski and Jacquemin (1988), Schohl (1990), Droucopoulos and Lianos (1993), Goddard and Wilson (1996), and Waring (1996).

Industry

When the IKS methodology was applied to the industry-level ROA data, the results indicate that there were, indeed, significant performance differences between performance strata in each period. Table 4 indicates that for any 5-year period, above 50 percent of the industries examined fell into the modal performance group, meaning their returns were not statistically distinguishable one from another in that period. For the rest of the industries, slightly more on average fell into the statistically superior stratum than fell into the inferior performance stratum. There was an anomalous period ending in 1985 in which 45 percent of the industries fell into the superior stratum, while only 3 percent were in the inferior performance stratum. This is in contrast to Gort and Singamsetti's (1976: 17) finding (with data from a different period of time) that industries had different characteristic levels of profitability and supports Rumelt's (1991: 168) observation that 'Most of the observed differences among industry returns have nothing to do with long-term industry effects; they are due to the random distribution of especially high and low-performing business units across industries.'

Rumelt (1991: 168) reports: 'As will be shown, an FTC industry return must be at least 15.21 percentage points above the mean to warrant a conclusion (95 percent confidence) that the true stable industry effect is positive. Fewer than one in forty (2.5%) industry returns are high enough to pass this test.' In the case here, 21 out of an average of 301 industries (or 7%) had returns that were statistically significantly above (at the same 95% level) the modal stratum of firms in all periods studied—almost three times what Rumelt found; also, that the methodology employed here identified three industries that performed in an inferior fashion for the entire 13 periods studied. Taken together these findings indicate that 92 percent of industries showed no significant differences in performance over time; this conflicts with traditional IO theory that industries in general exhibit significant differences in performance.

Relationships among levels

The second phase of the analysis was to examine the relationships between levels of organization and categories of performance. As described previously, we used ordinal regression, which predicts the cumulative probabilities of the ordered business unit performance strata (inferior, modal, superior) using the ordered corporate and industry performance strata and lagged business unit strata as factors and time as a covariate. The results of our analyses using ordinal regression with a logit link function are shown in Table 5 (for all firms, including single-business firms) and Table 6 (for diversified firms only). As can be seen in the full Model (1), both the model and most of its coefficients were statistically highly significant. The coefficient for time period was both nominally and statistically insignificant (in Table 5) and

Table 4. Industry, fraction in stratum

	5-year period ending:												
	84	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**
Superior	0.226	0.453	0.205	0.222	0.231	0.215	0.235	0.194	0.202	0.206	0.216	0.250	0.269
Modal	0.569	0.516	0.564	0.546	0.581	0.561	0.559	0.622	0.593	0.601	0.552	0.529	0.547
Inferior	0.205	0.031	0.231	0.232	0.188	0.224	0.206	0.184	0.205	0.193	0.232	0.221	0.184
$N =$	288	289	303	302	303	303	306	304	307	311	310	308	309

Copyright © 2003 John Wiley & Sons, Ltd.

Table 5. Ordinal regression estimates of business unit performance for all firms (standard errors in parentheses)

	(1) Full model	(2) Corporate + industry	(3) Segment only	(4) Corporate only	(5) Industry only
Constant BSU stratum = −1	−9.955***	−5.784***	−7.694***	−5.785***	−1.764***
	(0.076)	(0.038)	(0.043)	(0.034)	(0.020)
Constant BSU stratum = 0	−2.900***	−0.820***	−1.812***	−0.822***	1.071***
	(0.055)	(0.026)	(0.026)	(0.019)	(0.019)
Time period	−0.012**				
	(0.004)				
Lagged variable SU stratum = −1	−8.123***		−9.414***		
	(0.058)		(0.051)		
Lagged variable BSU stratum = 0	−4.206***		−4.780***		
	(0.039)		(0.036)		
Corporate variable stratum = −1	−4.972***	−6.942***		−6.944***	
	(0.055)	(0.040)		(0.040)	
Corporate variable stratum = 0	−2.084***	−3.045***		−3.047***	
	(0.038)	(0.027)		(0.027)	
Industry variable stratum = −1	−0.085	−0.023			−0.592***
	(0.048)	(0.035)			(0.028)
Industry variable stratum = 0	−0.054	−0.006			−0.245***
	(0.037)	(0.026)			(0.021)
−2 Log-likelihood ratio χ^2 (d.f.)	70236.61***	42762.13***	61005.32***	42671.13***	448.355***
	(7)	(4)	(2)	(2)	(2)
Nagelkerke pseudo-R^2	0.838	0.624	0.777	0.624	0.009
% Predicted correctly	88.2%	80.9%	88.6%	80.9%	60.6%
% Superior predicted	85.6%	75.0%	86.4%	75.0%	0%
N	56,688	56,688	56,688	56,688	56,688

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

Note: In ordinal regression models, constants (corresponding to the intercept in linear regression) are referred to as 'thresholds' and independent variables are referred to as 'location' variables.

statistically insignificant (in Table 6) and removing time period had very negligible effects on the models; the Nagelkerke pseudo-R^2 dropped only 0.001. This was not unexpected, because the IKS stratifications are based on relative performance, so that variations over time due to economic cycle and other effects are ameliorated. Because of its insignificance, time period was omitted from all subsequent models.

The full models (1) in both Tables 5 and 6 show that the coefficients for the lagged business segment unit (BSU) effects were about four times greater than for the corresponding corporate effects, which in turn were over two orders of magnitude larger than the corresponding coefficients for the industry effects.[6] The latter were not significant in models with variables for other levels. The full model correctly predicted 88.2 percent of the business segment categorizations into the inferior, modal, or superior strata, had a Nagelkerke pseudo-R^2 of 0.783, and did only slightly worse (85.6% correct) at predicting just the superior performers.

To further investigate the relative contribution of these effects, models were estimated using corporate only, industry only, and the combination of the two. As can be seen from Models 2, 3, 4, and 5 in both Tables 5 and 6, almost all of the predictive power in these models came from the corporate effect. The corporate effect only model (4) in the primary analysis had a Nagelkerke pseudo-R^2 of 0.624 and correctly predicted 80.9 percent and 75.0 percent of all and superior performers, respectively. The industry effect only model (5), while statistically significant, had a negligible pseudo-R^2 (less than 0.01), and predicted the performance of *none* of the superior performing business units in either sample.

[6] Direct interpretation of coefficients in an ordinal regression model is difficult due to the nature of the link function. For example, to convert to cumulative category probabilities requires taking the inverse of the complementary log-log link function. Nonetheless, important insights can be derived from the signs and the relative sizes of the coefficients since, in this case, all of the location independent variables are in the same units.

Copyright © 2003 John Wiley & Sons, Ltd.

Copyright © 2003 John Wiley & Sons, Ltd.

Table 6. Ordinal regression estimates of business unit performance for multiple business unit firms (standard errors in parentheses)

	(1) Full model	(2) Corporate + industry	(3) Segment only	(4) Corporate only	(5) Industry only	(6) 3 Segments only	(7) 4 Segments only
Constant BSU stratum = −1	−8.846***	−4.048***	−7.841***	−3.927***	−2.492***	−8.858***	−8.753***
	(0.096)	(0.043)	(0.064)	(0.036)	(0.033)	(0.150)	(0.215)
Constant BSU stratum = 0	−2.675***	−0.501***	−1.982***	−0.385***	0.442***	−2.684***	−2.564***
	(0.071)	(0.032)	(0.036)	(0.023)	(0.027)	(0.098)	(0.146)
Independent time period	0.010						
	(0.006)						
Lagged variable BSU stratum = −1	−8.925***		−9.282***			−9.164***	−9.340***
	(0.082)		(0.080)			(0.148)	(0.203)
Lagged variable BSU stratum = 0	−4.408***		−4.666***			−4.522***	−4.515***
	(0.051)		(0.050)			(0.090)	(0.123)
Corporate variable stratum = −1	−2.330***	−3.773***		−3.813***		−2.032***	−1.650***
	(0.082)	(0.054)		(0.054)		(0.159)	(0.211)
Corporate variable stratum = 0	−1.118***	−1.827***		−1.863***		−1.014***	−0.867***
	(0.048)	(0.031)		(0.031)		(0.083)	(0.113)
Industry variable stratum = −1	−0.108	−0.267***			−0.836***	−0.348**	−0.001
	(0.067)	(0.044)			(0.041)	(0.118)	(0.171)
Industry variable stratum = 0	−0.025	−0.157***			−0.486***	−0.105	−0.150
	(0.051)	(0.034)			(0.032)	(0.090)	(0.132)
−2 Log-likelihood ratio χ^2 (d.f.)	26369.42***	6490.85***	25366.98***	6452.29***	429.435***	8519.851***	4606.976***
	(7)	(4)	(2)	(2)	(2)	(6)	(6)
Nagelkerke pseudo-R^2	0.784	0.277	0.767	0.275	0.021	0.787	0.796
% Predicted correctly	88.5%	66.4%	88.5%	66.3%	58.8%	88.9%	89.4%
% Superior predicted	87.4%	62.6%	87.4%	62.6%	0%	88.0%	88.5%
N	24,452	24,452	24,452	24,452	24,452	7851	4111

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

The combination corporate + industry model (2) was not significantly improved from the corporate effect only model (3).

For enhanced comparability with Brush *et al.* (1999), we also estimated models for all firms with exactly three business segments (Table 6, Model 5) and exactly four business segments (Table 6, Model 6). Even with the considerably smaller subsamples for these models, the results were strikingly similar to our other models and had a slightly higher Nagelkerke pseudo-R^2.

Of particular note is the ability of most of the models to correctly predict membership in the business segment superior performance stratum over 85 percent of the time when less than 30 percent of the business segments in the samples achieved superior performance. (For completeness, we also estimated models for the complete sample of 70,268 observations using only corporate and industry effects, with similar results. The corporate effects were over an order of magnitude greater than industry effects.) Note also that, in contrast to the conclusions of Bowman and Helfat (2001: 14), with our methodology a higher proportion of single-business units in the sample significantly *improved* the ability of the corporate performance factor to correctly predict the overall (80.95% vs. 66.3%) and superior (75.0% vs. 62.6%) performance positions of the business segments. Including single-business firms at the corporate level made almost no difference in the ability of the industry factor to correctly predict the overall (60.6% vs. 58.8%—roughly the proportion of business segments in the modal group) and superior (0.0% vs. 0.0%) performance positions of the business segments. Thus, Hypothesis 1 (and its revised form Hypothesis 1b) was not supported in this study. Corporate factors yielded significantly better predictions of business segment performance categorizations than did industry factors.

McGahan and Porter's (2002b) study is perhaps the closest in the antecedent literature to this study. Table 7 shows a direct comparison of the results for the two studies. Since McGahan and Porter's data were at the four-digit SIC level, we reran our data using the four-digit SIC level. Results for McGahan and Porter (2002b) were drawn from their Table 5 in the column reporting results of the simultaneous ANOVA with correction for serial correlation on the full model. As can be seen, the two studies agree on the relative magnitude of the industry, corporate, and business segment effects and disagree only on the statistical significance of the industry effect. This latter is most likely due to the differing assumptions and measure of effects (parametric and variance explained for McGahan and Porter vs. non-parametric and prediction of performance position for this study). Note that the change from three-digit to four-digit SIC level affected our sample size but did not affect the relative magnitudes of the coefficients resulting from our methodology.

In attempting to replicate the findings of McGahan and Porter (1999b) using a different methodology, we used Cox regression models to produce the cumulative hazard rates of exiting the superior performance strata reported in Table 8. For the entire period studied, industry had the lowest hazard rate (0.374), indicating the most persistence, followed by the

Table 7. Comparison with McGahan and Porter's (2003) results

	McGahan and Porter (2003: Table 5)	This research (all firms)	This research (diversified firms only)	This research (all firms, 4-digit industry)	This research (diversified firms only, 4-digit industry)
Time period[a] coefficient	0.4	0.01	0.01	0.01	0.02
Industry coefficient	7.6	0.14	0.13	0.18	0.14
Corporate coefficient	10.8	7.06	3.45	7.43	3.59
Segment[b] coefficient	35.1	12.33	13.33	12.20	13.28
N	58,132	56,688	24,452	46,934	18,735
Model[c]	54.1	88.2	88.5	88.30	88.4
Error	45.9	11.8	11.5	11.70	11.5
Total	100.0	100.0	100.0	100.0	100.0

[a] For M&P this is year; for this research this is 5-year period.
[b] For M&P this is current segment; for this research it is lagged segment.
[c] For M&P this is percent of variance explained; for this research this is percent of segments correctly classified.

Copyright © 2003 John Wiley & Sons, Ltd.

Table 8. Cox regression estimates of cumulative hazard of exiting superior performance strata (standard errors in parentheses)

	Cumulative hazard	Events	Censored	Total
Industry	0.374***	185	1,019	1,204
	(0.027)			
Corporation	0.452***	1,695	10,096	11,791
	(0.009)			
Business unit	0.566**	3,038	14,862	17,900
	(0.008)			
Totals		4,918	25,977	30,895
−2 Log-likelihood ratio	85,884.41***			

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

higher corporate cumulative hazard rate (0.456), indicating less persistence, and then segment hazard rate (0.566), which indicates the least persistence. Thus Hypothesis 2 is supported. This order is precisely that found by McGahan and Porter (1999b). Comparing the results of Tables 5 and 7 suggests that the persistence of profits by organizational level and the importance of factors at that level to profitability may not be correlated.

Finally, we should note that all of these statistics reported here were based on a model that had significantly fewer degrees of freedom and a somewhat smaller number of observations than did the more traditional models in the antecedent literature. In spite of these limitations, the models here achieved substantial statistical significance and predictive power and the results clearly did not support the hypothesis that industry factors provided the dominant effect on business performance. To the contrary, our findings indicate that industry factors generally were not significant, but even in the case where they were they were negligible in influence and thus poor predictors of business performance categories. On the other hand, industry factors were found to have a stronger relationship with the persistence of performance position than did corporate factors, suggesting that different factors were associated with level of performance than were associated with maintenance of performance—whatever the level.

DISCUSSION

Previous research efforts investigating the importance of business unit, corporate membership, and industry for performance have all assumed a *ceteris paribus* framework that originated in IO economics and was implicit in the methodologies and interpretations of results employed. Although the nature of this adopted framework was usually not explicitly acknowledged in the literature, the choice of methodologies (parametric statistical variance decomposition techniques applied to relatively fine-grained, cross-sectional performance data) makes the implication clear. The result of these choices was a focus on measuring relative importance of factors in terms of the amount of variance they explained in the dependent variable. Ignored in this process was the possible strategic role of managers (and others) in controlling one or more of the factors under investigation and thus confounding the interpretation of the results obtained.

After reviewing antecedent research, our study employed non-parametric statistics and a methodology that was designed to allow for a *mutatis mutandis* framework. Taken together, the critical literature review section and the descriptive section of the empirical study provided a number of reasons why previous studies have produced findings that were both conflicting in interpretation and questionable in a strategic management context.

As an initial step in the discussion of the results, the limitations of the methodology should be summarized. First, it should be acknowledged that while the methodology chosen allowed for a *mutatis mutandis* assumption, it did not necessarily validate the necessity of that assumption. Second, the methodology chosen did not permit an evaluation of the effect of business unit effects on performance (except in lagged fashion), as did variance decomposition, since business unit

Copyright © 2003 John Wiley & Sons, Ltd.

performance category is the variable to be predicted. Third, the use of ordinal categories of performance made performance relative and thus obscured any effects of time. Fourth, the use of SIC codes as a basis for identifying industry boundaries, while standard in the literature, is problematic. Further, our sample, like all of the samples in this line of research, was a biased sample; it did not include private firms or small firms.

As just mentioned, the initial portion of the empirical study provided strong evidence that a number of parameters associated with the sample that has been widely used in previous studies shift, sometimes dramatically, over time. For example, Table 2 showed that the percentage of business units not affiliated with a corporation doubled from 1984 to 1996, while those that were part of a corporation declined by nearly 25 percent; it was also noted that the percentage of single business units in the superior performance stratum almost tripled in the same period; and Table 3 showed that when these business units were compared to diversified corporations, the former doubled their percentage in the superior performance stratum from 1984 to 1996. Table 4 provided evidence that the industry level was the most stable in terms of the proportional membership in each stratum of performance. The nature and magnitude of these and other changes over time, plus the effects of possible feedback loops noted in the literature review section, argue against continued applications of cross-sectional approaches and militate strongly in favor of a methodological approach that, at the least, allows for these features of the system being examined.

Previous studies have varied in their treatment of time in their models. Some studies have included time as a control variable (Rumelt, 1991; McGahan and Porter, 1997, 1999a, 1999b, 2002a, 2002b; Roquebert *et al*., 1996), while others have not (Schmalensee, 1985; Wernerfelt and Montgomery, 1988; Brush *et al*., 1999). In this study we demonstrated that performance relationships of concern shifted substantially over time. We included time as a control variable and demonstrated, by the resulting insignificance of that variable, that our ordinal methodology successfully removed the effects of time.

By generating performance strata that are statistically significantly different and highly aggregated, the methodology employed was able to develop statistics that avoided both parametric assumptions and a reliance on ability to explain variance in a finer-grained measure of performance as a measure of importance. The results obtained by our approach dramatically illustrate the nature of the trade-offs that were made in formulating a methodological approach that did not constrain the system being investigated to operate based on a *ceteris paribus* assumption. Rather than the refined measures of the coefficients of variance yielded by previous research, the approach here was able to report only statistics that are the equivalent of contingent probabilities over highly aggregated, ordinal categories of performance.

Rough though they may be, the findings reported here were statistically significant in spite of sample sizes and degrees of freedom that were significantly reduced from previous studies. The key results here are contrary to SCP theory (although the results on persistence support it). Given the poor showing of the industry factor as a predictor of business unit performance category and the stronger showing of the corporate factor as predictor of business segment performance position (particularly in the complete sample), the main hypothesis was rejected. These results are in substantial conflict with the findings of Schmalensee (1985), Wernerfelt and Montgomery (1988), Rumelt (1991), McGahan and Porter (1997), and Chang and Singh (2000); however, they are in strong agreement with the analysis of Bowman and Helfat (2001) and the findings of Roquebert *et al*. (1996), Brush *et al*. (1999), and particularly the latest study by McGahan and Porter (2002b), who found that corporate effects were larger than industry effects. The latter three studies apply two different methodologies to samples that are subsets of our sample and also employ different interpretations of how the importance of factors is measured; thus our study, with yet a third methodology and third interpretation of how importance is measured, provides some triangulation of support for the common set of findings. The importance of this for the strategic management area is that, taken together, these four studies provide reasonable (albeit not overwhelming) evidence for the notion that corporate factors may be a more significant influence on business segment performance than are industry factors. Further, the high level of corporate effects here, coupled with the antecedent literature's findings of significantly lower level

Copyright © 2003 John Wiley & Sons, Ltd.

of variance components associated with corporate factors, produced the basis for a strong inference that corporate managers have played a significant role in influencing firm performance and supports the arguments of March and Sutton (1997) and Meyer (1994).

DIRECTIONS FOR RESEARCH

Our approach here and its results strongly suggest that the issue of the importance of the levels of corporate and industry factors on business performance should be looked at anew. At a minimum, this renewed look should be based on assumptions and employ methodologies that at the least allow for the complications inherent in frameworks in which managers have effective strategic influence on the factors influencing performance. Some of the findings here suggest preliminary studies that show some promise. The longitudinal analysis that showed an increase in the number of single-business firms (Table 3) practically begs for a detailed analysis that provides a theoretical framework for this development. As part of that study, an examination of the increase in both superior and inferior-performing single-business firms that implies a possible bifurcation in the efficacy of business-level strategies in this period, would be of substantial help in informing future studies of the factors influencing business performance.

Another possible study would be to extend the time period covered from 1980 to 2000 and replicate the study here twice, once for the 1980s and again for the 1990s. This would permit an estimation of any longitudinal differences between the two periods and might indicate possible trends in industry and corporate effects. Additionally the suggestion here (Table 5) was that increased diversification might weaken the significance and predictability of the model. This could be tested by applying the model as Roquebert *et al*. (1996) did, to an increasingly diversified set of samples. A final incremental study suggested by the work here would be to change the methodology to one that allowed for a *mutatis mutandis* assumption yet employed absolute rather than relative measures of performance, and thus reintroduce time as a possible significant variable.

Researchers in the area addressed by this article have historically derived relationships among industry, corporate, and business effects from secondary data on firm performance and have eschewed following those implications into management behavior in the finance community. An interesting allied study would be to examine the fashion in which firm and industry analysts incorporate the performance relationships among these levels (and the types of lags in performance indicated in Tables 5 and 6) in arriving at their forecasts as well as their norms for diversification of portfolios. Similarly, a study of historical merger and acquisition behavior that examined the role that industry, corporate, and business factors played in the evaluation of target firms would be an interesting 'practical' extension.

An examination of Tables 2, 3, and 4 indicates that distinct minorities of the entities studied at each level exhibited performance above or below the modal category—and in an often asymmetric fashion, yet traditional parametric methodologies have to do with mean-seeking and often assume symmetric distributions. Development of additional, presumably non-parametric, methodologies that can accommodate deviation from the mean and outliers as well as asymmetric distributions of outcomes would potentially prove useful to continued progress in strategic management research.

The ideal approach to address the questions in the area of industry, corporate, and business factors on performance would be to employ a rich and detailed technique such as VCA in a manner analogous to the way Brush and Bromiley (1997: 827) describe its use in genetics, i.e., with the addition of equations that explicitly model the important learning processes, feedback loops, and implementation procedures identified in the strategic management literature. Perhaps initial steps in this direction would be to investigate the time-varying mechanisms that affect performance at all levels and find ways to practicably incorporate them into existing models. However this proceeds, it is clear that such an effort would involve an extensive program of theory development and empirical research just to determine the management formulae that condition the use and interpretation of the VCA.

Beyond the foregoing, the high level of corporate effects here, coupled with the earlier antecedent literature's findings of significantly lower level of variance components associated with corporate factors, produced the basis for a strong inference,

Copyright © 2003 John Wiley & Sons, Ltd.

but not strong evidence, that corporate managers have played a significant role in influencing firm performance and supports the arguments of March and Sutton (1997) and Meyer (1994) as well as the evidence from the management leadership literature assembled by Bowman and Helfat (2001). An ambitious research effort would be to design a study or set of studies that would provide evidence of the relative effects of management influences on performance at the business segment, corporate, and industry levels.

In any case, the need for additional research is clear and it is hoped that subsequent research can, at the expense of more difficult data collection, model formulation, and methodological complexity, provide a richer and more detailed analysis than was undertaken here of the issues incorporated in this stream of research.

ACKNOWLEDGEMENTS

The authors would like to thank Anita McGahan for generously sharing her research, and the Associate Editor and three anonymous referees for comments, critiques, and suggestions that substantially improved this article beyond its original manuscript. Responsibility for the content of the article rests with the authors.

REFERENCES

Argresti A. 1984. *Analysis of Ordinal Categorical Data*. Wiley: New York.

Armstrong BG, Sloan M. 1989. Ordinal regression models for epidemiologic data. *American Journal of Epidemiology* **129**: 191–204.

Bergh DD. 1995. Size and relatedness of units sold: an agency theory and resource-based perspective. *Strategic Management Journal* **16**(3): 221–239.

Bowen HP, Wiersema MF. 1999. Matching method to paradigm in strategy research: limitations of cross-sectional analysis and some methodological alternatives. *Strategic Management Journal* **20**(7): 625–636.

Bowman EH, Helfat C. 2001. Does corporate strategy matter? *Strategic Management Journal* **22**(1): 1–26.

Brown SL, Eisenhardt KM. 1998. *Competing on the Edge: Strategy as Structured Chaos*. Harvard Business School Press: Boston, MA.

Brush TH, Bromiley P. 1997. What does a small corporate effect mean? A variance components simulation of corporate and business effects. *Strategic Management Journal* **18**(10): 825–835.

Brush TH, Bromiley P, Hendrickx M. 1999. The relative influence of industry and corporation on business segment performance: an alternative estimate. *Strategic Management Journal* **20**(6): 519–547.

Carroll GR. 1993. A sociological view on why firms differ. *Strategic Management Journal* **14**(4): 237–249.

Chang S-J, Singh H. 2000. Corporate and industry effects on business unit competitive position. *Strategic Management Journal* **21**(7): 739–752.

Conover WJ. 1980. *Practical Nonparametric Statistics* (2nd edn). Wiley: New York.

Cubbin J, Geroski P. 1987. The convergence of profits in the long run: inter-firm and inter-industry comparisons. *Journal of Industrial Economics* **35**: 427–442.

D'Aveni RA. 1994. *Hypercompetition: Managing the Dynamics of Strategic Maneuvering*. Free Press: New York.

Droucopoulos V, Lianos TP. 1993. The persistence of profits in the Greek manufacturing industry. *International Review Applied Economics* **7**: 163–176.

Geroski PA, Jacquemin A. 1988. The persistence of profits: a European comparison. *Economic Journal* **98**: 375–389.

Ghemawat P, Ricart I Costa JE. 1993. The organizational tension between static and dynamic efficiency. *Strategic Management Journal*, Winter Special Issue **14**: 59–73.

Goddard JA, Wilson JOS. 1996. Persistence of profits for UK manufacturing and service sector firms. *Service Industries Journal* **16**: 105.

Gort M, Singamsetti R. 1976. Concentration and profit rates: new evidence on an old issue. *Occasional Papers of the National Bureau of Economic Research: Explorations in Economic Research* **3**: 1–20.

Hamel G, Prahalad CK. 1994. *Competing for the Future*. Harvard Business School Press: Boston, MA.

Hansen GS, Wernerfelt B. 1989. Determinants of firm performance: the relative importance of economic and organizational factors. *Strategic Management Journal* **10**(5): 399–412.

Hawawini G, Subramanian V, Verdin P. 2003. Is performance driven by industry- or firm-specific factors? A new look at the evidence. *Strategic Management Journal* **24**(1): 1–16.

Hoskisson RE, Hill CWL, Kim H. 1993. The multidivisional structure: organizational fossil or source of value? *Journal of Management* **19**: 269–298.

Jacobsen R. 1988. The persistence of abnormal returns. *Strategic Management Journal* **9**(5): 415–430.

March JG, Sutton RI. 1997. Organizational performance as a dependent variable. *Organization Science* **8**: 698–706.

McCullagh P. 1980. Regression models for ordinal data. *Journal of the Royal Statistics Society B* **42**: 109–127.

McGahan AM, Porter ME. 1997. How much does industry matter, really? *Strategic Management Journal*, Summer Special Issue **18**: 15–30.

McGahan AM, Porter ME. 1999a. The performance of U.S. corporations: 1981–1994. *Journal of Industrial Economics* **47**: 373–398.

Copyright © 2003 John Wiley & Sons, Ltd.

McGahan AM, Porter ME. 1999b. The persistence of shocks to profitability. *Review of Economics and Statistics* **81**: 143–152.

McGahan AM, Porter ME. 2002a. The emergence and sustainability of abnormal profits. Harvard Business School manuscript.

McGahan AM, Porter ME. 2002b. What do we know about variance in accounting profitability? *Management Science* **48**(7): 834–851.

Meyer MW. 1994. Measuring performance in economic organizations. In *Handbook of Economic Sociology*, Smeker N, Swedberg R (eds). Princeton University Press: Princeton, NJ; 556–578.

Meyer MW, Gupta V. 1994. The performance paradox. In *Research in Organizational Behavior*, Vol. 16, Staw BM, Cummings LL (eds). JAI Press: Greenwich, CT; 309–369.

Mueller DC. 1986. *Profits in the Long Run*. Cambridge University Press: Cambridge, U.K.

Porter ME. 1980. *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. Free Press: New York.

Powell TC. 1996. How much does industry matter? An alternative empirical test. *Strategic Management Journal* **17**(4): 323–334.

Ravenscraft DJ. 1983. Structure–profit relationships at the line of business and industry level. *Review of Economics and Statistics* **65**: 22–31.

Roquebert JA, Phillips RL, Westfall PA. 1996. Markets vs management: what 'drives' profitability? *Strategic Management Journal* **17**(8): 653–664.

Ruefli TW, Wiggins R. 2000. Longitudinal performance stratification: an iterative Kolmogorov–Smirnov approach. *Management Science* **46**(5): 685–692.

Rumelt RP. 1991. How much does industry matter? *Strategic Management Journal* **12**(3): 167–185.

Scherer FM. 1980. *Industrial Market Structure and Economic Performance* (2nd edn). Rand McNally: Chicago, IL.

Schmalensee R. 1985. Do markets differ much? *American Economic Review* **75**: 341–351.

Schohl F. 1990. Persistence of profits in the long run: a critical extension of some recent findings. *International Journal of Industrial Organization* **8**: 385–404.

Waring GF. 1996. Industry difference in the persistence of firm-specific returns. *American Economic Review* **86**: 1253–1265.

Wernerfelt B, Montgomery CA. 1988. Tobin's q and the importance of focus in firm performance. *American Economic Review* **78**: 246–250.

Wiggins RR, Ruefli TW. 2002. Sustained competitive advantage: temporal dynamics and the incidence and persistence of superior economic performance. *Organization Science* **13**(1): 82–105.

Copyright © 2003 John Wiley & Sons, Ltd.