RESPONSE TO McGAHAN AND PORTER’S COMMENTARY ON ‘INDUSTRY, CORPORATE AND BUSINESS-SEGMENT EFFECTS AND BUSINESS PERFORMANCE: A NON-PARAMETRIC APPROACH’

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In the comment on Ruefli and Wiggins (2003), a number of points are made supporting the variance component analysis approach to determining the importance of industry, corporate, and business segment factors on business segment performance. This response addresses in more detail the nature of the methodological and statistical assumptions made by variance components analysis or ANOVA and their implications for the ‘puzzling’ results obtained when these techniques are employed. The response then contrasts the variance-based methodologies with a non-parametric approach used in Ruefli and Wiggins (2003) that makes fewer and weaker assumptions and yields more robust and more internally consistent results. The response also examines the limitations of employing an autoregressive approach to measuring persistence of abnormal profits and contrasts it with a non-parametric methodology presented in the article.

INTRODUCTION

The comment (McGahan and Porter, 2005) on Ruefli and Wiggins (2003) raises a number of issues relevant to not only our article, but to the broader area of research on the importance of industry, corporate, and business segment factors to business segment performance. Rather than sequentially address each of the points noted in the comment, this response begins with an overview of the methodology employed in Ruefli and Wiggins (2003) as a way of providing a context in which to speak to the issues that were raised. In our research, time series performance data on entities at the levels of business segments, corporations, and industries were stratified on each level and in each period by the iterative application of the non-parametric Kolmogorov–Smirnov (IKS hereafter) test (Ruefli and Wiggins, 2000). This technique clusters entities into strata that are statistically significantly different in their performance from all other strata in that period. In using IKS the researcher does not specify a priori or ex post (as in most methods of clustering) the number or nature of the strata—the IKS technique determines those parameters from the data. Our application

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of IKS analysis in each period, for each level of organization, found a modal group comprising approximately 60 percent of the target entities at each organizational level: business segment, corporate, and industry (Ruefli and Wiggins, 2003; Tables 2, 3 and 4). On average, another 20 percent of the entities were in superior performance strata and 20 percent were in inferior performance strata.

For the methodology in Ruefli and Wiggins (2003), for each organizational level the sets of strata above the modal stratum were combined to yield one statistically significantly superior stratum and those below the modal stratum were combined to yield one statistically significantly inferior performance stratum. As noted in McGahan and Porter (2005), these three performance strata yield an ordinal ranking; however, contrary to the comment, this tripartite partitioning is statistically based and stands in contrast to arbitrary divisions of entities by performance into halves, quarters, deciles, and such. For the data in Ruefli and Wiggins (2003) (and also in McGahan and Porter, 1999), a partitioning of the entities into sets above and below the mean (to test for persistence of abnormal profit, for example) would result in each partition having 60 percent of its entities that were not statistically different from 60 percent of those in the other partition—or from the mean.

Having identified the performance position of each entity at each level in each period, these positions were then used in an ordinal regression to determine how well knowledge of performance position at each level predicted performance position at the business segment level. In order to determine this information for business segment position as predictor, the independent variables were lagged one period. In so doing, no assumptions were made about causality regarding management action or inaction—or the effects of other forces. The general assumption was mutatis mutandis and the context was aimed at addressing a version of Schmalensee’s (1985: 349) notion of contingent information, to wit: what does knowing about A tell you about B? In our case A was the performance position of industry, corporation, or business segment and B was the subsequent performance position of the business segment. Thus our measure of the importance of a factor was the degree to which knowledge of the performance position of the factor aided prediction of a business segment’s performance position.

ASSUMPTIONS

One of the points made in various ways in McGahan and Porter (2005) concerned the nature of assumptions. One of the most important of these is the assumption of ceteris paribus. This is a basic assumption in much of economic and strategic management research—so basic that it is often taken for granted and not invoked (Bierens and Swanson, 2000). But it does not have to be invoked to be applicable. In discussing ceteris paribus Black (1997: 58) notes, ‘All statements in economics include such a clause, either explicitly or implicitly: it is impossible to list all the things which could alter.’ The ceteris paribus assumption is also often embedded in the models and techniques we use in research, so the choice of technique includes the (hidden) baggage of adopting the assumption. In the discussion at hand, the ceteris paribus assumption is important because VCA embodies this assumption. The reason that genetics research using VCA employs a variety of genetic relations to provide a context for interpreting VCA results (Brush and Bromiley, 1997) is to try to better satisfy the ceteris paribus assumption.

Interpretation of VCA results in strategic management research usually eschews the contextual relations and directly equates importance of a factor with the size of its variance component. This equation is valid under the assumption of ceteris paribus and not necessarily otherwise.

A second area in which assumptions are smuggled into strategic management research by our choice of methodologies is with regard to the assumptions that accompany whole classes of statistical techniques. Parametric statistical techniques (to which class VCA belongs), the most commonly used, require assumptions about the nature of distributions and other population parameters. With regard to parametric statistical techniques Siegel and Castellan (1988: 3) state, ‘Such techniques produce conclusions which contain qualifiers, e.g., “If the assumptions regarding the shape of the population distribution(s) are valid, then we may conclude that . . .”’ These assumptions about parameters (e.g., distributions are Gaussian) and the subsequent qualifiers on results are very often not stated—for example in the reporting of VCA results. As a parametric technique a possible problem in the use of VCA is violation of normality (Allison et al., 1999). When the analysis is run on samples,
this is less likely—because of the central limit theorem—but may arise when population data are employed.

An alternative to using parametric statistical techniques and accepting their assumptions is to employ non-parametric statistical techniques. ‘Since populations do not always meet the assumptions underlying parametric tests, we frequently need inferential procedures whose validity does not depend on rigid assumptions. Non-parametric statistical procedures fill this need in many instances, since they are valid under very general assumptions’ (Daniel, 1978: 15). For these reasons non-parametric techniques were employed in Ruefli and Wiggins (2003) and thus our methodology, in contrast to most antecedent studies in the area, involved no parametric assumptions.

ORDINAL CATEGORICAL ANALYSIS

McGahan and Porter (2005) are correct in noting that, in comparison to using cardinal data, employing ordinal categories as in Ruefli and Wiggins (2003) results in the loss of some information. However, it should be noted that the cardinal to ordinal transformation also results in the loss of some noise—so while ordinal techniques may be less detailed, they may be more accurate. In McGahan and Porter (2005) in point seven it is stated that ‘This approach is fundamentally inaccurate because an observation with exactly the same level of profitability year after year may be categorized differently in each year. For example, an industry with exactly the same performance level in two years can be classified in different categories just because of differences in the other industries.’ A problem with the notion espoused in this quote is that to have an industry maintain its position vis à vis other industries simply by keeping its performance level constant strongly invokes an assumption of ceteris paribus. In the world of managers, where mutatis mutandis rules, constant levels of cardinal performance may yield improved, worsened, or constant ranking—depending on the performance of other business segments/corporations/industries. This notion of relative position is, in fact, central to strategic management (Porter, 1980, 1985) in the form of comparative advantage, relative cost position, etc. The use of ordinal categories in Ruefli and Wiggins (2003) was made in the spirit of the importance of relative position in strategic management and to avoid having to assume ceteris paribus.

VARIANCE EXPLAINED AS A MEASURE OF IMPORTANCE

McGahan and Porter (2005) assert that variance is an appropriate method of measuring performance differences. We agree with that—but with qualifications. First, if the objective is to measure the importance of a factor to the performance of a system, then dimensions involved must be clearly and consistently stated, particularly with relation to the dependent variable. Researchers employing VCA and ANOVA in the research area at issue have, at times, suggested that a larger coefficient on a variance component is an indication that the coefficient is more important to profitability when what is meant is that in the model the factor accounts for a higher proportion of variance in profitability. For example in the abstract of McGahan and Porter (2002: 834) it is stated that, ‘The purpose of the analysis is to identify the importance of year, industry, corporate parent, and business-specific effects on accounting profitability among operating businesses across sectors.’ On occasion the confusion is compounded by other researchers summarizing prior research. For example, Chang and Singh (2000) in discussing Schmalensee (1985) state, ‘He found that industry effects were the most important factor in explaining a firm’s profitability . . .’. In these studies, while the dependent variable in the equations is profitability, the results are in terms of variance of profitability—but are confusingly stated in terms of effect on profitability.

Even when is it clear that what is being discussed is amount of variance explained, there is a presumption that more variance explained is more important than less variance explained. (And because lower variance in the dependent variable associated with a factor means lower variance explained, there is a relationship between variance and variance explained.) Even if we grant that explaining more variance is preferred by researchers, we still must recognize that, for managers, more variance in profitability is not always desirable.

Examples of the confusion that the usual interpretation of variance components causes are evident in the strategic management literature involving VCA. For example, Rumelt (1991: 182)
states, ‘Given the extent of the literature on corporate strategy, corporate culture, the number of consulting firms that specialize in corporate management, and the focus on senior corporate leaders in the business world, it is surprising to find only vanishingly small corporate effects in these data. This result, first observed by Schmalensee, remains a puzzle and deserves further investigation.’ This quote makes the assumption that if a factor, e.g., corporate effects, is important, it should have a large variance component when, in fact, if some of the items cited in the first part of Rumelt’s quote are effective, the factor in question should have a small variance component.

In the same vein, McGahan and Porter (2005) note that including only diversified firms in this area of research biases results because diversified firms have lower variance in profitability. Revealed preference would suggest that a possible decrease in variance is likely one of the outcomes that motivates managers to diversify. If, as Rumelt observed, managers spend extensive amounts of time and resources managing corporate factors to reduce the variance of performance and if, as in point nine of McGahan and Porter (2005), they are successful, is there not a logical conclusion that for managers a small variance coefficient (reflective of lower variance in performance) on corporate effects is more important than a large coefficient? If researchers via a statistical technique attach more importance to higher variance in performance while managers of corporation attach more importance to lower variance in performance, we are then left with the dilemma of whose measure of importance should be employed in this area of research: that of researchers or that of managers.

Our reservations about variance analysis are not based only on the assumptions of random effects in VCA. Contrary to the assertion in McGahan and Porter (2005), point six, we do cite and acknowledge the contributions of Rumelt (1991) as well as McGahan (1999) (which we erroneously referred to as McGahan and Porter, 1999) and McGahan and Porter (1997, 2002, 2003)—although, in Ruefli and Wiggins’ (2003) article, we cited the latter two references as 2002a and 2002b, respectively. However, ANOVA techniques depend on the same assumptions of ceteris paribus, and rely on similar parametric assumptions, and therefore are subject to producing results with the same interpretation problems. Amount of variance explained by a factor in an ANOVA as a measure of importance raises the same ‘puzzle’ (to use the term in Rumelt, 1991) as does the size of a variance component.

MANAGERIAL EFFECTS

Our emphasis on allowing for the effects of managerial efficacy in our models was both for verisimilitude and because antecedent studies in this area had assumed them away with implicit ceteris paribus assumptions. We do not claim to be able to identify managerial drivers of performance (nor do our models rely on such drivers)—the nonparametric techniques and ordinal categories we employed merely allow for the possibility of managerial action, i.e., mutatis mutandis is assumed. Whether managerial actions (or inactions) increase or lower variance is not germane to our methodology—that is important is that our methodology accommodates such circumstances and generates the results in a robust and less ambiguous format.

PERSISTENCE

McGahan and Porter (2005) raise the issue of persistence in its third point. In Ruefli and Wiggins (2003), to determine the persistence of abnormal performance at each level, a relatively straightforward approach was adopted. Only abnormally high profits were examined and the probability of an entity leaving the superior performance strata in each time period was calculated—the lower that probability, the higher the persistence and vice versa. In contrast, the more usual autoregressive techniques (McGahan and Porter, 1999, 2003; Mueller, 1986; Waring, 1996) implicitly assume a priori that the objective is to determine the rate of decay of abnormal (both high and low) profits. Such techniques confound the behavior of superior, average, and inferior performers; i.e., they do not separate the rate of convergence of superior performers from that of inferior performers. So, in these traditional studies we don’t know, for example, how much of the persistence reported is due to poor performers continuing to underperform. Autoregressive techniques also require parametric

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1 What we cited as McGahan and Porter (2002a) was a working paper that is correctly referenced here as McGahan and Porter (2003).
assumptions, and do not (without adjustment of the data) compensate for overall trends in performance (i.e., they cannot tell whether inferior (superior) performers are converging to the mean or whether the mean is declining (rising) to meet the inferior (superior) performers). With respect to that last point, Barber and Lyon (1996) showed that the accounting performance data for corporate level in the COMPUSTAT database has been trending down over time. Table 1 shows the same trend for the data employed in Ruefli and Wiggins (2003) and in, among other studies, McGahan and Porter (1999).

AGGREGATION AND DIVERSIFICATION

In the comment’s eighth point it is stated that Ruefli and Wiggins (2003) ‘aggregate their data to the 3-digit level despite the availability of Compustat data at the 4-digit level.’ The point goes on to note that higher levels of aggregation in industry definition make it more likely that industry effects are obscured. In fact, as both the text and the results in Table 72 (Ruefli and Wiggins, 2003: 874) indicate, we analyzed the data at both 3- and 4-digit levels. Further, due to the robustness of our methodology, aggregation had only a slight effect on the size of our industry log-odds coefficient and no effect on its relative position or significance, with no significant effect on the model’s performance. Also, apropos of the ninth point in McGahan and Porter (2005) (though it correctly exempts Ruefli and Wiggins, 2003), wherein it is stated that using only diversified firms inflates the corporate effect, as the text and Table 7 (Ruefli and Wiggins, 2003: 874) indicate, we analyzed both diversified only and mixed samples and our methodology yielded no impact on the industry coefficient but a decrease in the size of the corporate log-odds coefficient—but, again, no change in its relative position or significance nor impact on the performance of the model. Thus our methodology is robust, not only in terms of level of industry aggregation, but also in terms of level of diversification in the sample.

CONCLUSION

Arriving at a determination of the relative importance of industry, corporate, and business segment effects of performance should be an important objective in strategic management research. We agree, for somewhat different reasons, with McGahan and Porter (2003b: 850) in their conclusion regarding further replications of VCA studies in this area: ‘While there are ways to continue to learn from this research, its limits suggest that the time has come to explore whole new approaches.’ In fact, Ruefli and Wiggins (2003) were clearly in this spirit, and clearly indicate there are both advantages and costs to employing whole new approaches that avoid the drawbacks of traditional methodologies. We avoided some confusion inherent in antecedent approaches and gained robustness and directness but lost the precision of cardinal measures and had to settle for much rougher ordinal categorical results. We join with McGahan and Porter in their call for additional new approaches that will shed more light on this important topic.

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REFERENCES


