

SUSTAINING COMPETITIVE ADVANTAGE: TEMPORAL
DYNAMICS AND THE RARITY OF PERSISTENT
SUPERIOR ECONOMIC PERFORMANCE

by

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ABSTRACT

In this research longitudinal data from two contrasting industries were stratified by levels of performance using a new methodology. Findings: (1) while some firms do exhibit superior economic performance, (2) only a small minority do so and (3) the phenomenon very rarely persists for long time frames.

Keywords: Competitive Advantage, Firm Performance

INTRODUCTION

One of the fundamental missions of strategic management research is to investigate and explain differences in performance among firms. The reigning incumbent explanation for the heterogeneity of firm performance is based on the concept of competitive advantage. This concept appeared in the strategic management literature in the early work of Ansoff (1965), but is probably most associated with the Harvard Business School and popularized by the work of Michael Porter in the early 1980s (Porter, 1979; 1980). More recently, in a special issue of the *Strategic Management Journal* on the search for new paradigms in strategy, the editor-in-chief wrote: “Competitive advantage has become for the field a central matter to understand and explain in terms of causality. It has not proven a simple task” (Schendel, 1994: 3). More recent work by Porter and others (Amit & Schoemaker, 1993; Barney, 1991; Conner, 1991; Ghemawat, 1986; Porter, 1985) has focused on the expanded concept of *sustained* competitive advantage, which, simply put, is the idea that some forms of competitive advantage are very difficult to imitate and can therefore lead to persistent superior economic performance (hence the subtitle of Porter (1985): *Creating and Sustaining Superior Performance*).

While there have been numerous theories and empirical studies of competitive advantage and its effect on firm performance, most of them have examined only limited time frames and almost none have addressed the important issue of the dynamics of the sustainability of the rewards of competitive advantage over long time frames. In other words, if it is in fact feasible to achieve a sustained competitive advantage, then one should observe persistence in superior economic performance over time. This research begins the effort to determine if this persistence is observed, and, if so, its incidence. Popular extant theories in strategic management, based on industrial organization economics (Porter, 1985; Porter, 1980) and the resource-based view of the firm (Barney, 1991; Conner, 1991) predict that factors that sustain competitive advantages generate superior economic performance that persists over time. On the other hand, historical economic theories such as neoclassical economics and the work of the Austrian school of economics (Jacobson, 1992; Schumpeter, 1934) as well as the hypercompetitive model (D'Aveni, 1994) of strategic management predict (for widely varying reasons) the opposite: that temporal dynamics, resulting from factors such as imitation, entry, and the introduction of substitutes, will erode almost all competitive advantages, thus preventing superior economic performance from persisting.

Whatever the theoretical underpinning, a common link in most of the research on competitive advantage is a focus on firm performance as the dependent variable. As a result of this focus, there has been considerable study of the nature of a wide range of independent variables that affect performance but little attention paid to the “topography” of performance itself (with a few notable exceptions, described below). This is akin to an epidemiologist studying the various factors that might affect a medical condition--without determining the incidence and prevalence of the condition in the population. This research attempts to shed additional light on the dynamics of the behavior over time of the primary dependent variable of strategic management research, economic performance, and in so doing reflect on the implications of those findings for strategic management theories.

While there have been few prior investigations into the topography of performance, there have been some worthy of note. Mueller (1986), in a time-series regression-based study of ROA (operationalized as variation from the mean ROA of the sample) for 600 large industrial firms over the period 1950-1972 utilizing COMPUSTAT and FTC databases, found that profit levels tended to converge toward the mean, but that the highest-performing firms converged the most slowly, and some of the high-performing firms’ profitability actually continued to increase over time. Jacobsen (1988), in a time-series regression-based study of ROI over the period 1970-1983 utilizing the PIMS SBU-level database, also found that profit levels converged over time, and concluded that “the conditions under which market forces do not drive return back to its competitive rate seem remote, if present at all” (Jacobsen, 1988: 415). Since both studies found that there was, in fact, some persistence of superior economic performance, the questions this research addresses as to the incidence and prevalence of such performance form a natural continuation of this line of research. By using a new methodology better suited to the identification of outliers, the present research avoids the use of autoregressive time series methodologies. Further, the time frame of this research, 1974-1993, complements the time period (1950-1972) studied by Mueller (1986). The present research also supplements the accounting measures of performance used in these prior studies with a market-based performance measure.

THE RESEARCH QUESTIONS

The primary empirical research question addressed in this research is: does superior economic performance persist over time, in a manner consistent with sustained competitive

advantage? If such persistence is found to exist (even if it is found to be rare), a set of derivative questions can also be investigated. How long does such performance persist? What fraction of firms in an industry exhibit persistent superior economic performance? If groups of firms exhibit this behavior, do the groups remain stable over time?

These questions are important both managerially and theoretically. From a managerial perspective, much of the published thinking on sustained competitive advantage implies that managers need to invest (perhaps considerable) resources in a search for an advantage and, if the search is successful, the firm can then reap consequent rewards, possibly over a long period of time. If, in fact, such rewards are difficult or impossible to sustain over time, then managers cannot condone extensive expenditures in the search for singular advantages, and must instead continually work to find new sources of temporary advantages in a sequence of short run circumstances (D'Aveni, 1994: 14-15).

From a theoretical perspective, there are competing disciplinary worldviews that address the idea of sustained competitive advantage. If, for example, competitive advantage can be demonstrated to be sustainable in the long run, then, in the extreme, economic theory needs to be adapted to encompass the idea. On the other hand, if competitive advantage is not sustainable, or only sustainable in the short run or the medium run, then strategic management theories need to be changed to reflect this reality. If competitive advantage is sustainable in the long run but is found to be very rare, this research would add to the growing impetus behind the resource-based view of the firm in strategic management research.

KEY CONCEPTS

The concept of competitive advantage has a long tradition in the strategic management literature. Ansoff (1965: 110) defined it thusly:

...(To) isolate characteristics of unique opportunities within the field defined by the product-market scope and the growth vector. This is the *competitive advantage*. It seeks to identify particular properties of individual product markets which will give the firm a strong competitive position.

South (1981: 15), drawing on the work of the McKinsey & Co. consulting firm in the late 1970s, defined competitive advantage as the “philosophy of choosing only those competitive arenas where victories are clearly achievable.” Much of the recent focus has been on sources of

competitive advantage; Porter (1985) states that there are, in general, only two possible competitive advantages a firm may possess, a cost advantage or a differentiation advantage. Others, particularly proponents of the resource-based view of the firm (Barney, 1991; Conner, 1991), have extended the definition to include a wider range of possible advantages such as physical capital (Williamson, 1975), human capital (Becker, 1964), technological opportunities and learning (Teece, 1980; 1983; 1986), and organizational capital (Tomer, 1987). For the purpose of this research, we will adopt the wider definition of competitive advantage as a capability (or set of capabilities) or resource (or set of resources) that gives a firm an advantage over its competitors which *ceteris paribus* leads to higher relative performance. This follows the definition offered by Besanko, Dranove, & Shanley (1996: 441) of competitive advantage as a firm outperforming its industry.

Received economic theory views superior economic performance as abnormal profits or rents, where rents are profits in excess of those predicted by equilibrium models (Bain, 1959; Klein, Crawford & Alchian, 1978; Ricardo, 1817; Schumpeter, 1934). This definition, however, assumes the existence of “normal” profits, which in turn assumes that the equilibrium model is valid. Rather than make any such assumption, this research will start with the less restrictive strategic management definition of statistically significantly above average performance relative to a reference set of comparable firms (typically an industry).

Of particular interest to strategists is the notion that advantages can be sustained for long periods of time yielding sustained superior performance. One of the more interesting aspects of conceptual discussions of this phenomenon is that they are fairly vague about what exactly is meant by “sustained.” Porter is the least ambiguous, and uses the phrases “long-term profitability” (Porter, 1985: 1) and “above-average performance in the long run” (Porter, 1985: 11) when describing the consequences of sustained competitive advantage, clearly implying that “sustained” in his usage is a long-term concept. Barney (1991), on the other hand, argues against the use of calendar time as a referent, and instead defines a sustained competitive advantage as a competitive advantage that “continues to exist after efforts to duplicate that advantage have ceased” (Barney, 1991: 102). While this latter definition is theoretically more precise, it is virtually impossible to meaningfully operationalize.

For the purpose of this research, we will adopt Porter’s approach, and use calendar time to determine if superior performance can be called “sustained.” Thus, persistent superior

economic performance is defined here as statistically significant above average performance relative to a reference set (such as an industry) that persists over a long-term period of calendar time (say, ten to twenty years). The time frame that determines the persistence of superior economic performance may vary from industry to industry depending on such exogenous variables as product life cycles, patent protections, copyrights, or other variables specific to an industry. For example, computer products generally have a product life cycle of only a few years, while auto parts and accessories have much longer product life cycles.

It is important to note that this research focuses primarily on the outcomes, superior economic performance and persistent superior economic performance, rather than the antecedents, competitive advantage and sustained competitive advantage. By studying the temporal dynamics of the outcomes associated with competitive advantage, however, we study the *raison d'être* of the construct.

THEORY DEVELOPMENT

Since almost all economic perspectives allow for at least temporary superior economic performance, they are all compatible with the concept of competitive advantage in the short run--where disagreements are possible is in the medium to long term. Neoclassical economics views superior economic performance as an aberration that goes away when equilibrium is achieved (Arrow & Hahn, 1970; Debreu, 1959). Both the structure-conduct-performance (SCP) industrial organization (IO) perspective (Bain, 1959; Mason, 1939; Mason, 1949) as well as the price theory industrial organization perspective (Stigler, 1968) allow for superior economic performance in the medium to long term as either the result of differing levels of industry profitability with entry barriers as the mechanism for protecting these abnormal profits (which is why price theory makes the distinction for contestable markets (Baumol, 1982), where entry barriers are not present) or within industries, due to the structure of the industry with concentration, particularly monopoly and oligopoly, and market share as primary determinants (Schmalensee, 1985). Evolutionary economics (Nelson & Winter, 1982) as well as the Austrian school of economics (see Jacobson (1992) for an excellent summary of the Austrian school) from which it draws, deem superior economic performance to be the result of cycles of innovation and entrepreneurial activity which will both create and then erode any advantages. Strategic management theories have adopted most of the potential explanations of the economic theories as

well as the resource-based view's concept of inimitable resources. The majority of the theories posit that the fundamental objective of the firm is profit maximization, which implies that all firms will seek a competitive advantage wherever possible in order to help achieve maximum profits. The resource-based view goes even farther, making the fundamental objective of the firm "above-normal returns" (Conner, 1991: 132).

Selecting neoclassical economics as the base case leads to the following proposition:

P1: No firm will achieve persistent superior economic performance over other firms in an industry (or reference set).

Should Proposition P1 be supported, as Jacobsen (1988) found, and no firm achieves persistent superior economic performance, that would be evidence favoring either the zero-profit equilibrium of neoclassical economics or very short cycles of competitive advantage and decline of Austrian and evolutionary economics. This research would be unable to continue as outlined, and additional research would be indicated to determine which of these theories offers the better explanation for the lack of persistence. Should at least one firm achieve persistent superior economic performance, as Mueller (1986) found, that would be additional evidence in favor of industrial organization economics, organizational economics, and strategic management theories. However, these theories predict different avenues for achieving such performance, and further proposition tests are necessary to determine which set of theories has the most support.

Both the SCP IO paradigm and evolutionary economics predict that sustained competitive advantage will be associated with industry concentration, so that a few large firms will be the beneficiaries of sustained competitive advantage. Strategic group theory (Hunt, 1972; Newman, 1973; Porter, 1973) predicts that a group or groups of firms following the same or similar strategies could be able to achieve sustained competitive advantage. The resource-based view of strategic management relates sustained competitive advantage to rare resources, which implies that persistent superior economic performance should also be rare. These four sets of theories all lead to the following proposition:

P2: Small numbers of firms will achieve persistent superior economic performance over other firms in an industry.

If proposition P2 is supported, the firms that achieve persistent superior economic performance must be examined relative to the industry or reference set to determine if industry concentration, the prediction of SCP IO and evolutionary economics, is associated with the performance. This will be examined as a sub-proposition P2b. In the absence of such concentration, an additional test can be performed to determine if strategic group theory from SCP IO economics (Hunt, 1972; Newman, 1973; Porter, 1973) is supported as the mechanism.

One of the assumptions of strategic group theory is that the strategic groups have predictive validity, i.e. firms in a strategic group have equivalent performance. If the firms demonstrating persistent superior economic performance, which form a group with equivalent performance, are in fact a strategic group, then the presence of mobility barriers (Caves & Porter, 1977) should make this group relatively stable, since other firms cannot readily change their strategies in order to enter the strategic group (Barney & Hoskisson, 1990). This leads to the following proposition:

P3: Groups of firms exhibiting persistent superior economic performance will remain stable in membership over time.

Both evolutionary economics (Nelson & Winter, 1982) and the Austrian school (Schumpeter, 1934) predict cycles of innovation followed by imitation and competition. Under these theories, different firms will experience various cycles of competitive advantage and decline, leading to turnover in the membership of the groups of firms exhibiting persistent superior economic performance.

If proposition P3 is supported, and industry concentration is not associated with the outcome from the test of proposition P2, then strategic group theory is supported. If industry concentration was found to be associated with sustained superior economic performance, then support for proposition P3 could be construed as only additional evidence of industry concentration. If proposition P3 is not supported, and industry concentration is not associated with the outcome from the test of proposition P2, then only the resource-based view of the firm offers a theory that explains all of the observed outcomes, and the argument that it is the rarity of resources that lead to sustained competitive advantage is supported. If industry concentration was

associated with the test of proposition P2, then contradictory evidence for proposition P3 offers additional support for Austrian and evolutionary economics.

METHODS

Data Sources. Data were collected from the COMPUSTAT PC-Plus data base for the twenty year period from 1974 to 1993 inclusive. The COMPUSTAT data bases have been widely used in both economics and strategic management inquiry because they are among the most comprehensive collections of financial data available. COMPUSTAT is limited to information on publicly held firms, and only limited line-of-business data are available. The former limitation is not severe, as most large companies in the U.S. are publicly held. The latter limitation has been viewed as a major drawback, but is accommodated in this research via sample selection and a methodological step to test the effects of the inclusion of diversified firms.

While a number of two, three and four-digit SIC industries, as well as non-industry samples (e.g., the *Fortune* 500) were examined, for purposes of explication two contrasting samples were extracted from the COMPUSTAT data base and are described below.

Variables. Economic performance was operationalized with two measures, an accounting measure, return on assets (ROA), and an economic measure, Tobin's q, the ratio of firm market value to the replacement cost of its assets. ROA, net income divided by total assets, was selected because much prior strategic management research has employed a measure of accounting returns, often ROA. Tobin's q was selected because some studies have found results to vary between accounting and economic measures (Hoskisson, Hitt, Johnson & Moesel, 1993). Tobin's q was operationalized as the ratio of market to book value. This ratio has been shown to be theoretically equivalent to Tobin's q (Varaiya, Kerin & Weeks, 1987) as well as empirically equivalent, with a correlation greater than 0.92 with all alternative operationalizations (Perfect & Wiles, 1992), and has been used previously in management research (Nayyar, 1993).

Superior economic performance was operationalized as statistically significant above average (relative to the industry or reference set) economic performance over a five year period, determined using the Iterative Kolmogorov-Smirnov stratification technique technique (Ruefli & Wiggins, 1994; Ruefli & Wiggins, 1996) described later in this section. A rolling five-year window window (Cool & Schendel, 1988; Fiegenbaum & Thomas, 1988) was used to create up to 16 distributions of returns for each firm for each of the two performance measures, which in

effect created 32 subsamples in both of the samples. Firms that did not have all five years of data in a period were excluded from the analysis for that period.

Industry Selection. Because some of the theories upon which this research is based focus on industry effects, selection of which industries to study is problematic. There are two main problems, (1) the general selection problem and (2) the diversified firm problem. The general selection problem was solved by selecting two contrasting samples. First, the Office Equipment and Computing Machines industry (SIC code 357) was chosen because it has been used in previous research into some of the effects to be studied, because it is known to be volatile and rapidly changing, and for reasons relating to the diversified firm problem, as explained below. The Auto Parts and Accessories industry (SIC 3714) was selected because it is stable and changes slowly, and could provide a contrast, as well as consisting of predominantly relatively non-diversified firms.

The second-mentioned problem is that the presence of diversified firms in a sample could potentially have an effect on the results. Since the primary statistical method to be employed focuses on mean and variances of returns, the diversification literature was searched to estimate the nature of the expected effects. With respect to the effect of diversified firms on the performance means, Hoskisson & Hitt (1990), summarizing some of both the theoretical and empirical literature, concluded that “a notable body of the research generally concluded that no relationship existed between firm diversification and performance” (Hoskisson & Hitt, 1990: 469), and our independent review of the literature reached the same conclusion. Thus mean returns should not be significantly biased in either direction by the inclusion of diversified firms. In terms of the variances of returns, Milgrom & Roberts (1992), following a long tradition, noted that firm diversification is designed to reduce risk (1992: 461), and defined risk as variance (1992: 461). In an empirical examination of diversification and risk (defined as variance) Amit & Livnat (1988) found, indeed, that diversification led to lower variances of returns. Thus the variances of returns should be biased toward stability (lower variances) by the inclusion of diversified firms. Further, the two industries selected contain a large number of single business or at least dominant-related firms in the sense of Rumelt (1974). However, to ensure that diversification was not an issue, an additional empirical test (described below) was conducted to test the effect of the inclusion of diversified firms and, as reported in the next section, no effect was found.

Proposition Testing. This research focuses on what is essentially an outlier or frontier phenomenon (Starbuck, 1993), superior economic performance. The fundamental problem faced in this research is the identification of the firms which exhibit this superior performance. All of the propositions developed depend on this identification. However, most statistical techniques are based on measures of central tendency, and focus instead on means and averages. In order to identify superior performers over time, a new methodology, based on an iterative application of the Kolmogorov-Smirnov two-sample test, will be used (Ruefli & Wiggins, 1994; Ruefli & Wiggins, 1996; Wiggins, 1995).

To initialize the Iterative Kolmogorov-Smirnov stratification (IKS) technique, proposition P1 will initially be assumed to be true, *i.e.*, it will be assumed that there is a single distribution of performance for the entire industry or reference set and that no firm has statistically significant superior performance. Each firm's distribution of performance levels for a period will then be iteratively tested against the group distribution of performance levels for that period using the nonparametric Kolmogorov-Smirnov two-sample test.

Firms which are found to have performance distributions that are different in a statistically significant ($\alpha = 0.05$) fashion from the group distribution will be set aside, and the process will be repeated until the stratum of firms sharing the main distribution stabilizes. The firms excluded from the main performance stratum will then be used as the basis for forming a second stratum, and the process will be repeated. This iterative process will continue until no further inclusions or exclusions can be made.

Note that, unlike cluster analysis, the IKS method does not predetermine the number of strata of performance distributions for an industry; strata emerge based on the characteristics of the data and the significance level established to discriminate between distributions. Further, the IKS methodology is, in Ketchen and Shook's (1996) terms, a polythetic divisive multiple-pass technique and, as such, mitigates against both the subjective involvement of the researcher and incompleteness of single-pass algorithms characteristic of traditional clustering techniques.

Strata Supersets and Category Validation with Discriminant Function Analysis.

While the performance strata developed by the Iterative Kolmogorov-Smirnov analysis form naturally ordered categories (Argresti, 1984) from high performance to poor performance that are statistically significantly different from each other, the possibility of varying numbers of

performance strata over time exists, making longitudinal comparisons difficult. Since we are only interested in the firms whose performance is above the industry or reference set average, as a form of *a fortiori* analysis (since it is conservative with respect to the propositions being tested), in each time period the number of performance strata will be compressed by to three by creating two supersets of strata: those above the modal stratum and those below the modal stratum. These two supersets, along with the modal stratum will form the basis for the analysis.

Because the performance strata are formed by distributions of firm returns which are not statistically distinguishable within the stratum, there is a potential for Type II error. While the overall probability of a Type II error is reduced due to the iterative testing in the process of the performance stratum formation, an additional statistical test is required to verify that no such error occurred. To validate the strata, discriminant function analysis (DFA) was used in a confirmatory mode with the Kolmogorov-Smirnov-derived supersets of performance strata as the grouping variable and the first moment of the distributions, mean, as the independent variable. Note that this differs from reports in the literature where DFA was employed to confirm groups generated by cluster analysis (e.g., Venkatraman & Prescott (1990)) in that both DFA and cluster analysis are parametric techniques that assume a multivariate normal distribution (Tatsuoka, 1988), whereas the Kolmogorov-Smirnov test is nonparametric and distribution-free.

The test of the propositions P1, that no firms will exhibit persistent superior economic performance will then be completed by examining the membership of the above-modal performance stratum over time to determine if any firms remain in this stratum for multiple overlapping time periods. Proposition 2, that small numbers of firms will achieve persistent superior economic performance, will be tested by examining the size of the above-modal performance stratum relative to the size of the industry or reference set. Proposition 2b will be tested by computing the market shares of any firms with sustained superior performance.

To test the propositions P3, that the stratum of firms exhibiting persistent superior economic performance will remain stable over time, ordinal time series analysis (OTSA), will be employed. OTSA is a technique based on state determined systems instead of measures of central tendency that is able to deal with the problem of missing observations such as firms coming into and going out of business (Collins & Ruefli, 1992; Ruefli & Wilson, 1990). OTSA information statistics (Collins & Ruefli, 1992) will be employed to evaluate transition rates between strata. Transition matrices and total weighted uncertainty statistics will be computed.

RESULTS

As the first step toward testing the propositions developed previously, the two sets of samples, the computing industry (SIC 357) and the automotive parts industry (SIC 3714) were stratified with the iterative Kolmogorov-Smirnov method. For each sample this method formed strata of

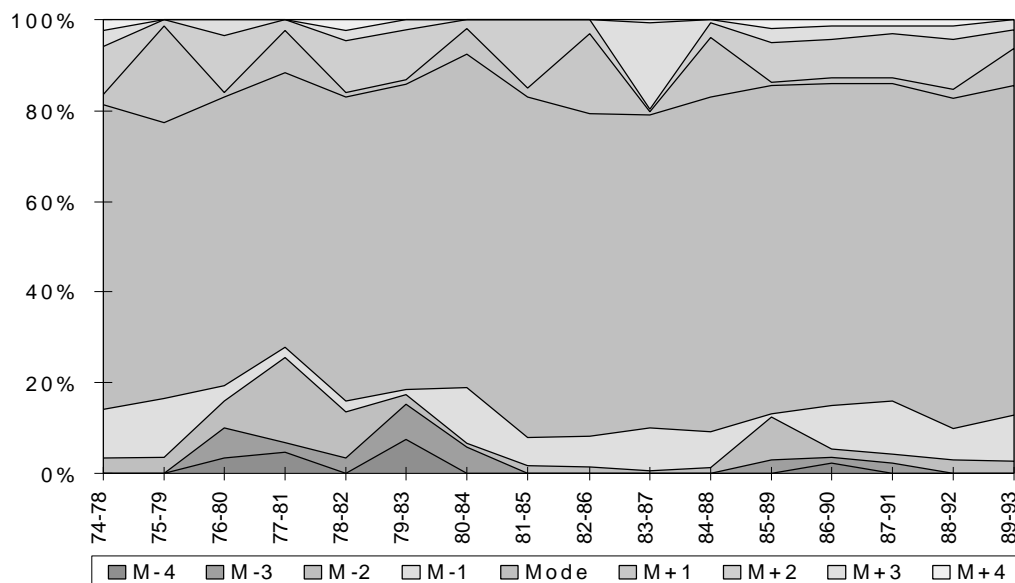


Figure 1 —Percentage of Firms in Strata Across Time SIC 357

statistically significantly different performance levels. The strata for SIC 357 ROA statistics which were derived are shown graphically across time in Figure 1. As can be seen from the figure, the number of strata varied, but within limits, across time; this was true for both measures, for both samples. For each of the samples examined, by each measure, in each period a significant fraction of the firms (roughly 60%) were categorized by the iterative Kolmogorov-Smirnov technique in the modal stratum. This figure agrees with the 63.6 % of firms in the modal stratum when 6541 firms in 56 industries were examined (Ruefli & Wiggins, 1994).

To generate the superset strata, those strata above the modal stratum were combined into the superior performance stratum, while those strata below the modal stratum were combined to form the inferior performance stratum. The superset strata are shown in the Appendix in Tables A1 through A4, which include the strata sizes, means, and standard deviations. The strata sizes are consistent between the two measures of performance. To validate the stratification supersets, DFA was employed in a confirmatory mode. For the computing samples, all of the discriminant functions were significant ($p < 0.05$) for both variables in all 5-year windows. In all four samples,

the fact that the superset strata discriminant functions were statistically significant demonstrates the validity of the superset performance strata.

The Effects of Diversification. Because the industry samples were based upon primary SIC code, some diversified firms that also conducted business in other SIC codes were included in these samples. To determine if the inclusion of the diversified firms materially affected the results for the non-diversified firms, the latter¹ were subsampled from the computing industry (SIC 357) ROA sample and the entire analysis described above was repeated on just those firms. Once again, all of the discriminant functions were statistically significant at least at the $p < 0.05$ level, and the average classification rate of over 60% was over two and one half times that expected by chance. To compare the classifications of the non-diversified subsample with those from the complete sample, each set of the observations was pooled and Cohen's kappa for interrater agreement was calculated. The two sets of analyses agreed on over 88% of the classifications with a value of kappa of 0.756 (with a standard error of 0.023 for an approximate z-score of 31.972, significant at the $p < 0.001$ level). Cohen's kappa was also computed for each 5-year window, and the results are shown in table A5 in the Appendix. In one period, the number of groups was unbalanced and kappa could not be computed, but in all the other periods kappa was significant at the $p < 0.001$ level, and in two periods the two analyses agreed on 100% of the classifications. With such high levels of agreement between the two sets of analyses, the inclusion of the diversified firms does not appear to materially affect the outcomes of the analyses, which is consistent with the conclusions of Hoskisson & Hitt (1990).

PROPOSITION ONE: PERSISTENT SUPERIOR ECONOMIC PERFORMANCE

To test proposition P1, the superset strata described above were examined to determine if any firms remained in either of the above average strata for multiple 5-year windows. In three of the samples, at least one firm remained in the above average strata for all 16 windows covering all 20 years of data. In the SIC 357 ROA sample, Hewlett-Packard alone achieved such truly

¹To remain consistent with prior diversification research, the coding was done strictly on SIC code classifications, even though this meant that many firms that would not be considered diversified by industry experts were in fact coded as diversified. For example, PC clone computer manufacturers such as Dell, Gateway 2000, Zeos, and others all report SIC codes for software, communications devices, and other add-ons which are ancillary to their main business.

persistent superior economic performance, as shown by the dark cells in Figure 2. Diebold and IBM each managed 15 years of superior performance.

Company	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89
	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
Apple Computer																
Cray Research																
DCA																
Diebold, Inc.																
Emulex Corp																
Hewlett-Packard																
IBM Corporation																
IIS Intelligent Info																
Intergraph Corp																
Intermec Corp																
NCR Corp																
SBE, Inc.																
Stratus Corp																
Tandem Computers																
Tseng Labs																
Revenue Share %	36	33	34	33	34	35	37	41	41	38	37	9	10	8	7	6
<i>without IBM</i>	2	2	3	3	4	5	5	9	9	9	9	9	10	8	7	6

Figure 2 — Office Equipment and Computing Machinery (SIC 357) ROA Sample Periods of Persistent Superior Economic Performance for 10 Years or more

Company	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89
	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
Augat Inc																
Clarcor Inc																
Modine Mfg Co																
Universal Mfg Co																
Revenue Share %	1	1	1	1	1	1	2	1	1	2	2	2	2	3	3	3

Figure 3 — Auto Parts and Accessories (SIC 3714) ROA Sample Periods of Persistent Superior Economic Performance for 10 Years or more

Company	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89
	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
Augat Inc																
Clarcor Inc																
Echlin Inc																
Gentex Corp																
Simpson Industries																
TRW Inc																
Revenue Share %	2	2	2	21	24	24	26	23	27	26	1	1	1	1	1	1
<i>without TRW</i>	2	2	2	3	3	3	4	2	4	4	1	1	1	1	1	1

Figure 4 — Auto Parts and Accessories (SIC 3714) Tobin's q Sample Periods of Persistent Superior Economic Performance for 10 Years or more

In the auto parts industry ROA sample, only Universal and Clarcor persisted in their superior performance (see Figure 3), and only Clarcor also achieved this result in the Tobin's q sample (Figure 4). In percentages, 0.35% of the SIC 357 ROA firms, 2.9% of the SIC 3714 ROA firms, and 1.72% of the SIC 3714 Tobin's q firms achieved 20 years of persistent superior economic performance.

Company	74 78	75 79	76 80	77 81	78 82	79 83	80 84	81 85	82 86	83 87	84 88	85 89	86 90	87 91	88 92	89 93
Codenoll Tech																
Cray Research																
Fingermatrix																
Intl. Totalizator																
Mylex Corp																
NEC Corp																
Pitney Bowes																
PSC Inc																
Stratus Corp																
Symbol Tech																
Threshold																
Voice Control																
Revenue Share %	0	0	0	5	5	5	6	6	6	8	9	11	11	10	11	1
<i>without NEC</i>	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1

Figure 5 — Office Equipment and Computing Machinery (SIC 357) Tobin's q Sample Periods of Persistent Superior Economic Performance for 10 Years or more

Only in the computing industry Tobin's q sample (Figure 5) did no firm achieve 20 years of persistent superior economic performance, although NEC remained in the above-average strata for 10 windows spanning 14 years. So in all 4 samples, clearly Proposition P1 is rejected. These results differ from the regression-based findings of Jacobsen (1988), who found, using ROI, that *all* abnormal profits decay over time, but concur with Mueller (1986), who found that some firms sustained profitability over the period 1950-1972.

PROPOSITION TWO: CONCENTRATION AND PERSISTENCE

Proposition P2 posits that small numbers of firms will achieve persistent superior economic performance. Figure 6 shows the numbers of firms achieving superior economic performance for multiple overlapping 5-year windows. As can be seen, between 20% and 25% of the firms in the four industry samples achieve statistically significant superior economic performance in at least two overlapping 5-year windows (i.e., 6 years) sometime between 1974

and 1993. As the number of periods increases, however, the proportion of firms who maintain such performance decreases rapidly.

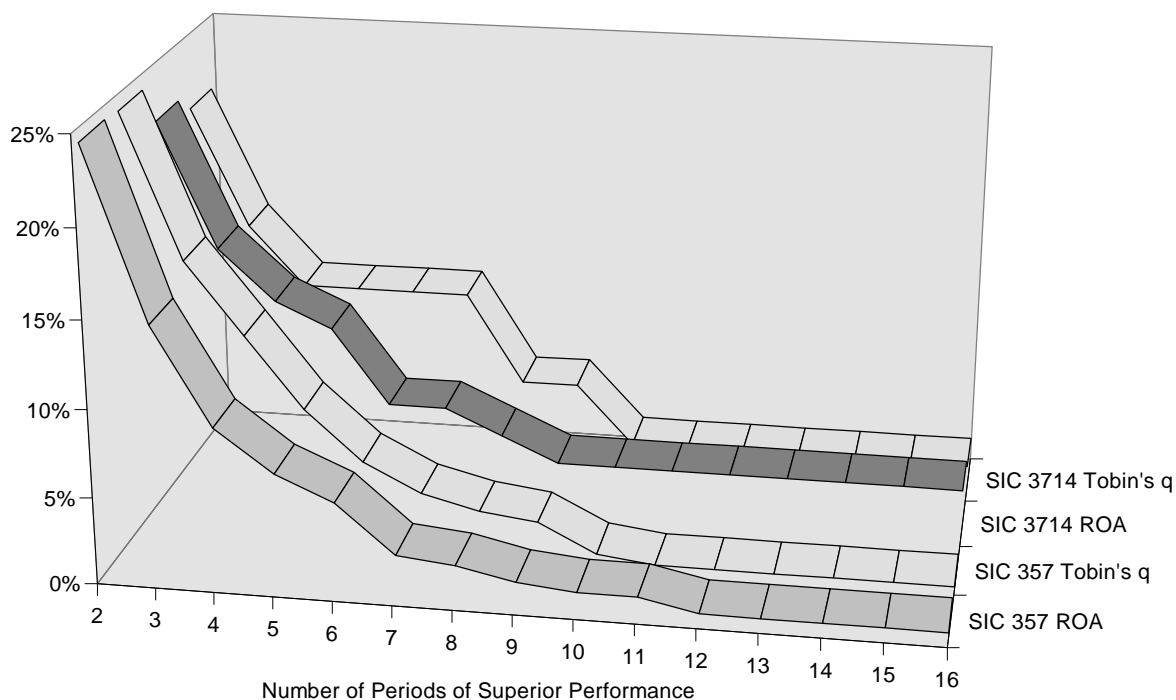


Figure 6 — Percentage of Firms Exhibiting Superior Economic Performance Over Multiple Time Periods

Two of the theories, SCP industrial organization and evolutionary economics, that predict the observed small numbers of firms exhibiting persistent superior economic performance in the industry samples do so on the basis of industry concentration (P2b). To examine whether this is in fact the mechanism that leads to the small numbers observed, the share of industry revenue for firms achieving 10 years or more of persistent superior economic performance was calculated and is displayed at the bottom of Figures 2 through 5. This revenue share was determined by summing the total revenues of all of the firms in the sample for each period and determining the proportion accounted for by the firms displayed in the charts. Because of the small numbers involved inspection alone was sufficient to test P2b.

For SIC 357, there does appear to be the predicted concentration effect in the ROA sample for the majority of the periods and also, to a much lesser degree, in the Tobin's q sample. However, in the ROA sample it is one company, International Business Machines, which accounts for virtually all of the apparent concentration, and in the Tobin's q sample, NEC Corporation does likewise to a much lesser degree. In the former case, the dominance of IBM

(but for only two-thirds of the periods), by itself, is support of the concentration proposition. In the latter case, however, the effect is much weaker, because NEC is one of the most highly diversified firms in the sample with substantial revenues from other industries.

In the SIC 3714 ROA sample (Figure 3), there is no evidence at all of industry concentration among the firms exhibiting persistent superior economic performance. The combined revenue share of the firms achieving persistent superior economic performance is never greater than 3%. The results for the Tobin's q sample (Figure 4) are similar those for the SIC 357 industry Tobin's q sample. Again one firm, TRW Inc., by itself provides all of the evidence of concentration (but for only seven periods), and again TRW is one of the most highly diversified firms in the sample. Given these results, the only support for the industry concentration proposition is in the SIC 357 ROA sample (Figure 2). These results are consonant with the regression-based work of Jacobsen (1988), who found no effect of concentration on the persistence of abnormal profits measured using ROI, as well as with the regression-based work of Mueller (1986), who found the effect of concentration in only a few industries.

PROPOSITION THREE: STABILITY AND PERSISTENCE

Proposition 3 was tested using ordinal time series analysis. In the state transition rate tables in this section that present the results of the ordinal time series analyses, the rows represent the prior period state (in this case, stratum), and the columns represent the subsequent period state (or stratum). The matrix elements therefore represent the probability of a firm moving from the row stratum in the prior period to the column stratum in the subsequent period. For example, in Table 1, the probability of a firm in the above average stratum (state or row 1) to the average stratum (state or column 2) is 0.246, as shown in the cell at row 1 column 2.

To → From	1	2	3
1	0.714	0.246	0.017
2	0.035	0.847	0.041
3	0.012	0.198	0.643

Table 1 — State Transition Rates for the Office Machinery and Computing Equipment (SIC 357) ROA Sample

Proposition P3 argued for stability in the membership of the performance strata over time. For the computing industry ROA sample, the only stratum that is close to stable is the average stratum, as shown in Table 1, with a probability of 0.847 that firms will remain in that stratum from period to period.

The results for the computing industry Tobin's q sample, shown in Table 2, are very similar. Again, the only stratum that is at all stable is the average stratum with a probability of 0.828 that firms will remain in that stratum from period to period.

To → From	1	2	3
1	0.688	0.212	0.027
2	0.035	0.828	0.045
3	0.064	0.225	0.642

Table 2 — State Transition Rates for the Office Machinery and Computing Equipment (SIC 357) Tobin's q Sample

The automotive parts industry has a slightly higher probability for the average performing stratum in the ROA sample, as shown in Table 3. More significantly, there is a relatively stable 0.782 probability of firms remaining in the top (well-above average) performance stratum. (Note, however, that even with a probability of 0.782 of remaining in the top stratum from one period to another, over two periods this probability drops to 0.61; over three periods to 0.48; and over four periods to less than 0.38.)

To → From	1	2	3
1	0.782	0.172	0.000
2	0.031	0.887	0.033
3	0.029	0.203	0.696

Table 3 — State Transition Rates for the Automotive Parts and Accessories (SIC 3714) ROA Sample

To → From	1	2	3
1	0.760	0.227	0.000
2	0.042	0.841	0.049
3	0.000	0.129	0.812

Table 4 — State Transition Rates for the Automotive Parts and Accessories (SIC 3714) Tobin's q Sample

In the automotive parts industry Tobin's q sample (Table 4), this apparent stability is again present in the above average strata. Again also, the average performance stratum is relatively

stable. Note also that the probability of remaining in the below average stratum is a relatively high 0.812.

In all of the samples the converse of proposition P3 (\sim P3) is supported, and the above average performing strata are not stable over time, with multiple firms entering and leaving the strata.

DISCUSSION AND IMPLICATIONS

The results of the proposition tests have interesting implications for both economics and strategic management perspectives on superior economic performance, as summarized in Table 5. The sustained competitive advantage notion of the SCP paradigm of industrial organization, which is also the foundation for much research in strategic management such as the work of Porter, receives almost no support from the results of this research. While the existence of persistent superior economic performance (\sim P1) and the small number of firms achieving it (P2) is in accord with SCP industrial organization and Porter's sustained competitive advantage, the mechanism by which SCP IO and Porter argue that this will occur, industry concentration, is only supported (P2b) in one of the industry samples, and there the concentration is due to the dominance of a single company. Porter's theory of strategic groups with mobility barriers and predictive validity is also not supported in these samples (\sim P3 and see also Wiggins & Ruefli, (1995)).

The prediction of neoclassical economics, the baseline model for many of the economic theories, is also not supported. The existence of long-term (20 years) persistent superior economic performance (\sim P1) in three out of the four samples is an indication that an equilibrium condition is not achieved.

Evolutionary economics and the Austrian school of economics fare somewhat better. The existence of very long-term (20 years) persistent superior economic performance (\sim P1) contradicts their long-term predictions, although the changing membership of the top two performance strata (\sim P3) are consistent with their predictions of cycles of innovation leading to periods of persistent superior economic performance. The small numbers of firms achieving persistent superior economic performance (P2), while consistent with evolutionary economics, does not directly support the theory because it is not associated with the predicted industry concentration (\sim P2b).

Theoretical Perspective	Supported By	Not Supported By
Economics		
1. Neoclassical economics		~P1
2a. SCP paradigm IO	~P1	P2, ~P2b, ~P3
2b. Price theory IO	~P1	
3. Organizational economics	~P1	
4. Evolutionary economics	~P3	~P1, P2
5. Austrian economics	~P3	~P1
Strategic Management		
6a. Porter	~P1	P2, ~P2b, ~P3
6b. Resource-based view	~P1, P2, ~P3	

Table 5 — Implications of Results for Theoretical Perspectives

The most favorable outcome for the theoretical perspectives is for the strategic management resource-based view of the firm, which is supported by the results of three of the proposition tests and which is not contradicted by the others. Persistent superior economic performance, which is the fundamental objective of the firm in the resource-based view, is found to exist (~P1), but is also found to be rare (P2), which is consistent with the concept of rare and valuable resources which lead to sustained competitive advantages. None of the supported propositions contradict the resource-based view of the firm.

Not surprisingly, the other perspectives which fare the best are price theory industrial organization economics and organizational economics, which both draw upon some of the same antecedents, e.g., transaction cost economics, as the strategic management resource-based view of the firm. These perspectives are also supported by the existence of persistent superior economic performance (~P1).

The findings of this research also have implications for strategy process research as well as the practice of management by firms. The fact that persistent superior economic performance is indeed rare, and that therefore the search for a single structural advantage such as proposed by Porter is unlikely to be successful, implies that the search for multiple small incremental advantages may be a fruitful alternative for managers to pursue and for strategy researchers to investigate. For example, Hewlett-Packard, the firm that achieved 20 years of persistent superior economic performance in the computer industry, is recognized for its multiple successive successful product innovations. It may be that the strategy *process* at Hewlett-Packard that has

led to such a series of successes is, in fact, their sustained competitive advantage (Adler, Riggs & Wheelwright, 1989; Bowen, Clark, Holloway & Wheelwright, 1994).

An aspect of this research which does not directly address any of the propositions but which points the way for some future examination is the large preponderance of firms in all time periods and in all samples that fell into the average or modal performance stratum. Over 60% of firms in all samples were statistically indistinguishable from the average. This large number of average firms, coupled with the relative symmetry of the sizes of the above average and below average strata, may offer an explanation for why previous research in economics using measures of central tendency (primarily regression analysis) found support for so many of the theories for which the present research failed to find support.

The temporal dynamics observed in this research also suggests that revisions to extant theories may be able to explain the observed behavior. As noted, well over half of all firms fall into the average stratum. The behavior of these firms is consistent with the neoclassical equilibrium model, although instead of converging on a point (where price equals marginal cost), they converge on a distribution. The variations around the mean of the average stratum, rather than representing simple random variation, could be explained by the more relaxed assumptions of organizational economics (Chandler, 1990; Cyert & March, 1963; Teece, 1983), with bounded rationality and complex preference functions accounting for the fluctuations. The few firms that achieve persistent superior economic performance are consistent with the predictions of the resource-based view of the firm. The entire system could be viewed as a homeostasis, with the average stratum representing the base state.

In such a homeostatic model, a few firms achieve superior economic performance, but the regulating mechanisms of Austrian and evolutionary economics, imitation and competition, constantly put pressure on these firms to return to the main group. A few firms also fail to achieve the performance levels of the homeostatic group, and end up in the below average strata, where most (if not all) firms are losing money. These firms must either return to the main group by becoming more efficient, or they continue the downward spiral and fail, becoming data points in ecological studies of firm non-survival. Some of the below average performers are firms investing heavily in attempting to achieve a competitive advantage (such as computer industry firms seeking technological advances), and if it is achieved they can make the transition directly to the above

average strata. The behaviors observed in this research are all consistent with such a complex homeostatic model of performance.

Limitations of the Research. The primary limitation of this research is its reliance on the corporate level data available in the COMPUSTAT data base, which is further exacerbated by potential industry identification problems caused by using SIC codes. On the other hand, the problem of diversified firms has been shown empirically to be not significant. Finally, while the results here have been replicated in studies of other industries and samples (e.g., the *Fortune* 500) during the same time period, there is no guarantee they will generalize to all industries or samples in all time periods.

Another limitation of this research is in the minimum time frame, five years, selected to represent superior economic performance. It may be that the appropriate time frames are shorter varying by industry or by competitive arena, and future research to examine this would be of interest. If, however, the appropriate time frames are longer than five years, the use of the rolling five year windows controls for this limitation. An associated limitation is that the data employed are both right and left-censored. However, they do cover two decades, and precisely the two decades in which the concept of sustained competitive advantage rose to prominence in strategic management.

Directions for Future Research. Although research by the authors has examined a number of industries with results very similar to those reported here, the most obvious direction for future research is to extend the methods used in this research to other industries, other samples, and other time periods. For example, since the analysis demonstrated that diversification did not materially affect the results, industries containing a large number of diversified firms could be studied. Examination of regulated industries would also be of interest. For example, a longitudinal study of the airline industry that spanned the periods before and after deregulation might be revealing. Also, replication over a longer time frame such as 30 or 40 years would be of great interest, particularly since this time frame would encompass the periods most heavily studied by the early empirical work in strategic management and would enhance the comparability of this research with prior investigations.

Because sustained competitive advantage was found to be limited to a handful of firms, and even for those firms further limited in temporal extent, future theoretical development will be

required to adapt theories of the firm to reflect this reality. Of all the theoretical perspectives examined in this research, only the resource-based view of the firm is consistent with all of the findings. It may be possible to construct a theoretical economic model, such as the homeostatic model proposed in the discussion section above, based on the richer and more relaxed assumptions of organizational and evolutionary economics that can account for the behaviors observed in the current research. Such a model might be able to integrate many of the theoretical perspectives that this research draws upon to develop a much more complex model of firm behavior that could predict the kinds of results found in this research.

In conclusion, by examining the topography of economic performance via a new data-driven technique that identifies superior economic performance, this research offers some important insights into the temporal dynamics of sustained competitive advantage. The avoidance of measures of central tendency allowed relationships which might have been obscured by averages to be highlighted, and the stratification technique employed resolved the problem of distinguishing superior economic performance. Implications for theories of strategic management are significant in that the revealed topography reveals an environment quite different in some aspects than that envisioned in several extant theories.

APPENDIX

Size	Mean	S.D.	Size	Mean	S.D.	Size	Mean	S.D.	Size	Mean	S.D.
74-78			75-79			76-80			77-81		
16	10.62	4.72	19	12.27	4.69	15	12.49	4.30	10	12.76	3.77
57	1.64	15.53	51	-0.19	22.50	56	2.05	21.25	54	5.48	13.96
12	-25.25	44.88	14	-12.47	37.12	17	-15.44	37.36	22	-17.64	37.27
78-82			79-83			80-84			81-85		
15	11.49	4.16	13	11.86	2.80	8	13.84	3.19	19	11.46	6.34
59	2.93	16.28	63	3.83	13.17	77	2.15	17.91	84	-1.61	29.28
14	-34.22	51.84	16	-45.37	62.05	20	-28.84	63.52	9	-56.12	55.78
82-86			83-87			84-88			85-89		
28	11.36	4.05	31	11.14	7.40	26	11.86	6.20	23	12.06	7.93
97	-3.79	34.12	102	-2.93	30.31	112	-2.98	26.12	116	-4.19	30.34
11	-57.35	61.12	15	-72.73	140.26	14	-62.15	56.21	21	-88.19	141.16
86-90			87-91			88-92			89-93		
23	12.63	5.75	23	12.51	9.71	28	13.33	6.76	21	14.14	7.88
117	-3.81	27.32	115	-2.72	19.67	119	-7.47	28.23	106	-4.64	25.30
25	-56.79	78.28	26	-64.02	152.72	16	-96.98	195.78	19	-70.00	167.60

Table A1 — Office Machinery and Computing Equipment (SIC 357) ROA Sample Superset
Strata Sizes, Means, and Standard Deviations

Size	Mean	S.D.	Size	Mean	S.D.	Size	Mean	S.D.	Size	Mean	S.D.
74-78			75-79			76-80			77-81		
6	6.00	7.21	1	19.55	9.04	9	13.11	34.29	11	13.83	34.50
33	2.11	2.73	38	1.93	4.68	36	1.94	4.75	39	1.88	3.84
14	0.58	2.35	12	0.82	0.29	12	1.02	1.53	9	0.82	0.31
78-82			79-83			80-84			81-85		
9	8.62	17.42	22	7.19	13.00	18	7.53	9.08	20	6.80	12.49
53	3.49	15.09	49	1.93	15.21	56	2.73	7.65	66	2.29	2.40
6	0.76	0.30	10	0.62	1.75	12	0.66	1.69	13	0.28	1.85
82-86			83-87			84-88			85-89		
19	9.52	27.40	14	8.49	14.98	17	6.84	8.33	22	6.26	37.23
71	2.49	2.80	99	2.68	11.65	94	2.68	12.62	98	2.31	12.49
13	0.97	0.57	15	0.38	2.31	20	-2.24	17.45	14	-4.86	21.89
86-90			87-91			88-92			89-93		
23	7.24	37.42	25	6.68	12.39	40	4.88	10.08	30	8.26	23.14
97	1.99	11.81	99	1.69	9.14	98	-3.98	117.98	78	1.69	4.12
17	-3.21	18.22	19	0.04	2.71	1	-7.09	6.50	11	0.32	1.83

Table A2 — Office Machinery and Computing Equipment (SIC 357) Tobin's q Sample Superset
Strata Sizes, Means, and Standard Deviations

Size	Mean	S.D.	Size	Mean	S.D.	Size	Mean	S.D.	Size	Mean	S.D.
74-78			75-79			76-80			77-81		
8	14.75	5.62	6	15.42	4.83	5	16.06	5.19	4	16.75	5.15
32	6.86	4.05	30	7.01	4.56	31	6.49	5.91	33	5.91	5.07
7	-10.58	20.47	7	-6.76	16.51	7	-5.69	15.80	5	-7.01	14.93
78-82			79-83			80-84			81-85		
4	16.63	4.23	6	13.07	5.18	5	12.03	5.12	6	12.89	4.99
34	4.16	7.90	28	3.67	5.99	28	3.93	5.50	25	4.53	5.36
3	-2.56	6.41	4	-8.82	32.96	4	-8.81	32.97	4	-9.60	32.90
82-86			83-87			84-88			85-89		
6	14.94	4.84	6	14.58	3.70	6	13.57	6.43	8	11.64	4.77
27	4.53	5.75	27	5.49	5.62	26	4.51	9.28	24	2.37	9.89
3	-16.05	40.42	4	-15.27	36.96	4	-11.13	26.07	3	-53.60	69.14
86-90			87-91			88-92			89-93		
8	8.58	15.04	4	11.69	5.43	5	13.92	8.84	7	624.62	3864.78
24	1.84	8.65	29	-5.77	68.63	28	1.19	10.06	28	0.53	22.52
4	-33.34	40.77	4	-36.69	33.81	6	-72.19	155.04	4	-22.93	37.38

Table A3 — Auto Parts and Accessories (SIC 3714) ROA Sample Superset Strata Sizes, Means, and Standard Deviations

Size	Mean	S.D.	Size	Mean	S.D.	Size	Mean	S.D.	Size	Mean	S.D.
74-78			75-79			76-80			77-81		
4	1.93	0.65	7	1.66	0.69	4	2.21	0.79	5	2.03	0.87
30	0.81	0.39	23	0.81	0.36	25	0.90	0.26	22	0.86	0.25
4	0.45	0.11	4	0.46	0.10	5	0.38	0.53	6	0.31	0.32
78-82			79-83			80-84			81-85		
5	2.06	0.89	5	2.16	0.93	6	1.96	0.83	6	2.36	0.90
22	0.82	0.32	21	0.91	0.42	22	0.90	0.43	20	1.06	0.50
4	0.25	0.29	5	0.25	0.28	2	0.02	0.28	2	0.17	0.39
82-86			83-87			84-88			85-89		
6	2.37	0.83	5	2.54	0.86	3	2.88	0.84	3	2.82	0.87
17	1.25	0.56	16	1.55	0.65	20	1.71	0.69	20	1.64	0.71
4	0.49	0.43	7	0.59	0.48	8	0.61	0.48	7	0.66	0.38
86-90			87-91			88-92			89-93		
3	2.50	0.78	7	2.19	0.70	6	2.69	0.99	4	3.63	2.23
19	1.45	0.65	17	1.15	0.49	15	1.79	1.54	19	2.00	1.49
9	-0.02	16.68	7	-1.62	17.34	11	-1.40	12.92	8	0.34	0.65

Table A4 — Auto Parts and Accessories (SIC 3714) Tobin's q Sample Superset Strata Sizes, Means, and Standard Deviations

Years	N	% Agreed	Cohen's kappa	S.E.	Approximate z-score
74-78	53	92.45%	0.84132	0.07000	9.90961●●●
75-79	48	85.42%	0.70186	0.10156	6.54569●●●
76-80	50	80.00%	0.59217	0.10013	7.23418●●●
77-81	46	95.65%	0.92434	0.05237	8.28698●●●
78-82	47	100.00%	1.00000	0.00000	9.07530●●●
79-83	45	93.33%	0.86540	0.06860	9.12686●●●
80-84	50	(1)	(1)		
81-85	48	100.00%	1.00000	0.00000	9.00464●●●
82-86	56	92.86%	0.81488	0.08797	8.22906●●●
83-87	60	95.00%	0.89853	0.05704	9.39579●●●
84-88	55	92.73%	0.82315	0.08437	7.98806●●●
85-89	49	95.92%	0.90180	0.06814	7.70481●●●
86-90	46	95.65%	0.91418	0.05958	8.03164●●●
87-91	33	93.93%	0.85806	0.09343	7.50128●●●
88-92	25	92.00%	0.77273	0.15250	6.38899●●●
89-93	21	95.24%	0.86538	0.13116	4.80048●●●
Pooled	732	88.80%	0.75617	0.02316	31.97211●●●

- p < .05
- p < .01
- p < .001
- (1) Groupings not comparable

Table A5 — Office Machinery and Computing Equipment (SIC 357) ROA Sample Strata Compared to Non-diversified Firms Subsample Strata

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