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THE IMPACT OF ALTERNATIVE OPERATIONALIZATIONS OF INDUSTRY STRUCTURAL ELEMENTS ON MEASURES OF PERFORMANCE FOR ENTREPRENEURIAL MANUFACTURING VENTURES

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Using a sample of 115 manufacturing ventures, this study examined elements of industry structure which prior theory and research in the fields of industrial organization economics, strategic management, and entrepreneurship suggest are the most important structural characteristics of industries. Future researchers should carefully select the particular operationalization of industry structure as our research demonstrates that the influence of industry structural elements on measures of firm performance is strongly dependent upon the particular operationalization utilized. In addition, measures of industry structure were found to have a differential impact on alternative measures of firm performance, suggesting that different performance measures are not interchangeable proxies for one another. © 1998 John Wiley & Sons. Ltd.

There have been an increasing number of studies in the field of strategic management which have integrated concepts from industrial organization economics into studies on the determinants of firm performance (e.g., Biggadike, 1979; Buzzell and Gale, 1987; Harrigan, 1981; Hambrick, MacMillan, and Day, 1982). It is widely recognized that improving firm performance is the primary purpose of strategic management (Schendel and Hofer, 1979; Venkatraman and Ramanujam, 1986). Prior research studies examining the influence of industry structure on the economic performance of business enterprises have used: (1) different measures and operationalizations of industry structure; and (2) different measures of firm performance. In addition, these studies have sometimes failed to provide strong theoretical justification for the measures and operationalizations utilized in such studies.

A discussion of different approaches to measuring industry structure used in prior research was provided by Kunkel (1991). In addition, a number of authors have discussed the variety of measures of firm performance used in prior research (Brush and VanderWerf, 1992; Cooper, 1993; Murphy, Trailer, and Hill, 1993). These differing approaches utilized in such studies have produced different and frequently conflicting results as to

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the relative influence of various industry structural elements on measures of firm performance. Thus, it is difficult to assemble a robust set of findings that can be used for guidance.

The primary purpose of this research was to examine the influence of alternative operationalizations of industry structural elements on alternative measures of firm performance. Specifically this research examined various measures and operationalizations of industry structural elements which prior research suggests are important; and then tested the influence of alternative operationalizations of three measures of industry structure on four different measures of firm performance which prior research suggests are important indicators of a firm's overall effectiveness and efficiency.

MEASURES OF INDUSTRY STRUCTURE

The structure-conduct-performance model of industrial organization economics developed by Mason (1939) and Bain (1956, 1959) proposes that industry concentration, the degree of product differentiation, and entry barriers are key determinants of economic performance. Bain states:

> Although [industry] concentration is the aspect of the structure of individual industries most frequently emphasized, there are other dimensions of structure which appear to have at least comparable importance. We may emphasize in particular *the degree of product differentiation* within the industry, and the *condition of entry* to the industry for potential new sellers. (1959: 210)

Bain also suggests that 'The "trend of demand" for industry output—whether it is secularly growing, declining, or remaining more or less stable ... might offer added explanations of observed differences in market conduct and performance' (1959: 265).

Caves supports Bain's theory regarding the primary structural characteristics of markets /industries, and states that the most important elements of industry structure are: '(1) seller concentration; (2) product differentiation; (3) barriers to the entry of new firms; and (4) growth rate of market demand' (1972: 16) In addition, Hofer (1975) theorizes that the stage of the product life cycle is the most important contingency variable influencing business strategy and firm performance.

Kunkel (1991) reviewed major theoretical and empirical works in the fields of industrial organization economics, strategic management, and entrepreneurship in order to determine the most important industry structural elements which influence industry and firm performance. Based on this review, Kunkel determined that the most important industry structural elements are life cycle stage, industry concentration, entry barriers, and product differentiation.

Prior theory and research in the field of industrial organization suggest that product differentiation is the largest source of entry barriers, particularly as a source of very high entry barriers (Bain, 1959; Caves, 1972; Mann, 1966). In addition, industry concentration and market growth rate/stage of the life cycle are often examined as sources of entry barriers. By contrast, Bain (1956, 1959) and Mann (1966) found that economies of large-scale plant are the least perceptible barriers to entry; and absolute cost advantages of established firms are not a frequent source of important barriers to entry.

In short, prior theory and research in the fields of industrial organization, strategic management, and entrepreneurship suggest that industry concentration, product differentiation, and stage of the life cycle are the three most important structural characteristics of industries. Entry barriers, exclusive of the degree of product differentiation, are a significant but somewhat secondary characteristic of market structure (Shepherd, 1975: 98). Therefore, this research examined the influence of: (1) industry concentration; (2) the degree of product differentiation; and (3) stage of the life cycle/industry growth rate on alternative measures of firm performance.

Prior research examining these elements of industry structure has utilized different operationalizations of these measures, often without providing strong theoretical justification for the particular operationalization chosen. In addition, these studies have produced frequently conflicting results with regard to the influence of industry structural elements on measures of firm performance.

This study sought to advance the understanding of the influence of industry structural elements on measures of firm performance. Thus, this study examined: (1) the three industry structural

elements which prior theory and research suggest are important structural characteristics of industries; (2) alternative operationalizations of these three industry structural elements which prior theory and research suggest are appropriate; and (3) the influence of these alternative measures and operationalizations of industry structural elements on multiple measures of firm performance.

MEASURES OF NEW VENTURE PERFORMANCE

There have been a number of strategic management studies which have explored the need for using multiple measures of economic performance (Bull, 1989; Chakravarthy, 1986; Kaplan, 1984; Venkatraman and Ramanujam, 1986). However, the majority of the research studies examining industry structure have utilized only one or two measure(s) of firm performance, while often failing to provide justification for the measure(s) selected.

Cooper noted that the diversity of performance measures which have been utilized in prior research makes comparisons across studies difficult. Cooper stated, 'We also need to understand more fully the effects of different performance measures and whether the factors that enhance performance vary according to the measure used' (1993: 251).

Prior theory and research in the fields of industrial organization, strategic management, and entrepreneurship suggest that measures of business performance based on (1) return on assets (ROA), (2) return on equity (ROE), (3) return on sales (ROS), and (4) sales growth (SG) are the most important/appropriate goals of business enterprises (Bourgeois, 1980; Chandler and Hanks, 1993; Murphy *et al.*, 1993; Venkatraman and Ramanujam, 1986). In fact these are among the most commonly used measures of firm performance in prior strategic management and entrepreneurship studies (Hofer, 1983; Murphy *et al.*, 1993).

Therefore, this research examined the influence of the three industry structural elements discussed above on these four measures of firm performance: (1) ROA, (2) ROE, (3) ROS, and (4) SG. It is acknowledged that other measures of performance such as EVA, MVA, market measures, and Hamel's (1997) recent suggestion of share of new wealth creation are also important indicators of business performance. Nonetheless, this study selected the four measures of business performance discussed above due to their primary importance in prior literature. In addition, the use of these four measures facilitates comparisons of this study's results with both prior and future studies on the influence of industry structure on alternative measures of firm performance.

HYPOTHESES

The industrial organization (IO) model, *(industry) structure → (firm) conduct → (industry) performance*, holds that industry structure determines or significantly affects industry performance. The unit of analysis in industrial organization is the industry, not the firms within a particular industry. Put differently, the focus of empirical research in industrial organization is on interindustry differences in performance, rather than differences in performance among individual business enterprises. As explained by Porter (1981), industrial organization theory implicitly assumed that all the firms in an industry were identical in an economic sense, except for differences in size.

In comparison, the unit of analysis in strategic management is the business enterprise, either a particular firm or a subsidiary/division of a firm. Therefore, it follows that strategic management studies typically examine interfirm differences in performance based on the influence of external variables (outside the direct control of the firm), internal competitive behavior variables, or both. In contrast to strategic management, industrial organization research typically does not examine the performance of firms within an industry or industries, but instead takes each industry as one observation with studies typically examining interindustry differences in market performance. As discussed by Jemison (1981), the difference in unit of analysis of IO and strategic management researchers has led to an emphasis on different types of data and research methods that has hindered efforts to compare results across disciplines.

There have been a large number of studies in the field of industrial organization which have examined the influence of interindustry differences in industry concentration, product differentiation, and, to a lesser extent, market growth

rate/stage of the industry life cycle on the overall profitability of various industries. As previously noted, there is substantial theory regarding the relative importance of these three measures as primary structural characteristics of industries. There is also a growing body of research in the field of strategic management which has examined the influence of these three industry structural elements on firm performance. However, the empirical evidence to date has often shown contradictory results with regard to interindustry and interfirm profitability differences based on these structural elements which may be due in part to the limitations discussed above. The results of some of the key studies examining the influence of these three industry structural variables on economic performance are discussed below.

Industry concentration

Industry concentration is theorized to be the most important industry structural element in the field of industrial organization (Bain, 1959; Caves, 1972; Koch, 1974; Mann, 1966). There have been a number of key industrial organization studies examining the influence of industry concentration on industry profitability (e.g., Bain, 1956; Brozen, 1970; Demetz, 1973; Mann, 1966; McGee, 1988; Stigler, 1968). In general, these studies have found: (1) that highly concentrated industries are the most profitable; and (2) little differences in profitability between industries with moderate vs. low levels of concentration. However, Brozen (1970) and McGee (1988) found statistically insignificant results between industry concentration and industry profitability. Thus, prior industrial organization studies have produced somewhat conflicting results with regard to the influence of industry concentration on industry performance.

While Hofer (1975) and Porter (1980) theorize that industry concentration is an important industry structural variable, there have been relatively few studies in the field of strategic management which have examined the influence of industry concentration as an autonomous variable on firm performance. The limited strategic management studies have frequently examined: (1) the influence of industry concentration on business strategy; and (2) the joint influence of industry concentration and business strategy on firm performance; neither of which are the focus of this study. Thus, these studies are not reviewed below. A summary of key strategic management studies on the influence of industry concentration on firm performance is provided in Table 1.

The findings shown in Table 1 reveal that there are substantial differences in the field of strategic management with regard to the influence of industry concentration on measures of firm performance. For example, two of these studies (Harrigan, 1981; Tsai, MacMillan, and Low, 1991) provide partial evidence that firms in highly concentrated industries are more successful. Conversely, two of these studies (Biggadike, 1979; McDougall, Robinson, and DeNiso, 1992) provide partial evidence that firms in industries with low concentration are more successful.

Those studies which utilized two measures of

Table 1. Prior strategic management industry concentration studies

Studies	Findings
Biggadike (1979)	Ventures entering industries with low concentration were more profitable than those ventures entering highly concentrated industries *No differences found for relative market share*
Harrigan (1981)	Firms in highly concentrated industries more profitable
Ravenscraft (1983)	*Industry concentration not related to firm profitability*
Marshall and Buzzell (1990)	*Industry concentration not related to firm profitability*
Kunkel (1991)	*Industry concentration not related to venture performance*
Tsai *et al.* (1991)	Ventures in highly concentrated industries achieve best market share gains *No difference found in return on investment*
McDougall *et al.* (1992)	Ventures entering highly concentrated industries experience slower market share growth *No difference found in return on investment*

performance found that the influence of industry concentration on firm performance differed according to the measure of performance utilized. These findings support prior calls for utilizing multiple measures of firm performance. These differing results between studies may also be attributable to the differing operationalizations of industry concentration utilized.

Despite these divergent findings, prior industrial organization and strategic management theory suggests that industry concentration is an important structural characteristic of industries. Thus, it is hypothesized that there will be statistically significant differences in venture performance based on the level of industry concentration in the venture's entered industry:

Hypothesis 1: There will be differences in venture performance based on the concentration of the venture's industry.

Prior theory and research (e.g., Bain, 1959; Mann, 1966) in the field of industrial organization suggest that highly concentrated industries are more profitable than industries with either moderate or low levels of concentration. In addition, prior theory and research (e.g., Harrigan, 1981; Porter, 1980) in the field of strategic management provide support that industries characterized by high concentration levels are more attractive.

Porter (1980) argues that highly fragmented industries lead to a higher degree of competition/competitive rivalry among firms, resulting in lower profit margins. Porter further notes that market leaders in highly concentrated industries can enhance profitability by playing a coordinative role through price leadership.

New entrants in highly concentrated industries with clearly defined market leaders have an opportunity to realize above-average profitability and sales growth objectives by serving neglected segments of the market. In addition, such new entrants may be of little interest initially to large established firms due to their relatively small size. Thus, it is hypothesized that:

Hypothesis 1a: Ventures in highly concentrated industries will achieve higher levels of performance than those ventures in less concentrated industries.

Product Differentiation

Product differentiation is theorized to be the second most important structural characteristic of industries (Bain, 1956, 1959; Caves, 1972). In addition, Bain (1956, 1959) and Mann (1966) found that product differentiation is the most important source of entry barriers, particularly for high entry barriers.

The most commonly utilized measure of the degree of product differentiation is advertising intensity. Two competing theories regarding advertising in the field of industrial organization are: (1) advertising eases the entry of new firms and products and increases competition; and (2) advertising builds and preserves monopoly power, creates barriers to entry, entrenches leading firms, and rebuffs new entrants who may offer superior products (McGee, 1988: 372).

Comanor and Wilson (1967) examined 3-digit industries producing consumer goods and found that industries with high advertising intensity earn higher rates of return on equity. Conversely, McGee (1988) discussed an alternative approach undertaken by Ayanian (1975) in which there was no statistically significant correlation between advertising intensity and industry profitability. Examining advertising intensity and industry profitability, McGee (1988) did not find a statistically significant relationship. McGee also noted that Bloch's study using FTC advertising and profit data for individual firms found that profits and advertising were unrelated. McGee further noted (1988: 371) that Nagle concluded '... final confirmation of advertising's competitive effect requires still further research.'

The influence of the degree of product differentiation in an industry on measures of firm performance has received scant attention in the field of strategic management. Prior research in strategic management has typically examined the degree of product differentiation, i.e., relative product quality/differentiation, as a competitive strategy variable. However, since this study focused on structural characteristics of industries as potential determinants of firm performance rather than on individual firm-level competitive strategies and tactics, these competitive strategy studies are not reviewed below.

In their examination of the frequency of new venture formations, Dean and Meyer (1996) did not find that product differentiation was an

important determinant. Conversely, Harrigan (1981) found that high industry advertising outlays increased the likelihood of new entrants into an industry. However Harrigan (1983: 88) later states, 'It would appear from this analysis that markets where advertising expenditures are high are less likely to be entered successfully.'

The strategic management studies of Sandberg (1986) and Kunkel (1991) which examined the influence of the degree of product differentiation in the firm's industry on firm performance have produced conflicting results. Sandberg (1986) found that ventures entering industries characterized by heterogeneous products achieved higher levels of performance than those ventures which entered industries characterized by homogeneous products. By contrast, Kunkel (1991) did not find statistically significant differences in venture performance based on the degree of product differentiation present in the venture's industry.

Despite these divergent findings, the vast majority of the prior theory in the fields of industrial organization and strategic management suggests that product differentiation is an important industry structural variable. Thus, it is hypothesized that:

Hypothesis 2: There will be differences in venture performance based on the degree of product differentiation present in the venture's industry.

Prior theory and research in the fields of industrial organization and strategic management offer conflicting viewpoints on whether firms are more successful in industries characterized by high or low degrees of product differentiation. Traditional industrial organization theory views high levels of differentiation in the industry as an important deterrent to entry. New entrants must spend heavily to overcome customer loyalty achieved by the established firms, thus reducing short-term profitability. Conversely, Porter (1980) argued that industries characterized by homogeneous products required new entrants to attend to cost and capacity considerations, which encourages retaliation against entrants and reduces venture performance.

In short, prior theory and research provides evidence that product differentiation is an important industry structural variable which should influence performance. However, prior theory and research offer conflicting evidence and guidance as to whether industries characterized by high or low degrees of product differentiation are more attractive. Thus, there could be an inverted U relationship between firm profitability and degrees of product differentiation in the ventures' entered industry, similar to some of the relationships Yip (1982) found in his study of entry barriers. Therefore, this study does not hypothesize whether ventures are more successful in industries with high vs. low degrees of product differentiation.

Stage of the life cycle/industry growth rate

Stage of the life cycle/industry growth rate is theorized to be an additional key structural characteristic in the field of industrial organization (Bain, 1959; Caves, 1972). Bain (1959) suggests looking at the 'trend of demand' in an industry as an important structural characteristic of individual industries. Porter (1980) argues that because rapid industry growth ensures that incumbents can maintain a strong financial performance, even though a new entrant takes some market share, an entrant into a rapidly growing industry may experience less retaliation. Also, Peltzman (1977) notes that rapid market growth can be beneficial for small firms in lowering costs and enabling such firms to more rapidly assimilate critical skills and knowledge needed for effectively competing in the marketplace. Rapid growth may also serve as an indicator of industry evolution (Sandberg, 1986). Shepherd (1975) discusses life cycles of industries as an important measure of structural change.

Spence provided further elaboration of the potential advantages accruing to ventures entering industries early in the life cycle:

> The learning curve creates entry barriers and protection from competition by conferring cost advantages on early entrants and those who achieve large market shares. These cost advantages are not permanent. But with moderately rapid declines in unit costs, they have significant impact on market shares and profitability. (1981: 68)

In new industries, i.e., early stages of the industry life cycle, the costs of entry may be much less than the costs would be for later entrants (Porter, 1980). There are initially few entry barriers and

no dominant oligopolists. Thus, early entrants may be able to erect entry barriers and gain monopoly profits. Specifically, new ventures entering industries in the introductory stage may realize the benefits of establishing: (1) product standards; (2) a reputation in the marketplace; (3) higher customer awareness; (4) switching costs; (5) control of scarce resources; (6) control of distribution channels; and (7) subsequent barriers to entry (Lieberman and Montgomery, 1988). Finally, industries in the early stages of development and growth provide an opportunity for new ventures to capture the new demand in markets which have relatively little likelihood of retaliation by established incumbents.

Research in the field of industrial organization examining the influence of industry life cycle stage/industry growth rate on industry profitability has been limited in comparison with other measures of market structure. In contrast to industrial organization, the field of strategic management has produced a relatively large body of research on the influence of stage of the life cycle and industry growth rate on firm performance.

Table 2 provides a summary of prior research which has examined the influence of stage of the life cycle and the industry growth rate on firm performance. The top portion of the table presents stage of life cycle studies, and the bottom portion represents studies on industry growth rate. Hambrick *et al.* (1982) delineate an important distinction between stage of the life cycle and industry growth rates:

> For most products, growth rates closely correspond with certain stages of the life cycle. The conceptual distinction is that each stage typically is attributed with characteristics in addition to growth rate, for example, customer adoption rates and the nature of competition. (1982: 511)

The stage of life cycle studies have used a variety of approaches for assessing the influence of stage of the life cycle rate on firm performance. Nonetheless, the vast majority of these studies found evidence of differences in firm performance based on the stage of the life cycle. Based on the prior theory and research, which support differences in firm performance based on the stage of the life cycle of the industry, it is hypothesized that:

Hypothesis 3: There will be differences in venture performance based on the stage of the life cycle in the venture's industry.

In addition, most prior theory and research suggests that firms which occupy or enter the introductory stage of the life cycle are more successful than firms which occupy or enter industries in later stages of the life cycle. Thus, it is hypothesized that:

Hypothesis 3a: Ventures competing in industries which are in the introductory stages of the life cycle will be more successful than ventures competing in industries in later stages of the life cycle.

With regard to the influence of industry growth rates on firm performance, Harrigan (1981), Miller and Camp (1985), Marshall and Buzzell (1990), and Siegel *et al.* (1993) found firm success was associated with entering rapidly growing markets. Using multiple measures of performance, McDougall *et al.* (1994) found that ventures in high-growth industries achieved higher sales growth, but not higher levels of return on sales. Therefore, it is expected that venture performance will be influenced by the industry growth rate. In addition, it is expected that ventures competing in rapidly growing industries will be more successful than those competing in slow-growth industries. Thus it is hypothesized that:

Hypothesis 4: There will be differences in venture performance based on the growth rate in the venture's industry.

Hypothesis 4a: Ventures competing in industries experiencing rapid growth will be more successful than ventures competing in slow growth industries.

METHODS

Sample

This research utilized a longitudinal research design for a cross-section of independent new ventures in various manufacturing industries. Specifically, the sample consisted of *high-potential independent new ventures* which had undertaken an initial public offering (IPO) within

Table 2. Prior strategic management life cycle/industry growth rate studies

Studies	Principal findings
Biggadike (1979)	Ventures entering industries in the introductory stage achieved higher relative market share than those entering growth stage; ventures entering moderately growing industries achieved superior profitability
Hambrick *et al.* (1982)	*Stage of the life cycle does not influence firm level return on investment*
Anderson and Zeithaml (1984)	*Stage of the life cycle does not influence firm profitability or market share*
Sandberg (1984, 1986)	Ventures entering industries in the development or growth stage were more successful
Buzzell and Gale (1987)	Firms in the early stage of the life cycle achieved superior performance
MacMillan and Day (1987)	Ventures entering industries in mature stage achieved lower levels of market share
Stuart and Abetti (1987)	Ventures entering industries in mature stage were more successful
Covin and Slevin (1990)	Ventures entering the growth stage were more successful on performance index *No difference in sales*
Kunkel (1991)	Ventures entering mature stage were more successful than those ventures entering development stage
McCann (1991)	*Stage of industry life cycle does not influence performance*
Tsai *et al.* (1991)	Ventures in early stages achieved best market share gains *No difference found for return on investment*
Harrigan (1981)	Firms in high-growth industries were more successful
Miller and Camp (1985)	Ventures entering rapidly growing markets were more successful than those entering slowly growing markets
Marshall and Buzzell (1990)	Firms in high-growth industries were more successful
Siegel *et al.* (1993)	Ventures entering high-growth industries achieve higher sales growth
McDougall *et al.* (1994)	Ventures in high-growth industries achieve higher sales growth *No difference found for return on sales*

the first 6 years of the venture's founding date. The choice of high-potential independent new ventures for our sample is important for several reasons. First, prior research (e.g., Birch, 1987; Kirchhoff and Phillips, 1988) indicates that most of the economic growth in the U.S. economy is a result of new venture formations and growth. In particular, Timmons (1994) suggests that the formation and growth of *high-potential* new ventures are responsible for the majority of this economic growth. Second, Cooper (1993) noted that research on independent new ventures offers many unexploited opportunities. Third, within the entrepreneurship literature it is well recognized that the choice of industry is critical to the new venture; in fact, so critical that choosing a growth industry is an investment decision criterion for many venture capitalists (MacMillan, Siegel, and Subba Narasimha, 1985).

Ventures in the manufacturing sector of the economy were chosen due to prior theory and research on firms in this sector of the economy in the fields of industrial organization, strategic management, and entrepreneurship, as well as the availability and applicability of the data for studying the relationships in this research. The final sample of high-potential independent new ventures in the manufacturing sector of the economy consisted of 115 ventures. The firms competed in 31 different 4-digit SIC code industries.

The ventures included in the final data base are not representative of all new ventures due to their availability of equity capital. This study's sample does offer comparability to other samples of firms undertaking IPOs. In particular, the average total assets (mean) prior to the quarter in which the venture went public was $11,324,000, which is very similar to comparable averages of $11,123,000 and $11,377,000 for studies conducted by Deeds, Decarolis, and Coombs (1997) and Burrill and Lee (1993).

It should also be noted that ventures included in the final sample were not a homogeneous set of firms with regard to pre-IPO characteristics such as revenues, net income, total assets, and total equity. Thus, the amount of the proceeds from the IPO which went directly to the venture (after fees and equity to shareholders) also exhibited substantial variation. The characteristics of this study's sample with regard to the aforementioned variables are shown in Table 3.

As shown in Table 3, this study's final sample exhibited substantial variation with regard to pre-IPO characteristics. Just under 49.6 percent of the ventures examined in this study had negative net income in the fiscal year prior to their IPO. In addition, between 10 percent and 15 percent of the ventures included in this study had a negative equity position and had failed to achieve any sales revenue prior to their IPO. In short, this study's final sample included success stories such as Sun Microsystems, Compaq, and Seagate, as well as eventual market failures such as Osborne Communications, Pinetree Computer, and Visual Technology.

Operationalization of variables

This study examined the influence of industry structural elements (i.e., industry concentration, product differentiation, and stage of life cycle/industry growth rate) on four different measures of venture performance. Most prior studies examining the influence of these industry structural variables have failed to provide strong theoretical justification for the particular operationalization(s) chosen. Thus, this study reviewed prior theory and research in the fields of industrial organization, strategic management, and entrepreneurship in order to determine the operationalizations with strong theoretical justification and the operationalizations which have been most frequently utilized in prior research.

Industry concentration

Bain (1956, 1959) was one of the early pioneers in the field of IO to examine the influence of industry concentration on industry profitability. Bain developed two different classification systems for the level of industry concentration which consisted of three and six categories respectively. Bain's (1959) first classification system was based on the eight-firm concentration ratio, and his second classification system was based on a combination of the eight- and four-firm concentration ratio. By contrast, Caves (1972) discussed a classification system based on a combination of the 20- and eight-firm concentration ratio which consisted of three categories.

Although the classic works in the field of industrial organization categorize industry concentration based on some combination of the eight-firm concentration ratio, the majority of the

Table 3. Sample characteristics

Characteristic	Lower quartile	Median	Mean	Upper quartile
Revenues for fiscal year prior to IPO	326,674	3,663,661	10,748,959	9,083,000
Net income for fiscal year prior to IPO	−912,000	5,500	−72,062	563,000
Total assets for quarter prior to IPO	1,202,000	5,385,000	11,324,157	10,542,000
Total equity for quarter prior to IPO	290,482	1,885,000	5,158,987	4,169,000
Proceeds of IPO to venture	4,416,000	7,392,500	14,304,996	12,429,051
Age of venture at time of IPO	31 months	42 months	41 months	49 months

research in the field of strategic management utilize the four-firm concentration ratio. For example, Biggadike (1979) provided one of the first strategic management studies on the influence of industry concentration on firm performance. Biggadike's three-category classification system, based on the four-firm concentration ratio, has also been used in subsequent studies (e.g., Kunkel, 1991; Robinson, 1995). The four operationalizations of industry concentration which prior theory and research suggest are appropriate and that are used in this study are shown in Table 4.

Product differentiation

The most commonly utilized operationalization of product differentiation in the field of industrial organization is the advertising intensity ratio, i.e., advertising expenditures divided by sales revenue. In addition, Bain (1959) and Caves (1972) suggest categorizing the degree of product differentiation in an industry based on whether the industry sells its product primarily to other industrial users or consumers, suggesting that products sold to industrial users are relatively undifferentiated, due to the ability of the buyers to make exact appraisals of the qualities of the different products available. Caves provided a further distinction among categories of product differentiation:

> If it pays for a producer to advertise, then it is very likely that he sells a differentiated product. This holds true almost by definition, since an undifferentiated product *is* one whose consumers cannot perceive any differences among brands. (1972: 20)

Yip (1982) and Harrigan (1981, 1983) were among the early researchers in the field of strategic management who examined product differentiation, and both authors utilized measures based on advertising expenditures. In addition, McDougall (1987) and Kunkel (1991) examined the advertising intensity (industry advertising /industry sales) as a measure of product differentiation, which combined with other subvariables to create a composite measure of entry barrier height.

Using a different approach, Buzzell and Gale (1987: 260) utilized a dichotomous categorization of product differentiation based on the PIMS data base responses to the question as to whether or not '. . . the products or services of this business are more or less standardized for all customers.' Finally, Sandberg (1984, 1986) and Kunkel (1991) classified the degree of product differentiation into three categories: (1) heterogeneous; (2) partially differentiated; and (3) homogeneous. These classifications were based on evidence of: (1) physical differences in products; (2) image differences in products; and (3) rates of changes in product technology.

This study utilized three approaches adopted from prior research to operationalize measures of product differentiation. The first two approaches involved utilizing measures of advertising intensity for categorizing degrees of product differentiation. The third approach categorized degrees of product differentiation consistent with the approaches utilized by Sandberg (1984, 1986) and Kunkel (1991).

More specifically, the first approach utilized a dichotomous categorization of the degree of product differentiation, as did Buzzell and Gale (1987). However, this study utilized the mean advertising intensity to classify industries into categories of high vs. low degrees of product differentiation. The second approach utilized a three-category classification of the degree of product differentiation, which is also based on the

Table 4. Industry concentration classification systems

Class	Ratio	Bain 3 category cut-points	Bain 6 category cut-points	Caves 3 category cut-points	Biggadike 3 category cut-points
Oligopoly	8-Firm		91–100		
	4-Firm		76–100		
High	20-Firm			75–100	
	8-Firm	70–100	85–90	50–100	
	4-Firm		65–75		75–100
High–moderate	8-Firm		70–84		
	4-Firm		50–64		
Moderate	20-Firm			Below 75	
	8-Firm	41–69		33–49	
	4-Firm				55–74
Low–Moderate	8-Firm		45–69		
	4-Firm		35–49		
Low	20-Firm			Not used	
	8-Firm	1–40	30–44	1–32	
	4-Firm		20–34		1–54
Atomistic	8-Firm		1–29		
	4-Firm		1–19		

advertising intensity of the industry. However, this approach utilized cut-points based on the recommendations of Bain (1956, 1959) and Caves (1972) regarding whether the industry sold its products primarily to other industrial users or consumers. More specifically, the cut-point of 0.5 percent for the homogeneous product classification converged with the type of industry characterized by sales to other producers (e.g., industrial machinery). The third approach is based on the classification system developed by Sandberg (1984, 1986) and subsequently utilized by Kunkel (1991). This approach is based on the product differences and product changes as discussed above.

An overview of the three operationalizations and the criteria utilized for classifying the degree of product differentiation present in the industry is provided in Table 5.

Stage of life cycle/industry growth rate

There has been very little examination of the influence of the stage of the life cycle/industry growth rate on performance in the field of industrial organization. By contrast, there have been a relatively large number of such studies in the field of strategic management. The majority of the strategic management studies have utilized the stage of the life cycle model, rather than the industry growth rate, as the stage of the life cycle categorization is based on both the market growth rate and additional information regarding customer acceptance of products. This study used two different measures of stage of life cycle and two different measures of industry growth rate.

Hofer (1977) suggested using a six-stage model of the life cycle (see also Hofer and Schendel, 1978). Sandberg (1984, 1986) utilized a six-stage model for his research, while Kunkel (1991) added a seventh stage to Hofer's model. In addition to market growth criteria, the seven stages are based on technological change in the product design and technological change in process design. Table 6 provides an overview of the market growth rate criteria utilized by Kunkel (1991) to classify the stage of the life cycle into the seven categories of the revised Hofer stage

Table 5. Product differentiation classification system

Class	2-Category advertising intensity ratio cut-points	3-Category advertising intensity ratio cut-points	Sandberg's 3-category product differences and change in product technology system
Heterogeneous	Ratio ≥ 1.1%	Ratio ≥ 1.0%	High
Partially differentiated	n.a.	0.5% < ratio < 1%	Moderate
Homgeneous	Ratio < 1.1%	Ratio ≤ 0.5%	Low

of the life cycle model. The revised Hofer seven-stage life cycle model was one of the two operationalizations of stage of life cycle used in this study.

The second operationalization of stage of life cycle came from the vast majority of prior stage of life cycle research in strategic management which has followed the approach based on the PIMS data base. The PIMS life cycle model contains the four stages of life cycle suggested by Shepherd (1975). The classification of the venture's industry into these four categories is based on the following criteria (Biggadike, 1979: 117):

1. Introductory: Primary demand just starting; many potential users unfamiliar with products.
2. Growth: Real growth 10 percent or more; technology and/or competitive structure still changing.
3. Maturity: Potential users familiar with products; technology and competitive structure stable.
4. Decline: Products viewed as commodities; weaker competitors exiting.

Table 6. Stage of the industry life cycle classification

Stage	Market growth rate	Change in growth rate
Development	Slight (positive, but less than population growth)	Little
Growth	Very large (greater than GNP growth)	Increases rapidly
Shakeout	Large (greater than GNP growth)	Decreases rapidly
Maturity	Moderate (less than GNP growth, but greater than population growth)	Decreases slowly
Saturation	Slight (positive, but less than population growth)	Little
Decline	Negative (less than zero)	Decreases rapidly, then slowly
Rejuvenation	Large (greater than GNP growth)	Increases slowly

While market growth rate is a key variable for classifying industries into the categories within both the Hofer (1977) and the PIMS life cycle model, the life cycle models also utilize other criteria for classifying industries into different stages. Hambrick *et al.* (1982) argues that the life cycle model is preferable to utilizing market growth rates in isolation, as the life cycle models capture more relevant information regarding market structure. Nonetheless, there have been numerous studies in the fields of strategic management (Hambrick and Lei, 1985; McDougall *et al.*, 1994; Miller and Camp, 1985) which have utilized market growth rates as an indication of industry structure.

Miller and Camp (1985), Hambrick and Lei (1985), Roure and Maidique (1986), and Siegel *et al.* (1993) utilized two categories of growth rate, based on whether the venture's industry was growing at 10 percent or more annually in real terms. However, Shepherd (1975) suggested using three categories of growth rate, which should include a category encompassing a category for a decline in market growth.

The first of the two market growth rate operationalizations used in this study utilized two categories of growth rates, high vs. low, based

on whether or not the venture's industry grows at more than a 10 percent annual rate in real terms. The second approach utilized three categories of growth rates: (1) high—market growing at 10 percent or more annually in real terms; (2) slow—market growing between 0 percent and 10 percent annually in real terms; and (3) negative—market growth rate declining in real terms.

New venture performance

This research examined the influence of the three industry structural elements on four measures of new venture performance which prior theory and research suggest are important: (1) return on assets; (2) return on equity; (3) return on sales; and (4) sales growth. The average of the first three complete fiscal years following a venture's initial public offering was used for each of these four measures. The use of 3-year averages is common in prior research (e.g., Sandberg, 1984, 1986; Kunkel, 1991). In addition, the use of 3-year averages smoothes out yearly fluctuations in the data, which are likely to be quite extreme with this sample of new ventures, while also providing measures which are more long term in nature.

Data sources

Multiple sources of data were utilized to operationalize the measures. Four-digit SIC codes were used in gathering industry information. Industry concentration ratios for each venture's entered industry was obtained from *Census of Manufactures Concentration Ratios in Manufacturing*, which is published by the U.S. Bureau of the Census.

Data for the two product differentiation operationalizations based on advertising intensity were drawn from the COMPUSTAT data base. Initial public offering prospectuses (IPOs) submitted to the Securities and Exchange Commission (SEC) between 1980 and 1987 were utilized to obtain information for classifying the remaining operationalization of the product differentiation industry structural variable. The IPO prospectuses of the individual ventures also provided information, exclusive of market growth rates, necessary for classification of the stage of the life cycle. Market growth rates were obtained from *Industry Norms and Key Business Ratios* compiled by Dun & Bradstreet Credit Services. Measures of venture performance were obtained from COMPUSTAT.

Data analysis

This study explicitly examined and tested the assumptions underlying the theoretical development of analogous parametric and nonparametric statistical techniques. The assumptions required for the appropriate usage of parametric analysis of variance and pairwise comparison procedures include: (1) normal distributions; (2) equal variances; (3) symmetric distributions; and (4) continuous distributions for the sampled populations of the dependent variables. By contrast, the appropriate usage of the nonparametric analysis of variance and pairwise comparison procedures requires continuous distributions for the sampled populations of dependent variables.

This study utilized distributional plots for testing the normality assumption required for the appropriate usage of parametric statistical tests of location. More specifically, this study examined five data plots to assess the distributional characteristics of this study's dependent variables: (1) histograms; (2) frequency distributions; (3) normality plots (plots of the empirical quantiles against the quantiles of a normal distribution); (4) box plots (comparative plots showing the minimum, maximum, lower quartile, median, and upper quartile of the dependent variables); and (5) stem and leaf plots (plots showing information similar to frequency histograms). Tukey (1977) and the SAS Institute (1988) provide further explanations of these plots.

This study also utilized three test statistics to assess the normality of this study's dependent variables: (1) Shapiro–Wilk test for normality; (2) measures of skewness; and (3) measures of kurtosis (see SAS Institute, 1988). In addition, test statistics were utilized to assess the validity of the equal variance assumption required for the appropriate usage of parametric tests of location.

The results of the entirety of these tests indicated that the normality assumption underlying the theoretical development of the parametric statistical techniques was substantially violated by this study's data due to skewness and kurtosis. In particular, the three profitability variables had skewness in the left (lower) tail while the sales change variable had skewness in the right (upper) tail. In addition, all four variables exhibited kur-

tosis, with the distributions less peaked than the normal distribution. Finally, all sampled populations of the dependent variables violated the equal variance assumption. Thus, the use of parametric statistical techniques is not valid for this study.

By contrast, the assumption of continuous distributions of the sampled populations required for the appropriate usage of the nonparametric statistical data analysis techniques was satisfied by this study's data. Therefore, this research utilized nonparametric techniques to analyze the relationships among industry structural elements and measures of firm performance. More specifically, the techniques that were used for nonparametric statistical data analyses included the Kruskall–Wallis analysis of variance procedure for testing the equality of medians from three or more samples and Mann–Whitney–Wilcoxon pairwise comparison procedure for testing the equality of medians.

RESULTS

The results of the tests of hypotheses in this study are presented in Tables 7–12. The format of the presentation of results may merit some explanation. The nonparametric analysis of variance results are presented in the form of *p*-values, which denotes the level of statistical significance. 'The *p*-value for a sample outcome is the probability that the sample outcome could have been more extreme than the observed one when $u = u_o$' (Neter, Wasserman, and Kutner, 1990: 12).

Gibbons (1985) and Daniel (1990) recommend presenting results in the form of *p*-values so that the reader can draw his/her own conclusion regarding the test results. In addition, the presentation of the results in the form of *p*-values facilitates the comparison of the levels of statistical significance generated for testing the influence of alternative operationalizations of industry structural elements on the measures of firm performance examined in this study.

When conducting nonparametric tests of overall comparisons involving three or more classes, Dunn (1964), Gibbons (1985), Daniel (1990), and Neave and Worthington (1988) recommend utilizing *p*-values of 0.15–0.25 to denote statistically significant results. Dunn states:

> On the general subject of $\propto$ I believe that in making multiple tests and comparisons, one might tend to use a value of $\propto$ considerably larger than the traditional 0.05. The advantage of using the overall level rather than making *p* tests each at a 0.05 level, say, lies in being able to communicate one's results better with an overall level. And so it seems that there is usually no reason to choose the level so high that substantial differences become exceedingly difficult to establish. (1964: 248)

Neave and Worthington further state, 'As a general rule, the higher the value of *k* [the number of classes] the larger the value of $\propto$ that should be used' (1988: 257). As Gibbons notes, 'As the number of comparisons increases, the overall level of significance is usually increased so that any possible single difference is more likely to be detected' (1985:182).

Consistent with the recommendations above, this study utilized a *p*-value of 0.25 as evidence of differences in venture performance based on the operationalization of the industry structural element under examination for the *analysis of variance* tests involving class sizes of *three or more*. For subsequent *pairwise* comparisons, this study utilized a *p*-value of 0.05 to denote statistically significant results, which is also consistent with the recommendations of Dunn (1964), Gibbons (1985), and Neave and Worthington (1988) for pairwise comparison procedures.

Table 7 contains the results (*p*-values) of the nonparametric analysis of variance test procedure for Hypothesis 1 regarding the influence of industry concentration on the four measures of performance examined in this study. Bain's (1959) three-category operationalization of industry concentration provided the strongest support of Hypothesis 1 regarding differences in venture performance based on the level of concentration in the venture's industry. This hypothesis is sup-

Table 7. Nonparametric analysis of variance results for industry concentration

	Industry concentration classifications			
Performance variables	Bain 3-category *p*-values	Bain 6-category *p*-values	Caves 3-category *p*-values	Biggadike 3-category *p*-values
ROA	0.23	0.49	0.48	0.83
ROE	0.14	0.13	0.13	0.77
ROS	0.15	0.29	0.42	0.65
SG	0.58	0.02	0.11	0.53

ported for three of the four measures of performances, utilizing a p-value of less than 0.25 as per the recommendations discussed above.

In addition, there is partial support for differences in venture performance for the six-category operationalization developed by Bain and the three-category operationalization discussed by Caves (1972), utilizing a p-value of 0.25. However, the three-category operationalization developed by Biggadike (1979) failed to support Hypothesis 1 regarding the influence of industry concentration. In short, it would appear that the three-category operationalization of industry concentration developed by Bain (1959) is a *superior* measure of industry concentration in its ability to discriminate between successful and unsuccessful ventures based on the level of concentration in the venture's industry for this study's data.

Based on the results of the nonparametric analysis of variance tests shown in Table 7, nonparametric pairwise comparison tests were utilized to determine if Hypothesis 1a is supported. Bain's three-category operationalization of industry concentration was chosen for these comparisons due to its superiority to the other operationalizations of industry concentration examined in this study. Pairwise comparison tests were utilized for the performance variables (ROA, ROE, and ROS) for which the analysis test produced p-values of 0.25 or less as discussed above.

This study expected that ventures in highly concentrated industries would be more successful than those ventures in less concentrated industries. The results shown in Table 8 provide partial support for Hypothesis 1a. More specifically, those ventures in the highly concentrated industries were significantly more successful than those in low-concentration industries for ROE and ROS, and approached significance for ROA. In addition, for ROS, ventures in high concentration industries were significantly more successful than those in industries with moderate concentration.

Table 9 contains the results (p-value) of the nonparametric analysis of variance test procedure for Hypothesis 2 regarding the influence of alternative operationalizations of the degree of product differentiation on performance. The nonparametric analysis of variance test procedure provides strong support for differences in venture performance based on the three-category advertising intensity operationalization of product differentiation developed in this study. More specifically, there are statistically significant differences in new venture performance measures of ROA, ROE, and ROS based on the degree of product differentiation in the venture's industry when utilizing the operationalization of product differentiation based on three categories of advertising intensity. Sales growth was not significant. The two-category advertising intensity operationalization of product differentiation and Sandberg's (1986) three-category operationalization of product differentiation failed to support the hypothesis regarding expected differences in venture performance. Thus, it would appear that the three-category advertising intensity operationalization of product differentiation developed in this study and supported by prior theory in industrial organization (Bain, 1959; Caves, 1972) is a *superior* measure of product differentiation in its ability to discriminate between successful and unsuccessful ventures for this study's data.

Prior theory and research offered bipolar views regarding the influence of the degree of product differentiation on performance. Due to the lack

Table 8. Pairwise comparison results for Bain's 3-category industry concentration measure

Performance variables	Industry concentration classification p-values	
	High > moderate	High > low
ROA	0.15	0.06
ROE	0.13	0.04
ROS	0.04	0.05

Table 9. Nonparametric analysis of variance results for product differentiation measures

Performance variables	Product differentiation classifications		
	2-Category advertising intensity ratio p-values	3-Category advertising intensity ratio p-values	Sandberg's 3-category system p-values
ROA	0.32	0.002	0.41
ROE	0.70	0.04	0.21
ROS	0.47	0.002	0.47
SG	0.28	0.53	0.83

of guidance from prior theory and research on the relative influence of the degree of product differentiation on new venture performance, no hypotheses were developed in this regard. However, the possibility of an inverted U relationship between degree of product differentiation and performance was discussed. Table 10 contains the results (p-values) of the nonparametric pairwise comparison tests for the three-category advertising intensity operationalization of product differentiation for ROA, ROE, and ROS.

The results provide support for an inverted U relationship between degree of product differentiation and performance. More specifically, those ventures in industries characterized by partially differentiated products were significantly more successful than those ventures in industries with homogeneous products for ROA, ROE, and ROS. The results were not significant for sales growth. In addition, new ventures which entered industries characterized by partially differentiated products were significantly more successful than those ventures which entered industries characterized by heterogeneous products for ROA and ROS. Finally, ventures entering industries characterized by heterogeneous products did not achieve statistically significant differences of venture performance when compared to those ventures which entered industries characterized by homogeneous products. Put differently, the ventures entering heterogeneous product environments did achieve somewhat higher levels of performance than those ventures entering homogeneous product environments, although the differences are not statistically significant.

Table 11 contains the results (p-values) of the nonparametric analysis of variance test procedure

Table 10. Pairwise comparison results for 3-category product differentiation classification

	Product differentiation classification p-values		
Performance variables	Partially differentiated > homogeneous	Partially differentiated > heterogeneous	Heterogeneous > homogeneous
ROA	0.0005	0.002	0.60
ROE	0.005	0.26	0.20
ROS	0.0005	0.003	0.38

Table 11. Nonparametric analysis of variance results for stage of the life cycle and industry growth rates measures

	Industry structural variables			
Performance variables	Hofer 7-stage of the life cycle p-values	PIMS 4-stage of the life cycle p-values	2-Category growth rate p-values	3-Category growth rate p-values
ROA	0.65	0.02	0.37	0.67
ROE	0.53	0.23	0.87	0.99
ROS	0.76	0.06	0.64	0.89
SG	0.54	0.48	0.60	0.19

for hypotheses regarding the influence of stage of the life cycle (Hypothesis 3) and industry growth rate (Hypothesis 4) on performance. There was no support for Hypothesis 3 using the seven stage of the life cycle operationalization. It should be noted that 80 percent of the ventures were classified as entering industries in the growth stage of the life cycle, possibly suggesting that the growth stage of the life cycle may be more attractive than other (later) stages of the life cycle. However, the small sample sizes in the remaining categories of the seven-stage model made it difficult to test the stage of life cycle operationalization using this sample. Using the PIMS four-stage model, Hypothesis 3 was supported for ROA, ROE, and ROS (using p-values <0.25 as discussed above). The results were not significant for sales growth. The PIMS life cycle model produced: (1) better differentiation among the industry structures entered by new ventures; and (2) stronger statistically significant results with regard to the influence of the life cycle on measures of new venture performance than the extended Hofer (1977) life cycle model.

The nonparametric analysis of variance test results for Hypothesis 4 are also shown in Table 11. The procedure failed to support differences in performance based on the real growth rate in the venture's industry. Thus, for this sample it would appear that the stage of the life cycle is a superior measure to industry growth rate in assessing the structural characteristics of the industry as argued by Hambrick *et al.* (1982).

Hypothesis 3a, that ventures in industries in the introductory stage of the life cycle would be

more successful than those ventures in later stages of the life cycle, was tested using the PIMS operationalization. In general, the results shown in Table 12 provide partial support for Hypothesis 3a. More specifically, ventures competing in industries in the introductory stage of the life cycle were significantly more successful than those ventures competing in industries in the maturity stage of the life cycle for ROA, ROE, and ROS. Again, the results were not significant for sales growth. In addition, ventures in the introductory stage achieved significantly higher levels of ROA and ROS than growth stage ventures.

DISCUSSION

Porter (1981: 609) argues, 'The traditional Bain/Mason paradigm of industrial organization (IO) offered strategic management a systematic model for assessing competition ... IO should now be of central concern to policy researchers.' Subsequent studies in the field of strategic management have heeded Porter's call, and attempted to integrate such concepts into research as an explanation of firm performance. However, prior research in strategic management has sometimes used approaches with regard to examining the influence of industry structural variables on firm performance that do not have strong theoretical justification. More specifically, a large number of prior studies have sometimes failed to provide strong theoretical justification for: (1) the measures of industry structure examined; (2) the approaches utilized to operationalize the measures of industry structure examined; and (3) the measures of firm performance selected. Thus, it is not surprising that the empirical findings to date have produced limited and often conflicting results with regard to the influence of various industry structural elements on firm performance.

Table 12. Nonparametric pairwise comparison results for PIMS stage of life cycle measure

	Stages of Life Cycle P-Values		
Performance variables	Introductory > growth	Introductory > maturity	Introductory > decline
ROA	0.006	0.01	0.08
ROE	0.16	0.05	0.24
ROS	0.02	0.02	0.06

This research demonstrated that the influence of industry structural elements on measures of firm performance is strongly dependent upon the particular operationalization utilized for various industry structural elements with this study's data. In addition, this study found that measures of industry structure have a differential impact on alternative measures of firm performance, suggesting that such performance measures of firm performance are not interchangeable proxies for one another.

This study examined elements of industry structure which prior theory and research in the field of industrial organization suggest are the most important structural characteristics of industries. In addition, the field of strategic management offered further support for the importance of the three industry structural elements examined in this research: (1) industry concentration; (2) product differentiation; and (3) stage of the life cycle/ industry growth rate. This study provides support for differences in venture performance based on all three of these industry structural elements.

Four operationalizations were utilized to assess the influence of industry concentration on measures of venture performance. This study found the three-category operationalization of industry concentration developed by Bain (1959) to be the superior measure of industry structure for discriminating performance for this study's data. In addition, this study found the six-category operationalization developed by Bain (1959) and the three-category operationalization discussed by Caves (1972) to be superior operationalizations of industry concentration when compared to the approach utilized by Biggadike (1979) for this study's data. The cut-points of industry concentration suggested by Biggadike resulted in the classification of 105 of our 115 ventures into the low-concentration industry category. This suggests that the four-firm concentration ratio of a 55 cut-point for classifying firms as low concentration developed by Biggadike, and later utilized by Kunkel (1991) and Robinson (1995), is too high for samples such as ours. Thus, had this study unquestioningly adopted the operationalization of industry concentration developed by Biggadike (1979) and used in subsequent

research, no differences in venture performance would have been attributed to industry concentration. Rather, this study found that new ventures competing in highly concentrated industries achieved superior levels of profitability performance. This finding supports prior theory in the field of IO and strategic management regarding the higher returns available to firms in highly concentrated/less fragmented industries.

This study utilized three operationalizations to assess the influence of product differentiation on measures of performance. The three-category operationalization of product differentiation, based in part on the advertising intensity ratio which was developed in this study and supported by prior IO theory (Bain, 1959; Caves, 1972), was found to be a superior measure of industry structure for differentiating performance among the three operationalizations examined for this study's data.

For this sample, the three-category operationalization of product differentiation developed by Sandberg (1984, 1986), and later used by Kunkel (1991), and Robinson (1995), did not differentiate performance among the degrees of product differentiation in the venture's entered industry. The use of this classification system resulted in 111 of the 115 ventures being classified as entering industries characterized by heterogeneous products. Thus, it is not surprising that this classification system did not produce statistically significant results, even though this substantially contradicts prior theory in the field of IO.

The two-category operationalization of product differentiation sometimes utilized in prior research can mask differences among performance due to using the mean as a cut-point. In addition, the two-category classification system would fail to detect an inverted U relationship between degrees of product differentiation and measures of new venture performance. Thus, had this study adopted the operationalization of product differentiation based on either the two-category advertising intensity ratio operationalization of product differentiation used in prior research or Sandberg's (1984, 1986) three-category operationalization, no differences in venture performance would have been attributed to product differentiation. Rather, this study found an inverted U relationship between new venture performance and the degree of product differentiation, similar to some of the relationships found by Yip (1982). Put differently, ventures competing in industries characterized as having partially differentiated products outperformed those ventures competing in industries which had either a high or low degree of product differentiation.

This finding offers a 'midrange' theory regarding the influence of the degree of product differentiation on venture performance. As noted by McGee (1988), IO provides two conflicting theories and viewpoints regarding the influence of the degree of product differentiation. One holds that high degrees of product differentiation ease the entry of new firms and products. The competing viewpoint is that high degrees of product differentiation entrench leading firms and rebuff new entrants who may offer superior products.

The results of this research suggest that industries characterized by either high *or* low degrees of product differentiation may be less attractive than industries characterized by partially differentiated products. Industries with high degrees of product differentiation may result in lower performance for young firms due to the necessity of substantial advertising expenditures over a number of years before overcoming buyer loyalty advantages of established firms. Conversely, industries with low degrees of product differentiation would likely be characterized by commodity products on which the primary basis of competition is price, thus reducing (potential) profit margins.

The final industry structural element examined was stage of the life cycle, or the closely related measure of industry growth rate. The PIMS's stage of the life cycle was found to be the superior differentiator of performance for this study's sample over the extended Hofer (1977) life cycle operationalization and both of the industry growth rate operationalizations. The results support the argument of Hambrick *et al.* (1982) regarding the superiority of stage of the life cycle to industry growth rates as an indication of market structure, due to the life cycle's inclusion of additional information as criteria for classification.

New ventures competing in industries in the introductory stage of the life cycle were the most successful. This finding supports prior theory regarding the advantage of early entrants in developing industries as well as other studies which have found that new ventures are more

successful when entering industries early in the life cycle.

This study also examined the influence of industry structural elements on multiple measures of performance which prior theory and research in the fields of industrial organization, strategic management, and entrepreneurship suggest are important. Measures of industry structure were found to have a differential impact on alternative measures of firm performance. Most striking was the lack of general support for the sales growth measure in comparison to the three profitability measures (ROA, ROS, and ROE). One possible explanation for the lack of support for the sales growth measure could be the pressures placed on these new ventures, which have just recently undertaken an IPO, by the external credit market to attain profitability. This could be especially important as nearly half of the ventures had failed to achieve profitability prior to their IPO. This finding offers support for the use of multiple measures of performance which convey different information.

It is recognized that this study's sample of high potential independent new ventures is not typical of all new ventures due to their access to relatively large amounts of equity capital raised through an IPO. Conversely, these *independent* ventures did not have access to capital resources of a parent company, which differentiates them from *corporate* ventures contained in the PIMS start-up data base. However, it should be noted that Shrader and Simon did not find a relationship among venture resources and venture performance, and suggested that the 'leverage of existing resources may be more important than the possession of any given resource' (1997: 63).

Although this study's sample did share some commonalties with other samples of ventures which had undertaken an IPO (e.g., Burrill and Lee, 1993; Deeds *et al.*, 1997), the results are not necessarily generalizable to all firms. Thus, future research should attempt to cross-validate these results on other samples of new ventures such as corporate-sponsored ventures and independent new ventures which have not undertaken an IPO, as well as other samples consisting of larger and more mature business enterprises.

While the primary purpose of this study was to provide an examination of the impact of alternative operationalizations of industry structural elements on measures of firm performance, we also performed some supplementary analysis on the data to test for the possibility of interaction effects between the industry structural elements on measures of firm performance. In order to explore the interaction effects, we used a nonparametric ANOVA procedure with ranked performance measures. We explored the following three possible interactions: (1) stage of life cycle (PIMS measure) and concentration (Bain three-category measure); (2) stage of life cycle (PIMS measure) and product differentiation (three-category advertising intensity measure); and (3) concentration (Bain three-category measure) and product differentiation (three-category advertising intensity measure).

Neter *et al.* noted, 'Typically, interaction effects are smaller than main effects' (1990: 691). Thus, it is not surprising that single main effect industry structural variables were sufficient to predict performance differences in many instances. More specifically, this study found that product differentiation and stage of industry life cycle did not interact to influence any of the three profitability variables examined. Nor did product differentiation and industry concentration interact to influence either ROA or ROE. However, the tests of interactions did yield some interesting results. While our earlier nonparametric analysis of variance tests of concentration (Table 7), product differentiation (Table 9), and stage of industry life cycle (Table 11) did not reveal a significant impact on sales growth, each of the three interactions we examined were significant for sales growth. Also, the interaction of concentration and product differentiation was significant for ROS. More closely examining complex interrelationships such as interaction effects holds promise for providing further explanations of performance differences among business enterprises.

Overall, the findings of this study suggest that future researchers should carefully select the particular operationalization of the industry structural elements chosen for examination. In addition, the findings suggest that future researchers should utilize multiple measures of firm performance since alternative measures of firm performance are not necessarily interchangeable proxies for one another. While industry structural elements were found to impact performance, differing operationalizations discriminated performance at varying levels of sig-

nificance. The identification and the testing of varying operationalizations of the most important industry structural elements on multiple measures of firm performance provide important guidance to researchers which has been lacking previously.

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