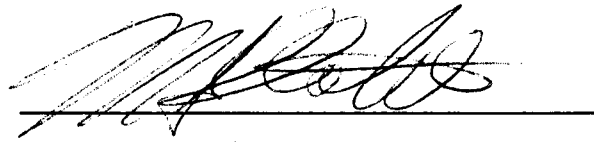


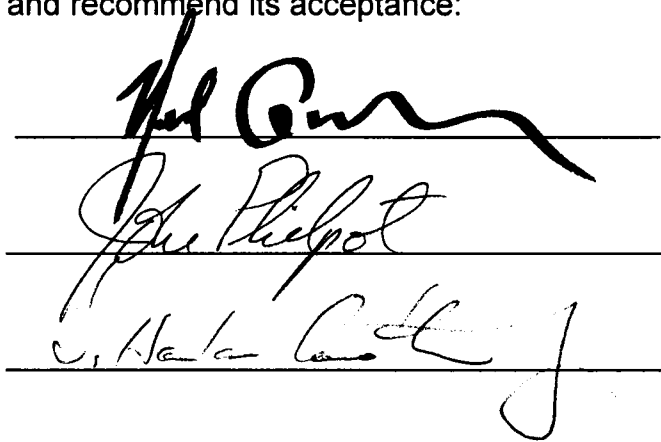
To the Graduate Council:

I am submitting herewith a dissertation written by Mark Gerard Spitzfaden entitled "The Role of Competitive Strategy in the Success of Initial Public Offerings of Stock: A Game Theoretic Examination of the Evolution of Strategy within Competitive Groups in the Southwestern United States." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business Administration.



Dr. Michael J. Stahl, Major Professor

We have read this dissertation
and recommend its acceptance:



Accepted for the Council:



Associate Vice Chancellor
and Dean of The Graduate School

**THE ROLE OF COMPETITIVE STRATEGY IN THE
SUCCESS OF INITIAL PUBLIC OFFERINGS OF
STOCK: A GAME THEORETIC EXAMINATION
OF THE EVOLUTION OF STRATEGY WITHIN
COMPETITIVE GROUPS IN THE
SOUTHWESTERN UNITED STATES**

A Dissertation

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Doctor of Philosophy

Degree

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Mark Gerard Spitzfaden

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ABSTRACT

This study examines how a firm's competitive strategy, relative to that of its direct industry rivals, can predict market performance. A game theoretic perspective, suggesting evolutionarily stable patterns in the variety of strategy choices among competitors, is directed toward addressing this issue in a sample of competitive groups in the Southwestern United States. In this study, a competitive group is characterized as a focal firm, which has recently gone public and its three most direct market rivals.

Measures are suggested and implemented to operationalize the constructs: evolutionary stability, strategic variety, fit of strategic variety with environmental variety and group density. The study sample consisted of 62 newly public firms and their respective competitive groups collected from a population of initial public offerings in the Southwestern United States. Results from regression analysis suggest that the fit of a competitive group's strategic variety with both the variety of threats and opportunities in the group's relevant environment can dependably predict a small portion of the variance in the evolutionary stability of the group.

Hypotheses suggesting that membership in more stable groups will lead to superior market performance, however, were not supported.

Finally, group density was found to be a significant predictor of the longer term market performance of initial public offerings of stock.

As a theory building effort, however, results of this study should be viewed as preliminary and relied upon only after verification via further empirical research. Suggestions for refinement of measures and directions for future research are offered.

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1. INTRODUCTION

So the rule of competition is not to count on opponents not coming, but to rely on having ways of dealing with them; not to count on opponents not attacking, but to rely on having what will not be attacked.

Sun Tzu, The Art of War.

The influence of competitor actions on the formulation of business strategy and firm performance is widely acknowledged. Perhaps foremost in the field of corporate competition and strategy is Michael Porter (1980) whose teachings on the topic have been the mainstay of Strategy curricula for over a decade. While we recognize that awareness of one's competition is essential; strategy researchers have found that managers are often at a loss when it comes to operationalizing this notion in practice (Zahra and Chaples, 1993).

Recent attempts to introduce theoretical perspectives which might guide much needed empirical investigations of competitive strategic interaction include forays into catastrophe theory (Gresov, Haveman and

Oliva, 1993), use of expectancy-valence models (Chen and Miller, 1993), application of an information processing framework (Smith, Grimm, Gannon and Chen, 1991) and adaptations of cybernetics (Miles, Snow and Sharfman, 1993). To date, however, there seems to be no consensus concerning the most effective theoretical framework within which to explore the dynamics of competitive interaction.

Purpose

The intent of the present research was to assess the utility of an alternate theoretical framework to interpret our small but growing body of knowledge relating to the competitive interaction of direct industry rivals. I propose that an ecological perspective, integrated with a game theoretic view can be of unique utility in guiding the formulation of research hypotheses and in facilitating the interpretation of collected data. This project uncovered evidence suggesting that managers should choose their competitive strategies as a function of the competitive strategies being pursued by their rivals. The key research questions at the outset were:

➤Is the success of a particular firm's competitive strategy a function of the competitive strategies chosen by direct rivals?

➤ *What specific information about competitor strategies and about the competitive environment is important in this respect?*

Value

To address the research questions, this study regards the competitive actions and interactions of a population of firms which have recently made their first public offering of stock (I.P.O.'s). Findings forthcoming from this study are therefore, beneficial to (1) managers attempting to maximize value to their shareholders and to their customers, (2) investment bankers who seek to underwrite only those I.P.O.'s with the greater probability of success, and (3) investors hoping to obtain a higher expected return on their investments in new issues.

Research Objectives

This study integrates and tests the applicability of a range of theoretical perspectives as they relate to competition among rival businesses. In particular, evolutionary game theory provides the basis upon which I have built my theoretical arguments. This theoretical perspective has gained much acceptance in the field of animal behavior

and holds promise as a means of better understanding human competition. The objective of developing and adapting evolutionary game theory to the study of business competition is to suggest an answer to my first research question: Yes, it is important to consider the competitive strategies of rivals. As is later shown, it may indeed be appropriate for strategic managers to regard the strategies of competitors to achieve a fit between the strategic variety of the competitive group and the variety of opportunities and threats in the environment.

This leads to the second research objective which derives from recent strategy research positing strategic variety as a construct germane to the study of competitive interaction (Miles, Snow and Sharfman, 1993). To wit, my objective was to empirically test for a relationship between strategic variety and the market performance of firms undergoing their initial public offerings of stock. Thus, with respect to my second research question, it is shown that information about the *variety* of strategies being utilized by competitors given the variety of their relevant environment business environment may assist in better selection of strategy by a particular focal firm. Research results should help guide future strategy research into the dynamics of organizational competition.

Theory building caveats. Since this is primarily an exercise in theory building, great caution must be exercised in the testing and

interpretation of hypothesized relationships. First, consistent with the reasoning of Kerlinger (1986) regarding theory building research, I have adopted a relatively higher α level of .10 for the purpose of assessing the statistical significance of relationships among measurement variables. While this α level is deemed appropriate for exploratory and theory building research, the increased probability that relationships will be reported where they may not actually exist must be acknowledged.

Second, when multiple independent tests are performed on a particular data set, the probability of reporting a spurious result as a legitimate significant relationship is increased (Miller, 19??). While the various regression analyses performed using the present study sample are not independent, it may be prudent to err on the side of caution. As such, discussion of study results is prefaced with an admonition of the dangers of drawing hasty conclusions from what should be regarded as preliminary and tentative findings.

Plan of the Dissertation

In the next section, THEORY, theoretical strings from a variety of disciplines are woven into an overall framework from which to assess competitive interactions and outcomes. Following the exposition of the proposed theoretical framework, the next section, STUDY DESIGN, puts

forth measurement variables with which to test proposed relationships among theoretical constructs and suggests a sampling strategy for creating an empirical arena for testing the veracity and usefulness of the theory in predicting performance outcomes for newly public firms.

Additionally, the ANALYSIS section lays out a specific scheme of statistical testing and analysis. Findings of this analysis are then reported and briefly characterized in the RESULTS section. Finally, in the DISCUSSION section, a summary of the project is provided, accompanied by a deeper discussion of the meanings and implications which can be drawn from the findings. Areas of possible weakness in the study and strategies for further refinement and extension are suggested.

2. THEORY

This study examines the interactions of direct industry rivals at two levels of analysis. First, the group of relevant competitors, or competitive group (Reger and Huff, 1993), is regarded. This level of analysis is consistent with the logic of the theory of games and industry evolution as they are applied in this study. Second, ramifications of the analysis at the competitive group level are extended to draw inference concerning strategic actions at the level of the individual firm.

Relevant findings of three primary streams of theoretical research are integrated to address the present research questions: (1)the theory of games, (2)the natural selection model of evolutionary theory and (3)cybernetics.

The Theory of Games

The theory of games was first formalized by Von Neuman and Morgenstern (1953) in order to better understand economic behavior. While its greatest impact has been in the field of economics, applications of game theoretic logic have migrated to other disciplines and other

functional areas in the field of business such as accounting (Wilson, 1983), marketing (Moorthy, 1985), finance (Myers and Majluf, 1984) and biology (Maynard Smith, 1982).

Game theory is the analysis of rational behavior in situations involving interdependence of outcomes -- "when my pay-off depends on what you do" (Camerer, 1991). Put simply, game theorists are about showing that a competitor's choice of best competitive strategy is a function of the strategy choices made by rivals. A central assumption of classical game theory is that the players will behave rationally, and according to some criterion of self interest.

By analyzing all possible combinations of rival strategies and their respective expected pay-offs, the competitive strategy with the highest expected pay-off can be identified. Game theory is particularly appropriate to situations wherein the set of strategies (and their pay-offs) which rivals may adopt is knowable, but the particular strategy chosen cannot be known with certainty. Strategy researchers, however, must study firms whose strategy choices are typically much broader than the "cooperate" or "defend" alternatives of the classic *prisoner's dilemma*. In addition, the pay-off associated with a particular business strategy may change from one instance to the next. Differences in the efficiency of implementation as well as unique circumstances in the general

environment can confound efforts to discretely associate strategies with their pay-offs. Such awkward multiplicity makes game theoretic models analytically recalcitrant; perhaps to the point of impossibility (Camerer, 1991: 145).

Nonetheless, the basic contribution of game theoretic reasoning remains. Computational and cognitive limitations prevent us from realizing robust game theoretical models of dynamic strategic interactions. Still, the underlying logic that the rational selection of strategy should be guided by an expectation of higher pay-offs is inescapable.

The Natural Selection Model

The natural selection model has its roots in the biological sciences. This view assumes that populations of organizations evolve much as populations of biological species evolve (Pugh and Hickson, 1989). The model in its original form applies at the population level of organizations rather than at the level of competitive groups or individual organizations (Aldrich and Pfeffer, 1976). The underlying logic of the model argues that environments differentially select organizations for survival on the basis of fit between the characteristics of the organization and the challenges and opportunities extant in the environment (Hannan and Freeman, 1988). A sometimes confusing ambiguity in terminology arises in that a high level of

“fit” between organizational characteristics and environmental challenges is associated with organizational “fitness”.

Fitness. The survival criterion of environmental selection and Darwinian fitness, according to the natural selection model, is in contrast to the criterion of rationality and self interest put forth in the theory of games. According to population ecologists in the field of management, environments select only optimal forms of organizations. In this way environments can be seen as perfecting organizational adaptation through an evolutionary process¹ (Hannan & Freeman, 1977). Astley (1985: 234), however, suggests an alternative to optimization, allowing that organizations may avoid being selected out (negatively selected) by being only “tolerably” fit. That is, within limits, a given environment may tolerate a variety of given forms, offering opportunity for variations to impose themselves.

The extent to which particular form manifests a closer match (or fit) between its adaptive characteristics and the requirements of its relevant environment should be regarded as that form’s fitness. Fit can therefore

¹ Evolution, in this context, is defined as a process of successive adaptations, approximating a better fit with the environment.

be viewed as a trait of an organism or group of organisms (an organization) which contributes to evolutionary fitness.

Level of selection. Organizational theorists often assume that selection processes can operate only on individual firms or organizations (Carroll, 1993). An alternative view is that organizations are embedded within systems of other competing organizations, over whom they may have some significant control; allowing that organizational outcomes may often be tightly interconnected with those of other firms (Porter, 1980). Whereas some have taken this to imply the absence of selection (Perrow, 1986), the view adopted here is that selection processes can operate on firms, groups of firms, populations of firms or communities of populations of firms (Astley, 1985 and Carroll, 1993).

A selection mechanism. The marketing concept and the notion (from economic theory) of *consumer sovereignty* dictate that firms can attain greater economic success by maximizing consumer welfare (Kotler, 1984). Changes in consumer markets, however, are often difficult to monitor and hard to interpret. In the late 18th century, Adam Smith observed that markets seem to respond according to an agenda all their own; as if guided by an *invisible hand*. Nonetheless, Richardson (1991), in his review of the cybernetics literature, finds that, whereas a system's actual causal mechanisms may be unobservable or beyond

comprehension, understanding can yet be attained via measurement of certain outcomes. Bowman (1982), for example, measured financial performance and found that it was closely tied to a customer focus in the computer industry.

Whether or not the driving forces of industry can ever be truly known, many believe price movements in the capital markets to be a fair proxy for the actual changes in the underlying market performance of traded firms. The efficient market hypothesis suggests that the prices of securities observed at any time are based on a "correct" evaluation of all information available at the time (Fama, 1976: 133). Fama (1976) cites and discusses several empirical studies which provide convincing evidence of market efficiency.

Thus a firm's or a competitive group's ability to serve consumer markets -- their fitness -- should be reflected in the market prices of their related securities. I look, therefore, to the capital markets for the outcomes of selection processes which may be at play.

Games and Evolution

In the field of evolutionary biology, the perspectives of the natural selection model and game theory have been merged into what is called evolutionary game theory (Maynard Smith, 1982). While the primary

applications of evolutionary game theory have been directed toward animal contests, the logic of the analysis may be suitable to a broader venue. What the theory proposes is that one group of animals (a firm is, in fact, an organized group of primates) will compete with other groups using a competitive strategy (or mix of strategies) which, having evolved through the natural selection process, yields the highest expected return² for each of the rival groups involved for a given level of risk. The competitive strategy of each group of individuals (or organization) within the competitive landscape evolves dynamically with respect to the strategies of rival groups toward some equilibrium point.

The ultimate resources or "prey" for which rivals compete is taken in this study to be the consumer dollars (Rothschild, 1990). Other resources which may be contested are seen here as incidental to securing a market for the firm's outputs.

Evolutionary stability. This process is said, by evolutionary game theorists, to result in an "evolutionarily stable strategy", or ESS, for that set of rival groups. An ESS is that mix of strategies which, when pitted against one another, can produce the highest expected level of Darwinian

² "Return", in this context, is the expected resource holding power of a group weighted by the risk of injury from rivals associated with its selected strategy (Smith, 1982: 114).

fitness for each member of the relevant set of rival groups; given the strategic composition and fitness attained by the rest of the groups in that set. This is the necessary outcome implied by the notion of equilibrium in discussions of repeated games (Camerer, 1991).

Another criteria for the ESS is that it must be non-invadable (Maynard Smith, 1982). This simply implies that for a particular set of rival groups, there is not another strategy or combination of strategies that could yield higher risk-weighted returns for that set - at that point in time. That is, the extant mix of strategies would dominate, thereby resisting invasion³. No higher return is possible at that point.

The perspective of evolutionary game theory may allow management researchers to side-step the problems associated with observing and computing pay-offs for an intractable variety of strategies and situations. Camerer observes that the mechanisms of adaptation and evolution can result in equilibration, even if players are not rational enough to reason game-theoretically (Camerer, 1991). The logic and algebra which underlie game theoretic arguments provide a rationale for how strategies can evolve through interplay with rival strategies. The outcome for a competitive group having a more evolutionary stable

³ This notion of being non-invadable bears a similarity to the concept of contestability (Baumol, 1972) and Porter's notion of entry barriers (Porter, 1980).

strategic profile is to perform better and endure less conflict and uncertainty. What ever may be the elegance and complexity of nature's game theoretic algorithms, certainly the characteristics of patterns of strategic interaction in such groups are the "right" ones. It falls then upon the strategy researcher to identify evolutionarily stable groups of rivals and to discern their patterns of strategic interplay from those of other, less successful groups.

A fleeting equilibrium. Since evolutionary stability implies an equilibrium of sorts, it is important to consider the time horizon or duration of the theorized period of stability. Economist Alfred Marshall wrote from a point of view that only biological conceptions can provide "depth" to economic analysis (Currie and Steedman, 1990: 11). It was his opinion that "...it is especially needful to remember that economic problems are imperfectly presented when they are treated as problems of static equilibrium, and not of organic growth"(Marshall, 1920: 461). French economist L. Walras concurred, insisting that "...actual economies are never in equilibrium", but are "moving through time, perpetually tending toward equilibrium without ever attaining it" (Walras, 1954).

Maynard Smith (1988) drew an analogy from Lewis Carol's Alice Through the Looking Glass to help make this point. He compared the plight of organism, continually having to change just to keep up with the

rate of change in its environment with the situation faced by the Red Queen, who had to maintain a vigorous pace just to hold her position.⁴

Evolutionary game theorists propose that competitive strategies evolve over time through interaction with rival strategies (Smith, 1982). The importance then of regarding evolutionary stability (like economic equilibrium) is that, over time, it implies a target - or evolutionary direction. Evolutionary stability should not be seen as an end resting state.

Risk of escalation. Part of the rationale of evolutionary game theory is that competitive strategies which are in some way complimentary, can help maximize the return to the competitive group by lowering the risk of expensive conflict. Huxley (1966) argued that escalated contests could result in injury to both contestants thus militating against the survival of the group. Indeed, game theorists have found that cooperation among rivals, rather than conflict (or defection), is more likely to be the successful equilibrium group strategy (Axelrod, 1984). Strategy theory too is concerned with not only the likely success of particular actions but also with the risks entailed by undertaking them (Carroll, 1993).

⁴ An application of this rationale might also support an interesting and enlightening discussion if the Japanese principle of *Kaizen* or continuous improvement.

The notion of evolutionary stability suggests that escalated contests waste needed resources. Therefore, the group strategies with the highest expected group pay-offs are those which hold conflict to a minimum. The strategies of individual rivals evolve and are selected for survival within the competitive group because they permit a level of competitive stability, wherein all relevant rivals (each seeking fitness) can simultaneously attain some degree of success.

Certainly, this perspective does not imply collusion. It merely suggests that greater strategic harmony can lead to more efficient competition among rivals; each vying with common desire for a needed resource -- customers.

Customer orientation: A broader view. Customers may often choose from among a number of competing firms as they contemplate a purchase decision. When managers consider only how *their* firm can address consumer needs, they fail to fully appreciate the scope of the customer's situation.

From the customer's perspective, a particular business is usually but one of several potential sources of a needed product or service. I propose that a true orientation to the needs of consumers includes the recognition that the customer's source of value is the group of rival firms who compete to supply that particular target market. Managers then must

abandon the myopic notion that their firm's outputs are the only ones that customers should consider. They might see themselves instead as members of a competitive community of firms which collectively is the customer's source of value (Nielsen, 1988).

As previously mentioned, this is not to imply that rigorous competition is inappropriate (it too can be a source of customer value) or that competitors should collude. It only suggests that managers take a more holistic view of the competitive landscape in order to better appreciate the unique contribution their firm might make to the creation of value by the greater competitive community of which they are a part. This view allows us to consider the similitude between the perspectives of evolutionary game theory and of strategic management.

But how can a competitive community best serve a target consumer group -- what are the antecedents of evolutionary stability with respect to competitive strategy?

Cybernetics

Cybernetics was defined by Weiner (1948) as "the science of control and communication, in the animal and the machine". In brief, cybernetics is concerned with how a system can attain and maintain control of its own outcomes within, and subject to, its relevant

environment. Ashby (1963), another prominent cyberneticist, subsequently extended Weiner's work (applying game theoretic logic) to develop his "law of requisite variety". The law suggests an answer to the question of how we might characterize an evolutionarily stable strategy.

The law of requisite variety. Ashby (1963) reasons, in his general theory of regulation, that living systems will seek to maintain constancy or equilibrium of conditions within by "buffering" the effect of environmental vagarity. This buffering effect is accomplished by developing (evolving) an appropriate variety of strategic countermeasures to potential environmental contingencies. The variety of strategies employed by a system (like a competitive group) should be sufficient to address the variety of disequilibrating forces it might encounter in its environment.

Evolutionary economists argue that greater variety in an industry increases the likelihood that appropriate firm responses are available to meet challenging industry conditions (Nelson & Winter, 1982). Lack of variety has been cited as promoting detrimental "head-to-head" competition and hindering organizational learning (Miles, Snow & Sharfman, 1993). It has also been suggested that a greater variety among firms' strategies is more likely to meet consumer demand and to maximize consumer satisfaction (Greenhut, 1970).

Miles, Snow and Sharfman (1993), examining the variety of strategies within an industry, argued that if an industry has less than its requisite variety, environmental disturbances are more likely to be insurmountable. Further, they were able to demonstrate empirically that "a set of firms must possess a level of variety requisite to its environment (e.g., the domestic or global economy) or it will experience decline".

We see then that while individual rivals clearly compete with each other for limited resources, the group as a whole also can be construed as competing, through use of strategic variety, with its environment. This notion of competition with the environment is the very essence of natural selection.

Optimal variety. The concept of strategic variety can be further refined. Miles, Snow and Sharfman (1993) suggest that, rather than looking only at sheer variety, the notion of "ideal variety" should be explored. Is it possible that there is a specific mix of strategies that will allow a competitive group to reach its highest attainable level of performance? Perhaps optimal strategic variety alone is the criteria for evolutionary stability. It may be worth exploring whether certain environments will adopt some optimum pattern of strategies within a competitive group. As a first study in this program of research, however,

this project will be limited to regarding only the relative amount of strategic variety; not how it might be patterned.

The implications of the foregoing discussion, with respect to competing organizations of humans, are embodied in the following propositions.

PROPOSITION 1: Competitive groups whose strategic variety more closely matches environmental variety will be found nearer to evolutionary stability.

PROPOSITION 2: As a competitive group's strategic variety grows closer to a match with environmental variety over time, the group will grow closer to evolutionary stability.

PROPOSITION 3: Individual firms who are members of groups closer to evolutionary stability will enjoy a greater expectation of success.

These propositions , therefore, address the first research question:
Is the success of a particular firm's competitive strategy a related to the

competitive strategies chosen by direct rivals? In as much as evolutionary stability is posited to be a function of an appropriate fit between environmental variety and strategic variety of the competitive group, and , as proposition 3 puts forth, membership in a more evolutionarily stable group can lead to firm success; then the first research question must be answered in the affirmative.

In addition these propositions illuminate the second research question which asks what specific information about competitor strategies is important in this regard. Needed information includes: (1) a knowledge of the variety in the competitive groups environment (2) a knowledge of the variety of strategies chosen by rivals in the competitive group and (3) a means by which to determine to what extent such strategic variety achieves a match with environmental variety.

Asymmetric Contests

Evolutionary game theorists believe that evolutionary stability is a condition related to harmony or balance of strategic actions among competitors. In order for an invading mutant strategy to succeed, it would have to provide for a higher overall pay-off for the competitive group. Indeed, I will be taking a measure of group pay-off as an indicator of evolutionary stability.

However, in his exploration of the logic of asymmetric contests in animals, Maynard-Smith concedes that the relationship between contest asymmetries and attainment of evolutionary stability remains unclear (1982: 117). In particular, his analysis reveals that when there is imperfect information about competitors, the potential effects of differences in size and resource importance can result in conditions of evolutionary stability with less-than-optimal pay-offs.

Smith refers to this kind of evolutionary stability as "paradoxical". Since competing firms often have less than perfect information about direct rivals, it may be important to better understand this phenomenon. Where a competitive group's ESS is a paradoxical ESS, wasteful conflict may be contributing to lower group pay-offs. Thus, any conclusions about relationships between requisite strategic variety and *non-paradoxical* evolutionary stability might be found to be moderated by contest asymmetries which may exist.

RHP asymmetries. The evolutionary game theory literature looks at size in terms of resource holding potential (Smith and Parker, 1976). Researchers in this field have found that when there is a larger discrepancy in the resource holding potential (RHP) of contestants, there is a lower probability that each will employ the same strategy.

However, when contestants don't have complete and accurate information on a rivals strengths, incorrect assessments can occur. Instances where similar strategies are employed despite significant size⁵ differences have been found to result in costly escalation (Riechert, 1978). It has been shown that such situations can result in stability but tend to lower overall group pay-offs (Smith, 1982). Such paradoxical ESS's would, therefore, not be associated with the kind of evolutionary stability of interest in the present study.

Larger firms, through supplier networks and internal capital markets, for example, can control more of the ancillary resources needed to penetrate consumer markets (Jones and Hill, 1988). Further, when all competitors have similar RHP, assuming sameness through lack of information is not an issue. Only when there actually are significant size differences within the competitive group can incorrect assessments lead to a paradoxical ESS. It is reasonable, therefore, to propose that asymmetries in the size of competitive group members will moderate the relationship between requisite strategic variety and the attainment of evolutionary stability.

⁵ Size in this context might be viewed as body size or physical strength.

PROPOSITION 4a: Greater size asymmetries between members of a competitive group will moderate the theorized relationship between requisite strategic variety and evolutionary stability.

Pay-off asymmetries. Evolutionary game theorists have found too that game theoretic predictions are often confounded by pay-off asymmetries. Pay-off asymmetries are said to exist when one contestant perceives a greater need for a contested resource than do opponents. When this is the case, the contestant with the greater need will often engage in riskier activities, chancing escalation, to acquire the resource.

Thompson and Strickland (1990) explain that competitors who are experiencing poor performance are more likely to engage in risky activities and may change their business strategies with greater frequency. Interestingly, Bowman (1982) also found that firms with poorer records of profitability engaged in risky activities. In one study he found that firms incurred risk by acting aggressively, "pushing too hard against the civil or public constraints of the law" (1982:39). Additionally, he associated the poor performance of risk takers with low customer orientation (1982: 38).

This form of wasteful risk taking can potentially siphon resources which might otherwise have been channeled toward satisfaction of

consumer needs. Bowman's (1982) findings were derived from the work of Kahneman and Tversky (1979) who suggested that individuals who are performing poorly will take greater risks. That is, when proceeding from a position of loss, desired gains can take on greater perceived value.

Kahneman and Tversky's contribution, referred to as prospect theory, guided Bowman's (1982) investigations of risk taking in business organizations and is the basis for the following proposition.

PROPOSITION 4b: Pay-off asymmetries between members of a competitive group will moderate the theorized relationship between requisite strategic variety and evolutionary stability.

The implication here is that when some firms are doing poorly with respect to their rivals, they will incur greater risk in order to *catch up*.

Incurring greater risks suggests that contested resources are more in demand by these poor performers, and are therefore regarded as having greater value. In the jargon of game theorists, these resources represent a pay-off higher to some contestants than to others.

3. STUDY DESIGN

A basic premise of this study is that phenomena at the level of the competitive group are affected by environmental variety and that this interaction can have an effect upon an individual firm within the group. Thus there are three germane levels of analysis: the focal organization, its competitive group and the industry environment.

Sampling Strategy

Focal firms. The research technique of examining group-level phenomena from the perspective of a 'focal' firm within the group is supported in studies by Katz & Gartner (1988), Carroll (1993), and Reger & Huff (1993). It allows for a more workable analysis, focusing on the perspective of a particular group member rather than trying to consider, simultaneously, the multiple perspectives of all group members. Additionally, in order for any findings which might be forthcoming to be useful to managers, a consideration of the viewpoint of the individual firm is necessary.

As stated, the arguments put forth in this dissertation flow, in part, from an evolutionary perspective. In this context, Carroll (1993) considers

whether the corporate or business level of analysis is more appropriate . He argues that the appropriate level of analysis should be determined by the strength of the interdependencies among firms relative to the strength of selection processes. When relative success is the selection criteria, Carroll finds that the evidence for profitability favors the business unit level of analysis.

Rumelt (1991) too shows that about 45 percent of firm profitability is accounted for by differences in business units. This finding suggests that selection may apply with greatest force to business units rather than to larger divisional or corporate units. Thus in order to assure an appropriate application of theory, I have sampled from a population of focal firms and their relevant rivals; each of which are single-line-of-business organizations.

Age. Population ecology's original question, "Why are there so many kinds of organizations?" (Hannan & Freeman, 1977), places particular emphasis on variation due to new organizational forms (Aldrich, 1979). It has been suggested that, indeed, there is a higher degree of diversity among newer organizations (Katz & Gartner, 1988). Hofer (1975) speculates that life cycle stage is perhaps the most important contingency variable in assessing business strategy. Indeed, Miles, et al. (1993) found that life cycle stage may negatively affect the amount of

strategic variety found in an industry (Miles, Snow & Sharfman, 1993). Variety is, therefore, likely to be greater in an environment where many organizations are still emerging than one in which most have already become well established.

Initial public offerings. Thus, in order to maximize the sample variance (Kerlinger, 1986: p.330) in terms of strategic variety, it seems sensible to sample from a population of newer firms. Newer firms are also more likely to be in a single line of business.

An additional consideration is the availability of data. Data on publicly traded firms are typically more available and accessible.

Since initial public offerings (IPO's) are generally the newest of publicly traded firms; this study samples from a population of IPO's which occurred in the Southwestern United States between 1988 and 1990. Due to practical limits on resources available to the investigator, it is necessary to constrain the scope of the study population. This region was chosen because preliminary investigations using *Standard and Poor's New Issue Index* (1992) suggest defining the population of IPO's in this way will likely yield a more robust sample with respect to firm variety and variety of industries represented. This sampling strategy has the added benefit of controlling for potential region effects which may exist.

Population. Preliminary results from a pilot study over a different time period indicated that this population may be between 250 and 350 IPO's along with each of their respective competitive group members. It was found, however, that the population consisted of only 196 firms. Of these, eight were found to be not suitable for this study because they were initial public offerings of limited partnerships, diversified firms, subsidiaries of a diversified company or corporations who engaged in primarily international operations. An additional eight firms were deemed not to be a part of the relevant population because they had one or more direct rivals in their competitive group who were private firms. Of the remaining 180 IPO'S, only one went out of business during the study period. Thus, the relevant population from which I was able to sample consisted of 179 initial public offerings.

IPO pricing anomaly. Sampling from IPO's holds additional interest in that it has always been somewhat of a mystery why IPO's experience apparently anomalous returns when compared to seasoned issues (Ritter, 1991). This remains one of the few unresolved exceptions to the efficient markets hypothesis. Might competitive strategy as it relates to the strategy of rivals be the, as yet, undiscovered valuation variable?

Study period. The time frame, from 1988 through 1990, was chosen because research shows that IPO pricing anomalies occur within the first three years of issue (Ibbotson, 1975 and Ritter, 1991). Therefore, issues newer than 1990 will not provide sufficient pricing history. IPO's which occurred prior to 1988 will be excluded because: (1) the proposed time frame is expected to yield a sufficient sample size, (2) even expert recollection can become dim as more distant memories are solicited (Yin, 1989) and (3) the early and mid-1980's were seen as a period wherein "industry specific fads" may have skewed the character of the new issues market with respect to the variables relevant to this study (Ritter, 1991).

Data Sources

A query to the *Securities Data Company* database provided the initial data set of IPO's from which the relevant population was determined. Operating, performance, industry and market data on the new issues were collected via the *Compustat* data base⁶. Supporting and background data were obtained from the *Compact Disclosure* data source. Composition of respective competitive groups were obtained by reviewing analysts reports catalogued in the *Investext* database.

⁶ Special thanks to J.C. Bradford and Associates for graciously providing access to their data resources.

As will be discussed later, the competitive group most relevant for the purposes of this study is the IPO firm and its three main competitors. Expert opinion of industry analysts was used to establish the relevant competitive group, containing the three main competitors, for each focal IPO. Analysts who work with the lead underwriter of the respective IPO's typically provide client firms and investors with reports detailing, among other things, the IPO firm's competitive environment. Such reports for the first and third years following a firm's initial public offering were consulted via the *Investext* database to determine the relevant competitor set.

Competitive Groups

Porter (1979: 215) explicitly refers to groups competing viably with each other in the same competitive arenas. Much of the strategic group literature, however, has focused on an exploration of companies competing like each other but not necessarily with each other (Hatten & Hatten, 1987). It is important then to distinguish between strategic groups and competitive groups.

Definition. Hatten and Hatten (1987) define a strategic group as "a grouping of organizations which pursue similar strategies with similar resources". They acknowledge, however, that such groups do not exist but are merely an analytical convenience. Reger and Huff (1993)

introduce the related concept of a "competitive group" calling for more research on the relationships between "firms that compete against each other". They also speculate that groupings of this sort may actually exist; in reality and in the minds of managers. The game theorist's view is that a strategic group is a cluster of competitors who find themselves in a game with each other (Porac & Thomas, 1990). Consistent with these views, I designate a competitive group as a set of businesses each trying to satisfy the same needs of the same target consumer segment within an industry. The notion of strategic variety put forth earlier simply suggests they may be satisfying consumer needs differently.

Much of the previous research on strategic groups, with respect to identifying and characterizing a group, however, remains relevant and shall inform the present discussion.

Identifying direct competitors. So what exactly is a competitor? Pitts and Snow (1986: 9) define competitor broadly as "[that] which attempts to exert downward pressure on a firm's ROI". Consistent with the present characterization of a competitive group, they go on to specify direct competitors as "firms that make products similar to our own and attempt to sell them to the same customers". In a similar vein, Dodge, Fullerton and Robbins (1994) describe competitors as, "other

organizations in the task environment competing for the same customers with the same products or close substitutes."

Perhaps the most obvious solution to the problem of ascertaining the focal firm's competitive group would be to merely ask its managers. However, a puzzling flaw of practical competitive analysis is the poor identification of competition by managers (Zahra & Chaples, 1993).

Other potential sources for identifying the focal firms' strategic groups are analysts associated with the various investment banking firms who had underwritten the new issues. Research suggests that analysts can be very accurate as data sources (Chen, Farh & MacMillan, 1993). Analysts typically are well prepared academically which provides them with a disciplined theoretical framework; plus they often have a deep knowledge of the particular firms or industries they are paid to investigate (Cosentino, 1990).

Thus, expert opinion concerning the composition of the competitive groups will be gleaned via industry reports authored by knowledgeable analysts associated with the respective focal firm's lead underwriter (Guttermann, 1990).

The core firms of the competitive group. Due in part to the natural limits of human cognition, executives typically focus on only a few companies when assessing the competitive field. Market environments

are given meaning in the minds of managers only through processes of selective attention and simplification (Pfeffer & Salancik, 1978). Thus the number of rivals actually considered may be limited to two or three (Porac & Thomas, 1990). Robert (1993) points out that no company has the resources to compete against all competitors and should not attempt to do so. He prescribes that a firm should target only few key competitors. This practical limitation to more thorough competitive analyses was specified in greater depth in Reger and Huff (1993) where managers' views of a strategic group was depicted as a "fuzzy set". That is, there were a few "core firms" which were tightly associated with the focal firm and a number of secondary and transient firms which implemented the strategic group recipe less consistently. This observation precipitated Reger and Huff's (1993: 116) call for "a more fine-grained view of membership within groups".

In order to address the research questions more efficiently, and in accord with the previous discussion, this study regards the relevant competitive group as the focal firm and its three most direct competitors. From the specified population I have selected as my study sample all focal firms and their associated competitive group members, each of which are single line of business, relatively new, publicly traded organizations.

The robustness of this scheme of operationalizing the relevant competitive group with just four rival firms is tested. Theorized relationships found in competitive groups which were more completely specified by the four core firms are compared to those of groups which were drawn from a more densely populated competitor set via moderated regression analysis. Arguments put forth in this and previous sections suggest there would be no significant differences.

Competitor set density proportion. For this study, the relevant competitive group is viewed as the focal IPO and its three main competitors. Competitor set density, however, is taken as the count of ALL of the focal IPO's significant competitors. Examining the density of the broader field of rivals addresses the importance of knowing the extent to which a four-member competitor set fully specifies the set of all competitors.

From my review of the analysts' reports, I was able to ascertain not only the IPO firm's three most direct rivals, but the total number of extant rivals as well. If, for example, the focal group's four members represent only twenty-five percent of the total number of significant competitors reported over the three-year study period, the variable, density proportion would take on the value, .25. Thus, the more incompletely the competitive

field is specified by the focal competitive group, the smaller the measure of population density.

This variable can also be taken as an indirect measure of competitor density, itself. That is, the larger the denominator of this proportion (the total number of competitors) the smaller the value of competitor density proportion as defined here.

RHP asymmetries. It is also important to regard size as it may relate to a firm's relative resource holding power. The RHP asymmetry measure is the coefficient of variation of assets of the four competitive group members. This measure was calculated with quarterly data compiled for the three years of the study period for each competitive group. The coefficient of variation is simply the standard deviation divided by the mean (Blaylock, 1972). By *standardizing* the deviations in size by the mean, I was better able to compare across industry settings where a typical firm's size may be inherently larger or smaller as a matter of course.

Pay-off asymmetries. The coefficient of variation of three year average return on equity (ROE) for the members of the focal competitive group is the measure of pay-off asymmetries. Recall that prospect theory provides the theoretical underpinning of the propositions relating pay-off asymmetries to evolutionary stability. ROE was selected as the

appropriate measure in this case because it is the performance measure used by Bowman (1982) in his development of prospect theory. It is theorized here that groups with a disproportionate number of poor performers will be less likely to attain evolutionary stability. Poorer performers will have a greater need to attract customers and will take greater risks to make up lost ground. Further, if an ESS is attained it is more likely to be what Smith (1982) called a paradoxical ESS.

Measures of Strategy

The cybernetics literature implies variety is necessary for a competitive group to meet the demands of the environment (Ashby, 1963). This and other theoretical perspectives presented suggest that, in order to better understand the competitive interaction of rival businesses, it is appropriate to examine the variety of approaches (competitive strategies) the members of a competitive group use to address the environmental forces acting upon them.

Indeed, Porter (1980) teaches that the essence of formulating competitive strategy is in relating a company to its environment. Additionally, he specifies that the ability of a firm to sustain above-average returns is, at least in part, determined by the strength of the competitive forces in its industry (Porter, 1980: 5). Porter goes on to outline strategic

approaches a firm might employ in coping with its competitive environment (Porter, 1980: 35). While Porter's earlier teachings were more focused on the industry as the germane level of analysis, he later allows that his framework can also be applied at the level of the strategic group or even the individual firm (Porter, 1991: 100). In this study, I will operationalize competitive strategy and the competitive environment with a close consideration of Porter's perspectives.

Business strategy. Porter (1991) advocates that strategy is the act of maintaining a dynamic alignment between a company and its environment. Andrews (1972:37) explains that business policy researchers should view strategy as the purposive development and utilization of the firm's capabilities to exploit existing or evolving opportunities in the business's competitive environment at an acceptable level of risk.

But business strategy is not a unidimensional phenomenon (White, 1986). Day and Wensley (1988) advocate that, in order to effectively characterize competitive strategy, a balance should be sought between the competitor-based and the customer-based perspectives. A competitor-based perspective is typically associated with production matters, reducing costs and striving for internal efficiency; whereas a customer-based perspective involves more of a focus on creating

customer value through product differentiation (Day and Wensley, 1988). Contrary to Porter's (1980) implication that these two approaches are mutually exclusive, Hill (1988) reports that it may be common to find circumstances wherein low cost and differentiation are sensibly pursued simultaneously. Other studies have also supported the view that a firm can pursue both low cost and differentiation (Phillips, Chang & Buzzell, 1983 and Karnani, 1984).

It may be too simplistic, however, to characterize strategy along merely two dimensions (Khandwalla, 1981). Porter (1980) includes a third generic strategy of focusing on a particular consumer group. Further, Stahl (1989) shows that focus is a separate and equally important dimension of strategy. Strategic focus, however, is implicitly considered in this study design via my operational designation of a competitive group as a set of rivals vying for the same customer set. It would therefore be redundant to consider focus in my operationalization of strategy.

Following Chamberlin (1933), economists generally distinguish between price (associated with low cost), promotional, and product competition. Apparently differentiation can be achieved either *perceptually*, through use of promotion; or *actually*, through product innovation. Indeed, Miller (1986) noted that there are at least two different types of differentiation strategies: those based on product innovation and

those based on intensive marketing and image management. This observation is consistent with Khandwalla's (1981) typology of key competitive factors: (1) production, (2) marketing and (3) research and development.

In accord with Khandwalla's typology and following Miles et al. (1993), I have operationalized the strategy construct multidimensionally; measuring (1) the production factor by the level of capital intensity (dollar value of plant, property and equipment per employee), (2) the marketing, or promotion differentiation, factor by the ratio of advertising to sales, and (3) the product differentiation factor as the ratio of R&D to sales.

My measure of strategy must also capture the effect that organizational size may have on each firm's strategic participation in the group. To do this I weighted the strategy value along each of the three dimensions, as I have operationally defined them, according to the sales of each particular rival as a proportion of total sales for that rival's four-member group. So measured, each rival firm's strategy can be construed as a point in three-dimensional strategy space.

Lawless and Finch (1989) used a similar approach, operationalizing these three dimensions of strategy using pre-existing *COMPUSTAT* variables that corresponded to measures identified by Miller (1986). A tripartite view of business strategy is consistent too with

Kumar et al. (1990), whose model (also an extension of game theory) was specified along the three strategic dimensions: manufacturing strategy, marketing strategy and financial strategy. While clearly advocating a multidimensional characterization of business strategy in game theory based research, their particular choice of dimensions was not based on strategy theory but was merely for the sake of model exposition.

Intended strategy. The proposed scheme for measuring strategy may be perceived as flawed in that it implicitly measures *intended* strategies. Firms reveal the relative importance they place on the strategic dimensions of low cost, product differentiation and promotion through their respective allocation of assets to them. However, efficiency in use of these assets may be more or less than rival firms. Unforeseen environmental contingencies may also result in such strategic investments turning out more or less efficacious than intended (Hambrick and Lei, 1985).

While these observations may be valid for any one firm, it is reasonable to assume that, over a large enough sample of firms and in accord with the central limit theorem, mean strategic outcomes will regress to mean strategic intentions. This assumption was validated in Miller's (1988) assessment of the reliability and validity of a similar scheme to measure business level strategy.

Firm size. The continuous measure of strategic variety for the competitive groups in this study is a weighted average of the differences between the strategies of the four constituent firms. That is, the *strategy contribution* of each member of a competitive group is weighted. The weighting factor is the level of sales of each rival firm as a proportion of the total sales of its four-member group - group market share.

Variety of group strategy. Each of the four core members of each sample competitive group was mapped in three dimensions: (1) investments in low cost strategy, (2) investments in promotion differentiation strategy, and (3) investment in product differentiation strategy. The measures for these dimensions, however, are recorded in different units. In order to attain a more even proportionality of these measures they were standardized with common mean and standard deviation. Similar to the scheme for variety measurement employed by Miles et al. (1993), I recorded the three coordinates of each member of a competitive group along with that for the focal firm. Instead of using subjective rankings of variety, however, my proxy of strategic variety is the calculated average of all six pair-wise Euclidean distances for the four points in strategy space (corresponding to the four group members). This measurement method captures, simultaneously, along all three strategy dimensions, the weighted strategic differences between the four

respective members of a competitive group, and yield a single, continuous measure of strategic variety. A graphical depiction of this method of measurement is provided in figure 1.

Measures of Environmental Variety

The construct, environmental variety, has yet to be operationalized directly in the strategy literature. Aldrich (1979) developed a scheme of six environmental dimensions upon which there is an "emerging consensus among researchers" (Dess & Beard, 1984: 54). Based on this scheme, Dess and Beard (1984) developed a more parsimonious characterization of organizational environments according to the three dimensions of munificence, dynamism and complexity. Their model has been supported by a confirmatory factor analysis (Rasheed & Prescott, 1987) which reported a three factor structure which explained 94 percent of the variance in their data.

According to cybernetics theory, however, the variety of strategies employed by a system (like a competitive group) should be sufficient to address the variety of disequilibrating forces it might encounter in its environment. Adapting established measures of organizational

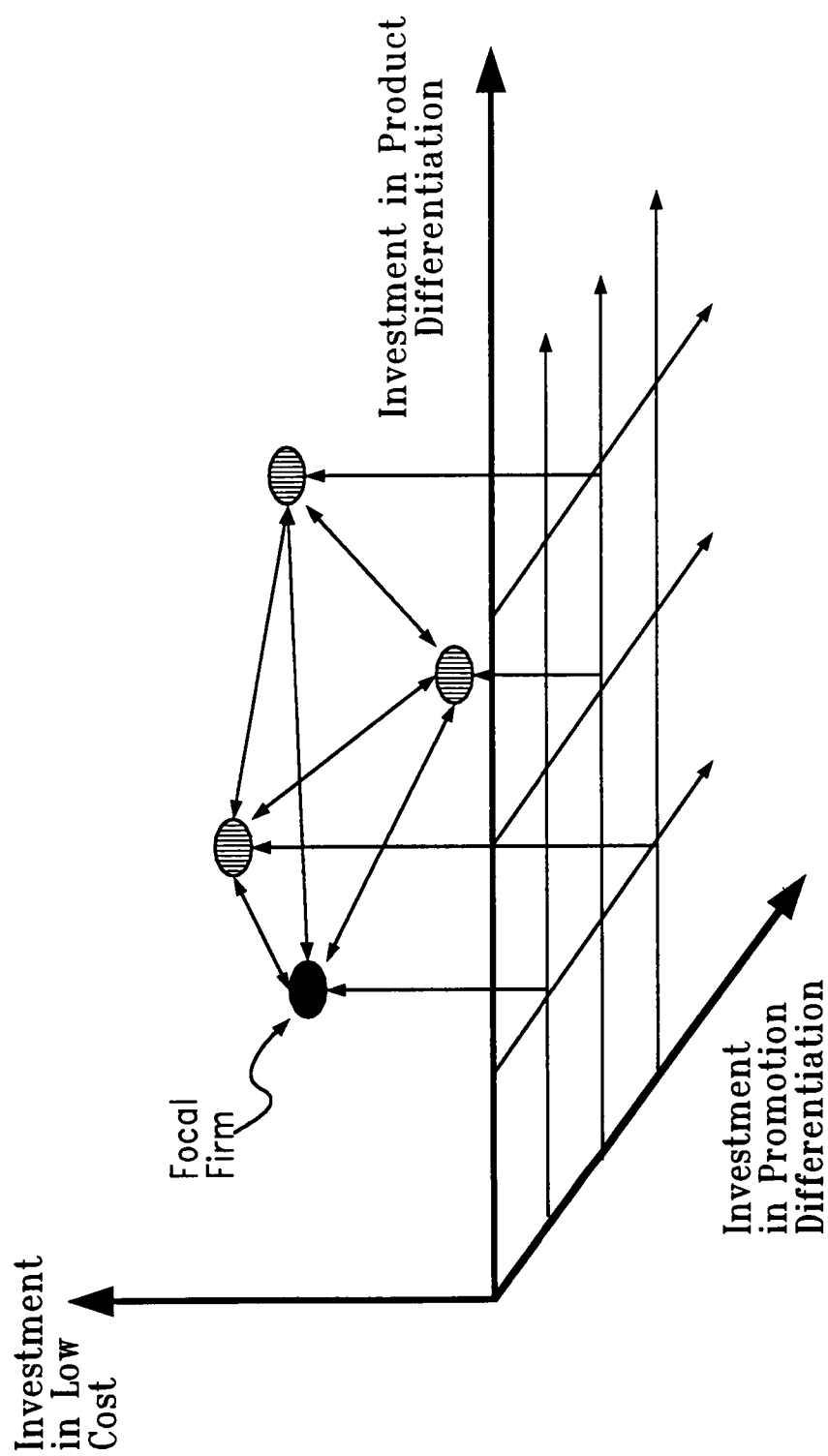


FIGURE 1: Measuring Strategy and Strategic Variety in a Four-member Competitive Group*

* *Strategic Variety = Average Euclidian Distance between Competitors in Strategy Space*

environments to the current study, I propose that environmental munificence and uncertainty will best capture the environmental variety construct.

Munificence. Based on Starbuck's (1976) concept, munificence captures the extent to which the environment can provide growth opportunities. Whereas most treatments of environmental selection focus on criteria for basic survival, it may be equally valid to consider the criteria for success or even prosperity.

It seems reasonable then to regard a munificent environment as one which affords opportunities to attain success in a variety of different ways. Von Bertalanffy (1940) asserted that systems may attain similar ends by a variety of different means. His notion of equifinality suggests that, in munificent environments, we may indeed find greater strategic variety.

To measure munificence, I have used a growth-based measure - industry sales growth - as it reflects abundance in terms of opportunities for market expansion (Wiersema and Bantel, 1993). While this variable represents only one of the measures identified by Dess and Beard (1984) in their factor analysis of munificence, it appears to strongly underlie the construct.

Based on quarterly industry sales data at the four-digit S.I.C. level from *Compustat*, I have calculated munificence as the cumulative quarterly change in total industry sales at the four-digit SIC level for a three year period preceding each of the three years of the study period.

In order to fully operationalize the notion of "variety of disequilibrating forces", it is also important to understand that the theorized need for strategic variety in the competitive group stems in large part from the uncertainty or threat associated with environmental forces it is likely to encounter.

Uncertainty. Dynamism and unpredictability have been identified as key components of the overarching construct of uncertainty (Bourgeois, 1980; Dess & Beard, 1984 and Khandwalla, 1977). Although he used perceptual rather than archival measures, Miller (1988) confirmed this, allowing the combination of these two variables into an overall uncertainty dimension.⁷

In accord with Boyd (1990), dynamism was measured as the standard deviation of quarterly industry sales growth over the prior three years for each year of the study period. Unpredictability was measured as

⁷ Miller (1988) calculated composite uncertainty as the mean of his unpredictability and dynamism scales.

the standard deviation in quarterly industry sales divided by the mean for the same periods. Following Miller (1988), these two factors were averaged. Then, taken as a composite measure, they were used as my proxy for environmental uncertainty.

Each measure of environmental variety (munificence and uncertainty) can thus be separately compared to the strategic variety of each of the competitive groups to determine degree of fit. Testing the dimensions of environmental variety separately seems appropriate since the dimension of munificence relates to the variety of opportunities presented by the environment whereas the uncertainty dimension is more representative of the variety of threats a firm is likely to encounter.

Fit Between Strategic and Environmental Variety

The fit between environmental variety and strategic variety is referred to here as *strategic fit*. Strategic fit occurs when the variety of strategies that best corresponds to the variety of environmental challenges is attained - that is, the *requisite* variety (Ashby, 1963). Since a different metric is employed in the measure of strategic variety and each of the measures of environmental variety, these values were standardized according to a common mean and standard deviation. This scheme for

operationalizing fit is depicted graphically in figure 2. I then took the absolute difference between the standardized score for strategic variety and each of standardized scores for environmental variety as my measures of strategic fit⁸.

Measures of Performance

Evolutionary stability. When the environment "optimizes", as Hannan and Freeman (1977) put it, it does so by selecting that subset of organizations that compete best for limited resources. The notion of evolutionary stability suggests that there is a point of competitive equilibrium at which no other combination of strategies can achieve higher group-level performance. Thus, at any point in time, the highest attainable levels of performance would necessarily be more evolutionarily stable.

In this dissertation, I argue that there exists a frontier, in terms of risk and return, which represents the limit allowed by the environment (the best a subset of organizations can do) at a particular point in time. This notion is reminiscent of Markowitz' (1952) revelation of efficient

⁸ For conceptual clarity, it is important to note here that a larger difference score between environmental and strategic variety will be associated with less fit.

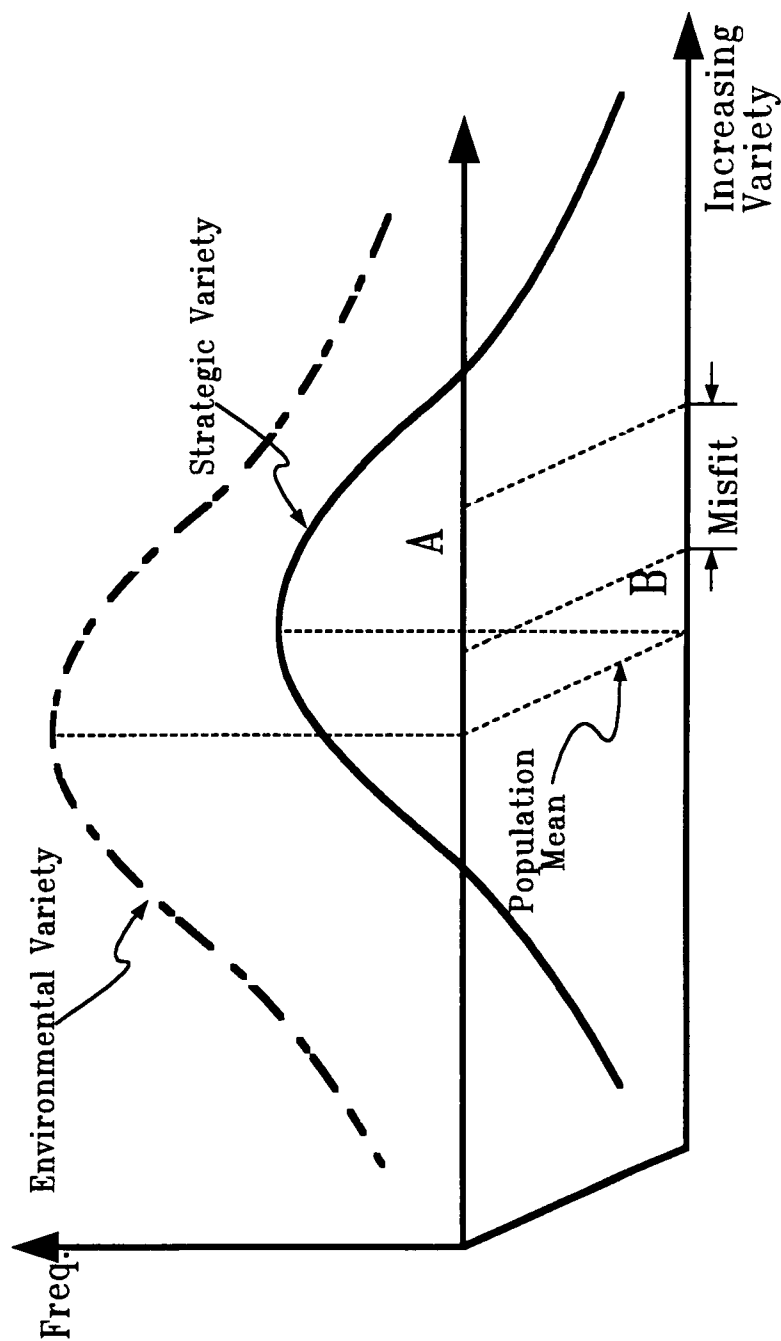


FIGURE 2: Distributions of Strategic Variety and Environmental Variety for a Population of Competitive Groups*

*Strategic Misfit = $|A_{std.} - B_{std.}|$

frontiers in the context of portfolio selection.

The efficient frontier portrayed in this context is depicted as a continuous function in risk/return space, representing the hypothetical optimal positions that a competitive group could occupy.

Mapping the efficient frontier. In order to delineate the frontier for my sample of competitive groups, I have mapped each competitive group in my sample with coordinates in risk and return. Return was mapped using three-year cumulative adjusted returns weighted by individual firm sales. Risk was simply regarded as the variance in stock return over the same period. To adjust for differing firm size within a competitive group, the group average return was weighted in accordance with the relative sales levels of each group member. I then employed Markowitz' (1952) time honored maximization algorithms to discern the natural limits of performance allowed by the environment for this sample of IPO's.

At issue in the present research is the question of how certain mixes of business strategy within a competitive group can lead to greater overall group efficiency; conceptualized here as evolutionary stability. In Markowitz' explication of portfolio theory, he proposed a method of generating an efficient frontier for a sample of firms. To discern the most

efficient investment portfolios, his method selects from a sample all possible combinations of firms (with their business strategies such as they are) combined in all possible proportions. The efficient frontier so computed represents a continuous function as a set of points which, for each applicable level of risk, specifies the upper limit of return the present environment will allow.

Of course, the efficient portfolios suggested by this technique may not actually exist. Thus actual strategic interaction is not considered. Indeed, an *actual* efficient frontier may not be discernible. The proposed technique is merely intended to suggest an efficient frontier which is isomorphic to the actual frontier, thereby allowing an assessment of relative distance from, and direction of progress toward, evolutionary stability. Figure 3 is provided to help illustrate this scheme for operationalizing evolutionary stability. Such a frontier will be computed for the first and third years of the study period.

The next step in the analysis involves locating the actual groups of competitors in relation to the efficient frontier. The weighted measure of return and the resulting measure of risk (as described above) was used for the group as a whole, as if combined into an investment portfolio.

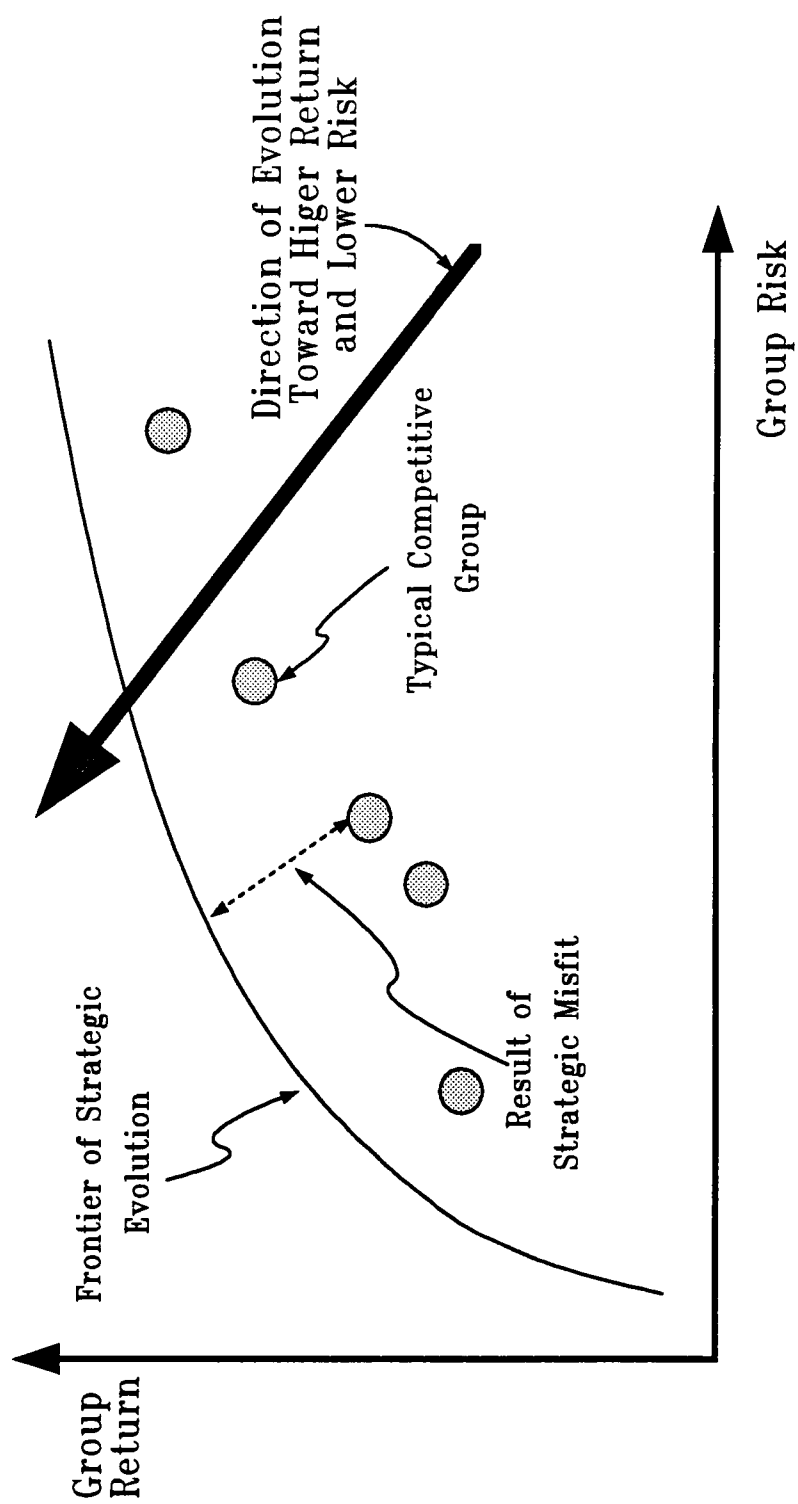


FIGURE 3: The Bounds of Strategic Evolution in Risk - Return Space

In this way, competitive group fitness and evolutionary stability was measured as the Euclidean distance from the groups coordinate in return/risk space to the nearest point on the efficient frontier. Smaller distances will indicate greater group return/risk performance and suggests greater evolutionary stability.

It is worth noting that stock market returns are not static and may seem to wander randomly in the short run. This observed "wandering" in market returns has been likened to Brownian motion (Osborne, 1959). While this in no way rules out the efficiency of the markets (Fama, 1976: 149), it does, in fact, suggest the appropriateness of the proposed technique for determining the limits to "directed random wandering" of returns. It supports also the contention that market efficiency may be the best proxy for discerning evolutionarily stable patterns of strategy in competitive groups.

As Carroll (1993) notes, "organizational evolution usually proceeds down a systematic path, no matter how much noise and disequilibrium the system contains". This, I propose, is the manner in which "tolerably fit" (Astley, 1985) competitive groups of organizations gravitate (through selection) toward "isomorphism" (Hannan & Freeman, 1977) with the environment.

As theorized, a competitive group's nearness to the efficient frontier is a measure of its evolutionary stability and is a function of the match between its strategic variety and the ambient variety of its environment. As my measure of nearness (i.e., evolutionary stability of the competitive group), I have calculated the linear distance between each group's coordinate and the point on the frontier nearest to it. It is predicted that groups located farther from the frontier will have the greater mismatch between their strategic variety and the variability in their industry environments. Thus, as this mismatch diminishes, so will the relative distance to the frontier.

IPO performance. The central focus of management should be the creation and delivery of customer value (Stahl & Bounds, 1991). Net customer value is defined as the perception of utility delivered, less the customer's cost to acquire it, from the various competitors in an industry - the customer's return on investment. This view does not necessarily dispute the classical notion that the objective of management is to maximize the wealth of the owners of the firm (Fama, 1976). It merely suggests that this objective might best be attained by adopting a consumer orientation. It is interesting to note further that, especially in the case of initial public offerings, an important target consumer group is the investing public (potential owners). Thus, at least for the purposes of this

study, a shareholder orientation may be a complimentary subset of an overall customer orientation (van Horne, 1990). I must note too that measures of performance in the securities markets are far more accessible and precise than more direct measures of customer satisfaction.

Accordingly, and consistent with the previous discussion of the capital markets as a selection mechanism and the implications of evolutionary game theory, I will use market measures as my proxy for firm performance in providing consumer value. Following Ritter (1991), I will operationalize firm performance as cumulative adjusted returns (C.A.R.) for the three years following the date of listing.

Hypotheses

Using the proposed measures to operationalize my research propositions, I formulated and tested the following hypotheses.

Cross-sectional evolutionary stability. The two proposed dimensions of environmental variety are munificence and uncertainty. Munificence refers to variety of opportunities in the environment, whereas uncertainty refers to possible threats implied by an unpredictable environment. While both can easily be construed as sources of variety,

they relate to sufficiently different kinds of variety to merit separate treatment in tests of the research propositions.

Hypothesis 1a: A competitive group's strategic fit with respect to environmental munificence will be positively related to its evolutionary stability.

Hypothesis 1b: A competitive group's strategic fit with respect to environmental uncertainty will be positively related to its evolutionary stability.

Recall that strategic fit is defined as the difference between the standardized measure of strategic variety and the respective standardized measures of environmental variety. Greater strategic fit is indicated by a smaller value. Recall also that Euclidean distance from the calculated efficient frontier is being used as the proxy for evolutionary stability.

Longitudinal evolutionary stability.

Hypothesis 2a: An increase over time in a competitive group's strategic fit with respect to environmental munificence will be related to greater evolutionary stability.

Hypothesis 2b: An increase over time in a competitive group's strategic fit with respect to environmental uncertainty will be related to greater evolutionary stability.

RHP asymmetries.

Hypothesis 3a: The relationship between a competitive group's strategic fit with respect to environmental munificence and the group's evolutionary stability will be moderated by RHP asymmetries within the group.

Hypothesis 3b: The relationship between a competitive group's strategic fit with respect to environmental uncertainty and the group's evolutionary stability will be moderated by RHP asymmetries within the group.

Pay-off asymmetries.

Hypothesis 4a: The relationship between a competitive group's strategic fit with environmental munificence and the group's evolutionary stability will be moderated by pay-off asymmetries within the group.

Hypothesis 4b: The relationship between a competitive group's strategic fit with environmental uncertainty and the group's evolutionary stability will be moderated by pay-off asymmetries within the group.

IPO performance.

Hypothesis 5: The evolutionary stability of an IPO firm's competitive group will be positively related to IPO performance.

Group density proportion. One major concern with the proposed study design is that a four member competitive group may simply be too small to capture the more complex dynamics of a broader field of competitors. To test the robustness of viewing the competitive group in this way, I have tested an additional hypothesis.

Hypothesis 6: The relationship between IPO performance and the evolutionary stability of its relevant competitive group will be moderated by the density of the broader field of competitors.

Evidence supporting acceptance of this hypothesis, would suggest a reconsideration of whether this research stream has any utility to managers whose cognitive limitations constrain them to consideration of only a few key competitors.

A model of the research propositions is presented in figure 4.

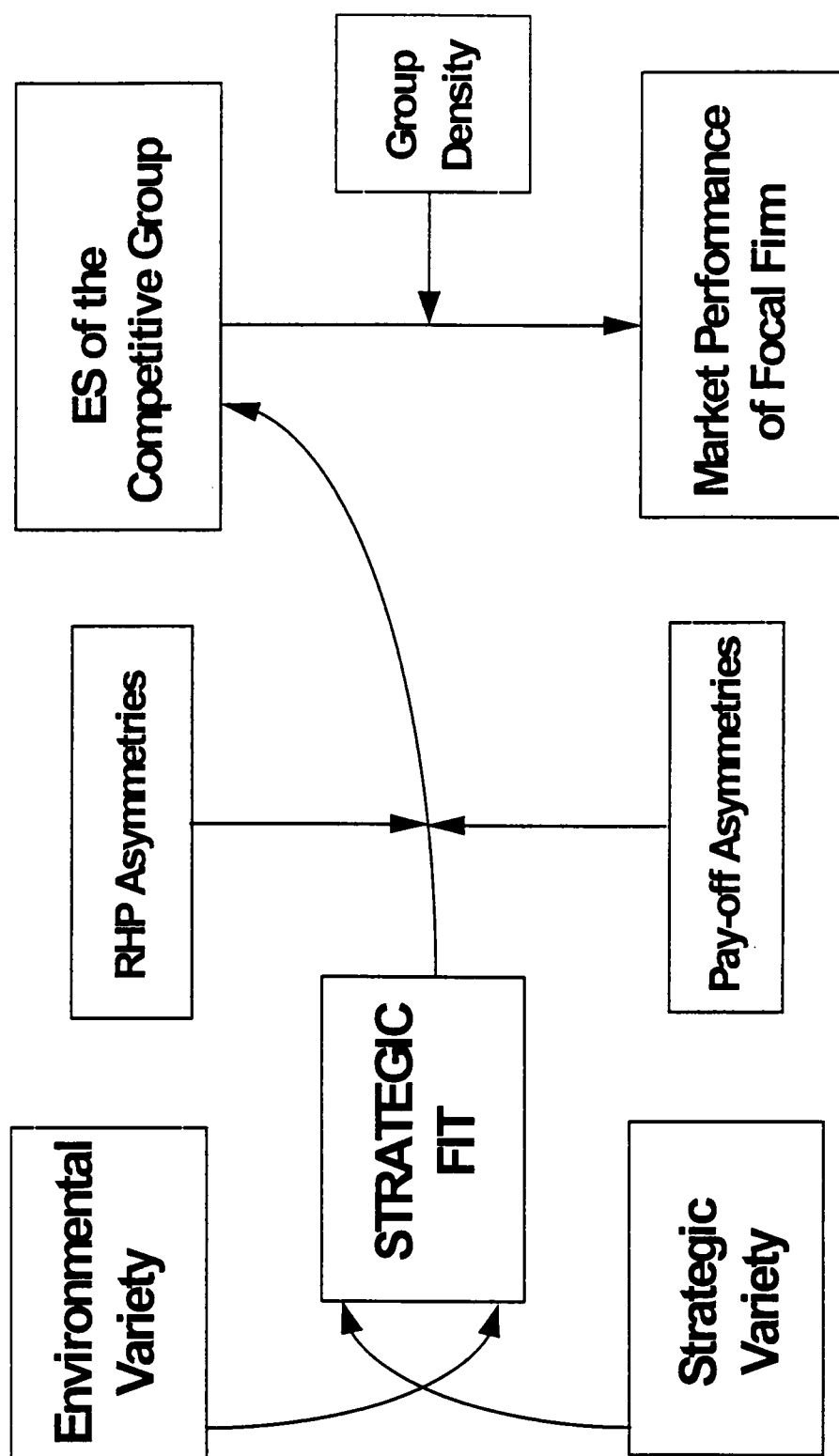


FIGURE 4: Full Research Model

4. ANALYSIS

Because many of the measures employed in this study are newly derived or adapted from other fields of study, the distribution of collected data cannot be known, *ex ante*, with much certainty. As such, linear regression is suggested to test for hypothesized relationships because this technique of statistical analysis has been found to be particularly robust and tolerant of reasonable deviations from normality.

Hypotheses 1a and 1b

I have employed the *SPSS* statistical software package to test the following regression equations:

$$ES_{t1} = \beta_0 + \beta_1(\text{FIT}_{t1} \text{ Munif.}) + \varepsilon$$

$$ES_{t1} = \beta_0 + \beta_1(\text{FIT}_{t1} \text{ Uncert.}) + \varepsilon$$

where:

ES_{t1} = Evolutionary Stability: A competitive group's distance from the calculated efficient frontier at the end of the year of initial offering,

$FIT_{t1} \text{ Munif.}$ = The absolute difference between the standardized measures of strategic variety and environmental munificence at the end of the year of initial offering, and

$FIT_{t1} \text{ Uncert.}$ = The absolute difference between the standardized measures of strategic variety and environmental uncertainty at the end of the year of initial offering.

Hypotheses 2a and 2b

The essence of hypotheses 2a and 2b is that a positive change in the strategy fit to the environment should be associated with a positive change in evolutionary stability. Such a finding of correlated change over time would bolster the salience of the theoretical arguments and provide evidence of a causal relationship between strategic fit and evolutionary stability.

The following regression equations will test these hypotheses.

$$\Delta ES_{(t3-t1)} = \beta_0 + \beta_1(\Delta FIT_{(t3-t1)} \text{ Munif.}) + \varepsilon$$

$$\Delta ES_{(t3-t1)} = \beta_0 + \beta_1(\Delta FIT_{(t3-t1)} \text{ Uncert.}) + \varepsilon$$

where:

$\Delta ES_{(t3-t1)}$ = Change in Evolutionary Stability: The change in a competitive group's distance from the calculated efficient frontier from the beginning of the study period to the end,

$\Delta FIT_{(t3-t1)} \text{ Munif.}$ = Change in Strategic Fit with Munificence: The change in the absolute difference between the standardized measures of strategic variety and environmental munificence from the beginning of the study period to the end, and

$\Delta FIT_{(t3-t1)} \text{ Uncert.}$ = Change in Strategic Fit with Uncertainty: The change in the absolute difference between the standardized measures of strategic variety and environmental uncertainty from the beginning of the study period to the end.

Unfortunately, the relatively short time period of this study will not permit a more rigorous test of any longitudinal relationships which may exist. The point at this early stage in this line of research, though, is only to provide evidence which might lend a temporal dimension to any findings which may be forthcoming. Searching for correlated changes over the three year period of the study should be sufficient for this purpose.

Hypotheses 3a and 3b

These hypotheses were investigated using regression analysis to test the following relationships involving asymmetries in resource holding potential (RHP).

$$ES = \beta_0 + \beta_1(FIT_{Munif.}) + \beta_2(ASYMM.RHP) \\ + \beta_3(FIT_{Munif.} * ASYMM.RHP) + \varepsilon$$

$$ES = \beta_0 + \beta_1(FIT_{Uncert.}) + \beta_2(ASYMM.RHP) \\ + \beta_3(FIT_{Uncert.} * ASYMM.RHP) + \varepsilon$$

where:

ES = Evolutionary Stability: A competitive group's distance from the calculated efficient frontier,

$FIT_{Munif.}$ = The absolute difference between the standardized measures of strategic variety and environmental munificence,

$FIT_{Uncert.}$ = The absolute difference between the standardized measures of strategic variety and environmental uncertainty,

$FIT_{Munif.} * ASYMM.RHP$ = The interaction of strategic fit with respect to environmental munificence and RHP Asymmetry, and

$FIT_{Uncert.} * ASYMM_{RHP}$ = The interaction of strategic fit with respect to environmental uncertainty and RHP Asymmetry.

This statistical technique, referred to as moderated regression, tests for the presence of an interaction effect (Neter, Wasserman and Kutner, 1990). The effect of strategic fit on evolutionary stability, in this model, depends upon the level of RHP asymmetries which may exist. A significant β_3 coefficient would provide evidence that such an interaction effect exists.

Hypotheses 4a and 4b

Hypothesis 4a and 4b will also be tested using moderated regression. The following regression models will test both the main and interaction effects.

$$ES = \beta_0 + \beta_1(FIT_{Munif.}) + \beta_2(ASYMM_{Pay-off}) + \beta_3(FIT_{Munif.} * ASYMM_{Pay-off}) + \varepsilon$$

$$ES = \beta_0 + \beta_1(FIT_{Uncert.}) + \beta_2(ASYMM_{Pay-off}) + \beta_3(FIT_{Uncert.} * ASYMM_{Pay-off}) + \varepsilon$$

where:

ES = Evolutionary Stability: A competitive group's distance from the calculated efficient frontier,

$FIT_{Munif.}$ = The absolute difference between the standardized measures of strategic variety and environmental munificence,

$FIT_{Uncert.}$ = The absolute difference between the standardized measures of strategic variety and environmental uncertainty,

$FIT_{Munif.*ASYMM.Pay-off}$ = The interaction of strategic fit with respect to environmental munificence and Pay-off Asymmetry, and

$FIT_{Uncert.*ASYMM.Pay-off}$ = The interaction of strategic fit with respect to environmental uncertainty and Pay-off Asymmetry.

Hypothesis 5

This hypothesized relationship between IPO performance and the evolutionary stability of its competitive group was tested according to the following regression equation.

$$CAR_{IPO} = \beta_0 + \beta_1(ES) + \varepsilon$$

where:

ES = Evolutionary Stability: A competitive group's distance from the calculated efficient frontier and

CAR_{IPO} = Cumulative adjusted returns of the IPO firm for the three year study period.

Hypothesis 6

A similar regression model, including a term representing a possible interaction between competitive group density and evolutionary stability on IPO performance is proposed.

$$\text{CAR}_{\text{IPO}} = \beta_0 + \beta_1(\text{ES}) + \beta_2(\text{DENSITY PROP.}) + \beta_3(\text{ES} * \text{DENSITY PROP.}) + \varepsilon$$

where:

ES = Evolutionary Stability: A competitive group's distance from the calculated efficient frontier,

CAR_{IPO} = Cumulative adjusted returns of the IPO firm for the three year study period

DENSITY PROP. = density proportion, or the four members of the focal group as a proportion of number of competitors in the broader competitive field and

ES * DENSITY PROP. = The interaction between evolutionary stability of the focal competitive group and density of the extended competitive group.

Significance on the β_3 coefficient will suggest that, in a significant number of cases, a four member competitive group is under specified.

5. RESULTS

In this section I first discuss the study sample and present the efficient frontiers that were calculated from stock return data. Next I present the results of the proposed regression analyses testing the research hypotheses. While some hypotheses were supported, others yielded perplexing results when viewed from the proposed theoretical perspective.

Outcomes of these analyses, while equivocal, seemed to point toward a model more predictive of IPO market success. As such, the results chapter concludes with a more exploratory "ex post" analysis wherein I perform preliminary tests of apparently significant covariants of stock market returns to IPO firms.

The Study Sample

In order to insure that competitor firms which were identified remained direct rivals over the entire 3 year study period, analyst reports for both the first and third years following the initial public offering were consulted. In cases where dual reports were not available or where reports did not provide clear and definitive information about competitors, the competitive group was dropped from the sample. Of the initial 179

firms found to be in the relevant population, 72 survived this screening criteria. Of those seventy-two, ten were subsequently found to have competitors which were either diversified corporations or were privately traded. Thus, the study sample contained 62 IPO'S and their competitive groups. This is equivalent to a sampling rate of 35% of the relevant population.

Of the 62 useable competitive groups in the sample, there were 20 whose offering date was in 1988, 12 who first went public in 1989 and 30 whose initial public offering occurred in 1990.

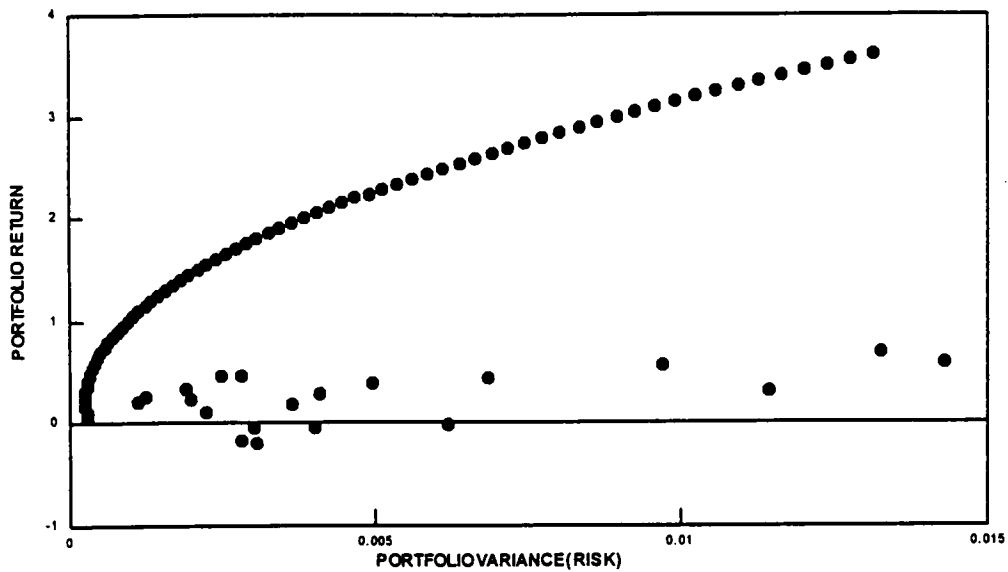
The Efficient Frontiers

The first step in the analysis was to assess the evolutionary stability of the sample competitive groups. To do this, monthly stock returns (including dividends) were collected for the IPO firms and each one of their respective competitors. Using the returns for each of the firms in each competitive group, an efficient frontier was calculated for the first and third years post-offer for each of the three years under study. Seventy-two firms were used in the 1988 calculations, forty-six for 1989 and ninety-four contributed to the determination of an efficient frontier for 1990.

As discussed earlier, an efficient frontier consists of a series of points which indicate, for each desired rate of return, the minimum risk which one could expect to incur by carefully selecting certain stocks in certain proportions with which to compile an equity investment portfolio. The actual competitive groups being studied here form portfolios of their own with certain risk and return characteristics. It is the extent to which those characteristics deviate from optimal efficiency (the frontier) that is being taken here as the measure of evolutionary stability. Figures 5, 6 and 7 show charts of the actual efficient frontiers for the beginning and end of each of the three years being studied.

The points plotted below the efficient frontiers on each chart depict the risk and return positions of the competitive groups. To ascertain the measure of evolutionary stability, the linear distances from a point depicting a competitive group to each calculated point along the efficient frontier in a particular time period were compiled. It is the minimum value of this compilation of distances which, for each competitive group within a time period, was taken as the measure of group performance or evolutionary stability. The smaller the minimum distance, the more stable

EFFICIENT FRONTIER FOR 1988 COMPETITIVE GROUPS
YEAR 1



EFFICIENT FRONTIER FOR 1988 COMPETITIVE GROUPS
YEAR 3

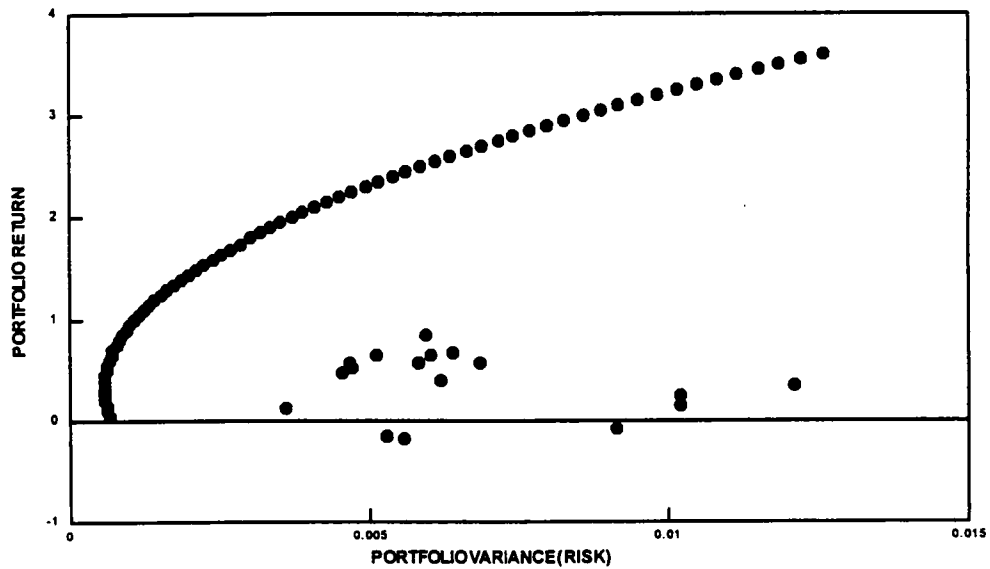
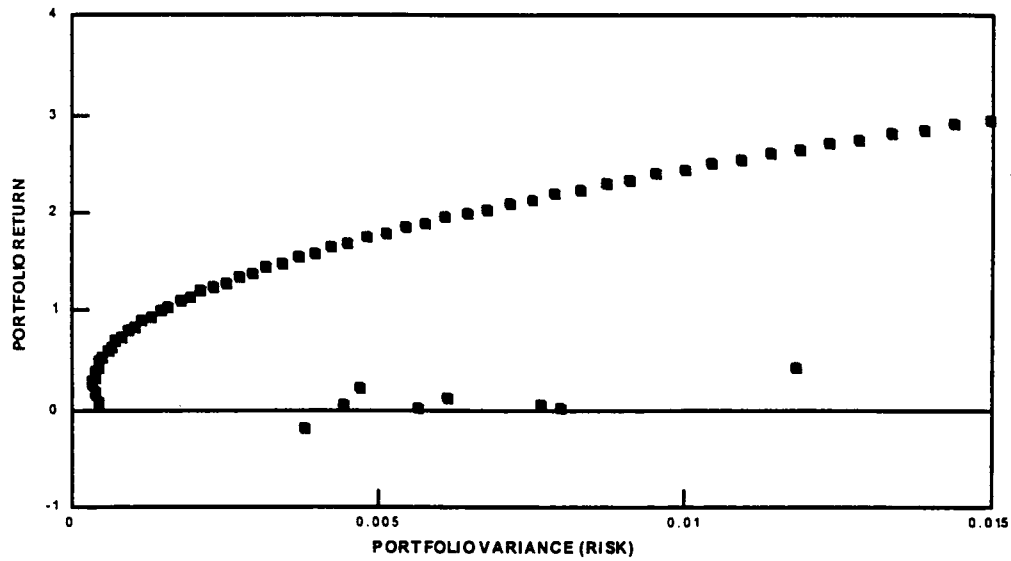


FIGURE 5: Efficient Frontiers for 1988 IPO'S

EFFICIENT FRONTIER FOR 1989 COMPETITIVE GROUPS
YEAR 1



EFFICIENT FRONTIER FOR 1989 COMPETITIVE GROUPS
YEAR 3

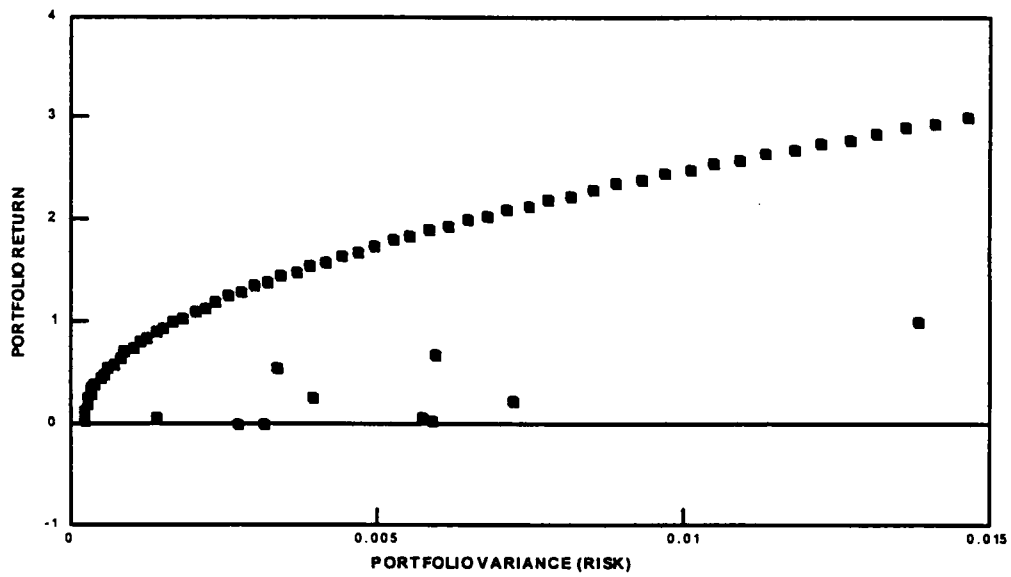
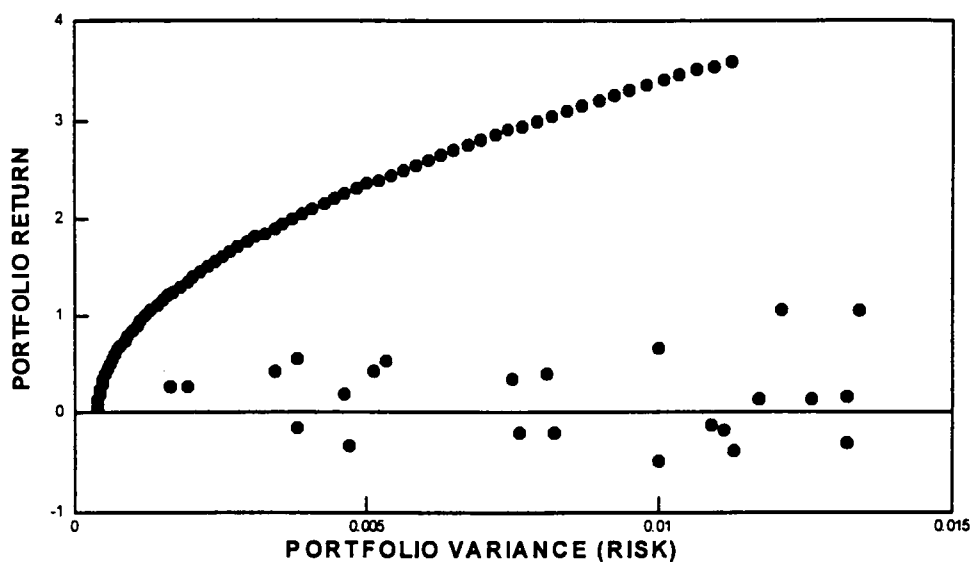


FIGURE 6: Efficient Frontiers for 1989 IPO'S

EFFICIENT FRONTIER FOR 1990 COMPETITIVE GROUPS
YEAR 1



EFFICIENT FRONTIER FOR 1990 COMPETITIVE GROUPS
YEAR 3

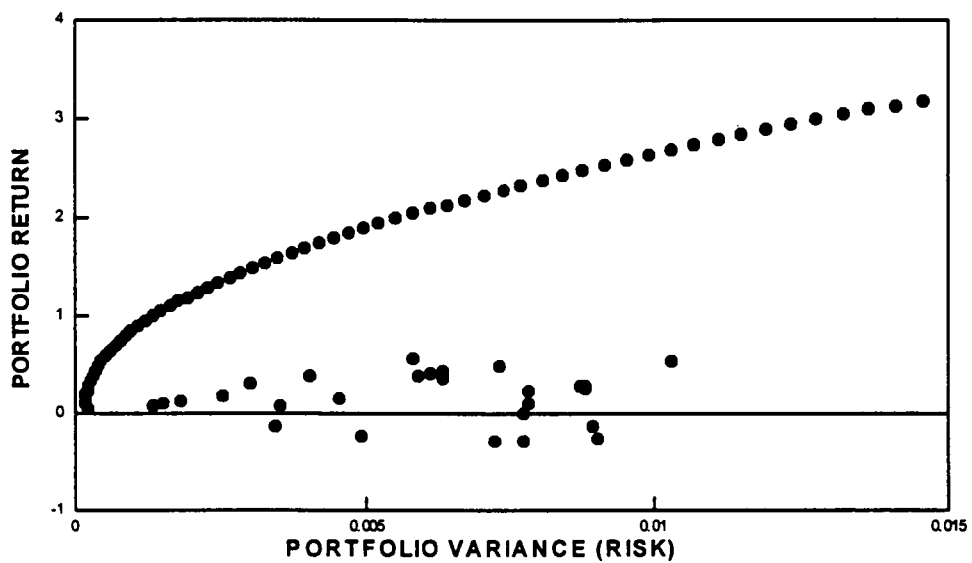


FIGURE 7: Efficient Frontiers for 1990 IPO'S

the group was viewed as being with respect to the return they were able to secure and the risk they were able to avoid.

Regression Analyses

Hypotheses were tested using the *SPSS* statistical software package to perform linear regression analysis. The results of those tests are reported below.

Probability of a spurious result. Since there is a greater probability of obtaining at least one spurious result when performing multiple analyses on a single data set (Miller, 1981), the dimensions of this potential confound must be assessed at the outset. The probability that at least one spurious result will occur given that a particular H_0 is true is given as:

$$P\{\text{at least 1 spurious result} \mid H_0 \text{ true}\} = 1 - (1 - \alpha)^m$$

where:

α = level of significance

m = number of independent tests performed

In all, 10 separate regressions are performed on the present data set where the risk of a Type I error is controlled at $\alpha = .10$. Thus, the

upper bound on the probability of encountering a spurious result is .65. Clearly, a call for caution in interpretation of results is well warranted.

Hypothesis 1a. The first hypothesis, suggesting a relationship between the evolutionary stability of a competitive group and environmental munificence was tested. Test results are reported in figure 8. Those results, showing a p-value of .077 for the regression model indicate that, at an α level of .10, there is evidence in support of the hypothesized relationship. The effect of environmental munificence on evolutionary stability, however, is small. Regarding the adjusted R Square for this model, one finds that barely 4% of the variance in evolutionary stability is accounted for using this predictor variable.

As with the measure of evolutionary stability, recall that the measures of strategic fit are difference measures where *smaller* values represent better fit. Thus, the positive sign of the beta coefficient shown in figure 8 can be taken as evidence that the hypothesized direction of the relationship between these two constructs is as predicted. A better fit between strategic variety and munificence does appear to be associated with greater evolutionary stability.

<u>Dependent Variable:</u>		Evolutionary Stability (Year 1)			
Multiple R				.22628	
R Square				.05120	
Adjusted R Square				<u>.03539</u>	
Standard Error				.07969	
<u>Analysis of Variance</u>					
		Degrees of Freedom	Sum of Squares	Mean Square	
Regression		1	.02056	.02056	
Residual		61	.38103	.00635	
F	=	3.23804	Significance of F	=	<u>.07700</u>
<u>Regression Coefficients</u>					
Variable	B	SE B	Beta	T	Sig. T
Fit of Strategic Variety with Munificence					
	.021319	.011848	.226283	1.799	.0770
(Constant)	.132041	.01012		13.045	.0000

FIGURE 8: Regression Analysis and ANOVA Table for Hypothesis 1a

Hypothesis 1b. The next hypothesis tested was posed in consideration of a potential relationship between evolutionary stability and fit strategic variety with environmental uncertainty. The results of this regression analysis and the associated ANOVA table are provided in figure 9. As with hypothesis 1A, results from this test provide evidence of a small but significant relationship between evolutionary stability and strategic fit with environmental uncertainty.

Again, where $\alpha = .10$, the positive beta coefficient on the independent variable, .243, suggests that the direction of the hypothesized relationship is as predicted.

Apparently, a better fit between strategic variety and both environmental munificence and environmental uncertainty has a small influence on evolutionary stability.

Hypothesis 2a. Tests of the hypotheses relating change in strategic fit over time with change in evolutionary stability are a bit more difficult to interpret. Differences between first and third year post-offer evolutionary stability were calculated by subtracting first year values from third year values.

$$\Delta ES_{(t3-t1)} = ES_{t3} - ES_{t1}$$

Dependent Variable: Evolutionary Stability (Year 1)

Multiple R	.24285
R Square	.05898
Adjusted R Square	<u>.04329</u>
Standard Error	.07936

Analysis of Variance

	Degrees of Freedom	Sum of Squares	Mean Square
Regression	1	.02268	.02368
Residual	61	.37791	.00630

F = 3.76042 Significance of F = .05720

Regression Coefficients

Variable	B	SE B	Beta	T	Sig. T
Fit of Strategic Variety with Uncertainty	.022796	.011755	.242852	1.939	.0572
(Constant)	.131960	.010079		13.092	.0000

FIGURE 9: Regression Analysis and ANOVA Table for Hypothesis 1b

Thus, a positive difference would be associated with a move *closer* to evolutionary stability and a negative difference would indicate a move *away*.

Temporal change in strategic fit was calculated similarly, such that a positive value for change in fit could be associated with attainment of greater fit.

$$\Delta FIT_{(t3-t1)} \text{ Munif.} = FIT_{t3} \text{ Munif.} - FIT_{t1} \text{ Munif.}$$

AND

$$\Delta FIT_{(t3-t1)} \text{ Uncert.} = FIT_{t3} \text{ Uncert.} - FIT_{t1} \text{ Uncert.}$$

Regression analysis testing the relationship between the change in evolutionary stability and the change in fit between strategic variety and environmental munificence, shown in figure 10, yielded no significant results. As such, no interpretation can be derived.

Hypothesis 2b. Regression analysis was also performed to test for a possible relationship between change in evolutionary stability and change in fit between strategic variety and environmental uncertainty. Results of this regression analysis are illustrated in figure 11. This regression model proves to be significant, where α is equal to .10, with a p-value of .0164. While the value of adjusted R-Square shows that

Dependent Variable: Change in Evolutionary Stability (Year 1 to Year 3)

Multiple R	.13396
R Square	.01794
Adjusted R Square	<u>.00158</u>
Standard Error	.10802

Analysis of Variance

	Degrees of Freedom	Sum of Squares	Mean Square
Regression	1	.01279	.01279
Residual	61	.70004	.01167

F = 1.09637 Significance of F = .2993

Regression Coefficients

Variable	B	SE B	Beta	T	Sig. T
Change in Fit of Strategic Variety with Munificence	-.015303	.014615	-.133959	-1.047	.2993
(Constant)	.091685	.013718		6.684	.0000

FIGURE 10: Regression Analysis and ANOVA Table for Hypothesis 2a

Dependent Variable: Change in Evolutionary Stability (Year 1 to Year 3)

Multiple R	.30381
R Square	.09230
Adjusted R Square	<u>.07717</u>
Standard Error	.10385

Analysis of Variance

	Degrees of Freedom	Sum of Squares	Mean Square
Regression	1	.06579	.06579
Residual	61	.64704	.01078

F = 6.10102 Significance of F = .01640

Regression Coefficients

Variable	B	SE B	Beta	T	Sig. T
Change in Fit of Strategic Variety with Uncertainty	-.028952	.011721	-.303807	-2.470	.0164
(Constant)	.091857	.013189		6.965	.0000

FIGURE 11: Regression Analysis and ANOVA Table for Hypothesis 2b

barely 8% of variance in the dependent variable was accounted for, perhaps the more interesting result of this analysis is the sign of the beta coefficient on the independent variable.

Recall that both evolutionary stability and strategic fit get “better” as their respective values get smaller. Therefore, in the case of evolutionary stability, a beneficial move closer to the efficient frontier would be indicated by a larger value in year 1 (less stability) being subtracted from a smaller value (more stability) in year 3. Since a larger value subtracted from a smaller value results in a negative number, moves closer to evolutionary stability would be associated with smaller values of change in evolutionary stability.

Likewise a change to better fit between strategic variety and environmental uncertainty would also be indicated by the lower values. Thus the negative beta coefficient in the regression model suggests that greater evolutionary stability occurs when fit between strategic variety of the group and environmental uncertainty becomes worse! Why might greater misfit result in increased stability? More will be said on this topic later in the results section.

Hypothesis 3a. Hypotheses 3 a & b and 4 a & b test for an interaction between strategic fit and group asymmetries on the dependent

variable, evolutionary stability. The regression model shown in figure 12 shows that no such interaction effect can be supported in the case of RHP asymmetries acting with strategic fit with respect to environmental munificence. Using an α level of .10, however, the analysis shows that this model can be said to account for 6% of the variance in evolutionary stability. Taken in the context of the exploratory, theory building nature of this study, however, this interpretation should be seen as tentative and must be considered only with extreme trepidation

Recall for a moment the test of hypothesis 1a wherein just the one main effect of strategic fit with munificence was regarded. The current model, including the additional main effect of group RHP asymmetries shows an adjusted R Square of almost twice the 3.5% of the previous formulation. This provides evidence that might lead one to cautiously suspect that group RHP asymmetries play a small role in the evolutionary stability of the group.

Hypothesis 3b. The moderating effect of group RHP asymmetries on the main effect between strategic fit with respect to environmental uncertainty and the dependent variable, evolutionary stability, is examined in figure 13. As shown, the model is not significant with α equal to .10 and, as such, not interpretation can be derived.

Dependent Variable: Evolutionary Stability

Multiple R	.33033
R Square	.10912
Adjusted R Square	<u>.06304</u>
Standard Error	.07854

Analysis of Variance

	Degrees of Freedom	Sum of Squares	Mean Square
Regression	3	.04382	.01461
Residual	59	.35777	.00617
F = 2.36808		Significance of F = <u>.08000</u>	

Regression Coefficients

Variable	B	SE B	Beta	T	Sig. T
Fit of Strategic Variety with Munificence	.035637	.027239	.297001	1.308	.1959
RHP Asymmetry of the Group	.035653	.022481	.205451	1.586	.1182
Interaction Term	-6.74E-04	.009346	-.016773	-.072	.9428
(Constant)	.090292	.027946		3.231	.0020

FIGURE 12: Regression Analysis and ANOVA Table for Hypothesis 3a

Hypotheses 4a & 4b. Because no significant relationships were revealed in the tests of a moderating effect of pay-off asymmetries on the relationship between strategic fit and evolutionary stability, regression results for hypotheses 4a and 4b are discussed here summarily. Figures 14 and 15 show that neither regression model was significant at the 90% confidence level.

Hypothesis 5. Hypothesis 5 posits that greater evolutionary stability in an IPO firm's group of direct competitors can have a positive effect on the three-year cumulative adjusted returns of the newly public company. Actual monthly market returns (including dividends) for the sample IPO's were differenced from the return to the S & P 400 for each month of the three-year period following the year of initial offering.

The S & P 500 is the usual index applied when seeking to discern firm returns in excess (or less than) the level of return to the greater market of public equities. The S & P 400, however, was chosen in this case. Since the S & P 400 differs from the S & P 500 primarily via the exclusion of utility equities, it was seen as a more realistic index to apply against the current sample of smaller, newer firms.

Dependent Variable:**Evolutionary Stability**

Multiple R	.30764
R Square	.09464
Adjusted R Square	<u>.04781</u>
Standard Error	.07918

Analysis of Variance

	Degrees of Freedom	Sum of Squares	Mean Square
Regression	3	.03801	.01267
Residual	59	.36359	.00627
F	= 2.02099	Significance of F	= <u>.12090</u>

Regression Coefficients

Variable	B	SE B	Beta	T	Sig. T
Fit of Strategic Variety with Uncertainty	-.002983	.027370	-.025846	-.109	.9136
RHP Asymmetry of the Group	.042077	.022490	.242470	1.871	.0664
Interaction Term	.011996	.010135	.285176	1.184	.2414
(Constant)	.084217	.028012		3.006	.0039

FIGURE 13: Regression Analysis and ANOVA Table for Hypothesis 3b

Dependent Variable: Evolutionary Stability

Multiple R	.29739
R Square	.08844
Adjusted R Square	<u>.04129</u>
Standard Error	.07945

Analysis of Variance

	Degrees of Freedom	Sum of Squares	Mean Square
Regression	3	.03552	.01184
Residual	59	.36608	.00631
F = 1.8757		Significance of F =	<u>.14370</u>

Regression Coefficients

Variable	B	SE B	Beta	T	Sig. T
Fit of Strategic Variety with Munificence	.025130	.016254	.209433	1.546	.1275
Pay-Off Asymmetry of the Group	2.67E04	.002689	.054019	.099	.9212
Interaction Term	1.42E-04	7.66E-04	.102940	.186	.8530
(Constant)	.129788	.012018		10.800	.0000

FIGURE 14: Regression Analysis and ANOVA Table for Hypothesis 4a

Dependent Variable: Evolutionary Stability

Multiple R	.24280
R Square	.05895
Adjusted R Square	<u>.01028</u>
Standard Error	.08072

Analysis of Variance

	Degrees of Freedom	Sum of Squares	Mean Square
Regression	3	.02367	.00789
Residual	59	.37792	.00652
F = 1.2112		Significance of F =	<u>.31380</u>

Regression Coefficients

Variable	B	SE B	Beta	T	Sig. T
Fit of Strategic Variety with Uncertainty	.012921	.015813	.111942	.817	.4172
Pay-Off Asymmetry of the Group	1.78E-04	.002960	.036025	.060	.9522
Interaction Term	1.85E-04	7.62e-04	.147911	.243	.8085
(Constant)	.129879	.012389		10.483	.0000

FIGURE 15: Regression Analysis and ANOVA Table for Hypothesis 4b

Hypothesis 5, proposing a relationship between the evolutionary stability of the competitive group and the market performance of the IPO was not supported. As can be seen in figure 16, the regression model fell short of the minimum acceptable 90% level of significance.

Hypothesis 6. Finally, hypothesis 6 reflects an attempt to uncover an interaction effect which may have acted in conjunction with the main effect of evolutionary stability of the competitive group on the performance of the focal IPO firm. As hypothesized, group density percent was considered to have a possible influence upon the effect of evolutionary stability on IPO market performance.

The variable, group density proportion, was calculated as the quotient of the number of members in the competitive group and the total number of direct competitors reported by analysts.

$$\text{DENSITY PROP.} = \frac{\text{NO. OF MEMBERS IN THE FOCAL GROUP}}{\text{NO. OF MEMBERS IN THE COMPETITIVE FIELD}}$$

A moderated regression model was formulated and tested as shown in figure 17. While the overall model was significant with a p value of .0012, the hypothesized interaction effect was not supported. It is interesting, though, to note that as a main effect, density

Dependent Variable: Cumulative Adjusted Returns of Focal IPO's

Multiple R	.15859
R Square	.02515
Adjusted R Square	<u>.00890</u>
Standard Error	.83236

Analysis of Variance

	Degrees of Freedom	Sum of Squares	Mean Square
Regression	1	1.07248	1.07248
Residual	61	41.56949	.69282
F = 1.5478		Significance of F =	<u>.21830</u>

Regression Coefficients

Variable	B	SE B	Beta	T	Sig. T
Evolutionary Stability of the Group	-1.6342	1.31346	-.15859	-1.244	.2183
(Constant)	.9072	.202820		4.473	.0000

FIGURE 16: Regression Analysis and ANOVA Table for Hypothesis 5

Dependent Variable: Cumulative Adjusted Returns of Focal IPO's

Multiple R	.48746
R Square	.23762
Adjusted R Square	<u>.19818</u>
Standard Error	.74867

Analysis of Variance

	Degrees of Freedom	Sum of Squares	Mean Square
Regression	3	10.13251	3.37750
Residual	59	32.50946	.56051
F =	6.0258	Significance of F =	<u>.00120</u>

Regression Coefficients

Variable	B	SE B	Beta	T	Sig. T
Evolutionary Stability of the Group	-3.04318	2.38264	-.29533	-1.277	.2066
Density Percent	-1.52360	.50232	-.50156	-3.033	.0036
Interact Term	.66473	2.19213	.07382	.303	.7628
(Constant)	2.11570	.45394		4.661	.0000

FIGURE 17: Regression Analysis and ANOVA Table for Hypothesis 6

proportion may have quite a significant effect on the after-issue market performance of the IPO firm.

Further, the sign on the beta coefficient for that variable is negative, suggesting that as density proportion gets smaller (more competitors), cumulative adjusted returns get higher. Do newly public firms who compete in an environment more densely populated with rivals enjoy a greater probability of success?

Ex Post Exploratory Analyses

The scientific approach is a special systematized form of reflective thinking and inquiry. Dewey (1933), in his influential How We Think, outlined a general paradigm of inquiry. In summary, his scientific approach to inquiry involves (1) recognition and formulation of a problem, (2) construction of hypotheses and (3) hypothetical relations are tested through observation (Kerlinger, 1986). In the process, the original problem, or even the original hypotheses may be changed. Dewey emphasized that the temporal sequence of reflective thinking is not fixed. Thus, on the basis of research evidence, an hypothesis may be accepted or rejected and this information is, in turn, fed back to the original problem. Following this notion of information feedback, I have tested two additional regression models based on the previous findings.

Longitudinal change in fit. The findings of the analysis of hypothesis 2b were curious. Why was it that greater misfit with respect to environmental uncertainty was correlating with greater evolutionary stability? Taking my lead from these apparently anomalous findings, I resolved to enter both of the change variables into the model, regressing them on the dependent variable, evolutionary stability. It was hoped that considering both environmental fit variables in a single multiple regression model would help illuminate this quandary. The results of this model are shown in figure 18.

The sign and significance of the beta coefficient for the indicator variable portraying change in strategic variety with respect to environmental uncertainty remained unchanged. Further, the second indicator variable measuring change in strategic fit with respect to munificence also became significant.

Additional analysis to investigate a possible interaction between these two fit variables yielded no significant findings. Apparently, when taken together in the same model, these variables each play a small but significant role in changes in evolutionary stability, explaining more than 10% of the variance.

Toward a better model. Continuing toward the objective of better understanding the role of competition and strategic variety on IPO

Dependent Variable: Change in Evolutionary Stability (Year 1 to Year 3)

Multiple R	.37584
R Square	.14126
Adjusted R Square	<u>.11215</u>
Standard Error	.10186

Analysis of Variance

	Degrees of Freedom	Sum of Squares	Mean Square
Regression	2	.10069	.05035
Residual	60	.61214	.01038

F = 4.85247 Significance of F = .01120

Regression Coefficients

Variable	B	SE B	Beta	T	Sig. T
Change in Fit of Strategic Variety with Munificence	.04634	.02527	.40567	1.834	.0717
Change in Fit of Strategic Variety with Uncertainty	-.06136	.02108	-.64383	-2.911	.0051
(Constant)	.09211	.01294		7.120	.0000

FIGURE 18: Regression Analysis and ANOVA Table for Exploratory Analysis 1

success and taking advantage of the insights gleaned from the preceding analysis, I set about formulating a new model which would have better predictive power. The weak and perplexing findings from the analyses of hypotheses 1 and 2 as well as those of the above exploration gave cause to wonder whether evolutionary stability was a valid intervening construct for the purposes of this study. Thus, I chose only the most significant predictor variables from the previous analyses and formulated a regression model to test their effects *directly* on IPO market performance. Results of this exploratory model are presented in figure 19.

Change in strategic fit with both munificence and uncertainty in the environment appear to be significant predictors of after-offer returns. Note that the dependent variable in this analysis takes on larger values with more beneficial performance (opposite of the evolutionary stability variable). Thus the signs of the beta coefficients on these variables are consistent with those from the previous analyses. In light of the finding that strategic fit has some effect upon evolutionary stability, as well as on focal firm performance, it is troubling to note that the hypothesized effect of evolutionary stability on focal firm performance was not supported. This observation suggests that the construct of evolutionary stability may be unstable, insufficiently specified or may not even exist.

Dependent Variable: Cumulative Adjusted Returns of Focal IPO's

Multiple R	.53895
R Square	.29047
Adjusted R Square	<u>.25377</u>
Standard Error	.71478

Analysis of Variance

	Degrees of Freedom	Sum of Squares	Mean Square
Regression	3	12.13143	4.04381
Residual	59	29.63319	.51092
F = 7.91481		Significance of F =	<u>.0002</u>

Regression Coefficients

Variable	B	SE B	Beta	T	Sig. T
Density Percent	-1.2311	.33547	-.40950	-3.670	.0005
Change in Fit of Strategic Variety with Munificence	-.38614	.17880	-.44159	-2.160	.0350
Change in Fit of Strategic Variety with Uncertainty	.42513	.14852	.58282	2.862	.0058
(Constant)	1.13749	.25647		4.435	.0000

FIGURE 19: Regression Analysis and ANOVA Table for Exploratory Analysis 2

The density proportion predictor variable, as at the group level, remains a strong indicator of higher performance at the level of the focal IPO firm. Again, the sign of the beta coefficient remains as before indicating that 3-year cumulative adjusted returns are higher in firms which compete in the more densely populated competitive fields. The adjusted R Square for the overall model is better than .25 and is highly significant with a p-value of .0002.

While these findings are interesting and potentially useful, they must be regarded with a measure of trepidation due to the exploratory nature of this portion of the analysis.

6. DISCUSSION

The objective of this study was to determine whether strategy is an important aspect of competing successfully and to develop a better understanding of how the competitive strategy adopted is a game theoretical function of the strategies employed by rival firms - a relationship leading to "evolutionary" stability.

Summary

Because there exists no clear theoretical framework within which to explore such areas of inquiry, a new perspective was introduced and implemented. Many academics, confronted with this same reality, are also reexamining the relevance of the extant concepts and tools of the strategy field. Practitioners, also lacking a consistent and useful strategy paradigm, seem to have focused more on implementation; abandoning strategy as either unimportant or uninteresting (Prahalad & Hamel, 1994).

Theory. This study drew upon existing, but underutilized, population ecology theory from the field of organizational behavior and integrated with it some theoretical insights from evolutionary game theory borrowed from the field of animal behavior. Implicitly recognizing that business organizations are, in fact, groups of primates vying in common

for limited resources, conceptual and empirical findings of animal behaviorists concerning strategic interaction, it is argued, can fairly be brought to bear.

Extending the scope of the conceptual component of this exercise yet further, theories of games and of cybernetics were also woven into the tapestry of theory developed for and applied in this study. Game theory (as incorporated into evolutionary game theory) provided conceptual grounding to the notion that payoffs can be a function of the strategies employed by rivals. Cybernetics supports the idea that stability in a system of organisms is reflected in the closeness of the match between the variety of strategies employed by that system and the variety of environmental opportunities and threats which confront the system. It is this *match* of variety for variety which is said to increase the system's overall fitness and thus promote its positive selection or adoption by the environment.

Finally, the study proceeded with the explicit notion that, in today's competitive markets, the success of any business entity (or system of entities) is tied inexorably to its ability to meet customers' demand for quality, low price and variety (Carothers, Sanders & Kirby, 1989). A novel perspective adopted here, however, is that of regarding customers as

benefactors, not of just one focal firm's product offerings, but of the cache of utility provided by the broader community of competitors.

Having established this theoretical base, it remained to develop measures with which to operationalize the theoretical constructs into variables to facilitate testing. Constructs are *approximated* units, which by their very nature cannot be observed directly (e.g., evolutionary stability, strategic variety or environmental variety). Variables, however, are the *observed* units which are operationalized empirically by measurement. In more general terms, a theory may be viewed as a system of constructs and variables in which the constructs are related to each other by propositions and the variables are related to each other by hypotheses (Bacharach, 1989).

Measures. Measurement variables formulated for this study to test the proposed theoretical framework include those used to operationalize the constructs: evolutionary stability, strategic variety and environmental variety. To facilitate the measurement of evolutionary stability, this researcher raided the intellectual armory of the academic field of finance. Using the calculated efficient frontier (Markowitz, 1957) as an indicator of the direction and boundary of evolutionary selection. The measure of evolutionary stability of the competitive group was then taken as the Euclidean distance of the group (or portfolio of rivals) from the nearest

point on the frontier. This newly proposed measure captures simultaneously the performance dimensions of risk and return and regards a group's position, not only in relation to other groups, but especially as it compares to the hypothetical maximum that the environment will allow. It was felt that such a scheme would be singularly appropriate to notions of group evolution espoused by the suggested theoretical framework.

The constructs of strategic and environmental variety were operationalized adapting well established measures from the field of strategic management to the current purpose. Competitive strategy was examined along Porter's (1980) dimensions of low cost and differentiation (both perceived and actual). To better appreciate the variety of utility reaching customers and for the purposes of contrasting strategic variety and environmental variety, a new scheme of strategy measurement was introduced. Members of a competitive group were "mapped" in *strategy space* according to their respective firm's product offerings along the three standardized dimensions of low cost, perceptual differentiation and actual product differentiation. Strategic variety was then represented as the average Euclidean distance between these strategy coordinates for each group.

The variety of environmental opportunities and threats were operationalized respectively as industry uncertainty and munificence. Again, these are well established measures from the field of strategic management which were applied in the exposition of this new theoretical frame work. In contrast to previous studies, however, this study operationalized "fit" between strategic variety and environmental variety as the arithmetic difference between the standardized measures of these constructs.

Findings. Tests of hypotheses suggesting a positive relationship between evolutionary stability of the competitive group and the fit of strategic variety with both environmental munificence and uncertainty provided mixed results. The hypothesized positive relationship with munificence was supported, whereas the positive relationship to uncertainty was not (in initial testing). Ex post analysis, however, did reveal that both of these dimensions of environmental variety may play a role in predicting IPO market performance.

Hypotheses 2a and 2b, that greater strategic fit with respect to environmental munificence and uncertainty led to greater evolutionary stability, were constructed to test the notion that change occurred in this population via longitudinal adaptation, or evolution. Both hypotheses were supported. However, an unexpected negative sign on the beta

coefficient for the main effect of strategic fit with uncertainty suggested that greater misfit could result in greater evolutionary stability.

In some animal competitive situations misfit does foster stability by obviating extended contests. Given the exploratory nature of the present study, however, continued speculation on this issue would only be indicated by further empirical evidence of this apparently paradoxical relationship.

Hypotheses were also constructed to ascertain whether the relationship between strategic fit with environmental variety and evolutionary stability at a point in time was influenced by size (or RHP) asymmetries and by pay-off asymmetries. Results showed that only size asymmetry had a significant moderating effect. Findings here were relatively weak and ambiguous and should be viewed with caution.

Hypothesis 5, that there is a positive relationship between evolutionary stability of the competitive group and market performance of the focal IPO was not supported. As this hypothesis represented one of the main thrusts of the proposed theoretical framework, it gives cause to reconsider the utility applying evolutionary game theory, in this form, to inquiries concerning the competitive dynamics of young public corporations.

The overall model for the last hypothesis, suggesting competitive population density as a moderator of the (unsupported) effect between evolutionary stability and IPO market performance was supported. However, a closer look indicated that it may be the main effect of competitive population density that carried the model as no interaction effect was supported.

Recommendations for Future Research

While findings from this early empirical foray into the development and application of this new line of theoretical reasoning may be marginal and tentative, they do point clearly the direction for future empirical and conceptual research efforts.

On evolutionary stability. The weak and unstable effects among focal firm performance, evolutionary stability and fit of strategic variety with environmental variety, suggest that more work is needed before evolutionary game theory can be declared *operational* in the field of strategic management. Significant findings are small and difficult to interpret yet still provide encouragement to continue in this vein of research.

In particular, the paradoxical finding that relates misfit between strategic variety and environmental munificence to higher evolutionary

stability of the group and focal firm performance needs to be further explored. To accomplish this, a more fine-grained measure of the fit between strategic variety and environmental variety should be developed. The current measure has apparently captured the dimension of fit (or misfit) but cannot reveal whether misfit is a result of more strategic variety than is indicated by the environment - or less. Since misfit seems to be an unexpectedly significant correlate of desired performance outcomes, the specific direction of the mismatch becomes an important factor.

Alternative explanations. When conducting academic research in general, and particularly when equivocal and perplexing results occur, there is an onus upon the researcher to consider alternative plausible explanations for observed phenomena.

A fundamental tenant of the ecological doctrine, as it has been applied in the field of organizational behavior, is that adaptive change in response to challenges in the environment is the underlying mechanism of organizational evolution. In the study of animal behavior too, adaptation is seen as compensation for environmental change which, in turn, fosters stability. *Homeostasis* thus describes the state of dynamic balance maintained by multiple interacting systems that constitute the self-regulatory process (Cannon, 1929).

Lewontin (1979), however, in his critique of the adaptationist program, points out several logical errors in this line of thinking; two of which may be particularly germane. The first is the *confusion of levels* wherein evolutionary reasoning is used to explicate the specific content of human actions as flowing from the genotype which is a quality of individuals. The basic philosophical error is the confusion of properties of sets with properties of members of sets. However, the longitudinal changes considered in this study are cultural adaptations, transmitted by teaching, learning, modeling, etc. As such, arguments assuming genetic transmission of traits may not be relevant.

A second critique posed by Lewontin can be described as *imaginative reconstruction*. This is Lewontin's term for "thinking about a species, past or present, and literally inventing a reason why a certain trait should have been favored by natural selection". He argues that, whereas "...some such explanations are no doubt correct, others are not, and in the absence of experimental falsifiability there is no way to tell which is which".

Experimental evidence generated by this study supports a small but significant relationship between adaptive change over time with respect to the matching of strategic variety to environmental variety and evolutionary stability. This finding lends some credence to an "evolution-

by-selection" rationale. Given the small effect size, however, other potential contributing causal factors cannot be ruled out. More conceptual work is needed to root out competing plausible explanations for why some competitive groups were seen to be more evolutionarily stable than others.

Strategy matters/Competition matters. The proposed theoretical model was not fully supported via empirical evidence on the positive relationship between evolutionary stability and IPO performance. An exploratory extension of the analysis, however, suggested that relating differences in IPO performance to fit between group strategic variety and variety in environmental opportunities and threats would be an interesting and useful area of continued academic inquiry. The variety of competitive strategies among rivals appears also to be a concept worthy of serious consideration for managers hoping to enhance customer value as well as shareholder value.

An especially compelling outcome of the exploratory analysis was the strong direct relationship uncovered between competitive population density and IPO performance. If future research should affirm this relationship, economists propounding the benefits to the firm of a more monopolistic competitive landscape may need to reformulate their models. Perhaps the greater positive effect on shareholder value is achieved by

regarding how customer value can be increased via a broader and more varied community of competitors.

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VITA

Mark Gerard Spitzfaden was born in Gretna, Louisiana in 1957. After graduation from West Jefferson High School in 1975, Mark began working in the offshore oilfields as a rig welder. In this capacity, he was able to travel extensively, working at drilling locations off the Eastern coast of the U.S., the Western coast of Africa, and the Gulf coast of Mexico. It was this exposure to petroleum entrepreneurs and their "wildcatting" spirit that initiated Mark's interest in the study of business venturing and prompted his decision to continue his formal education.

Mark initiated his pursuit of higher education at Nichols State University in Thibodaux, Louisiana. There, he received his Associate of Science degree in Petroleum Technology in 1983. Following graduation from Nichols, Mark went on to attend the University of Southern Mississippi in Hattiesburg.

In 1987, he received his Bachelor of Science degree in Marketing and was then accepted to the University of Southern Mississippi's Graduate School of Business. In 1989, Mark received his Master of Business Administration in Finance as well as a second Bachelor of Science degree in Management Information Systems. He was accepted to the doctoral program in Strategic Management at the University of Tennessee in Knoxville in 1990.

While at the University of Tennessee, Mark performed scholarly research which has been accepted for publication and presented before both regional and national audiences. In December of 1994, he earned his Ph.D. under the direction of Dr. Michael J. Stahl, Associate Dean of the University of Tennessee's College of Business.

Since 1984, Mark has owned and operated, *Amaranth Arabian Stud*, an Arabian Horse breeding and training enterprise. At present, he holds the position of Associate Professor of Entrepreneurship and Management at California Polytechnic University in Pomona, California.