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# DECOUPLING RISK TAKING FROM INCOME STREAM UNCERTAINTY: A HOLISTIC MODEL OF RISK

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*This paper builds and tests a holistic model of risk in organizations. Using structural equations modeling, we disaggregated risk into two distinct components, managerial risk taking and income stream uncertainty, or organizational risk. This allowed us to identify an array of organizational and environmental antecedents that have either been examined in isolation or neglected in previous studies about risk. Our results suggest that both organizational and environmental factors promote risk taking. Further, we found strong support for behavioral theory of the firm and agency theory on risk but not upper echelons theory. Our data also suggest that environmental characteristics have a negligible direct effect on organizational risk. Instead, the environment's impact on risk occurs primarily through managerial choices.* Copyright © 1999 John Wiley & Sons, Ltd.

Understanding risk in organizations remains an important goal in strategic management (Miller, 1998; Miller and Leiblein, 1996; Pablo, Sitkin and Jemison, 1996). This endeavor, however, has been hampered by confusion over the meaning and measurement of risk. In some cases, risk is used to describe managerial choices associated with uncertain outcomes (managerial risk taking). In others, however, risk is a characteristic of organizations experiencing volatile income streams (organizational risk). Given these disparate meanings, it is not surprising that several independent streams of risk research, each grounded in distinct theoretical frameworks, have emerged. Thus, despite considerable research on risk, confusion over risk's multiple meanings has hindered the field's advancement.

Part of this confusion occurs because studies often do not make an explicit distinction between managerial and organizational risks. Instead, most have used organizational risk to proxy for managerial risk taking because it is assumed that managerial risk taking causes variations in organizational performance. Organizational risk measures are therefore used in lieu of managerial risk taking behaviors. However, if risk is truly multidimensional (Baird and Thomas, 1990; Miller and Bromiley, 1990), explorations based on one definition that do not simultaneously incorporate the other may be mis-specified. Further, the strength of the relation between managerial and organizational risks has essentially been untested in empirical research explaining performance instability.[1] This study contributes to risk research by directly examining

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[1]An exception is Miller and Bromiley's (1990) finding that different measures of risk load separately on three factors they termed strategic, firm performance and market performance. However, their study stopped short of establishing the relationship among these factors.

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the causal relation between managerial risk taking and organizational risk.

Beyond integrating independent risk research streams, this study also fills important gaps within each stream. For example, as robust and useful as results about managerial risk taking seem, their poor explanatory power has suggested that additional theoretical perspectives are warranted (Sitkin and Pablo, 1992). We therefore draw on recent advances in two managerial-focused perspectives to fill that void. First, agency theorists have begun to consider the influence of corporate governance design on managerial risk preferences (e.g., Saunders, Strock and Travlos, 1990; Wright *et al*., 1996). Second, upper echelons theory provides a promising explanation of managerial risk taking by examining the role of top management team characteristics on managerial choice behavior (e.g., Bantel and Jackson, 1989; Hambrick, Cho and Chen, 1996).

Organizational risk has also received partial attention. In particular, environmental influences on risk have either been analyzed inconsistently or have been modeled incompletely. Past research has demonstrated that risk varies by industry (Fiegenbaum and Thomas, 1986) or by some industry characteristic (Woo, 1987). Other research has controlled for industry effects through measures such as average industry performance (Bromiley, 1991). However, controlling for industry effects through broad measures of industry performance, or single characteristics like market power, does not provide a basis for understanding *why*, or *how*, industry differences in risk occur. For example, it is not clear whether environmental characteristics influence risk taking or influence organizational risk directly. Although this question partly results from the use of organizational level measures in capturing risk taking, it also results from imprecise modeling of environment in risk research. To examine if and how industry context may influence risk, this study utilizes a well-established framework for examining the influence of environmental characteristics on managerial and organizational risk separately.

In sum, this paper overcomes the conceptual incompleteness of prior risk research by developing a holistic model that distinguishes between managerial risk taking and organizational risk. While we believe that organizational risk is influenced by managerial risk taking, we also suggest a firm's level of risk is caused by a constellation of consequential, though frequently overlooked, environmental and organizational factors. Combining agency and upper echelon theories with extant risk research drawing on behavioral theory of the firm (e.g., Bromiley, 1991; Wiseman and Bromiley, 1996) suggests four clusters of factors that may influence risk: industry characteristics, characteristics of the organization's decision makers, attainment of organizational goals, and the organization's resource base. If all these factors influence risk, then prior models examining only one are incomplete. In the next section, we develop a testable model of organizational and managerial risk.

## HOLISTIC MODEL OF MANAGERIAL AND ORGANIZATIONAL RISK

To further our understanding of risk relations and how organizational and managerial risk differ, we must enlarge the spectrum of factors used to explain them (Blalock, 1984) by incorporating important perspectives that previously have been considered only in isolation. In following this approach, we extend Bromiley's (1991) model of risk in three ways. First, we distinguish between organizational risk and managerial risk taking. Second, we precisely model environmental influences on risk using Dess and Beard's (1984) taxonomy of environmental dimensions. Finally, we enlarge Bromiley's base risk model to recognize other possible influences on managerial risk by drawing on agency theory and upper echelons theory. Although these extensions increase the complexity of the basic risk model, they also allow us to address important questions about why industries, as well as particular firms within industries, may experience high levels of performance volatility independent of managerial risk taking.

This study examines two important types of risk prevalent in organizations. First, managerial risk is defined as management's *proactive* strategic choices involving the allocation of resources. Strategic choices involve uncertainty because they promote change in organizations. Examples of strategic choices associated with managerial risk include acquisitions (e.g., Pablo *et al*., 1996), innovation (e.g., Hoskisson and Johnson, 1992) and changes in diversification (e.g., Hoskisson, Hitt and Hill, 1992). While decisions not to take action might also create risk, it is difficult to assess the extent to which 'non-action' is a calculated decision rather than the outcome of other organizational forces (e.g., inertia). We therefore limit managerial risk's conceptual net to proactive strategic choices. Further, we focus on specific strategic choices that have traditionally been used to represent managerial risk taking. Decisions among strategic initiatives having different risk characteristics are the essence of strategic choice and are clearly an important issue in strategic management and ultimately firm performance (Sturdivant, Ginter and Sawyer, 1985). Hence our results may also inform strategic choice research and begin the process of linking scholarship on risk taking to that of strategic choice.

The second type of risk explored in this study is 'organizational risk' defined here as income stream uncertainty. Organizational risk is important to strategic management since income variation can have negative consequences for the firm as a whole (Amit and Wernerfelt, 1990) as well as for its managers (Miller and Bromiley, 1990). Thus, scholars have sought to understand the effects of particular strategies (e.g., Kim, Hwang and Burgers, 1993; Montgomery and Singh, 1984) or environmental conditions on income stream uncertainty. We suggest that organizational risk is caused by the direct effects of both environmental factors and managerial risk taking. Further, some environmental and organizational factors may indirectly influence organizational risk through their effects on managerial risk taking. In the following sections, we develop hypotheses that are integral to the holistic model of managerial and organizational risk.

## ENVIRONMENTAL CHARACTERISTICS AND RISK

An under-researched area within strategic management risk research is the influence felt by environmental or industrial factors. This may be partly due to the inherent complexity in defining and measuring the environment's influence. In particular, the problem facing researchers is how to reduce the vast array of environmental characteristics into a few meaningful constructs. One promising approach identified a set of three environmental dimensions from a factor analysis of Aldrich's (1979) environmental scheme: complexity, munificence, and dynamism. The resulting empirically derived taxonomy (Dess and Beard, 1984) has been extensively used (e.g., Boyd, 1995; Keats and Hitt, 1988; Wiersema and Bantel, 1993) because it addresses environmental characteristics in a fairly parsimonious, quantitative fashion. For this reason we use Dess and Beard's taxonomy to model environmental characteristics on managerial and organizational risk.

### Environmental characteristics and organizational risk

Researchers of strategic management customarily assume that environments determine the 'playing field' on which rivals compete. This argument suggests that environmental forces should have unique and direct effects on organizational risk. Although past research has implicitly assumed that environmental forces affect performance instability (Fiegenbaum and Thomas, 1986), little direct measurement of environmental factors on organizational risk has occurred.

**Complexity.** Highly complex environments should increase organizational risk. Complexity corresponds to industry size and describes the extent of competitive heterogeneity within an industry. Complex environments consist of many competitors with different competencies catering to a variety of customer segments (e.g., monopolistic competition), while simpler environments mirror oligopolies with highly developed 'rules' or norms of interaction. Industry complexity is likely to increase variability in firm performance because industry blind spots (Zajac and Bazerman, 1991) make it difficult for firms to fully estimate the potential effects of recently implemented strategies. Organizations cannot adequately prepare for the responses of all rivals to their strategy since not all rivals are known or understood. Indeed, sheer numbers of rivals increase the possibility of novel reactions to standard strategic actions (Nelson and Winter, 1982). Conversely, actions taken by unmonitored firms can have an unforeseen impact on both sales and profits of all firms in the industry. Hence, performance fluctuation is likely in industries with numerous rivals acting independently and with limited awareness and understanding of the competitive environment.

In contrast, organizational risk should be lower in less complex industries. Fewer firms in an industry increases the predictability of rivals because regular interaction between competitors fosters understandings of rival strategies and tendencies (Axelrod, 1984). Further, the extent of strategic variety, or types of strategies in use, is lower in oligopolies (Miles, Snow and Sharfman, 1993). Finally, less complex industries are likely to evidence industry norms for interaction (i.e., industry rules) that limit competitive reactions and reduce income stream volatility (Porter, 1980). Thus, environmental complexity should increase organizational risk.

*Hypothesis 1: There is a direct positive relation between environmental complexity and organizational risk.*

**Munificence.** Munificence describes an environment's ability to support sustained growth and is commonly associated with a market's growth in demand (Dess and Beard, 1984; Keats and Hitt, 1988). Empirical evidence suggests that organizational risk should be greater in industries experiencing abundant resources (Porter, 1980). One explanation is the role played by the character of competition during industry growth (Scherer and Ross, 1990), and argues that firm performance may be greatly influenced by the tactical actions of rivals trying to accumulate a disproportionate share of the industry's growing stock of resources. For example, competitive dynamics among rivals impacts performance instability in industries characterized by intensive research and development (Singh and Whittington, 1975) and advertising (Caves and Porter, 1978). This suggests that some portion of organizational risk may be attributed to competitor actions during periods of growth (Wiseman and Bromiley, 1996). While firms may be profitable and growing during munificent periods, they also experience heightened instability in those rates (Levitt, 1965). In contrast, performance stability (low risk) compensates firms for the lower profit levels normally experienced by firms in low growth mature industries (Porter, 1980). Thus, munificence should increase organization risk.

*Hypothesis 2: There is a direct positive relation between environmental munificence and organizational risk.*

**Dynamism.** Dynamism should also increase organizational risk because dynamism describes environments typified by change that is difficult to predict (Dess and Beard, 1984; Wholey and Brittain, 1989). This argument is straightforward. In the absence of luck, organizational survival can be severely threatened by incessant environmental fluctuations because organizations find it very difficult to respond with the necessary changes. As the predictability of change decreases, firms find themselves less prepared with the requisite responses (D'Aveni, 1995), and should therefore experience considerable levels of fluctuations in performance.

The effects of dynamism on heightened performance volatility can be seen in industries experiencing changes in their regulatory climate (Reger, Duhaime and Stimpert, 1992). Managers may be aware that altered regulations will impact operations, however, the repercussions on industry structure are largely beyond managers' control, and are often imprecisely understood until well after the change (Nelson and Winter, 1982). Organizational risk is also increased when industry growth rates change unexpectedly because of new technologies or product features, breakthroughs in substitute products, supply changes, or even changes in political conditions (Nelson and Winter, 1982). Conversely, low levels of dynamism suggest highly predictable and stable environments where firms experience stable performance (Miller and Friesen, 1980). Hence, we expect that dynamic environments cause greater organizational risk.

*Hypothesis 3: There is a direct positive relation between environmental dynamism and organizational risk.*

### Environmental characteristics and managerial risk

**Munificence.** Munificence should impact managerial risk taking since it offers managers more opportunities (Hambrick and Finkelstein, 1987) requiring entrepreneurial decision making, and an abundance of discretionary resources under conditions of limited understanding of means-ends linkages. During periods of munificence, environments are less understandable because information is of questionable accuracy and becomes quickly obsolete. Despite this uncertainty, the need to maintain or expand market share under competitive pressure forces managers to accept risk-laden experiments and gambles. For example, in the early stages of industry emergence it may be necessary to invest in product or process development despite uncertainty about whether the chosen design will conform to eventual industry standards (Teece, 1987).

Munificent periods also present decision makers with expansion capital derived from increased cash flows (Singh, 1986) providing opportunities for accepting risk with limited impunity. Managers of firms enjoying a strong cash position are less likely to be concerned about the downside effects of risky choices. In contrast, economic downturns reduce a firm's prospects because of reduced cash flows and fewer growth opportunities resulting from the downturn. In this environment, management should exhibit lower levels of risk taking. For example, executives accept risk when pursuing mergers in periods of market growth because they are less motivated to reduce the variability of their firm's returns. Indeed, Lubatkin and O'Neill (1987) found that mergers completed during bull markets carried larger risk burdens than those occurring in bear markets. Similarly, we expect that munificence should result in greater managerial risk taking.

*Hypothesis 4: There is a direct positive relation between environmental munificence and managerial risk taking.*

**Dynamism.** Discontinuities associated with dynamism create considerable risk for strategists (Bourgeois, 1985). A common response to environmental uncertainty is to 'weather the storm' by insulating the firm and maintaining the status quo (Milliken, 1987). Low risk responses are more appealing than risky alternatives because forecasts are unreliable. Thus, there is little guarantee that the environment will not shift again and render resource-consuming strategic changes obsolete.

Empirical evidence also supports a negative relation between environmental dynamism and managerial risk taking. A common strategy for firms operating in uncertain environments is to focus on internal characteristics. For example, firms are inclined to divest business units and adopt a simpler structure during periods of dynamism (Keats and Hitt, 1988). As well, firms increase their investments in market surveillance. More extensive boundary spanning activities are believed to reduce the risk of the strategic choices by buffering the organization from potentially disturbing environmental influences (Fennell and Alexander, 1987). In sum, we expect firms to evidence greater risk taking in static environments than they do in periods of dynamism. Stated formally,

*Hypothesis 5: There is a direct negative relation between environmental dynamism and managerial risk taking.*

## ORGANIZATIONAL CHARACTERISTICS AND RISK

### Organizational characteristics and managerial risk

Distinct theoretical traditions have independently suggested influences on managerial risk taking. These include the role of aspirations and expectations on problem framing as suggested by behavioral theory of the firm (BTOF) (Bromiley, 1991), characteristics of the top management team (TMT) as suggested by upper echelon theory (Bantel and Jackson, 1989), and managerial ownership as suggested by agency theory (Saunders *et al.*, 1990).

**Aspirations and expectations.** Following Bromiley (1991), we argue that discrepancies between aspirations and expectations influence risk. Differing from Bromiley, we model aspirations and expectations directly on managerial risk taking. This distinction more precisely captures the essence of why aspirations and expectations may influence risk. Building on the BTOF (Cyert and March, 1992), Bromiley argued that the framing of a choice situation as either a gain or a loss (c.f., Kahneman and Tversky, 1979) may also influence risk taking. In particular, when decision makers are faced with the prospect of failing to meet their objectives, they accept higher risk options that offer an opportunity to reach the goal and avoid the loss. In contrast, when decision makers sense they will achieve their goals, they prefer safer options that avoid jeopardizing goal attainment (Wiseman and Bromiley, 1996; Lant, 1992).

According to BTOF, aspirations represent a 'success reference' used to judge the quality of actual performance (March and Shapira, 1992) whereas expectations indicate anticipated actual performance (Lant, 1992). Higher aspirations are logically more difficult to reach which induces increased risk taking. Thus we argue that, *ceteris paribus*, rising aspirations cause greater managerial risk. Conversely, expectations represent an anticipated performance level. Higher expectations associate with higher actual performance and result in lower risk taking. Considered in tandem, the difference between one's aspirations (goals) and expectations (performance) results in an attainment discrepancy (Lant, 1992). A positive discrepancy is evidenced when performance is expected to fall below predetermined goals. Risk taking is most likely in these cases. In contrast, a negative attainment discrepancy indicates that performance exceeds aspirations. Managers of these firms should evidence lower levels of risk taking to avoid jeopardizing their success. Thus we predict that positive attainment discrepancy increases managerial risk, while a negative attainment discrepancy decreases managerial risk. This relation captures the non-linear relation around the success reference point between performance and managerial risk taking predicted by March and Shapira (1992).[2]

*Hypothesis 6: There is a direct positive relation between attainment discrepancy and managerial risk taking.*

**Top management team characteristics.** Composition of the top management team should be a critical factor explaining risk taking. Originally presented by Hambrick and Mason (1984), upper echelons theory suggests relations between decision maker characteristics, strategic choices, and performance. We believe that high levels of heterogeneity in top management team (TMT) characteristics should promote managerial risk taking. Heterogeneous teams mitigate pressures to maintain the status quo (Milliken and Lant, 1991). Executives with different backgrounds attend to, and create meaning from, different environmental facets. Diversity of perspectives increases the likelihood that more uncertain, risky, and non-routine strategies will be considered (Bantel and Jackson, 1989).

Diversity of perspectives encouraged by team heterogeneity might arise from several characteristics. For example, functional backgrounds are associated with unique vocabularies, mental models, and networks (Hambrick and Mason, 1984). Greater variety in the functional areas represented on the team, therefore, should promote diversity of thought (Hambrick *et al*., 1996). Similarly, it has been shown that teams are more proactive when members' formal educations represent a variety of curricula (Hambrick *et al*., 1996). Finally, there is evidence that heterogeneity in team tenures encourages strategic change (Milliken and Lant, 1991). We therefore expect that TMT heterogeneity will increase managerial risk taking.

*Hypothesis 7: There is a direct positive relation between TMT heterogeneity and managerial risk taking.*

**Managerial ownership.** There is an increasing body of agency theory research suggesting that managers who do not hold an equity position in their firm are less likely to engage in risk taking than managers who do (Galbraith and Merrill, 1991; Saunders *et al*., 1990). The argument suggests that equity ownership can be used to align the interests of owner-managers with those of shareholders, prompting owner-managers to choose strategic initiatives that are consistent with stockholder goals (Agarwal and Mandelker, 1987) through calculated risk taking. That is, *ceteris paribus*, equity ownership mitigates the risk aversion normally exhibited by managers with risk neutral preferences held by diversified shareholders (Tosi and Gomez-Mejia, 1989). The propensity of owner managers to engage in higher levels of risk taking than non-owner managers results from the down side effects of 'employment risk' associated with gambles that do not pay off. Non-owner managers may feel that taking risks jeopardizes their employment since non-winning gambles are potentially 'rewarded' with termination or firm bankruptcy (Walsh and Seward, 1990). Fear of job loss, coupled with a limited financial interest in the outcomes of successful risky

[2]March and Shapira (1992) also postulated a second 'failure' reference point such that as firms move closer to failure, they reverse their tendency toward risk taking and become risk averse in order to avoid insolvency. Consistent with previous risk research, we do not model this second reference point due to data limitations that inhibit our ability to include firms facing insolvency.

strategies reduces risk taking by non-owner managers. Thus we predict that equity ownership by managers increases their risk taking behavior.

*Hypothesis 8: There is a direct positive relation between managerial ownership and managerial risk taking.*

**Slack.** The BTOF (Cyert and March, 1992) also includes a role for slack resources in predicting decision behavior. This view suggests that slack may buffer against fluctuations in environmental conditions and thus absorb shocks that could lower productivity and harm performance. In this sense, slack allows firms to avoid risky changes (March, 1988; Meyer, 1982). When slack levels are low, firms engage in a search for new sources of resources in order to replenish resource reserves. This 'hunger-driven' view of slack has found support in prior risk research. For example, Bromiley (1991) and Wiseman and Bromiley (1996) both found negative associations between various forms of slack and organizational risk. Conversely, others have argued for and found a positive relation. For example, the 'threat-rigidity hypothesis' (Staw *et al*., 1981) predicts that when a firm's survival is in doubt, it becomes rigid and thus risk taking is reduced. This suggests that low levels of slack—generally associated with firms in distress (Hambrick and D'Aveni, 1988)—should correspond to lower risk taking. Research by Singh (1986) supports this view: he found a positive association between absorbed slack and risk taking.

Our view follows that of BTOF in arguing for a hunger-driven view of slack. That is, we view slack as a measure of firm health (Hambrick and D'Aveni, 1988) such that adequate levels of slack provide insurance against unanticipated adverse economic shocks. Firms seek to preserve a level of slack and thus when slack resources fall, managers may increase efforts at raising resource levels through various risk-laden actions. Thus, slack negatively associates with managerial risk taking.

*Hypothesis 9: There is a direct negative relation between slack resources and managerial risk taking.*

## Managerial risk taking and organizational risk

Miller and Bromiley (1990) argue that risk contains multiple components: strategic (i.e., managerial), organizational and market. Yet research on risk has often down-played these distinctions by implicitly assuming that managerial risk taking is isomorphic with organizational risk (e.g., Bowman, 1982; Fiegenbaum, 1990; Fiegenbaum and Thomas, 1988). We argue that choices with high uncertainty (managerial risk taking) provide only a *partial* explanation of firm performance uncertainty (organizational risk).

Decisions to invest in research and development (R&D) provide a good example of the relationship between risk taking and performance variations. R&D investments are highly uncertain because their outcomes are distant and frequently do not produce the intended payoffs. Because only 27% of R&D projects achieve financial success (Scherer and Ross, 1990), these investments are associated with large cash flow variances relative to other expenditures (Galbraith and Merrill, 1991). Thus, we expect that R&D investment should increase organizational risk.

Diversification is expected to reduce organizational risk. At the heart of this view is Chandler's (1962) seminal research suggesting that firms often diversify because their resources exceed industry demand. To effectively utilize capacity and *maintain* profit levels, Chandler argued that firms diversify. Recent evidence supports the view that income stream variation is influenced by diversification (Lubatkin and Rogers, 1989). Further, diversification has been used to indicate low levels of risk taking (Hoskisson *et al*., 1992). Thus, we predict that choices bearing higher risk increase organizational risk, while choices of lower risk reduce organizational risk.

*Hypothesis 10: There is a direct positive relation between managerial risk taking and organizational risk.*

Since previous findings suggest that prior risk taking influences subsequent risk taking, our model also controls for prior managerial risk taking by including managerial risk measured in the previous period. The complete model can be articulated in two structural equations:

*Managerial Risk* = ($\gamma_4$) Munificence − ($\gamma_5$) Dynamism + ($\gamma_6$) Attainment discrepancy + ($\gamma_7$) TMT heterogeneity + ($\gamma_8$) Ownership − ($\gamma_9$) Slack + ($\gamma_c$) Prior managerial risk + $\zeta_1$

*Organizational Risk* = ($\gamma_1$) Complexity + ($\gamma_2$) Munificence + ($\gamma_3$) Dynamism + ($\beta_{10}$) Managerial risk taking + $\zeta_2$

## METHODS

Hypotheses were tested using structural equations modeling. Analyzing the hypothesized relations simultaneously results in more accurate estimates of relations among constructs and avoids biases associated with single-indicator models (James, Mulaik and Brett, 1982). As well, structural equations modeling allows for alternative models to be contrasted which enables the evaluation of competing theoretical hypotheses (James *et al.*, 1982).

We followed the two-stage structural modeling approach suggested by Anderson and Gerbing (1988) by testing measurement and structural models sequentially. This two-stage approach allows us to assess construct validity (Stage 1) in the measurement model separately from the adequacy of the proposed theory (Stage 2) in the structural model (Bollen, 1989). Thus, the likelihood of interpretational confounds is reduced because the validity between constructs is established prior to investigating hypothesized relations

### Sample and time frame

Firms in the Compustat data base with a 2000 to 3999 SIC code possessing complete data were included in the study. The resulting sample included 235 firms representing 64 industries at the three digit SIC level. Comparisons of Compustat's SIC assignments were made with other secondary data sources (*Million Dollar Directory, Ward's Business Directory*) to enhance confidence in our coding. The sample was restricted to firms in manufacturing industries to reduce problems associated with differences in accounting data across vastly different types of businesses and to provide some comparability of factors such as technology and capital intensity. This sample was specifically selected to ensure that a variety of environmental conditions were represented. Sampled firms served diverse product markets ranging from children's toys to space vehicles and guided missiles.

Eight years of data were collected spanning 1984–1991 using a lagged structure. Environmental variables were measured in years 1984–1988 as were attainment discrepancy and slack. Managerial characteristics (ownership and top management team heterogeneity), risk taking, and organizational risk were assessed during 1987–1991. Data for all measures were calculated and averaged over their respective five-year time frame providing 235 observations per indicator. Using five-year periods in a lagged design enhances comparability of our results with much of the previous risk research (e.g., Bettis, 1981; Fiegenbaum and Thomas, 1986, 1988; Cool, Dierickx and Jemison, 1989).

Several other factors also influenced us to use this particular lagged scheme. First, lagging managerial risk taking and performance instability from environmental and certain organizational characteristics provides a realistic depiction of the temporal interplay between these constructs. Second, we measured team heterogeneity and managerial ownership concurrent with risk taking to reflect the simultaneous impact of managerial characteristics on risk taking. Third, we incorporated an overlap period (1987 and 1988) to recognize differences in the speed with which environmental and organizational characteristics impact risk taking and performance. Some characteristics might take several years before their effects are reflected in managerial risk taking and organizational risk, while others may have a more immediate influence. In sum, while identifying the appropriate lags in organizational research is often unclear (Miller and Leiblein, 1996), we relied on a scheme that was both consistent with our theoretical base and was comparable with past research efforts.

### Measurement

This section describes measures used in testing the structural model. Although additional measures were included in the initial measurement model, these measures failed to exhibit convergent validity and thus were eliminated from the model. Measures were primarily taken from Standard and Poor's Compustat and Compustat II Business Line data bases. Other data sources included proxy statements, form 10-Ks and Dun and Bradstreet's *Reference Book of Corporate Managements*.

**Complexity.** Aldrich (1979) defined complexity as the amount of heterogeneity present in a firm's environment. However, Dess and Beard's (1984) operationalization resulted in a primary factor they called 'geographical' concentration. In a direct extension of Dess and Beard's model, Rasheed and Prescott (1992) used industry concentration to represent complexity. Indeed, despite the limited set of studies using this typology, virtually all have relied on concentration as the measure of complexity (Boyd, 1995; Keats and Hitt, 1988). Following this empirical tradition we measure complexity as industry concentration. The argument supporting this measure recognizes that highly concentrated industries are characterized by considerable strategic similarity (Miles *et al*., 1993) consisting of a small number of strong, relatively homogenous firms. These characteristics lower information burdens on inhabitants (fewer competitors generate less information and norms of interaction reduce the need for information) and thus lower industry complexity. In contrast, low concentration corresponds to higher complexity since these industries are comprised of numerous, heterogeneous firms following different types of competitive strategies. Heightened competition increases both the supply of potentially relevant information as well as the necessity of gathering this information.

Based on this argument as well as prior research, we used the inverse of the four firm concentration ratio as one indicator of complexity. This measure was calculated by dividing the combined sales of the four largest firms in Compustat (ranked by sales) within each industry by the total sales of that industry where the industry is defined by three-digit SIC. Our second indicator of complexity measures the number of industry competitors. This measure simply counts the number of competitors identified by Compustat within each industry by year and averages the number over the five year period. This measure is inversely related to the four firm concentration ratio. It should be noted that both measures include firms that may not be present in all five years (due to bankruptcy, start-up etc.), hence the number of firms included in these measures is generally larger than the industry sample examined in this study.

**Munificence.** Munificence identifies availability of resources to support environmental growth. Key indicators of munificence are growth in industry sales and employment, since they identify increases in resources at different stages of the manufacturing process. That is, growth in total employment identifies growth in resource commitments while growth in net industry sales was used to capture growth in outputs. Following the methodology employed by Keats and Hitt (1988) we calculated average growth in industry sales and employment over the years 1984–1988. Using all firms not already included in our sample, we acquired total sales and employment for each industry by year. The natural logarithms of these totals were then entered into quasi-time series regressions with time serving as the independent variable. The antilogs of the resulting regression slope coefficients ($\beta$) were then used to capture industry growth.

**Dynamism.** Dynamism identifies difficult-to-predict industry changes (Dess and Beard, 1984). Measures of this construct typically capture variance in industry characteristics such as industry sales (Keats and Hitt, 1988). The same procedure used in generating the munificence indicators was used to calculate measures of dynamism. However, in this case antilogs of the standard errors of industry sales and industry income were used to capture differences in the variability of industry growth rates (Keats and Hitt, 1988). Both industry sales and industry operating income were used because variability in these measures are most likely to be associated with an organization's income stream variability.

**Managerial ownership.** Managerial ownership identifies the degree to which managers hold equity positions in their firms. Equity was defined as common stock held directly or indirectly (e.g., a family trust) for the executives' benefit, not including options to purchase additional shares in the future (i.e., stock option plans). While it is widely believed that options induce risk taking, their exercise is not guaranteed. Thus, we chose a more conservative test of the ownership—managerial risk taking relation, by eliminating stock options from our measure of executive ownership.

Two measures of managerial ownership were used. One measure captured the proportion of equity ownership held by all officers and directors as a group. This aggregate percentage was based on the number of common shares outstanding on the date of record (60 days prior to the firm's annual meeting date) as reported in annual proxy statements. Stock holdings of top management team (TMT) members provided our second measure of ownership. As required by the SEC, firms must report the equity positions of top managers holding a minimum of 5% of their firm's outstanding common stock, or are a member of the board regardless of stock held. The proportional equity holding of each reported team member was identified from proxy statements, form 10Ks, or annual reports and summed for all members of the TMT.

**Upper echelons.** We defined membership in the TMT as those individuals at the highest level of management—the chairman, chief executive officer, president, and chief operating officer, the next highest tier, and any other officers who are on the board of directors. We avoided using position titles, such as vice president, to define TMT membership since this approach can lead to the inclusion of up to five levels of management (Wiersema and Bantel, 1992). Defining the TMT as the two highest executive levels, regardless of the titles used, increases the consistency of our measure across the sampled firms.

Heterogeneity in upper echelon membership was assessed using Blau's (1977) categorical index of heterogeneity. The first measure captured the mix of education curriculums represented in the TMT (Hambrick *et al.*, 1996; Wiersema and Bantel, 1992). This variable measured dispersion of the highest obtained university degree achieved as defined by six educational specializations: science, art, business, engineering, medicine, and law. The second measure identified the team's functional heterogeneity (Hambrick *et al.*, 1996; Michel and Hambrick, 1992). Team member specializations (e.g., marketing/sales, human relations/labor relations, engineering etc.) were acquired from Dun and Bradstreet's *Reference Book of Corporate Managements*, firm proxy statements, and form 10-Ks.

**Attainment discrepancy.** We measured attainment discrepancy through a method suggested by Bromiley (1991). Aspirations for each year were identified by comparing each firms' performance from the previous year (both ROA and ROE) with their respective industry average for that year. When performance exceeded the industry average, aspirations were determined by multiplying prior year performance by 1.05 (effectively adding a growth factor). Conversely, aspirations were coded as industry average performance from the previous year when the firm's performance was below that average. Attainment discrepancy was then calculated by taking the difference between aspirations and the firm's actual performance (ROA and ROE) (Wiseman and Bromiley, 1996). By subtracting performance from the reference, attainment discrepancy captures the nonlinear relation around the success reference predicted by March and Shapira (1992). This process was repeated for each year and then averaged across years for each firm.

**Slack**. Three types of slack were included in the study: available, recoverable, and potential (Bourgeois, 1981; Cheng and Kessner, 1997). Available slack is measured as the firm's quick ratio and addresses the firm's liquidity including assets such as idle working capital, marketable securities, accounts receivable, or funding in reserve, such as unused lines of credit. Recoverable slack identifies excess administrative and operational expenses (e.g., administrative salaries, travel, and entertainment). Recoverable slack was measured as the ratio of general and administrative expenses to sales. Potential slack identifies a firm's unused borrowing capacity which we measured as debt/equity.

**Managerial risk taking.** We identified two types of decisions that characteristically involve high levels of uncertainty and unpredictability in their outcomes as well as holding a possibility of generating losses large enough to negatively impact a firm's performance. First, R&D expenditures capture managerial risk taking since the benefits of R&D investment are distant (Ravenscraft and Scherer, 1982), exhibit low rates of success (Scherer and Ross, 1990), and have high outcome uncertainty (Galbraith and Merrill, 1991; Hoskisson and Johnson, 1992). In order to control for firm size, R&D expenses were scaled by firm sales (Hitt *et al.*, 1996; Miles *et al.*, 1993).

Two additional indicators of managerial risk taking focused on diversification: widely accepted by strategists as a means for reducing performance variability (c.f., Hill and Snell, 1988; Hoskisson *et al.*, 1992; Hoskisson and Johnson, 1992). One diversification indicator counted the five year average number of four digit industries that our sampled firms compete in. A second diversification indicator was Jacquemin and Berry's (1979) entropy measure. This measure complemented the segment count because it took into consideration not only the number of segments, but also the relative importance of each four digit segment to the firm's total sales.

**Organizational risk.** Consistent with past risk research, we measured income stream uncertainty using the variance in ROA (e.g., Bettis and Mahajan, 1985; Cool *et al.*, 1989). This measure was complemented with the five-year variance in price earnings ratio (stock price/earnings per share). We chose this second measure because it captures an element of risk that is relevant to stockholders (Miller and Bromiley, 1990) but also corresponds to income stream uncertainty.

**Control variables.** A firm's past history of risk taking influences current decisions about risk (Bromiley, 1991). Hence, we controlled for previous levels of research and development expenditures (R&D/sales) and diversification (entropy and segment count). Prior risk taking was measured from 1984 to 1986, the three years preceding measurement of managerial risk. We did not control for industry levels of risk taking and organizational risk by scaling these measures because this would have removed the variance we were attempting to explain. That is, our risk model seeks to identify the extent to which organizational factors versus industry factors explain differential levels of risk. For example, removing industry influences on variance in price earnings would have circumvented our ability to isolate the effects of complexity, munificence, and dynamism on this indicator as opposed to organizational influences including risk taking.

### Estimation and analysis

The structural and measurement models were tested using the maximum likelihood fitting function within EQS. All data were transformed to approximate normal distributions in order to avoid problems resulting from non-normality. Model goodness of fit was ascertained in several ways since all indices currently in use may exhibit undesirable characteristics (Jaros *et al.*, 1993; Williams and Holahan, 1994). The indices used here include Bentler's (1989) comparative fit index (CFI), and the parsimonious fit index (PFI) (James *et al.*, 1982). Although reported, the chi square statistic was not used to assess model fit since it is strongly affected by sample size (Bollen, 1989).

## RESULTS

### Stage 1—Measurement model

**Convergent validity.** Convergent validity was demonstrated through the statistical significance of the measurement model's parameter estimates using a z-ratio. This test statistic is formed by dividing the parameter estimate by its asymptotic standard error (Widaman, 1985): Z-ratios greater than 1.96 are considered significant at the 0.05 level. We also examined convergent validity through the size of factor loadings. A factor loading in excess of 0.40 provides support for convergent validity (Hitt *et al.*, 1996; Ford, MacCallum and Tait, 1986). Finally, an overall test of convergent validity was provided by the CFI which estimates the percentage of variation explained by a proposed model relative to a model of complete independence. Values may range from 0 to 1 where a value of 0.90 signifies that 90% more variance is explained by the measurement model than the null model. Values of 0.90 or better indicate a good fitting model (Bentler, 1989) whereas values below 0.90 indicate improvement in the model is possible (Bentler and Bonett, 1980; Bollen, 1989).

Table 1 provides the fit indices for the measurement model. The CFI suggests a good model fit (CFI = 0.900) and indicates that the measurement model explains 90% more variance in the data than does a null model of complete independence. Evidence of convergent validity was further provided by the factor loadings between measures and constructs. All factor loadings were significant ($z > 1.96$) and all but one (TMT functional heterogeneity) exceeded 0.40. The standardized mean loading was 0.729, indicating that the observed variables were valid indicators of the appropriate latent constructs.

**Discriminant validity.** Comparisons between the proposed measurement model and theoretically derived nested models were conducted to see if the proposed model's latent constructs were distinct from each other. The process entailed collapsing sets of constructs into a single construct and comparing the reduced model's fit with that of the baseline model. Two criteria were used to determine whether fit of the reduced

Table 1. Fit indices for nested sequence of measurement models

| Model | CFI | ΔCFI | $\chi^2_{df}$; p[a] | $\Delta\chi^2_{\Delta df}$ |
|---|---|---|---|---|
| 1. Ten-factor model | 0.900 | | $439.43_{185}$; $p < 0.001$ | |
| 2. Single-factor model | 0.531 | | $1421.40_{230}$; $p < 0.001$ | |
| Model 2-1 difference | | −0.369 | | $+981.97_{45}$; $p < 0.001$ |
| 3. Equate *Complexity* and *Munificence* | 0.900 | | $439.47_{186}$; $p < 0.001$ | |
| Model 3-1 difference | | +0.000 | | $+0.04_{1}$; $p > 0.10$ |
| 4. Equate *Upper Echelons* and *Ownership* | 0.898 | | $445.84_{186}$; $p < 0.001$ | |
| Model 4-1 difference | | −0.002 | | $+6.41_{1}$; $p < 0.025$ |
| 5. Equate *Managerial Risk Taking* and *Organizational Risk* | 0.890 | | $464.76_{186}$; $p < 0.001$ | |
| Model 5-1 difference | | −0.010 | | $+25.33_{1}$; $p < 0.001$ |
| 6. Final Measurement Model *Complexity* and *Munificence* collapsed and measured with three indicators | 0.911 | | $385.77_{173}$; $p < 0.001$ | |

[a]Probabilities are stated in inequality terms as chi-square tables are sparse.

model was different from our baseline measurement model. First, lack of discriminant validity would be evidenced if a reduced model's CFI fell by less than 1% (Widaman, 1985). Second, we performed sequential chi square difference tests (SCDTs) by contrasting chi square of the original measurement model with the reduced alternatives (Steiger, Shapiro and Borne, 1985). Based on the nested model results, a final 'best' model was produced that was theoretically meaningful and free of obvious specification errors. In the following section, we describe results of relevant nested model tests.

First, we examined the possibility that a single underlying construct best explained variation in the sample data (Model 2). A single construct model may be caused by similarity in the methods used in generating the data, or from arbitrary relatedness among measures (James *et al.*, 1982). Both the low fit index (CFI = 0.531) and the significantly higher residual ($\Delta\chi^2_{45df} = +981.97$, $p < 0.001$) indicate the single factor model did a poor job explaining the data. Thus, multi dimensionality of the model was maintained.

Following prior empirical studies using Dess and Beard's typology (Keats and Hitt, 1988), we collapsed complexity and munificence into one construct (Model 3). This test generated the same CFI as our baseline model ($CFI_3 = 0.900$, ΔCFI = +0.000) and a produced non-significant increase in chi square ($\Delta\chi^2_{1df} = +0.04$, $p > 0.10$) indicating these constructs failed to discriminate. The high correlation between complexity and munificence makes theoretical sense because industries consolidate when sales growth slows (Porter, 1980). Because rivalry is high in complex, high growth industries, it appears the collapsed construct reflects factors associated with industry rivalry.

We next examined the discriminant validity between upper echelons and managerial ownership since both are characteristics of the top management team (Model 4). The resulting indicators of this test were inconsistent. CFI fell by less than 1% (ΔCFI = −0.002). However, $\chi^2$ evidenced a significant rise ($\Delta\chi^2_{1df} = +6.41$; $p < 0.025$). Since extant theory treats these constructs as distinct, we maintained their distinction in the final measurement model.

Finally, we tested the discriminant validity between managerial risk taking and organizational risk (Model 5). Past research has relied on organizational risk to proxy for managerial risk taking. It was therefore important to test whether treating them as distinct was warranted. Collapsing the two risk constructs resulted a practical drop in CFI (CFI = 0.890; ΔCFI = −0.010) and a significant increase in chi square ($\Delta\chi^2_{1df}$ = 25.33, $p < 0.001$). The two constructs therefore remained distinct in the final model. All other nested model tests, not described here, supported the measurement model's discriminant validity.

Based on these results, our final measurement model (Model 6) collapses complexity with munificence into a single construct called 'industry rivalry' that appears to be a function of life cycle effects. High levels of rivalry are common in fragmented industries characterized by rapid growth in sales (Scherer and Ross, 1990). For that reason, we retained the two original concentration measures of complexity and the sales growth indicator. The resulting nine-factor final measurement model achieved a CFI of 0.911. The standardized mean factor loading was 0.732 (again, only TMT functional heterogeneity failed to surpass the 0.40 benchmark). All indicators are statistically significant ($z > 1.96$). Figure 1 contains standardized factor loadings for the final, 'best', measurement model.

### Stage 2—Structural model

Using the best fitting measurement model we next estimated the structural portion of the covariance model. The parsimonious fit index (PFI) was used in addition to the CFI for assessing model fit. Incremental fit indices (such as CFI) may favor complex models over more parsimonious models since the contribution to model fit from each additional parameter is not considered (Mulaik *et al.*, 1989). In contrast, the PFI accounts for the number of degrees of freedom lost in deriving a particular fit and therefore yields higher scores to models with more degrees of freedom. A PFI value in excess of 0.60 suggests a model that fits the data parsimoniously (Williams and Podsakoff, 1989). Results of structural model tests are found in Table 2.

The proposed structural model (Model 2) did a good job of reproducing the sample covariance matrix as indicated by a CFI of 0.902. Further, the model obtained a PFI of 0.647 indicating that fit was achieved without the expense of unnecessary constructs. Next, we contrasted the proposed structural model with a predetermined sequence of potentially better 'nested' alternative models. Using this approach avoids data 'exploring' (Hoyle and Panter, 1995; James *et al.*, 1982). First, we compared the proposed structural model with the fully saturated model postulating relationships between all of the model's constructs (i.e., the final, best measurement model). Removal of five paths from the saturated model appears to have harmed model fit. Reduction in CFI approached Widaman's criteria ($\Delta$CFI = –0.009) and chi-square evidenced a significant increase ($\Delta\chi^2_{5df} = +14.22$, $p < 0.05$). The deterioration in model fit indicates there is some misspecification in the theoretical model (Model 2). Specifically, it lacks a path or paths that are important to the overall fit of the model.

Next, we contrasted the baseline model with the next *less* constrained model in which a relation was added between attainment discrepancy and organizational risk. Past risk research has asserted a strong positive relation between performance and income stream uncertainty (Bowman, 1982; Fiegenbaum and Thomas, 1988). Because firm performance is represented in our model through attainment discrepancy, it was theoretically appropriate to add this path. Results indicated an improvement in fit over the baseline structural model (CFI = 0.906, $\Delta$CFI = +0.004; $\Delta\chi^2_{1df} = -9.94$; $p < 0.001$). Not surprisingly, the PFI fell because of the added parameter (PFI = 0.646; $\Delta$PFI = –0.001), but remains within acceptable levels. Finally, the standardized parameter estimate was significant ($\gamma = +0.291$; $z = 2.580$; $p = 0.010$). These results suggest that adding a path from attainment discrepancy to organizational risk provides a substantive improvement over our proposed baseline model. In addition, this structural model is preferred over the saturated model (Model 1) because it is more parsimonious and is not significantly inferior ($\Delta$CFI = –0.005; $\Delta\chi^2_{4df} = +4.28$; $p > 0.10$).

Our final nested model test contrasted fit of the baseline with the next *more* constrained model. For this test, we removed the path from ownership to managerial risk taking. There is evidence to suggest that managers are reluctant to accept risk when equity ownership represents a significant proportion of their total wealth (Wright *et al.*, 1996). Since we controlled for neither the personal wealth of managers, nor the composition of their portfolios, it is possible that there was variance among equity-holding managers in their willingness to take risks. If that variance existed, removing the path would result in a minor change in the model's overall fit.

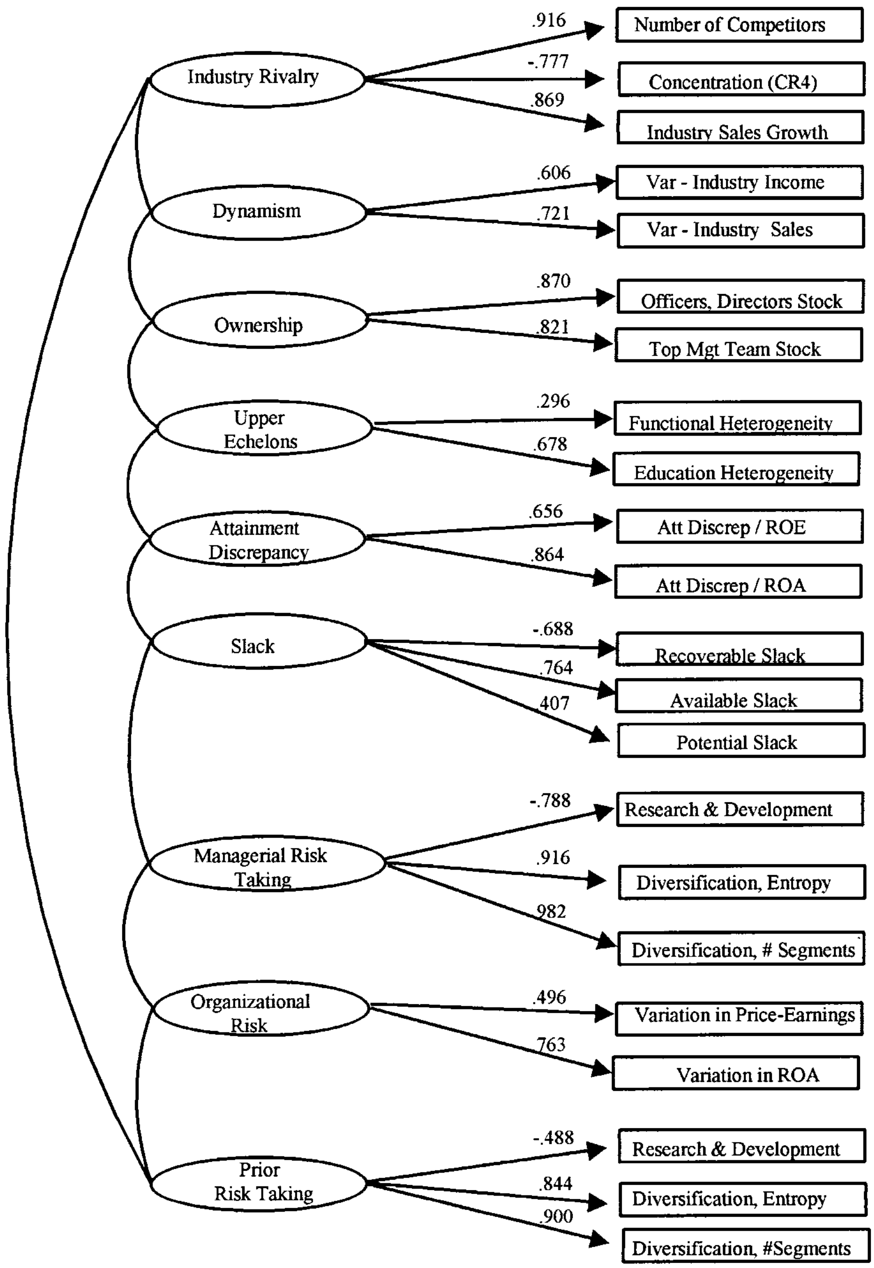


Figure 1. Covariance structure analysis—nine factor measurement model. (Standardized factor loadings, all statistically significant)

Results of this test do not support that view. Surprisingly, the PFI of the more constrained structural model deteriorated (PFI = 0.618; ΔPFI = −0.029). The CFI of the more constrained model was also reduced (CFI = 0.855; ΔCFI = −0.047) and the SCDT was significant ($\Delta\chi^2_{1df}$ = +118.94; $p < 0.001$). In sum, removing managerial ownership generated a fit that was inferior to the baseline model.

**Hypothesis tests.** Using the 'best' structural model identified in the nested model tests (Model 3), we proceeded to examine the hypotheses through the parameter estimates. Figure 2 provides estimates generated by those tests. All path

Table 2. Fit indices for nested sequence of structural models

| Model | CFI | ΔCFI | PFI | ΔPFI | $\chi^2_{df}$; p[a] | $\Delta\chi^2_{\Delta df}$; p |
|---|---|---|---|---|---|---|
| 1. Measurement Model *(fully saturated model)* | 0.911 | | | | $385.77_{173}$; $p < 0.001$ | |
| 2. Baseline structural model | 0.902 | | 0.647 | | $399.99_{178}$; $p < 0.001$ | |
| Model 2-1 difference | | −0.009 | | | | $+14.22_{5}$, $p < 0.05$ |
| 3. Less constrained model (added *Attainment Discrepancy—Organizational Risk*) | 0.906 | | 0.646 | | $390.05_{177}$; $p < 0.001$ | |
| Model 3-2 difference | | +0.004 | | −0.001 | | $-9.94_{1}$; $p < 0.001$ |
| Model 3-1 difference | | −0.005 | | | | $+4.28_{4}$, $p > 0.10$ |
| 4. More constrained model (deleted *Ownership—Managerial RT*) | 0.855 | | 0.618 | | $508.99_{179}$; $p < 0.001$ | |
| Model 4-2 difference | | −0.047 | | −0.029 | | $+118.94_{1}$; $p < 0.001$ |

[a]Probabilities are stated in inequality terms as chi-square tables are sparse.

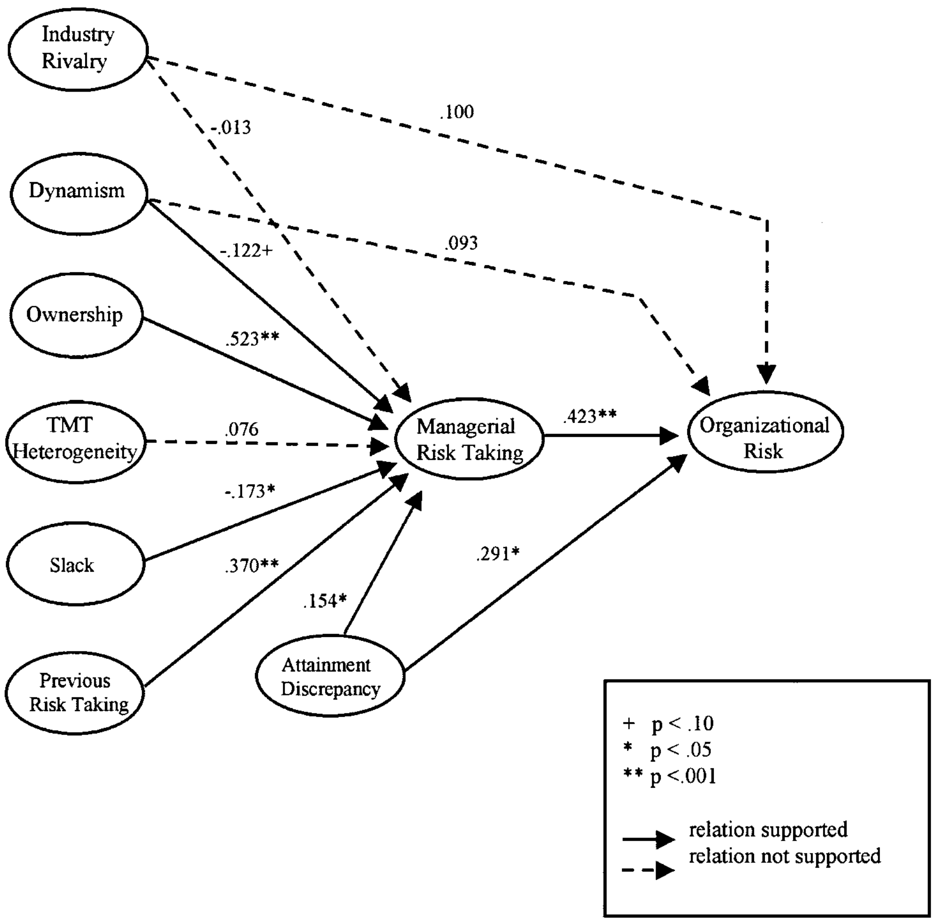


Figure 2. Covariance structure analysis—test of final structure model. Asterisks depict significant standardized parameter estimates. Disturbance and measurement error effects are omitted for clarity.

coefficients shown in Figure 2 represent standardized estimates.

Table 3 presents results for the final 'best' structural model (Model 3). For purposes of direct comparison, we also present parallel results for the baseline theoretical model (Model 2). Hypotheses 1 and 2 were combined to reflect the collapsing of the complexity and munificence constructs done during the measurement estimation stage. The anticipated positive effect of industry rivalry on organizational risk (H1) was not supported ($\gamma$ = +0.100; $p > 0.10$). The relation between dynamism and organizational risk (H3) was also not supported ($\gamma$ = +0.093; $p > 0.10$). Further, we detected no effect for the influence of industry rivalry on managerial risk taking (H4: $\gamma$ = –0.013; $p > 0.10$). The proposed negative influence of dynamism on managerial risk taking, however, was supported ($\gamma$ = –0.122; $p = 0.099$).

Three of the four organizational characteristics that were predicted to influence managerial risk taking received support. The anticipated effect of attainment discrepancy was supported (H6: $\gamma$ = +0.154; $p = 0.030$), however TMT heterogeneity (H7) exhibited a non-significant influence on managerial risk taking ($\gamma$ = +0.076; $p = 0.435$). As predicted, managerial ownership (H8) exhibited a positive influence on managerial risk taking ($\gamma$ = +0.523; $p < 0.001$). Slack resources (H9) exhibited the predicted negative influence on managerial risk ($\gamma$ = –0.173; $p = 0.018$). In support of Hypothesis 10, managerial risk taking exhibited a strong influence on organizational risk (H10: $\beta$ = +0.423; $p < 0.001$). Finally, the effect of previous risk taking on managerial risk (control) was significant ($\gamma$ = +0.370; $p < 0.001$) In sum, five hypotheses were significant as was the risk taking control. As well, we detected a direct negative influence of attainment discrepancy on organizational risk through a nested model test.

## METHODOLOGICAL CONSIDERATIONS

As with all empirical research, this study contained practical constraints that limit interpretation

Table 3. Structural equations modeling results comparing hypothesis tests for the theoretical and final models

| Hypothesis | Description of path | Hypothesized direction | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | | | Path coefficient | Z | Path coefficient | Z |
| 1 | Industry Rivalry → Organization Risk | + | 0.200 | 2.406 | 0.100 | 1.100 |
| 3 | Dynamism → Organization Risk | + | 0.265 | 2.425 | 0.093 | 0.860 |
| 4 | Industry Rivalry → Managerial Risk Taking | + | –0.025 | –0.372 | –0.013 | –0.196 |
| 5 | Dynamism → Managerial Risk Taking | – | –0.135 | –1.754 | –0.122 | –1.647 |
| 6 | Attainment Discrepancy → Managerial Risk Taking | + | 0.174 | 2.360 | 0.154 | 2.172 |
| 7 | TMT Heterogeneity → Managerial Risk Taking | + | 0.074 | 0.771 | 0.076 | 0.781 |
| 8 | Managerial Ownership → Managerial Risk Taking | + | 0.517 | 6.372 | 0.523 | 6.401 |
| 9 | Slack Resources → Managerial Risk Taking | – | –0.172 | –2.374 | –0.173 | –2.364 |
| 10 | Managerial Risk Taking → Organizational Risk | + | 0.542 | 6.081 | 0.423 | 4.645 |
| Control | Prior Risk Taking → Managerial Risk Taking | | 0.367 | 6.190 | 0.370 | 6.276 |
| Added Path[a] | Attainment Discrepancy → Organizational Risk | + | | | 0.291 | 2.580 |

[a]This path was hypothesized in the next-best unconstrained model.

of its results, but also provide opportunities for future research. First, Bentler's EQS does not allow for missing data. Therefore, sampled firms were limited to those with complete data. This necessitated the exclusion of both start-up and failed firms having less than the full eight years of data. The exclusion of failed firms precluded a test of a second 'failure' reference predicted by March and Shapira (1992). The loss of start-up and failed firms leaves open questions about risk exploring possible differences between failed and established firms and between start-ups and established firms.

Second, two important constructs, munificence and complexity failed to discriminate in the first stage of data analysis. Although our selection of indicators was consistent with prior research (e.g., Boyd, 1995; Keats and Hitt, 1988; Rasheed and Prescott, 1992), it seems clear that this lack of discrimination results from the strong relation between industry growth and industry concentration. Since the combined indicators of complexity and munificence appear to coincide with competition associated with life cycle effects, we renamed the collapsed construct 'industry rivalry.' Future research should consider how to distinguish between the various dimensions of environment and even to determine whether these distinctions are important.

Next, many of the arguments presented to support our hypotheses suggested causal relationships. To maintain the integrity of the risk model, we relied on a lagged design and utilized covariance structure analysis. Nonetheless, the data were gathered in five-year cross-sectional panels. While issues of causality are always difficult to ascertain, additional study is warranted to determine whether the causal relationships implied here are valid.

Finally, this study examines risk independently from returns. While our approach is typical of organizational studies of risk, economic studies of decision behavior tend to combine the risk and return aspects of strategic choices. Although some models using the latter approach have been criticized for failing to provide a fully specified model of risk preferences (e.g., Weber and Milliman, 1997), there may be opportunities to extend this study by looking more closely at choices where risk and returns are considered simultaneously.

## DISCUSSION AND IMPLICATIONS

Organizations face complex challenges ranging from globalizing markets, and advancing technology to evolving structural forms. Challenges such as these call for a greater appreciation of risk relations within organizations. Despite strides in this direction, however, a full understanding of risk remains elusive. This paper offers three contributions toward filling that gap. First, we test a model of risk at the organizational level of analysis that decouples managerial risk taking from organizational risk. Second, we integrate a broader array of organizational effects on risk than have been identified in the past—in particular, we consider the effects of upper echelons and agency theories. Third, we supplement the traditional behavioral approach to risk with environmental explanations, a source of income stream uncertainty that has been overlooked in risk research. In the sections that follow, we elaborate on these points and discuss theoretical and empirical contributions to the study of risk resulting from this research.

### The distinction between managerial risk taking and organizational risk

A key contribution of this paper is the distinction we draw between managerial risk taking and organizational risk. Because empirical research and conventional wisdom have suggested that risk taking is associated with performance variations (Baird and Thomas, 1985; Bettis, 1982; Bowman, 1982), many organizational scholars have used an organizational risk measure as a proxy for managerial risk taking (e.g., Bowman, 1982; Fiegenbaum and Thomas, 1986, 1988). Such an action is warranted if these risk constructs are isomorphic. Consistent with Miller and Bromiley (1990), however, our tests of discriminant validity indicate that risk taking and organizational risk are not isomorphic. Indeed, model fit was reduced when the two constructs were assumed to be perfectly correlated. Our evidence therefore suggests that while managerial risk taking contributes to organizational risk, these are distinct constructs. Future researchers must therefore carefully define and specify the type of risk examined.

Distinguishing between managerial choices and organizational outcomes helps answer questions about the role managers play in creating firm performance (Rumelt, 1991). Since Child (1972), some scholars have argued that managerial choices mediate the influences of environment on organizational outcomes (Astley and Van de Ven, 1983). That is, top managers choose strategies (and presumably risk) that align their organizations with environmental conditions (Hofer and Schendel, 1978; Miller and Friesen, 1980). In contrast, others argue that environmental factors such as market structure or turbulence directly influence organizational outcomes (Aldrich, 1979; Porter, 1980; Schmalensee 1985). Our results support the former perspective. We failed to detect a direct influence of environmental characteristics on organizational risk that was independent of managerial risk taking. Our results, however, do suggest that managers respond to dynamic environments by selecting lower risk alternatives that mitigate dynamism's effects on the firm's income stream. These results are consistent with the perspectives of practicing executives—64% of whom believe that 'most of a large company's success or failure is determined by decisions and actions of the CEO' (Reingold and Borrus, 1997).

This study also provides insights about managerial risk taking that are independent of organizational risk. The literature is replete with anecdotal evidence that certain strategic choices are riskier than others. Empirical support, however, is sparse. Our study supports two indicators of managerial risk taking (R&D and diversification), that both loaded significantly on the managerial risk taking construct. These results are encouraging because they suggest that, despite unique motivations underlying these strategic choices, there is commonality between them as well.

Finally, this study focused on providing a broader explanation for managerial risk taking and distinguishing between managerial and organizational levels of risk. This model represents a special case of strategic choice whereby organizational and environmental factors influence managerial choices which in turn influence organizational outcomes. It seems probable, therefore, that the larger strategic choice literature may inform risk-return research (and vice versa). However, before these two literatures can be brought into greater harmony, several issues must be resolved. First, how one translates strategic choice into choices of risk requires primary research into managerial perceptions of risk, strategy, and investment choices. Considerable research has argued that R&D represents a risk-laden choice (e.g., Hill and Snell, 1989), however, it is equally conceivable that lack of investment in R&D creates risks for the firm's survival. Further, diversification is often viewed as a low-risk choice, yet actual research suggests that some forms of diversification increase firm risk (Lubatkin, 1988). Therefore, determining how managers perceive these options is key to linking strategic choice literature with behavioral risk research.

### An expanded framework of risk

A second key contribution of this paper is the broad array of perspectives we used to explain risk in organizations. In particular, we supplemented the traditional behavioral approach to risk with insights from agency theory and upper echelons theory.

**Agency theory.** We detected a positive influence of ownership on managerial risk taking. Consistent with the agency view, we found that managers holding an equity stake in their firm are more likely to engage in risk taking than are non-owner managers (Agarwal and Mandelker, 1987; Galbraith and Merrill, 1991; Hill and Snell, 1988). Whereas prior studies have focused on specific industries such as banking (Saunders *et al.*, 1990) and high technology (Galbraith and Merrill, 1991), this study extends research by finding a positive link across a broad sector of industries.

Our findings call for the inclusion of corporate governance mechanisms in future models of executive risk taking. However, more detailed arguments focusing on specific elements of compensation such as long-term compensation, bonuses and stock related forms are also possible (see for example, Wiseman and Gomez-Mejia, 1997). In pursuing this line of research, caution must be advised. This study used rather coarse measures of managerial ownership that did not control for manager's portfolio diversification. It is possible that undiversified ownership may actually increase risk bearing and thus reverse the relation found here (Coffee, 1988; Beatty and Zajac, 1994; Wright *et al.*, 1996). Formally recognizing the influence of risk bearing on risk taking represents yet another area for examination by behavioral risk scholars (c.f., Sitkin and Weingart, 1995). We believe that formal integration of agency theory with behavioral views of risk would represent an important step toward bridging competing explanations for managerial choice behavior.

**Behavioral theory of the firm.** We found strong support for behavioral explanations of risk. First, we detected a positive influence by attainment discrepancy on risk taking. Our data suggest that as performance deteriorates (the attainment discrepancy increases), risk taking is encouraged. Further, a nested model test detected a positive relation between attainment discrepancy and organizational risk. One interpretation of this direct influence on organization risk is that attainment discrepancy captures managerial influences on organization risk not already included in our measure of managerial risk taking. That is, in response to unsatisfied aspirations, managers have a variety of risky laden options in addition to R&D spending or diversification from which to chose. It is possible that the influence of attainment discrepancy on organizational risk reflects alternative forms of risk taking (or hedging).

Slack exhibited the expected negative influence on managerial risk taking. Contrary to the perspective that slack provides the resources necessary to engage in entrepreneurial decision making (Singh, 1986), our data support a 'hunger-driven' view of risk. That is, low levels of slack resources lead to increased investment in riskier alternatives (Bromiley, 1991; Wiseman and Bromiley, 1996). Hence, it appears that managers may alter their risk preferences with their firm's overall financial health.

**Upper echelons.** Interestingly, the relation between top management team heterogeneity and managerial risk taking was not significant. Several explanations present themselves. First, some studies suggest that the association between team composition and choice behavior may be moderated by a variety of organizational and environmental conditions (Jackson, May and Whitney, 1995). That is, studies of TMT heterogeneity on choice behavior may need to consider the embedding systems within which they operate (Jackson, 1992).

Second, it is possible that wealth and performance considerations are more important to predicting risk preferences than TMT heterogeneity. For example, Walsh (1988) detected no relation between work experience and the content of managers' schemas. He concluded that managers are not simple-minded information processors. This may be especially true when personal wealth is linked to the outcomes of top management's decisions (i.e., TMT members hold equity positions in their firms). Therefore, the key managerial characteristic for predicting risk taking may be the extent of ownership held by top decision makers and firm performance achievement.

Third, a common assumption in tests of upper echelon theory is that demographic diversity corresponds to diversity in underlying attributes. However, it is likely that TMT members have passed through several screens designed to reduce variability in values, ability, knowledge and attitudes (Schneider, 1987). Thus, there is good reason to believe that despite the appearance of demographic heterogeneity, TMTs may not exhibit variance in attributes influential to risk preferences.

Finally, our findings may have resulted from our operationalization of TMT heterogeneity. Specifically, our measure of tenure heterogeneity failed to demonstrate convergent validity with our other measures and was thus eliminated. Further, the factor loading for functional heterogeneity was marginal, at best. Hence, we would concur with Hambrick *et al.* (1996) that heterogeneity may not be a unidimensional construct. Additionally, others have criticized the use of demographic measures as proxies for complex cognitive processes (Lawrence, 1997; West and Schwenk, 1996). Thus, it is possible that some form of heterogeneity is important but that demographic indicators are unable to detect the relation. Clearly, if upper echelon theory is to contribute to our understanding of managerial choice behavior, more attention must be given to effectively capturing TMT heterogeneity.

### The influence of environment on risk

We identified no effect of industry rivalry on risk taking, however we did detect a negative influence of dynamism. It appears that managers respond to industry turbulence by pursing alternatives promising lower risk such as reduced investment in R&D and greater diversity. This suggests that managers may attempt to offset environmentally generated income stream uncertainty through strategic options designed to reduce that variability (Froot, Scharfstein and Stein, 1994). This is appealing since lower income stream variability reduces both debt and other operating costs (Amit and Wernerfelt, 1990; Copeland and Weston, 1992; Cornell and Shapiro, 1987) and has been associated with higher compensation (Gomez-Mejia, 1994).

Preliminary results of the baseline structural model indicated that both industry rivalry and dynamism had direct influences on organizational risk. Organizations in industries characterized by higher levels of rivalry and those in dynamic industries were most likely to evidence performance instability. However, the industry effects on organizational risk essentially disappeared when we added a direct path between attainment discrepancy and organizational risk in a nested model test. Hence, our results are inconsistent with previous research that has, when using coarser measures of environment, detected a positive association between environment and organizational risk.

This inconsistency with previous findings led us to examine an alternative model of environmental influence on risk. Specifically, we conducted a post hoc test in which we modeled the direct effects of industry rivalry and dynamism on attainment discrepancy by adding a third structural equation to the model. This addition to the model was suggested by our earlier finding that managerial risk mediated the influence of environment on organizational risk, and our interpretation that attainment discrepancy's influence may reflect unmeasured managerial risk preferences. Although caution is warranted when interpreting these results due to the exploratory nature of this test, we find the results somewhat intriguing. Both parameter estimates were significant in a model that achieved an adequate fit (CFI= 0.898; PFI = 0.654; $\chi^2_{181df} = 410.99$). Higher levels of rivalry ($\gamma = +0.465$; $p < 0.001$) and dynamism ($\gamma = +0.173$; $p = 0.047$) were associated with higher attainment discrepancies. All other relations in the model remained substantially unchanged. Given the simultaneous strong relation between attainment discrepancy and organizational risk, it would appear that environment's effect on organizational risk is mediated by the attainment discrepancy.

It would seen unlikely that high levels of attainment discrepancy directly 'cause' performance volatility. Rather, our interpretation is that managers experiencing an attainment discrepancy brought about by a challenging environment take strategic actions to reduce their performance gap. Our indicators of the managerial risk taking construct intended to pick up some of these actions. In designing the study, we limited risk taking to actions that are widely associated with risk across many industry types and conditions. However, depending on the specific industry, other strategic actions might also be considered risky (e.g., alliances, globalization, retrenchment). Also, a firm's depth of experience with different strategies will influence the riskiness of these actions. Future research, therefore, might attempt to capture a wider array of risky choices that are industry- as well as firm-specific to help explain the effects of attainment discrepancy on organizational risk through risk taking.

In sum, our results about environment and risk extend prior risk research by disaggregating the industry risk variable used as a control measure in previous research (Bromiley, 1991; Wiseman and Bromiley, 1996) into specific environmental dimensions that distinguish between turbulence and life cycle effects. Our results suggest that greater care must be given to modeling industry influences on risk since these factors appear to exhibit varied influences on managerial and organizational risk.

## CONCLUSION

This study developed and tested a comprehensive model of organizational risk. By utilizing a more holistic approach than has been used in the past, insights were gained about the effects of environmental characteristics and organizational factors on managerial risk taking and organizational risk. In particular, this study makes several contributions to the study of risk. We have: (1) demonstrated the non-equivocality between managerial risk taking and income stream uncertainty while upholding conventional wisdom that risk taking increases organizational risk, (2) built and tested a model of risk in organizations that more completely reflects the complexity of business contexts, and (3) demonstrated the unsettling effects environments can have on the stability of a firm's income stream through the mediating role of managerial choice behavior.

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Appendix: Means, standard deviations, and correlations[1]

| | Mean | St Dev | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Industry size | 84.9 | 85.73 | 1.00 | | | | | | | | |
| 2. Concentration Ratio (CR4) | 0.723 | 0.21 | –0.86* | 1.00 | | | | | | | |
| 3. Industry Employment Growth | –9.70 | 13.31 | –0.73* | 0.69* | 1.00 | | | | | | |
| 4. Industry Sales Growth | 16.7 | 17.86 | 0.95* | –0.81* | –0.62* | 1.00 | | | | | |
| 5. Variation—Industry Income | 0.278 | 0.216 | –0.02 | 0.09 | 0.25* | 0.05 | 1.00 | | | | |
| 6. Variation—Industry Sales | 0.121 | 0.090 | 0.19* | –0.34* | 0.05 | 0.25* | 0.52* | 1.00 | | | |
| 7. Officers, Directors Stock Holdings | 12.0 | 13.69 | 0.04 | 0.06 | 0.09 | 0.06 | –0.22* | –0.18* | 1.00 | | |
| 8. TMT Stock Holdings | 6.42 | 9.63 | 0.02 | 0.06 | 0.08 | 0.04 | –0.17* | –0.17* | 0.86* | 1.00 | |
| 9. Functional Heterogeneity | 0.635 | 0.083 | 0.11 | –0.12 | –0.12 | 0.12 | 0.09 | 0.12 | –0.15* | –0.11 | 1.00 |
| 10. Education Heterogeneity | 0.531 | 0.127 | –0.04 | 0.01 | 0.10 | –0.02 | 0.11 | 0.13 | –0.38* | –0.28* | 0.24* |
| 11. Attainment Discrepancy—ROE | –0.047 | 0.042 | –0.37* | 0.28* | 0.24* | –0.36* | –0.17* | –0.24* | 0.01 | –0.06 | –0.12 |
| 12. Attainment Discrepancy—ROA | –0.112 | 0.103 | –0.49* | 0.44* | 0.32* | –0.48* | –0.27* | –0.40* | 0.11 | 0.06 | –0.15 |
| 13. Recoverable Slack | 0.272 | 0.170 | –0.27* | 0.12 | 0.24* | –0.26* | 0.17* | 0.15* | –0.27* | –0.27* | 0.06 |
| 14. Available Slack | 1.67 | 1.18 | 0.28* | –0.15* | –0.20* | 0.28* | –0.13 | –0.12 | 0.33* | 0.36* | –0.06 |
| 15. Potential Slack | 0.359 | 0.325 | 0.26* | –0.16* | –0.22* | 0.27* | –0.23* | –0.12 | 0.09 | 0.11 | 0.14 |
| 16. Research and Development | 0.037 | 0.016 | 0.03 | 0.14* | 0.12 | –0.01 | –0.17* | –0.17* | 0.70* | 0.67* | –0.18* |
| 17. Diversification—Entropy | 0.412 | 0.232 | –0.26* | 0.06 | 0.15* | –0.25* | 0.24* | 0.22* | –0.69* | –0.67* | 0.12 |
| 18. Diversification—# Segments | 2.07 | 1.77 | –0.25* | 0.06 | 0.14* | –0.23* | 0.24* | 0.20* | –0.67* | –0.65* | 0.11 |
| 19. Variation in Price Earnings | 0.031 | 0.066 | 0.19* | –0.10 | –0.04 | 0.18* | 0.16* | 0.11 | 0.24* | 0.26* | 0.06 |
| 20. Variation in ROA | 0.005 | 0.001 | 0.31* | –0.17* | –0.10 | 0.36* | 0.09 | 0.00 | 0.25* | 0.20* | –0.02 |
| 21. Control: R&D | 0.049 | 0.056 | 0.01 | 0.11 | 0.09 | 0.03 | –0.21* | –0.19* | 0.71* | 0.71* | –0.18* |
| 22. Control: Entropy | 0.465 | 0.508 | –0.26* | 0.16* | 0.20* | –0.25* | 0.13* | 0.04 | –0.25* | –0.26* | –0.04 |
| 23. Control: # Segments | 2.21 | 1.43 | –0.24* | 0.13* | 0.18* | –0.23* | 0.16* | 0.06 | –0.32* | –0.31* | –0.08 |

[1]n = 235

*Correlation significant at $p < 0.05$

Appendix: Continued

| | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10. Education Heterogeneity | 1.00 | | | | | | | | | | | | | |
| 11. Attainment Discrepancy—ROE | –0.03 | 1.00 | | | | | | | | | | | | |
| 12. Attainment Discrepancy—ROA | –0.03 | 0.77* | 1.00 | | | | | | | | | | | |
| 13. Recoverable Slack | 0.13 | 0.07 | 0.15* | 1.00 | | | | | | | | | | |
| 14. Available Slack | –0.20* | –0.07 | –0.06 | –0.77* | 1.00 | | | | | | | | | |
| 15. Potential Slack | –0.07 | 0.04 | 0.15* | –0.31* | 0.40* | 1.00 | | | | | | | | |
| 16. Research and Development | –0.22* | 0.13 | 0.12 | –0.21* | 0.28* | 0.01 | 1.00 | | | | | | | |
| 17. Diversification—Entropy | 0.24* | –0.24* | –0.26* | 0.42* | –0.43* | –0.16* | –0.70* | 1.00 | | | | | | |
| 18. Diversification—# Segments | 0.23* | –0.25* | –0.25* | 0.38* | –0.40* | –0.14* | –0.77* | 0.95* | 1.00 | | | | | |
| 19. Variation in Price Earnings | –0.18* | 0.18* | 0.33* | –0.30* | 0.18* | –0.10 | 0.15 | –0.27* | –0.26* | 1.00 | | | | |
| 20. Variation in ROA | –0.07 | 0.36* | 0.40* | –0.30* | 0.20* | 0.04 | 0.34* | –0.43* | –0.43* | 0.49* | 1.00 | | | |
| 21. Control: R&D | –0.25* | 0.11 | 0.11 | –0.28* | 0.32* | 0.07 | 0.76* | –0.65* | –0.85* | 0.16* | 0.30* | 1.00 | | |
| 22. Control: Entropy | –0.07 | –0.19* | –0.30* | 0.09 | –0.20* | –0.20* | –0.62* | –0.49* | 0.56* | –0.15 | –0.26* | –0.51* | 1.00 | |
| 23. Control: # Segments | –0.09 | –0.27* | –0.33* | 0.10 | –0.11 | –0.18* | –0.69* | 0.55* | 0.60* | –0.18* | –0.28* | –0.56* | 0.93* | 1.00 |

[1]n = 235.
*Correlation significant at $p < 0.05$.