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Risk and procedural rationality: a behavioral theory perspective

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Abstract

Purpose – The purpose of this paper is to explore the impact of perceived risk on the procedural rationality of the decision process rather than decision choices or outcomes. The moderating roles of attainment discrepancy and organizational slack are also explored.

Design/methodology/approach – These relationships, motivated by behavioral theory, are tested using survey data of capital investment decisions in a sample of 128 public firms in the USA.

Findings – The findings suggest an inverted-U shaped relationship between perceived risk and procedural rationality. In addition, absorbed slack and attainment discrepancy played moderating roles on the perceived risk-procedural rationality relationship.

Research limitations/implications – This study has several implications for research. First, the influence of risk is extended beyond decision outcomes to include decision processes. Second, the core arguments of behavioral theory, including uncertainty avoidance and decision context, appear to hold for the decision process. However, the effects of risk appear to be in the form of an inverted U-shaped relationship, differing from prior behavioral theory research related to decision outcomes.

Practical implications – Perceived risk and the organizational context can lead to differing approaches to making decisions. As perceived risk increases, managers appear to alter the extent of information gathering and analysis. Organizations may consider designing different decision processes for different situations that take these managerial tendencies into account.

Originality/value – The contribution of this study is the extension of behavioral theory explanations of risk from decision choices or outcomes to the procedural rationality of the decision process. The findings show that risk has a non-linear influence on the procedural rationality of the decision process.

Keywords Risk management, Organizational strategy, Organizational behaviour, Uncertainty management

Paper type Research paper

1. Introduction

Risk represents a crucial influence on the strategic decisions of an organization. Research has clearly demonstrated strong linkages between risk and organizational decision choices, as well as between risk and organizational performance (Bromiley, 1991; Fiegenbaum and Thomas, 1986; McNamara and Bromiley, 1999; Miller and Bromiley, 1990; Miller and Leiblein, 1996; Palmer and Wiseman, 1999; Wiseman and Bromiley, 1996). Environmental, organizational and cognitive factors appear to play significant roles in risky choices.

The behavioral theory of the firm (BTOF) is one of the most prevalent theoretical perspectives in the risk literature (Bromiley *et al.*, 2001, p. 269). "The central BTOF themes of search and responses to uncertainty provide a basis for theorizing about organizational risk." Within the BTOF, risk represents the volatility of potential outcomes, including the potential for downside loss (Bromiley *et al.*, 2001). The BTOF

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suggests that the firm's decisions are strongly influenced by its performance relative to aspirations and the levels of organizational slack (Cyert and March, 1963). In terms of organizational risk, this implies that as firms fall below aspirations in terms of performance, the firm will be more likely to pursue risky choices in search of ways to improve performance, while performance above aspirations leads to risk avoiding choices and search according to established routines. Organizational slack acts as a buffer against fluctuations in the external environment. Researchers have generally supported behavioral theory views using numerous measures of risk, as well as expanding the notion of reference points (Bromiley, 1991; Chen and Miller, 2007; Greve, 2003a, 2007; March and Shapira, 1987; Miller and Bromiley, 1990; Miller and Chen, 2004; Miller and Leiblein, 1996; Palmer and Wiseman, 1999).

While the findings relating to the BTOF have provided a better understanding of the impact of risk on strategic decisions at the organizational level, the emphasis has been on risk-taking choices or outcomes, particularly risk-seeking vs risk-avoiding choices. The effects of risk on the decision process have received less attention at the organizational level. For example, how does the level of risk associated with a decision alter the nature of information gathered during the decision process? Do firms use the same analytical process for decisions with different risk levels? Prior research has shown that contextual factors, such as the magnitude of the decision and the volatility of the environment, affect information processing activities and conformity to existing formal processes (Leblebici and Salancik, 1981; Sutcliffe and McNamara, 2001; Wright and Goodwin, 2002). In addition, different types of decisions may call for different decision processes (Maritan, 2001; Mintzberg *et al.*, 1976). This is particularly important since the decision-making process impacts the effectiveness of the decision, with different processes leading to different choices, which can produce different outcomes for strategic decisions (Dean and Sharfman, 1996).

The objective of this study is to examine the relationship between perceived risk and the decision process within the context of capital investment decisions. Specifically, three key relationships are examined. First, this study explores the direct relationship between risk and the procedural rationality. This relationship is based on managerial efforts to manage risk through uncertainty avoidance behaviors, such as short-run feedback responses and negotiated environments (March and Shapira, 1987). The other two relationships demonstrate the importance of decision context on the effects of risk within the BTOF, specifically the moderating influences of attainment discrepancy and organizational slack on the risk-procedural rationality relationship. To date, the BTOF literature has focused on organizational decision outcomes. By exploring this set of three relationships, this study provides crucial insight into a less understood area – the nature of the organization's process used to make risky choices. Behavioral theory principles are extended by linking it with the procedural rationality of the firm's processes.

The paper proceeds as follows. First, the nature of procedural rationality, the key construct in this study, is discussed. Next, risk is linked to procedural rationality by drawing on the existing literature related to uncertainty avoidance in the BTOF. The role of decision context is highlighted next, examining the moderating roles of attainment discrepancy and organizational slack. The following section discusses the research design and analysis of these hypotheses in the context of capital investment decisions. Finally, the results of these empirical tests are presented, which is followed by a discussion of the implications of these findings.

2. Theory and hypotheses

2.1 Measuring decision process: procedural rationality

Procedural rationality is defined as "... the extent to which the decision process involves the collection of information relevant to the decision and the reliance upon analysis of this information in making the choice" (Dean and Sharfman, 1993a, p. 1071). Procedural rationality involves efforts to make the best decision possible under the circumstances. Higher levels of procedural rationality indicate the gathering of more decision-related information and more extensive analysis, while lower levels of procedural rationality represents less information gathering and lower less extensive analysis. This construct was chosen for several reasons. First, it captures important elements of the decision process: information gathering and analysis. Second, prior research has demonstrated that procedural rationality is a very important component of decision-making processes (Dean and Sharfman, 1993a, 1996; Maritan, 2001; Sharfman and Dean, 1997). Third, from a practical perspective, these studies have demonstrated the reliability of the procedural rationality construct.

2.2 Linking risk and procedural rationality: the role of uncertainty avoidance behaviors

Cyert and March (1963) outline four key characteristics of organizational decision processes: quasi-resolution of conflict, uncertainty avoidance, problemistic search and organizational learning. This study emphasizes the role of uncertainty avoidance primarily in explaining the risk-procedural rationality relationship, with an additional secondary connection to organizational learning.

While decisions typically involve uncertainty, organizations seek to avoid uncertainty through two mechanisms – feedback react decision procedures and negotiated environments. First, managers try to avoid the requirement of correctly anticipating future events by relying on decision rules that emphasize reaction to short-run feedback. Second, managers try to arrange a negotiated environment by imposing plans, standard operating procedures, industry practices and uncertainty absorbing contracts (Cyert and March, 1963). The standard operating procedures and industry practices often involve the gathering of information, processing or analysis of information using prescribed tools or formats, and finally, reliance on this analysis in the decision process, i.e. elements of procedural rationality. While the managers cannot eliminate the uncertainty associated with a decision, they can make the decision more tractable through these uncertainty avoidance behaviors (Cyert and March, 1963; Cyert *et al.*, 1996).

It is also worth noting that Cyert and March's (1963) notion of organizational learning is relevant here. Organizations adapt attention rules and search rules when they find rules that lead to satisfactory performance levels. Attention rules (i.e. certain criteria) and search rules are embodied in the procedural rationality of decision processes in terms of information gathering and analysis. The principle of organizational learning suggests that managers may modify their decision process under certain conditions.

Thus, the BTOF suggests that uncertainty avoidance behaviors impact the procedural rationality of the decision process. The next step involves identifying how such behaviors impact the risk-procedural rationality relationship. March and Shapira (1987) explicitly connect such behaviors with risk, suggesting that managers seek to avoid risk with these uncertainty avoidance behaviors. In addition, these authors suggest that managers may use information to manage or modify risk associated with a decision by securing new information and additional estimation. Audia and Greve,

2007 also link risk with uncertainty avoidance by focusing on the decision outcomes. According to Audia and Greve, 2007, a risky decision (such as a factory expansion) involves uncertain consequences and the potential for losses.

These arguments suggest the following logic. Organizational decisions, such as capital investment decisions, are often associated with uncertainty related to performance consequences, i.e. the impact on organizational income streams. Such decisions are risky given this uncertainty in performance and the associated potential for loss. Managers seek to manage such risk, limiting exposure to negative outcomes, which is a primary source of motivation for managers (March and Shapira, 1987). One of the primary mechanisms managers can use to manage risk is the information gathering and analysis during the decision process (i.e. procedural rationality).

As noted above, managers may alter the decision process depending on the conditions surrounding the decision (March and Shapira, 1987; Maritan, 2001; Sutcliffe and McNamara, 2001). In terms of decision process, the actions managers take to manage risk include gathering more information or conducting more analysis related to a decision to assess risk (March and Shapira, 1987; Wright and Goodwin, 2002). Thus, as the perceived risk of a decision increases, managers will be more extensive in their information gathering and analysis. More information and analysis can provide managers with a greater understanding of the potential outcomes of the decision, including the potential for negative outcomes. For example, when making loan decisions in more volatile environments, decision makers in banks were more likely to gather more information, at times even more than required by standard loan application forms used by the bank (Leblebici and Salancik, 1981). In addition, decision makers gather information over and above prescribed levels when trying to gain more knowledge about an exchange decision (Sutcliffe and McNamara, 2001). The additional information and analysis can help the manager to approach the decision from different perspectives (March and Shapira, 1987). Alternatively, it is worth noting that after gathering such information and conduction additional analysis, managers may change or restructure the decision characteristics to alter the risk associated with the decision.

Combining these arguments, greater levels of perceived risk are expected to be associated with more managerial effort to manage or control such risk. In other words, under conditions of lower perceived risk, managers may rely on existing standard operating procedures related to the decision process in terms of information gathering and analysis. However, when managers perceive high risk associated with a decision, managers are more likely to gather more information and conduct more analysis in the organizational decision process to manage the risk and achieve a more tractable decision problem. These linkages between uncertainty avoiding behaviors, risk and procedural rationality lead to the following hypothesis regarding the direct effects of risk:

H1. There will be a positive association between the perceived risk associated with a decision and the procedural rationality of the decision process.

H1 implicitly assumes a linear effect of perceived risk on procedural rationality. However, there is the possibility that the relationship between risk and procedural rationality may involve curvilinear effects. According to *H1*, at low levels of perceived risk lower levels of procedural rationality would be expected, as noted above. As perceived risk increases, procedural rationality would also increase. Yet, at some point, the risk associated with a decision may become so great that more analysis or greater

information provides little value to help manage risk or make the decision more tractable in terms of uncertainty. Once this threshold is reached, decisions beyond this level have perceived variance of outcomes so great additional analysis may provide little helpful information (Courtney *et al.*, 1997). In these situations, firms may rely on judgmental approaches or experience rather than additional analysis (Daft and Lengel, 1986; Leblebici and Salancik, 1981), suggesting lower levels of procedural rationality. This leads to the following hypothesis:

H1a. There will be a negative curvilinear relationship, i.e. an inverted-U shape, between perceived risk associated with a decision and the procedural rationality of the decision process.

2.3 The moderating effects of attainment discrepancy and organizational slack

The first hypothesis deals with the direct relationship between risk and the procedural rationality of the decision process. According to Greve (2003a, p. 1057), "research on individual risk taking has found that individuals are generally averse to risk, but the degree of risk aversion depends on the context of choice." The tenets of BTOF suggest that attainment discrepancy and organizational slack can influence the risk aversion tendencies of managers.

2.3.1 Attainment discrepancy. Attainment discrepancy refers to the difference between firm performance and aspirations as judged by managers (Lant, 1992). Greve (2003b, 1998) refers to performance relative to aspirations as a "master switch" that alters organizational behaviors. Attainment discrepancy influences search, cognitive efforts, and risk taking. Managers are likely to be concerned when performance falls short of aspirations, triggering problemistic search (Cyert and March, 1963) to improve performance. When organizational performance falls below its aspiration level, i.e. positive attainment discrepancy, organizations are likely to alter their processes in search of solutions to improve performance (Miller and Leiblein, 1996; Wiseman and Bromiley, 1996). Conversely, the likelihood of engaging in organizational change declines when attainment discrepancy is deemed favorable (Greve, 1998). When an organization is performing above its aspiration level, negative attainment discrepancy, decision makers tend to adhere to existing routines and procedures for operations, avoiding costs and increased uncertainty associated with search (Miller and Leiblein, 1996). Firms tend to maintain current routines and limit investments in innovation when performance exceeds aspirations (Levinthal and March, 1981). Risk scholars have extended these arguments to include risk-seeking or risk-avoiding choices depending upon performance relative to aspiration level by linking search with risk-taking. (Bromiley, 1991; Palmer and Wiseman, 1999; Singh, 1986; Wiseman and Bromiley, 1996).

The first hypothesis suggests that uncertainty avoidance behaviors on the part of managers in the organizational decision process results in a positive risk-procedural rationality relationship. This study contends that this relationship is moderated by attainment discrepancy. When organizational performance is above the reference point, managers are likely to adhere to existing organizational routines and standard operating procedures. These current processes, such as the procedural rationality of the decision process, are leading to satisfactory performance. Thus, the relationship hypothesized above, is maintained, with a positive slope between risk and procedural rationality. In contrast, when organizational performance is below the aspiration or reference level, managers are more likely to alter existing routines in search of

improved performance. Existing routines involve an established level of information gathering and analysis, which are not leading to satisfactory performance. Managers will be more likely to move away from these routines of information gathering and analysis and change the level of procedural rationality. The poor performance will result in efforts to close the performance gap through more extensive problemistic search, which can include additional information gathering and increased analysis. Thus, when performing below aspirations, or positive attainment discrepancy, the positive risk-procedural rationality relationship is likely to be enhanced, becoming steeper in terms of slope. These arguments suggest a positive moderating impact of attainment discrepancy:

H2. Attainment discrepancy will positively moderate the perceived risk-procedural rationality relationship. When performance is below the aspiration level, i.e. positive attainment discrepancy, the positive risk-procedural rationality relationship will be enhanced (steeper in slope), relative to when performance is above the aspiration level, negative attainment discrepancy.

2.3.2 Organizational slack. Organizational slack represents excess resources that the firm possesses over and above what it needs to maintain existing operations. From the behavioral theory perspective, according to Cyert and March (1963), slack reduces the problems of scarcity. The excess resources serve to protect the organization from downside risk (Cheng and Kesser, 1997), acting as a buffer against failure (Audia and Greve, 2007) or against fluctuations in the environment. This buffer can influence the risk tolerance of managers (Greve, 2003b) as well as managerial perceptions of issues related to decision making, such as the potential for loss (Wu and Tu, 2007). In addition, higher levels of slack lead to less strict performance monitoring and more lax controls and performance monitoring in the face of uncertainty (Chen and Miller, 2007; Greve, 2003b, 2007). Conversely, organizational flexibility is reduced and strategic options are limited when firms have little slack (Miles, 1982).

In the context of this study, the presence of organizational slack is expected to moderate the positive perceived risk-procedural rationality relationship. Under low levels of slack, organizations lack the cushion of excess resources. As a result, managers would be expected to perceive higher potential for losses, which would suggest that managers will exhibit strong uncertainty avoidance behaviors. The lack of a buffer exposes the organization to potential losses, and managers are less secure in terms of income and employment risk. Thus, when managers perceive higher levels of risk under low levels of organizational slack, even greater levels of information gathering and analysis would be expected in the decision making process in order to manage or control this risk, as noted above. Thus, lower levels of slack are likely to enhance the risk-procedural rationality relationship. However, when organizational slack is high, one would expect that this positive risk-procedural rationality relationship to be less steep. The buffer provided by slack reduces perceptions of downside risk by managers (Cheng and Kesser, 1997) likely reducing the extent of uncertainty avoidance behaviors. In addition, more lax controls and less strict performance monitoring (Greve, 2003a, 2007) suggest that there will be less information gathering and analysis of managerial decisions under conditions of excess resources. These arguments suggest the following hypothesis:

H3. Organizational slack will negatively moderate the perceived risk-procedural rationality relationship. Under high levels of organizational slack, the positive risk-procedural rationality relationship will be reduced (flatter in slope), relative to low levels of organizational slack.

3. Methods

3.1 Sample and questionnaire

This research focuses on the capital investment decision process in public companies. Public firms tend to be larger and typically employ relatively structured capital investment decision approaches. Firms in the USA with data available from 1998 to 2000 were identified in COMPUSTAT. Using this list, a survey instrument was sent to the chief executive officer or chief operating officer for 1,800 randomly selected firms. The survey was administered in 2001. Usable responses were received from 130 firms, or a response rate of 7.2 percent. This response rate was somewhat low but corresponds to other surveys sent to top management regarding sensitive information (Graham and Harvey, 2001). Owing to the response rate, there exists the potential for non-response bias. This was examined by conducting *t*-tests for differences in the means of participating and non-participating firms on several key organizational variables – revenues, employees, capital expenditures, capital intensity, and performance (ROA). No significant differences were found, with t-statistics ranging from 0.865 to 1.034, indicating that the threat of bias is limited.

These 130 firms represent a wide cross section of industries with over 60 different three-digit SIC codes represented. In addition, 12 percent of the firms in the sample are Fortune 500 firms. Owing to missing archival data for the measures described below, two firms had to be dropped from the sample, resulting in a total sample of 128 firms.

The questionnaire was designed in a two step process. First, a series of interviews were conducted with top managers at six large public companies to help design the survey and identify the appropriate key informants related to capital investment decision processes. Second, the survey was pre-tested on both academics and executive MBA students. The questionnaire asks respondents to respond to several question items related to perceived risk levels and the nature of the decision process for one of six types of capital investments chosen by the respondent. Rather than focus on a single investment decision, the survey asks respondents to focus on the nature of the process used across multiple decisions of the same types of investment. These types of investments included replacement, cost reduction/efficiency, investment to expand capacity, expansion to new markets, enhancement of existing product, and new product. These categories were identified from surveys of capital investment practices in the literature (Bierman, 1988) and validated through interviews with senior management. The categories reflect investments with varying degrees of risk which is critical to this study.

3.2 Dependent variable

3.2.1 Procedural rationality. Procedural rationality incorporates the notion of extent of information gathering, extent of analysis, usage of quantitative analytical techniques, focus on relevant information, and the nature of the decision process (i.e. analytical vs intuitive). A more procedurally rational process reflects a more comprehensive approach to the decision making process. For procedural rationality, the five scale

items were taken from Dean and Sharfman (1993a, 1996). These five scale items exhibited strong reliability with a Cronbach's α of 0.73. The scale items are listed in the Appendix.

3.3 Independent variable

3.3.1 Perceived risk. Knight (1921) and March and Simon (1958) define risk as the probability distribution of consequences for an alternative. Risk has commonly been measured using variability or volatility measures (Bromiley *et al.*, 2001; Ruefli *et al.*, 1999). Recent empirical work has also discussed the importance of downside risk (Miller and Leiblein, 1996; Miller and Reuer, 1996). For this study, risk consists of:

- The volatility of returns.
- Downside risk associated with the capital investment project, as perceived by the decision-maker.

As such, definitions from Miller and Bromiley (1990), Miller and Leiblein (1996), Miller and Reuer (1996), and Palmer and Wiseman (1999) were used to create scale items that measure the perceived variance in investment returns, the perceived potential exposure to loss associated with an investment, and the perceived sensitivity of returns to market events associated with an investment. This construct consists of three items with a Cronbach's α of 0.74. The scale items are listed in the Appendix. Although these items were created directly from definitions in the literature, the construct validity of these items was assessed through a pre-test with a sample of management faculty and doctoral students prior to pre-testing the entire survey as discussed above.

3.4 Moderating variables

3.4.1 Attainment discrepancy. Following Palmer and Wiseman (1999), this construct was calculated by comparing the firm's ROA in the previous year against the industry average for that year. If the firm exceeded the industry average, the aspiration target was calculated by multiplying prior ROA by 1.05. If the firm was below the industry average, the aspiration target was the industry average for the prior year. Attainment discrepancy represents the difference between the firm's aspiration level and its actual performance. This process was completed for the firm's ROA from 1998 to 2000, and then a three-year average attainment discrepancy was created. A positive value indicates performance below the aspiration level, while a negative value indicates performance above the aspiration level.

3.4.2 Organizational slack. Slack has been shown to impact decision-making, particularly from a behavioral theory perspective (Bromiley, 1991; Cyert and March, 1963; Greve, 2003a; Palmer and Wiseman, 1999). Slack can impact the propensity to search or change organizational processes (Greve, 2003a). Slack was measured using two common measures: absorbed slack and potential slack. Absorbed slack (also referred to as recoverable slack) is measured as the average ratio of selling, general and administrative expenses to sales (Greve, 2007; Wiseman and Bromiley, 1996) from 1998 to 2000. Potential slack (Bromiley, 1991; Greve, 2003b; Wiseman and Bromiley, 1996) refers to the leverage of the firm, measured as the ratio of the firm's debt to equity, again taking the average from 1998 to 2000. Both measures were obtained from COMPUSTAT.

3.5 Control variables

3.5.1 Firm size. Capital investment analysis may differ according to the size of the firm (Graham and Harvey, 2001). Larger firms may be able to provide more resources to the analysis of capital investments, and they may have more sophisticated and/or formal processes than small firms. Firm size is controlled for using the natural log of the three-year average of total employees (from 1998 to 2000), which was obtained from COMPUSTAT. Two other measures of firm size – total revenues and total assets – were also tested in the analysis. Since all three measures yielded consistent results, only total employees will be discussed here.

3.5.2 Managerial stock ownership. A wealth of evidence has shown that managerial stock ownership can influence managerial decision making, particularly in terms of decision choices (Palmer and Wiseman, 1999; Ryan and Wiggins, 2002; Sanders, 2001; Wright *et al.*, 2007). It represents a measure of managerial wealth tied to the performance of the organization, which has been shown to influence managerial risk assessments. Given this study's focus on uncertainty avoidance and managerial attempts to manage risk, it is necessary to control for the effects of such ownership. Managerial stock ownership is measured as the three-year average (1998-2000) of the percentage of stock owned by the top management team of the firm. The ownership percentage data was obtained from EXECUCOMP.

3.5.3 Investment scale. The size of an investment can potentially impact the rationality of the decision making process. As Sanders and Hambrick (2007) point out, the size of the investment outlay can impact the perceived risk of the decision. The hypothesized relationships are intended to examine the impact of the returns of the investment rather than the size of the investment. As such, the size or scale of the investment was controlled for using a single item scale on the survey that states: "The scale of this type of investment, in terms of dollars, is larger than other types of investments" (1 = strongly disagree; 7 = strongly agree).

3.5.4 Industry. Farragher *et al.* (1999) offer evidence that capital budgeting approaches may differ across industries. Industry was controlled for using seven dummy variables that represent the single-digit SIC code for the firms included in the sample 2 of the ten single-digit categories were not represented in our sample – Agriculture, Forestry and Fisheries and Public Administration).

3.5.5 Capital intensity. Firms that have relatively higher levels of capital investments will be more likely to expend more resources in the evaluation of these investments, and possess more experience in making these investment decisions. These factors may influence the findings, thus should be controlled for. This research uses the three-year average (1998-2000) of capital intensity (capital expenditures/sales) for each firm, obtained from COMPUSTAT.

3.6 Analysis

The hypotheses are tested using multiple regression with interaction terms to test for moderating effects. Following Aiken and West (1996), all variables were centered prior to creating the interaction terms.

4. Results

Table I presents the descriptive statistics and correlation matrix for all of the variables. Table II presents the results of the regression analysis. Note that for all models, the

Table I. Means, standard deviations, and correlations

	Mean	SD	1	2	3	4	5	6	7	8
1. Procedural rationality	5.19	0.79								
2. Perceived risk	3.59	0.99	0.16****							
3. Absorbed slack	0.21	0.17	0.15****	0.05						
4. Potential slack	0.95	1.20	0.03	0.01	−0.29**					
5. Attainment discrepancy	0.04	0.13	0.03	0.02	0.11	0.02				
6. Firm size	0.27	1.91	0.31***	0.09	−0.04	−0.01	−0.01			
7. Capital intensity	0.21	0.29	0.05	0.06	0.07	0.08	−0.06	−0.23**		
8. Managerial ownership	6.51	11.84	0.16****	−0.01	0.14	−0.05	−0.03	−0.07	−0.09	
9. Investment scale	4.97	1.66	0.21*	0.16****	0.10	−0.03	0.09	−0.15****	0.16****	−0.11

Notes: $N = 128$; industry dummy variables not included; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; $^{****}p < 0.10$

Table II.
Results for direct effects, curvilinear effects, and moderating effects

	Model 1 Control variables	Model 2 Direct effects	Model 3 Curvillinear effects	Model 4[a] Moderators included	Model 5[a] Moderating effects
Intercept	5.12***	4.74***	3.35***	5.18***	5.03***
Firm size	0.16***	0.15***	0.15***	0.15***	0.16***
Capital intensity	−0.53	−0.66****	−0.52	−0.49	−0.47
Managerial ownership	0.01*	0.01****	0.01****	0.01****	0.01****
Investment scale	0.12**	0.11**	0.09*	0.10*	0.10**
Perceived risk		0.10*	0.82**	0.16*	0.20**
Perceived risk squared			−0.09*	−0.09*	−0.08*
Attainment discrepancy				−0.03	−0.02
Absorbed slack				0.07	0.05
Potential slack				0.04	0.03
Perceived risk * attainment discrepancy					0.16****
Perceived risk * absorbed slack					−0.18*
Perceived risk * potential slack					−0.06****
F	4.42***	4.28***	4.55***	3.72***	3.51***
Adj. R^2	0.23	0.24	0.27	0.26	0.28
R^2	0.30	0.32	0.35	0.36	0.39
Change R^2	–	0.02****	0.03*	0.01*	0.03***

Notes: $N = 128$; industry dummy variables not included; [a]variables centered for interaction effects. $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; $^{****}p < 0.10$

variance inflation factors (VIFs) were examined for any potential issues related to multicollinearity. No problems related to multicollinearity were evident as all VIFs were well below the threshold value of 10. Model 1 includes only the control variables (except for the industry dummy variables which were not included in the table to preserve space). Firm size is positively associated with procedural rationality, indicating that larger firms appear to rely on more procedurally rational capital investment decision processes. Managerial ownership is positively associated with procedural rationality as well, indicating greater ownership is associated with more procedurally rational decision processes. Finally, investment scale is positively associated with procedural rationality, suggesting that managers are more procedurally rational for larger investment outlays.

Model 2 presents the analysis of the direct effects in isolation. For *H1*, it was argued that when managers perceived greater risk, they would be more likely to be more procedurally rational in the decision process. The statistics of model fit suggest strong support for the model ($F = 4.28$ $p < 0.001$), with the model explaining over 24 percent of variance in the dependent variable. The regression coefficient for perceived risk is positive and significant ($p < 0.05$). *H1* is supported, suggesting that uncertainty avoidance behaviors on the parts of managers leads to greater levels of information gathering and analysis when managers perceive higher risk with an investment. The support for *H1* is consistent across all models (Models 2-5) in Table II, with perceived risk positive and significant in each of the models.

H1a suggested that the risk-procedural rationality relationship may actually be curvilinear, arguing for an inverted-U shaped relationship. In Model 3, the coefficient for the squared perceived risk term is negative and significant ($p < 0.05$), while the coefficient for the perceived risk term is positive and significant ($p < 0.01$). This supports *H1a* indicating that the risk-procedural rationality relationship is actually curvilinear, with an inverted-U shape. Again, this finding is supported for all models including the squared perceived risk variable. As managers try to manage risk, levels of procedural rationality increase as perceived risk increases; however, at some point the risk becomes so great that additional efforts will yield little benefit. At very high levels of perceived risk, managers actually use less information and analysis, taking a more intuitive approach.

The second hypothesis investigates the moderating effects of attainment discrepancy on the risk-procedural rationality relationship. As evident in Model 5, the coefficient on the risk-attainment discrepancy interaction term is positively related to procedural rationality ($p < 0.10$). It appears that attainment discrepancy has a positive moderating influence, providing marginal support for *H2*. To help interpret this finding, Figure 1 plots the interaction (all independent and moderating variables were centered in Model 5). When organizations are performing above aspirations (low attainment discrepancy), the risk-procedural rationality relationship is positive, but the slope is not very strong, as managers adhere to existing decision processes. However, when organizations are performing below aspirations, managers alter existing processes to gather additional information and conduct more analysis to find ways to close the performance gap. This is evidenced by a stronger risk-procedural rationality relationship, with a steeper positive slope.

H3 examines the moderating impact of organizational slack. As you can see in Model 5 in Table II, the coefficients of both slack-risk interaction terms are negative.

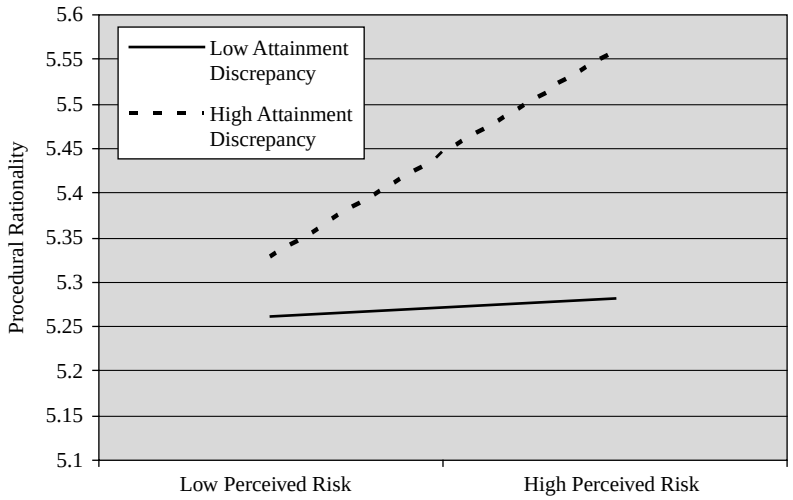

Figure 1.
Moderating effects of attainment discrepancy

Absorbed slack exhibits a strong ($p < 0.05$) negative moderating influence on the risk-procedural rationality relationship, while potential slack exhibits a marginally strong ($p < 0.10$) negative moderating influence. Figures 2 and 3 present the plots of these interactions. Both Figures 2 and 3 demonstrate a similar pattern. Under conditions of low slack, a relatively steep and positive risk-procedural rationality relationship is observed, supporting the notion of managerial uncertainty avoidance and concerns over risk exposure when there is no buffer due to slack. However, when such a buffer exists and excess resources are more abundant, a flatter or even negative slope for the risk-procedural rationality relationship is observed. This is particularly pronounced for potential slack. The slack buffer and relaxed control environment appears to lower the rationality of the decision process. These results present moderately strong support for *H3*.

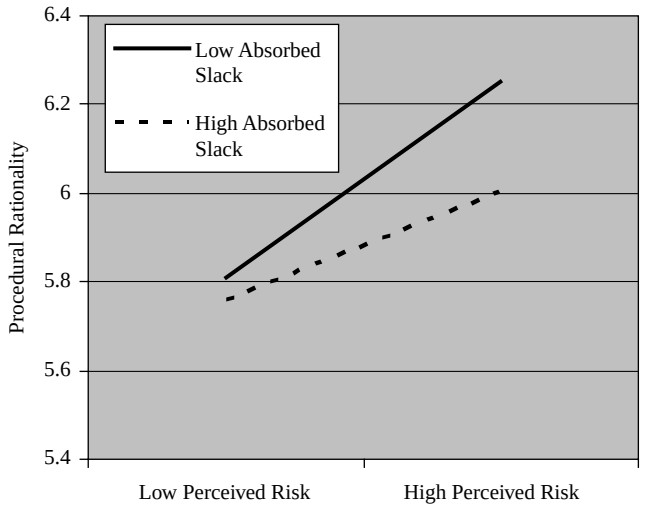

Figure 2.
Moderating effects of absorbed slack

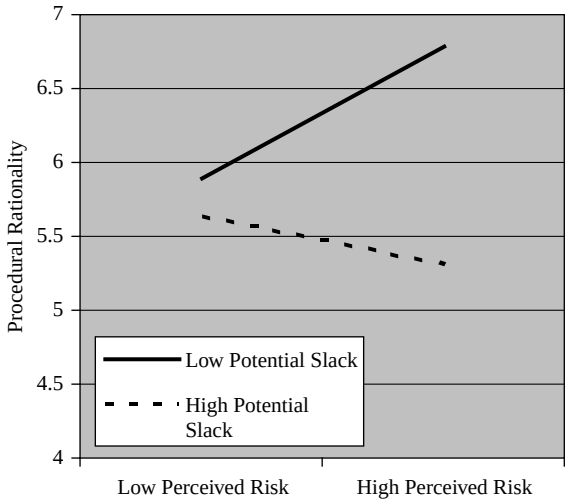

Figure 3.
Moderating effects of potential slack

For *H1* and *H1a*, both the independent and dependent variable are gathered from the same respondent. Following Oswald *et al.* (1994), two *post hoc* strategies were employed to examine the potential impact of common method bias on these findings. First, Oswald *et al.* (1994) employ confirmatory factor analysis to conduct Harman's one-factor test (Podsakoff and Organ, 1986). A confirmatory factor analysis model was conducted to test the relationship between perceived risk and procedural rationality, specifying a single factor. The fit statistics for this single factor model demonstrated very poor fit (AGFI = 0.417; RMSEA = 0.222; Normed Fit Index = 0.306), suggesting that more than one factor exists and the potential for common methods bias is limited. The second *post hoc* strategy, partialling, involves controlling for possible causes of artifactual covariance between the independent and dependent constructs. The partialling procedure is a more conservative test of the effects of common method variance, and "... when partialling procedures are used, some amount of the true (rather than artifactual) variance between the independent and dependent variables may also be removed" (Oswald *et al.*, 1994, p. 485). Two potential sources of common variance were identified for which data was available: the functional background of the respondent and the organizational level of the respondent. The multiple regression analyses discussed above in Model 1 were conducted again with additional controls for functional background and organizational level. The additional controls do not change the results discussed above. Thus, while common methods bias cannot be ruled out completely, both Harman's one-factor test and partialling indicate limited effects of common methods bias in the findings. The next section discusses the implications of these results for both research and practice.

5. Discussion and implications

The objective of this study was to link the understanding of the effects of risk to the decision process, extending beyond linkages to decision choices that exist in the literature. Building from the notion of uncertainty avoidance behaviors employed by managers in the organization to manage risk, this study explored the influence of

perceived risk and the decision context on the decision process relying on behavioral theory arguments. Focusing on capital investment decision processes, this research examines the direct effects of risk on procedural rationality and the moderating impacts of attainment discrepancy and organizational slack. This study offers three key findings with important implications.

First, there is a strong relationship between perceived risk and procedural rationality of the decision process, which is consistent across all models. This extends the critical role of risk from risky choices to the nature of the decision process. At lower levels of perceived risk, this suggests that organizational decision processes involve less information-intensive, analytical approaches. As managers perceive more risk in a capital investment decision, they are likely to be more procedurally rational in their decision making process, including more information gathering and analysis. However, this manifestation of uncertainty avoidance behaviors is only evident up to a point; as the perceived risk of a decision reaches a certain level, the relationship changes. Beyond this critical point, further increases in perceived risk result in decreasing levels of procedural rationality. Beyond this inflection point, it may be that the variance in potential returns may be so wide as to not yield information that will be useful to decision makers to manage risk (Courtney *et al.*, 1997). In these conditions, managers appear to recognize this futility and not waste scarce organizational resources in gathering or analyzing additional information, resulting in lower levels of procedural rationality.

The second key finding relates to the moderating impact of performance relative to aspirations. Attainment discrepancy positively moderates the risk-procedural rationality relationship, although this implication should be considered with a note of caution since the strength of this relationship is not as strong as the direct effects of risk discussed above. When the firm is performing above aspirations, firms are likely to adhere to existing decision processes. However, when performance falls below aspirations, managers are more likely to engage in problemistic search to close the performance gap (Chen and Miller, 2007; Greve, 2003a). This entails additional information gathering and analysis and a more rigorous approach in the decision process. Thus, the attainment discrepancy arguments of behavioral theory that have been supported related to decision outcomes also appears to hold for decision processes to some extent.

The third and final key finding involves the moderating impact of organizational slack. Slack appears to influence the risk perceptions of managers (Cheng and Kesser, 1997; Greve, 2003b) In the absence of slack, the risk exposure concerns of managers result in relatively greater procedural rationality in the decision process. However, when excess resources or financial cushion exist, managers exhibit lower levels of information gathering and analysis, reflecting reduced perceived exposure in terms of job and income risk. The reduced perceptions of downside risk results in lower levels of uncertainty avoidance behaviors. The more lax controls and monitoring in the presence of slack, as suggested by Greve (2003b) and Nohria and Gulati (1996), may include reduced procedural rationality in making decisions. Again, a note of caution is warranted. While this finding held for both forms of slack – absorbed and potential slack, the results are considerably stronger for absorbed slack. The principle effects of slack suggested by the BTOF receive support from these findings.

In sum, this study provides several important implications for the literature. First, this research has extended the field's understanding of the influence of risk beyond

decision outcomes to include decision processes. The second contribution involves identifying the existence of an inverted-U shaped risk-procedural rationality relationship. Finally, the core arguments of behavioral theory, including uncertainty avoidance and the importance of decision context (attainment discrepancy and slack) have been supported, thereby extending the robustness of behavioral theory arguments in organizational decision-making.

This research also provides several areas for interesting future research. While numerous potential avenues may exist, two will be mentioned here. First, behavioral theory is one of the most popular perspectives adopted in the risk literature. Agency theory represents a second popular perspective that has been used to link risk and organizational decision-making (Bromiley *et al.*, 2001). While this study has extended behavioral theory to include the decision process, future research could pursue a similar approach with agency theory. Do the existing prescriptions of agency theory extend beyond decision choices to decision process? Given the focus of agency theory on risk aversion, it would seem probable that there is a strong relationship between agency theory-based predictors and procedural rationality. Second, this study has focused on how uncertainty avoidance behaviors explain the perceived risk-procedural rationality relationship. Other scholars (Dean and Sharfman, 1993b) have examined the uncertainty-procedural rationality relationship, without incorporating risk. It would be interesting to explore a model of the procedural rationality of the decision process that included both risk and uncertainty measures, since these two concepts are distinct but interrelated (Bromiley *et al.*, 2001).

The findings also have implications for practice. Organizations can better understand how the nature of investment decisions, in terms of associated levels of risk, and the organizational context surrounding the decisions can lead to differing approaches to analyzing and making the decision. The findings suggest that managers employ varying degrees of information gathering and analysis in the decision process for different decisions, even though the formal decision process remained constant. Organizations may consider designing different capital investment decision processes for different investment situations. This will help ensure that investment decisions receive an appropriate level of evaluation, one that balances the need for information and analysis with the risks involved in the decision. This may help to improve the effectiveness of decisions, as well as the efficiency of the decision process in terms of resources consumed. This study also calls attention to the fact that situations involving very high levels of risk are approached with lower levels of procedural rationality. Organizations need to consider processes for such investments that involve more rational approaches in terms of information gathering and analysis. Perhaps, the nature of the information gathered and the type of analysis conducted differs for such situations, possibly requiring more qualitative analysis for example. Lastly, the findings suggest that too much slack can reduce the pressure on managers to be procedurally rational in the face of risk. Organizations need to be more cognizant of the impact of slack on managerial perceptions. When ample levels of slack exist, organizations need to be more diligent in monitoring the rationality of the decision process to avoid potential future problems related to poor organizational decisions.

At this point it is also important to note several limitations of this study. First, as noted above, the response rate for the survey instrument was somewhat lower than expected. The respondents of the questionnaire were part of the top management team,

who face tremendous time pressure due to their responsibilities in the organization. In addition, the topic of capital investment decisions is a sensitive area of strategic management. Follow up calls to non-respondents, as suggested by Dillman (2000), identified these two issues as the biggest reason for non-response – management time and corporate policies prohibiting discussion of organizational practices. A comparison of the responding firms to non-responding firms on critical strategy and organizational variables was conducted, as noted above. No evidence of non-response bias appears to exist. The lower response rate also reduced the sample size. A larger response rate, and thus larger sample, would have enhanced the power of the analyses. Another limitation involves the survey approach. The survey requires managers to assess the decision making process, relying on the perception of the individual. Future research could provide additional support for these findings by through first-hand observation of the decision-making process, as well as using multiple respondents from each firm (which also suffers from non-response issues (Perrone *et al.*, 2003). While these issues do indicate potential limitations, the supplementary analyses for non-response bias and common methods bias demonstrate the potential effects are somewhat limited.

5.1 Summary

The effects of risk on decision making are of critical concern to strategy scholars. This study extends our understanding of the risk effects to include the procedural rationality of organizational decision processes. The findings provide general support for uncertainty avoidance and behavioral theory views of the decision process. Future endeavors could serve to link decision process, decision choice, and decision effectiveness, thereby completing our understanding of the causal chain.

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Appendix

Survey items for procedural rationality and perceived risk

Procedural rationality. These items were taken directly from Dean and Sharfman (1993a,b, 1996). The Cronbach's α for these five items was 0.73:

1. How extensively does your firm look for information in making the decision for this type of investment? (1 = not extensively at all; 7 = very extensively)
2. How extensively does your firm analyze the relevant information before making a decision for this type of investment? (1 = not extensively at all; 7 = very extensively)
3. How important were quantitative analytic techniques in making the decision for this type of investment? (1 = not at all important; 7 = very important)
4. How would you describe the process that had the most influence on the firm's decision for this type of investment? (1 = mostly analytical; 7 = mostly intuitive)
5. In general, how effective was the firm at focusing its attention on relevant information and ignoring irrelevant information for this type of investment? (1 = not at all effective; 7 = very effective)

Perceived risk. These items were created from the definitions of the multiple dimensions of risk in Miller and Bromiley (1990), Miller and Leiblein (1996), Miller and Reuer (1996), and Palmer and Wiseman (1999). The Cronbach's α for these three items was 0.74:

1. How would you rate the volatility of returns related to this type of investment? (1 = not volatile at all; 7 = very volatile)
2. How would you rate the sensitivity of this type of investment's returns to fluctuations in the industry or market? (1 = not sensitive at all; 7 = very sensitive)
3. How would you rate the likelihood of incurring a financial loss from this type of investment? (1 = not likely at all; 7 = very likely)

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