The Journal of Risk and Uncertainty, 31:2; 163–186, 2005
© 2005 Springer Science + Business Media, Inc. Manufactured in The Netherlands.

How Do Information Ambiguity and Timing of Contextual Information Affect Managers' Goal Congruence in Making Investment Decisions in Good Times vs. Bad Times?

JOANNA L. Y. HO jlho@uci.edu
L. ROBIN KELLER* lrkeller@uci.edu
The Paul Merage School of Business, University of California, Irvine, CA 92697-3125

PAMELA KELTYKA pkeltyk@uakron.edu
G. W. Daverio School of Accountancy, University of Akron, Akron, OH 44325-4802

Abstract

Information ambiguity is prevalent in organizations and may influence management decisions. This study draws upon research on information bias and ambiguity research to empirically test how information ambiguity and non-financial factors (e.g., interpersonal information) affect managers' capital budgeting decisions when in good vs. bad times. Ninety-two managers completed two experiments. In Experiment One, the information was presented sequentially. Our results show that without the presence of non-financial factors, managers tend to maximize the firm value. After receiving non-financial factors, a significant number of managers switched to the self-serving option in good times (the gain condition) but stayed with firm-value maximization in bad times (the loss condition). In Experiment Two, the information was presented simultaneously in the presence and absence of ambiguity. We found that in the presence of ambiguity, the information presentation has no impact on managers' self-serving bias in good times or their firm-value maximization tendency in bad times. Interestingly, we also observed managers' use of interpersonal information even in the absence of ambiguity.

Keywords: information ambiguity, firm-value maximization, self-serving bias, presentation mode

JEL Classification: D8

Capital budgeting decisions directly affect the success or survival of a company. Capital investment theory suggests that such decisions should be based on the economic merits of the projects (Demski, 1997). However, when making capital budgeting decisions, managers are greatly influenced by non-financial factors such as coalitions, interpersonal relations, intuition, and politics, which may conflict with maximization of stockholder wealth, as shown by in-depth investigations of specific cases in field research and the business press (e.g., Moreno, Kida, and Smith, 2002; Kida, Moreno, and Smith, 2001; Bower, 1986; Mukherjee and Henderson, 1987; Pinches, 1982). Yet we have little systematic knowledge of the extent to which these non-financial factors (hereafter called interpersonal information)

*To whom correspondence should be addressed.

and information ambiguity influence managers' capital budgeting decisions at the expense of stockholder wealth when managers are in a gain (good time) or loss (bad time) condition.

Information ambiguity is prevalent in organizations and may influence managers' decisions. This paper defines ambiguity[1] as "uncertainty about the processes by which the outcomes are determined" (Curley and Yates, 1985, p. 274). For example, assessing the return of a new project at 18% is unambiguous, but ambiguity exists when a manager can only conclude that the return lies between 14 and 22%. While in the first case the process is precisely known, in the second case there is ambiguity about which return will be realized. Prior studies have shown that when facing outcome ambiguity (Gonzalez-Vallejo, Bonazzi, and Shapiro, 1996; Oliver, 1972) and probability ambiguity (Hogarth and Kunreuther, 1989; Kunreuther, 1989; Kuhn and Budescu, 1996; Kunreuther et al., 1995; Viscusi and Magat, 1992) people are ambiguity averse in the domains of gain and loss. However, in a capital budgeting context and using a within-subject design, Ho, Keller, and Keltyka (2002) show that the majority of managers were ambiguity averse in the gain condition and switched to ambiguity seeking in the loss condition. Almost all the prior studies employed a research design in which the outcome of an unambiguous option is equal to the midpoint of the imprecise numerical outcome. Such a design cannot discern the magnitude of managers' ambiguity aversion/seeking that may impact their intention to maximize their firm value. In the real world, managers normally operate in a rich environment in which there is a disparity between the midpoint of an ambiguous option and an available unambiguous option. This study investigates the robustness of the prior research through manipulation of the midpoint so the unambiguous option does not equal the midpoint of the ambiguous option.

Causal evidence (Reimann 1990; Ruhl and Cowen, 1992) and prior managerial accounting research using stylized analytical or game theoretic models (Feltham and Xie, 1994; Kachelmeier and Shehata, 1994) suggest that managers often maximize their own self-interest at the expense of the firm's interest. Also, managers incorporate target value when they make decisions under uncertainty and they are more risk averse in the gain domain and risk seeking in the loss side (Bowman, 1982; Laughhunn et al., 1980). Prior research on information bias has studied the role of a self-serving bias (Hsee, 1995, 1996) and judgment bias (Russo, Meloy, and Wilks, 2000) in personal decision-making. Information bias occurs when an individual distorts the provided information to support his/her final decision.

This study draws upon research on information bias (Hsee, 1995, 1996; Russo et al., 2000), ambiguity research (Einhorn and Hogarth, 1985; Ho, Keller, and Keltyka, 2002) and prospect theory (Kahneman and Tversky, 1979, 1984) to examine empirically the extent to which managers consider the firm value when making capital budgeting decisions and identifies conditions under which managers are more likely to be influenced by non-financial factors to increase their self interests. Capital budgeting decisions may sometimes be in the process of being made as information is received. Consequently, we conducted this experimental research to examine whether prior research which presented information simultaneously would have had the same results if information were presented sequentially.

[1] In the decision theory literature, ambiguity and vagueness are used interchangeably. We use the term ambiguity throughout this paper. A known probabilistic process can be unambiguous. A lottery that yields 100 with a known probability of .01 is not ambiguous since there is no uncertainty about the process (a 1/100 chance of winning).

Two separate experiments were conducted to observe managers' capital budgeting decisions in both a gain and a loss condition. The two experiments differed in the way the information was presented to the managers. In Experiment One (Sequential) two different pieces of information were presented sequentially with the managers selecting one of the two projects for implementation after reading each piece of information. Experiment Two consisted of two different studies and had the information presented simultaneously. In the first study (Simultaneous–Ambiguity) there was ambiguity about the return of one of the two projects while in the second study (Simultaneous–Unambiguity) both projects had unambiguous returns. Since Experiment Two used a simultaneous presentation mode, in both studies the managers made one decision regarding project selection after reviewing all the simultaneously received information.

Our results demonstrate the robustness of a gain condition (i. e. "good times") effect on promoting a manager's own self-interest over the firm's interest even when the information involves no ambiguity. Furthermore, in the unambiguous condition in which managers have no chance of achieving the firm's target return, called a loss condition (i.e. "bad times"), they also switch from focusing on the firm's interest to their own self-interest. Our results also suggest that the different information presentation modes did not significantly influence managers' choice behaviors. So, research results from experiments presenting information simultaneously should apply also to cases when information is presented sequentially. Finally, this research provides evidence that the phenomena demonstrated in psychology laboratory experiments with student subjects persist in capital budgeting decision contexts with experienced manager subjects.

1. Theoretical issues and hypotheses development

1.1. Capital budgeting decision and information ambiguity

Capital budgeting decisions involve the analysis of long-term investment alternatives with cash inflows and outflows over multiple time periods (Zimmerman, 1997). When the investment options do not cover the same periods, they are not directly comparable. Consequently, managers normally rely on capital investment theory when making a capital budgeting decision (Morse and Zimmerman, 1997). To maximize shareholder wealth, capital investment theory requires managers to estimate total cash inflows and outflows while taking into consideration income tax implications, a required rate of return, inflation, and project risk (Berry, 1984; Horngren, Foster, and Datar, 1997).

Since capital investment theory was introduced in the 1950's, a growing acceptance of these decision rules has been evident in the corporate world (Scapens and Sale, 1981). Furthermore, Fatemi, Ang, and Chua (1983) empirically examined if managers consider shareholder wealth maximization when making investment decisions. Using both cross-sectional and time-series data of 326 large management controlled firms, they concluded that firm-value maximization played an important role in managers' investment decisions. However, firm-value maximization is not the sole criterion in these decisions (e.g., Moreno, Kida, and Smith, 2002; Kida, Moreno, and Smith, 2001), self-interest and emotional affect can be major factors.

Prior studies on outcome ambiguity show that people exhibit ambiguity avoidance in the gain condition (Gonzalez-Vallejo, Bonazzi, and Shapiro, 1996; Ho, Keller, and Keltyka, 2001) and ambiguity seeking in the loss condition (Ho, Keller, and Keltyka, 2001), but these studies did not examine self-interest. For example, Gonzalez-Vallejo, Bonazzi, and Shapiro (1996) reported that in a gain condition their undergraduate students considered the unambiguous option favorably and avoided ambiguous options that might jeopardize them in achieving the target. Viscusi and Chesson (1999) examined the reversal in attitudes toward ambiguity as the mean risk rises and used 'fear' and 'hope' effects to account for ambiguity-averse and ambiguity-seeking behaviors contingent on risk level. More specifically, when ambiguity generates a 'fear' effect (i.e., offering a small chance of a significant loss), people are inclined to be ambiguity averse. However, when ambiguity generates a 'hope' effect (i.e., offering a chance of avoiding a very likely adverse event), people tend to be ambiguity seeking. In a capital budgeting context, Ho, Keller, and Keltyka (2002) found that managers tend to select the project with the precise (unambiguous) return in a gain condition and the project with the range of possible returns in the loss condition.

When making capital budgeting decisions, managers often are asked to evaluate a variety of projects, some with ambiguous outcomes and some with unambiguous outcomes. Almost all the prior studies employed a research design in which the outcome of an unambiguous option is equal to the midpoint of the imprecise numerical outcome. In such a case, a person may believe the expected return of the ambiguous option would equal the midpoint. This would occur if the person faced with the ambiguity assumed there was a symmetric probability distribution over the range of outcomes, with the midpoint as the mean. Then, given the same expected returns of both ambiguous and unambiguous projects, managers are likely to be ambiguity averse in the gain condition and ambiguity seeking in the loss condition. While it is necessary to test theories by imposing such constraints, seldom does this equality occur in business decisions. Instead, because managers do not operate in such a "stylized" environment, there is likely to be disparity between the midpoint of an ambiguous option and any available unambiguous option. Normally principals design incentive schemes to align managers' welfare with the firm value. As such, without the presence of non-financial factors, it is anticipated that when the projected returns of unambiguous and ambiguous options are not equal, managers will select the option with a higher projected return despite the difference being marginal.

H1.1 *Maximizing Firm Value Hypothesis*: Without the presence of non-financial factors (i.e., facing only the projected returns of the ambiguous and unambiguous options), managers will be more likely to choose a project consistent with firm-value maximization, i.e., selecting the project with a higher projected return.

1.2. Managers' self interest

In the real world, managers consider not only financial information concerning the capital budget, but also their self interests. When making capital budgeting decisions, managers are often provided with information other than the returns of the projects being evaluated. Prior field studies show that managers consider more than the financial information directly

related to the project (e.g., Moreno, Kida, and Smith, 2002; Bower, 1986; Mukherjee and Henderson, 1987; Pinches, 1982). Pinches (1982) described the capital budgeting process of business executives through his own observations while working with executives. He argued that the decision-making process is much more complicated than what is suggested in the financially oriented capital budgeting literature. Specifically, Pinches found that managers' capital budgeting decisions were influenced by non-financial factors such as coalitions, interpersonal relations, bargaining, and politics. Moreno, Kida, and Smith (2002) also reported that when making capital budgeting decisions, managers' affective reactions can influence them to choose alternatives with lower economic value. Bower (1986) also conducted an in-depth study of why projects were approved by managers in four different companies. He found that personal stakes play an important role in managers' capital budgeting decisions.

Mukherjee and Henderson (1987) reviewed prior surveys on the capital budgeting process and reported disparities between practices and capital budgeting theory. They found that many projects were rejected for non-financial considerations such as personalities and interdepartmental politics. Thus, they concluded that capital budgeting theory fails to capture managers' capital budgeting decision processes since it does not encompass the personal stakes of a manager (e.g., power, ego, personal relationships with the project submitter such as a protégé, a family friend, and coalition) and organizational factors.

Kleinmuntz and Kleinmuntz (2003) describe a decision support system they developed for capital budgeting for hospitals that explicitly considers both monetary and non-monetary factors with a multiple attribute value function for evaluating options. Using this approach does not necessarily mean the manager decides solely on self interests, just that non-monetary objectives are formally considered. Our focus in this paper is on non-financial factors which are not relevant to the decision from the firm's perspective.

Managers' goal-incongruent or self-interested behaviors have been reported in studies using either analytical or game-theoretic models (Feltham and Xie, 1994; Kachelmeier and Shehata, 1994), a laboratory experiment (Ho and Vera-Muñoz, 2001), and in anecdotal reports (Thackray, 1985; Reimann, 1990; Ruhl and Cowen, 1992). For example, the CFO of Applied Power, Inc. argued that executives have egos and the need for power, and become emotionally attached to certain favorite businesses. Therefore, to remain competitive managers must no longer focus on personal gains but look at shareholder value when considering business decisions (Reimann, 1990). Other examples of managers' achieving self-interest at the expense of the firm value have been found in both executive compensation and stock options (Thackray, 1985) and overhead allocation (Heerma and Rogers, 1991) contexts.

In today's business environment, managers' investment opportunities may include investing in equipment essential to operations (replacement of broken equipment) or new technology, such as a flexible manufacturing system (Raiborn, Barfield, and Kinney, 1999). A gain condition occurs when managers are required to select one project among several whose estimated returns exceed the company's targeted return, thereby increasing firm value. However, when companies find it necessary to invest in new technology, frequently the return on these projects is lower than the targeted rate of return (Raiborn, Barfield, and Kinney, 1999), resulting in a loss condition.

When operating under a gain condition, managers are assured of attaining the corporation's goals and objectives. Their decisions will not be scrutinized as closely since they are operating at a higher level of performance than expected. As such, it is easier for managers in a gain condition to consider information that may be important to them personally but not directly related to the capital budgeting decision and sometimes even at the expense of the firm value. In contrast, in a loss condition in which the expected returns of different projects are less than the firm's target return, managers may be more likely to focus on possible ways of improving their performance and thereby lack an incentive to consider the interpersonal information. In other words, it is expected that, in a loss condition, managers will consider only relevant information (e.g., projected returns of the options) and will be less influenced by interpersonal information when making capital budgeting decisions.

H1.2.1 *Influence of Interpersonal Information in a Gain Condition Hypothesis:* When the projected returns of the projects are greater than the company's target return, managers will be more likely to select the project that appears to maximize their self-interest at the expense of the firm value.

H1.2.2 *Influence of Interpersonal Information in a Loss Condition Hypothesis:* When the projected returns of the projects are lower than the company's target return, managers will be less likely to select the option that appears to maximize their self-interest at the expense of the firm value.

The above discussions suggest that managers' self-serving bias is evident in a gain condition but not in a loss condition. Table 1 summarizes predictions of all the hypotheses in this study. The next section discusses whether the presentation mode of the information and information ambiguity are necessary conditions for information bias.

1.3. Information bias and presentation mode

Hsee (1995, 1996) proposed an elastic justification theory in which a combination of a self-serving bias and ambiguous information can explain how individuals incorporate irrelevant information into their decision-making process. A self-serving bias occurs when an individual has a desire to use the available information in a biased way and the environment provides him/her with an opportunity to do so. When both the desire and environment are present, individuals will focus on features of a project that will increase their self-interest while neglecting all other features. Hsee argued that with the presence of ambiguous information, the information can be interpreted in more than one way, and there is an opportunity for people to match their interpretation of the ambiguous information with their biased view.

Russo, Meloy, and Wilks (2000) examined the effect of pre-decisional information on job related judgments for professional people, auditors and sales people. They predicted that work experience, a personal stake in the quality of the decision, and a self-selection bias for certain professional fields would reduce information distortion. Their results showed

Table 1. Summary of designs and hypotheses of experiments one and two.

Larger % of participants will:	Consistent with	Hypothesis
A. Experiment One—Sequential Receipt of Financial, then Interpersonal Info.		
Before reviewing interpersonal information		
Gain Condition		
Choose AHMR	Firm-value maximization	H1.1
Loss Condition		
Choose AHMR	Firm-value maximization	H1.1
After reviewing interpersonal information		
Gain Condition		
Switch to ULR	Self-interest maximization	H1.2.1
Loss Condition		
Stay with AHMR	Firm-value maximization	H1.2.2
B. Experiment Two—Simultaneous Receipt of Financial and Interpersonal Info.		
Ambiguous Information		
Gain Condition		
Choose ULR	Self-interest maximization	H1.3.1
Loss Condition		
Choose AHMR	Firm-value maximization	H1.3.1
Unambiguous Information		
Gain Condition		
Choose ULR	Self-interest maximization	H1.3.2
Loss Condition		
Choose UHR	Firm-value maximization	H1.3.2

AHMR: ambiguous higher midpoint return.
ULR: unambiguous lower return.
UHR: unambiguous higher return.

three factors influencing the distortion of information by professional people. The first factor was confidence; as each attribute was reviewed and evaluated, the individual's confidence in the leading alternative increased. Second, with sales people, distortion increased marginally with the more important attributes. And third, when looking at individual differences among the subjects, only the mood of the sales person was positively related to the mean level of distortion.

Managers may be presented with information either simultaneously or sequentially. Hsee (1995, 1996) reported a self-serving bias when information was presented simultaneously. As we proposed in H1.2.1, a self-serving bias exists when the information is presented sequentially and when managers are in good times. Because of the prevalence of this self-serving bias, we predict that the information presentation mode will not affect managers' consideration of non-financial factors when they make capital investment decisions. More specifically, when managers are in good times, they will exhibit a self-serving bias regardless of whether the information is presented simultaneously or sequentially. In contrast, when managers are in bad times, they will either stay with or go for the firm

value maximization depending on whether the information is presented sequentially or simultaneously.

H1.3.1 *Information Presentation Mode Hypothesis:* The information presentation mode (i.e., sequential vs. simultaneous) will have no impact on managers' self-serving bias when they are in good times or on their firm-value maximization tendency when they are in bad times.

Although Hsee (1995, 1996) found elastic justification under *ambiguous* information conditions, we expect that elastic justification can exist with *unambiguous* information as well. When there is no ambiguity about the return of two capital projects, normatively managers will select the project that is consistent with firm-value maximization. However, in a gain condition when both projects assure managers that the corporation's goals and objectives will be achieved, we expect that managers will make their decision based on interpersonal information. In other words, managers will place more weight (W_p) on interpersonal information than on firm value (W_f). In contrast, in a loss condition when the expected returns of the projects are unambiguous, we predict managers will make a decision consistent with firm-value maximization. That is, managers will place more weight (W_f) on firm value than on interpersonal information (W_p).

The above discussion leads to the following hypothesis.

H1.3.2 *Influence of Interpersonal Information in an Unambiguous Condition Hypothesis:* When the expected returns of the projects are unambiguous, W_p is greater than W_f in a gain condition; however, W_f is greater than W_p in a loss condition.

2. Experiment one–Sequential information

Experiment One examines when managers maximize the value of the firm and the extent to which they incorporate interpersonal information into their capital budgeting decisions in a gain and a loss condition. In order to achieve these goals, managers were asked to select a project before and after the presentation of interpersonal information.

2.1. Experimental design

A total of 30 managers from various industries on the West Coast and in the Midwest participated in this study. Participants received the instrument from one of the researchers, completed the instrument in private, and returned their completed questionnaires anonymously to the researcher. These participants had moderate capital budgeting experience[2].

[2]Capital budgeting experience was measured on a 9-point scale with three anchors: "not often" (coded 1), moderately often (coded 5), and "very often" (coded 9). The mean (standard deviation) of capital budgeting experience in this experiment was 4.43 (2.57), suggesting our subjects possessed a moderate level of capital budgeting experience.

The subjects' average (standard deviation) management work experience was 4.87 (4.19) years, ranging from no experience to 20 years.[3] As an incentive, the participants were offered a copy of the results of the study along with a gift for completing the questionnaire.

The experimental design is a within-subject design with the subjects analyzing both a gain and a loss condition. A within-subject design is utilized because it provides control over variability in the characteristics of the participants (Keppel, 1991). To avoid an order effect, the gain and loss cases were randomly presented in the survey booklet and the survey booklets were randomly distributed to the participants.

2.2. Case materials and task

The experimental task included two parts. In Part One, subjects were asked to respond to two cases; one in a gain condition and the other in a loss condition (discussed below). The structure of these two cases is identical. In each case, subjects assume the role of the manager described in the case. They were provided with background information that included a brief history of the department or division the manager oversees, the corporate target return used in analyzing capital budgeting projects, a description of the investment bonus plan, and specific information regarding the internal rate of returns (IRRs) of the two projects being considered for implementation. The gain and loss conditions were manipulated by the returns of the projects and a minimum target return established by the company. For example, the minimum target return for both cases was 16%. In the loss (gain) condition, the projected IRRs of the two options were 10% (20%) and 7 to 15% (17 to 25%) respectively with both options being lower (higher) than the target return. Notice that while one project was described with a precise IRR (10% in the loss condition), the other one was described with an ambiguous IRR (7 to 15% in the loss condition). Also, in both the gain and loss cases, the option with a precise return had a lower return than the midpoint of the range of returns with the option with an ambiguous return (11% in the loss condition and 21% in the gain condition). Hereafter, the ambiguous and higher midpoint return will be referred to as the "AHMR" project and the unambiguous and lower return as the "ULR" project. Designing the midpoint for the AHMR project one percentage point greater than the ULR project provides a minimum bound for the trade-off between ambiguity aversion and firm-value maximization.[4]

After reading the description of the two options, the subjects were asked to respond to the following question, "Given the information above, if you must choose one project, which would you select"? A 9-point Likert scale was used with the following anchors, "definitely choose Project A (the one with a 17–25% IRR)" (coded 1) and "definitely choose Project B (i.e., 20% IRR)" (coded 9).

[3]Out of the ninety-two subjects used in these two experiments, nine did not have management work experience. In Experiment One, there was only one individual reporting no management work experience. A data analysis was run with and without the nine subjects, and we observed qualitatively similar results. Therefore the data analysis presented includes all subjects.

[4]Managers choosing the unambiguous lower return option ULR demonstrate willingness to give up at a minimum 1% in return compared to the midpoint return of the ambiguous higher midpoint return option AHMR.

The subjects then responded to the question "The project you selected will increase your personal well being more than the well being of the company" and was recorded on a 9-point Likert scale anchored at "extremely disagree" (coded 1) and "extremely agree" (coded 9). Also, they were asked "Based on the above information, what would you personally consider an acceptable IRR for the case?" To explore whether the subjects perceived the ambiguous option as having a higher projected return than the precise option, and to better understand the relationship between the subjects' likelihood assessments and their capital budgeting decisions, subjects were asked to provide subjective probability estimates. Before making the subjective probability estimates, the subjects were provided with a brief explanation about subjective probabilities and an example indicating how the assessment should be made. For example, in a gain condition subjects were asked to assess the likelihoods that the IRR for project A (the one with a 17–25% IRR) is both greater than or equal to and less than the precise return of the unambiguous option (e.g., 20% IRR). Since subjects selected their projects prior to providing these likelihood assessments, their project selections were not affected by their likelihood assessments.

2.2.1. Presentation of new information. Once the subjects completed the above tasks, they were presented with information that was not related to the economic merits of the project but should have been important to them personally. This information was designed to be *associated solely with the unambiguous option and to make that option better for their personal interests.* The subjects were then asked to again indicate their choice between the unambiguous and the ambiguous options and whether the project selected would increase their personal well being more than the well being of the company using a 9-point Likert scale and two additional questions.[5]

In Part Two, the subjects completed a background questionnaire consisting of the number of cost/management accounting courses taken, years of management experience, job title, and predominant industry in which they work. Also, they were asked, "how difficult was it to select the projects for implementation?" and "how interesting were the cases in the test instrument?" This data was collected using a 9-point Likert scale anchored at "not difficult (interesting)" (coded 1) and "very difficult (interesting)" (coded 9). The mean (standard deviation) for the difficulty question was 4.27 (1.69) and for interestingness of cases was 4.98 (1.63). This suggests that the task was not difficult and was moderately interesting.

2.3. Results

2.3.1. Manipulation checks. Recall that subjects were asked to refer to (the case's) projects and indicate whether they consider their personal financial position within the company as a

[5]The first additional question was: "How does the non-economic related information influence your decision?" with "1" being no influence, "5" being moderate influence, and "9" being significant influence. The second additional question was: "Referring to (the case's) projects, would you consider your personal financial position within the company during this year as a. . . " A 9-point Likert scale was used with the following anchors, "loss condition" (re-coded 1), "survival condition" in the sense of "getting by" (re-coded 2), and "gain condition" (re-coded 3). The purpose of asking this question is to validate the design of a gain and a loss condition.

gain condition/loss condition on a 9-point Likert scale: anchored at "loss condition" (coded 1) and "gain condition" (coded 9). As predicted, under a gain condition the mean was 7.30, which is significantly higher than the mean (3.76) under the loss condition ($F(1, 27) = 66.41$, $p < .0001$). The subjects were also asked to provide an acceptable IRR given the information described in the case. We expect that subjects will anchor on the midpoint return and then make an adjustment to derive their acceptable IRR. Therefore, the average acceptable IRR in the gain condition is expected to be higher than that in the loss condition. Our results show that in the gain condition the average (standard deviation) acceptable IRR was 19.52 (1.50), while in the loss condition it was 11.95 (2.23); the difference being statistically significant ($F(1, 26) = 128.30$, $p < .0001$). In sum, our results show that our manipulation of a gain and a loss condition was successful.

2.3.2. Test of H1.1 (maximizing firm value)–Before receiving interpersonal information. H1.1 predicted that without the presence of non-financial factors (i.e., when given only the returns of the two projects), the subjects would select the ambiguous AHMR project (which has a midpoint that yields a return that is 1% greater than that of the other project) despite the ambiguity and regardless of whether it is in the gain or loss domain. Recall that the subjects' capital budgeting decisions were expressed on a 9-point scale with a preference score from 1.0 to 4.9 indicating the choice of the ambiguous AHMR project (maximizing firm value), a score from 5.1 to 9.0 indicating the choice of the unambiguous ULR project, and a score of 5.0 indicating indifference between the AHMR and the ULR project. Table 2 summarizes descriptive statistics for the number of subjects making each choice, subjective probabilities, and the preference scores before and after reviewing interpersonal information.

As seen in Table 2, before reviewing interpersonal information, under a gain condition, 73% of the 30 subjects chose the AHMR project and 27% of them chose the ULR project; the difference being statistically significant ($z = 4.09$, $p < .001$). Similarly, under the loss condition, 90% of those same 30 subjects chose the AHMR project and only 10% of them selected the ULR project. Again, the difference between their choices of the AHMR and the ULR projects is statistically significant ($z = 20.66$, $p < .0001$). Furthermore, as seen in Table 2, the subjects' total average (standard deviation) preference scores are 3.71 (2.18) in the gain condition and 2.82 (1.58) in the loss condition. These low numbers indicate a preference for the AHMR option. These low numbers are significantly different from the midpoint of indifference between the ambiguous and precise options of a score of 5 ($t(29) = -3.24$, $p < .003$; $t(29) = -7.54$, $p < .000$). These results suggest that when receiving IRRs only, the subjects had a tendency to maximize firm value in both a gain and a loss condition, despite ambiguity.

However, one may question if the subjects viewed the ambiguous option as having a higher expected IRR than the unambiguous option. Therefore, we conducted additional analyses to examine the consistency between the subjects' beliefs and their subsequent capital budgeting decisions. Recall that the subjects were asked to provide a subjective probability estimate that the expected IRR of the ambiguous project is either greater than or equal to, or lower than, that of the unambiguous project. When a subject provides a probability estimate of .51 or higher that the ambiguous project has an IRR that is greater

Table 2. Descriptive statistics for subjects' subjective probabilities, choice behaviors, and preference scores in both gain and loss conditions–experiment one: Sequential information.

	Number (%) selecting the project			
	Probability is higher that the $AHMR_{IRR}$ is $\geq$20% in a gain (10% in a loss)	Probability is higher that the $AHMR_{IRR}$ is <20% in a gain (10% in a loss)	Total	Preference score* Mean (s.d.)
Before reviewing interpersonal information (H1.1)				
Gain Condition				
AHMR+(17–25% IRR)	21 (70%)	1 (3%)	22 (73%)	2.52 (.82)
ULR (20% IRR)	4 (13%)	4 (13%)	8 (27%)	7.00 (.89)
Total	25 (83%)	5 (17%)	30 (100%)	3.71 (2.18)
Loss Condition				
AHMR (7–15% IRR)	24 (80%)	3 (10%)	27 (90%)	2.41 (.96)
ULR (10% IRR)	1 (3%)	2 (7%)	3 (10%)	6.50 (1.32)
Total	25 (83%)	5 (17%)	30 (100%)	2.82 (1.58)
Overall				
AHMR			49 (82%)	2.46 (.89)
ULR			11 (18%)	6.86 (.98)
Total			60 (100%)	3.27 (1.94)
After reviewing interpersonal information (H1.2.1 & H1.2.2)				
Gain Condition				
AHMR (17–25% IRR)	10 (33%)	1 (3%)	11 (37%)	3.05 (.79)
ULR (20% IRR)	15 (50%)	4 (13%)	19 (63%)	7.06 (.75)
Total	25 (83%)	5 (17%)	30 (100%)	5.59 (2.10)
Loss Condition				
AHMR (7–15% IRR)	22 (73%)	2 (7%)	25 (83%)	2.81 (1.11)
ULR (10% IRR)	2 (7%)	2 (7%)	4 (13%)	6.75 (1.50)
Indifference	0 (0%)	1 (3%)	1 (3%)	5.00 (0)
Total	24 (80%)	5 (17%)	30 (100%)	3.41 (1.78)
Overall				
AHMR			36 (60%)	2.88 (1.02)
ULR			23 (38%)	7.00 (.88)
Indifference			1 (2%)	5.00 (0)
Total			60 (100%)	4.50 (2.22)

+AHMR: ambiguous higher midpoint return.
ULR: unambiguous lower return.
*1 = definitely choose the AHMR option; 9 = definitely choose the ULR option.

than or equal to that of the unambiguous project, he/she should select the ambiguous project for implementation, assuming the goal is to maximize return.[6]

As seen in Table 2 (first column), 83% of the subjects in both the gain and loss condition confirmed that they believed that the expected IRR_{AHMR} is greater than or equal to IRR_{ULR}. Consistent with such beliefs, 84% (21/25) of them in the gain condition and 96% (24/25) of them in the loss condition indicated that they would choose AHMR. Also, among those who believed that the expected IRR_{AHMR} would be lower than IRR_{ULR}, 80% (4/5) in the gain condition selected the ULR project while 40% (2/5) in the loss condition selected the ULR project. These results suggest that there is a consistency between our subjects' estimated likelihood of expected returns and their subsequent decision.[7] These overall results support H.1.1 that without the presence of non-financial factors, managers are likely to make choices that maximize firm value.

2.3.3. Test of H1.2.1 (gain) and H1.2.2 (loss)–After receiving the interpersonal Information. Recall that the interpersonal information is designed to be associated with the ULR project. H1.2.1 predicts that under a gain condition managers are more likely to be influenced by the interpersonal information and select the ULR project. Recall that when only the IRRs of the projects were known, 22 subjects (73%) chose the AHMR project (see Table 2). However, after reviewing the interpersonal information, half of them (11) or 37% of the total subjects in the gain condition switched to the ULR project. As expected, no one switched from the ULR project to the AHMR project after reviewing the interpersonal information. This makes a total of 37% (63%) of the subjects choosing the AHMR (ULR) project. The difference between the percentage of the subjects choosing the AHMR project before and after reviewing the interpersonal information is statistically significant (73 vs. 37%, $z = 3.07$, $p < .002$). Also, the total average preference score increased from 3.71 to 5.59, indicating that subjects' firm-value maximization tendencies have been significantly reduced ($t(29) = -4.96$, $p < .000$), since higher numbers indicate greater preference for the precise option with the lower return.

In contrast, H1.2.2 predicts that in a loss condition managers are less likely to be influenced by the interpersonal information (than they were in the gain condition) and would tend to choose the AHMR project. As expected, the effect of the interpersonal information on managerial choices seen in the gain condition is not evident in the loss condition. Recall that there were 27 subjects (90%) under a loss condition choosing the AHMR project before receiving the interpersonal information. After reviewing the interpersonal information, a large majority of the subjects (25 or 83%) continued to choose the AHMR project. The difference in these percentages is not significant (90 vs. 83%, $z = .7632$, $p < .447$). Furthermore, as seen in Table 2, only one subject, who believed that the expected IRR of the AHMR project would be greater than or equal to the ULR project, switched from choosing the AHMR project to the ULR project after reviewing the interpersonal information. Taken together, these results suggest that, in a loss condition, as hypothesized, managers continued

[6]If strict equality holds, then the person could be indifferent: if expected $IRR_{AHMR} = IRR_{ULR}$.

[7]Furthermore, we could attribute the strong desire to select the AHMR project in the loss condition (90% of the subjects) partly to managers' risk-seeking attitude.

Table 3. Regression results.

	Unstandardized Coefficients				
Independent Variables	B	Std. error	Beta	*t*	Sig.
Panel A. Experiment One—Sequential					
Gain Condition:					
Interpersonal information	.636	.091	.745	6.979	.000
Probability estimate	3.795	1.273	.318	2.981	.006
Loss Condition					
Interpersonal information	.553	.115	.676	4.825	.000
Panel B. Experiment Two: Simultaneous—Ambiguity Study					
Gain Condtion					
Interpersonal information	.665	.152	.514	4.365	.000
Probability estimate	−8.043	1.777	−.533	−4.527	.000
Loss Condition					
Interpersonal information	.479	.162	.502	2.949	.006

to choose options consistent with firm-value maximization rather than promote their own self-interest by selecting the ULR project.

2.3.4. Regression analysis. We also ran a regression analysis to provide additional information as to what may be driving the results. The dependent variable is the difference between the preference scores before and after receiving the interpersonal information. There were two independent variables, one was the degree to which the subjects indicated their project selection decision was influenced by the interpersonal information. The second independent variable was the likelihood assessment that the expected IRR_{AHMR} was greater than IRR_{ULR}. As shown in Panel A of Table 3, both the interpersonal information and the probability estimates were significant in the gain condition. These results indicate that the more influential the interpersonal information, the greater the difference between the preference scores. Also, the subjects' probability estimates affected the difference in the preference scores.

However, in the loss condition, the results show that managers' choice behavior is influenced only by the perceived influence of interpersonal information. A one-point increase in the influence of the interpersonal information causes a .553 increase in the difference score. Interestingly, in the loss condition the manager's probability estimates do not influence his/her choice behavior. A possible explanation for this result may be due to the nature of the loss domain. The projects in the loss condition provide no opportunity to attain the company's 16% target return. Consequently, neither project gives the manager hope of achieving the corporate goal. Even if the manager thought there was a high probability the ambiguous project provided a return greater than 10%, it does not guarantee making the required 16% return and therefore the probability estimates might have had no bearing on the project selected for implementation.

Taken together, the results of Experiment One support the hypothesis that managers tend to maximize the firm value when facing only the IRRs. Also, our finding shows that after receiving interpersonal information, in a gain condition the subjects were influenced by the interpersonal information while in a loss condition they showed a greater tendency to maximize firm value.

3. Experiment two–Simultaneous information

The results from Experiment One may be due to the presentation of the information sequentially. In Experiment Two we continued to investigate when managers appear to maximize firm value and when they incorporate interpersonal information into their capital budgeting decisions, but this time the information was presented simultaneously. We also tested to see if the managers maintained their use of interpersonal information in the absence of ambiguity. Therefore, Experiment Two consists of two separate studies. The first study maintains the ambiguity found in one of the projects and will be referred to as the "Simultaneous–Ambiguity" study. The second study eliminated the ambiguity and will be called the "Simultaneous–Unambiguity" study.

There were 62 subjects from the West Coast and Midwest participating in Experiment Two. With the Simultaneous–Ambiguity study, 33 individuals had management work experience of a mean (standard deviation) of 7.64 (6.67) years, ranging from no experience to 28 years.[8] The Simultaneous–Unambiguity study had 29 participants with an average management work experience of 7.48 (6.41) years that ranged from no experience to 31 years.[9] The subjects in Experiment Two were offered the same incentive as those in Experiment One. Table 4 summarizes comparisons of the subjects' background information for the three subject groups. As seen in Table 4, similar to subjects in Experiment One, the subjects in Experiment Two indicated moderate experience in their firms' capital budgeting decisions and perceived levels of task difficulty and task interestingness to be moderate. Also, the ANOVA results show no significant differences in subjects' risk attitude and ambiguity intolerance among the three studies, suggesting the managers participating in the three groups came from the same population.

3.1. Case materials

The experimental design and procedures are exactly like those in Experiment One. The only difference between these two experiments is that rather than asking subjects to give their choices before and after reviewing interpersonal information (as in Experiment One), we presented all the information simultaneously to the subjects in Experiment Two. Also, after participants selected a project in light of both financial and non-financial information, they were asked to respond to the question on likelihood assessments of the IRR for a project

[8]Out of the 33 individuals participating in this study, five of them reported no management work experience.
[9]Out of the 29 participants in this study, two of them did not report their work experience and one indicated no management work experience.

Table 4. Comparisons of subjects' background information.

	Experiment one—sequential	Experiment two—simultaneous ambiguity	Experiment two—simultaneous unambiguity	ANOVA results		
				df	F	p
Risk attitude[a] (1 = extremely risk averse; 9 = extremely risk seeking)	5.17 (2.42)	4.66 (2.44)	4.57 (2.53)	2, 88	.509	.603
Ambiguity intolerance[b] (1 = extremely intolerant; 9 = extremely tolerant)	3.25 (2.37)	3.09 (2.37)	3.22 (1.90)	2, 87	.044	.957
Task difficulty (1 = not difficult; 9 = very difficult)	4.27 (1.69)	4.94 (1.83)	4.50 (1.63)	2, 88	1.210	.303
Task interesting (1 = not interesting; 9 = very interesting)	4.98 (1.63)	5.58 (1.48)	5.06 (1.54)	2, 89	1.398	.252
Capital budgeting participation (1 = not often; 9 = very often)	4.43 (2.57)	4.45 (2.82)	4.79 (2.92)	2, 89	.161	.852

[a]43% (47%, 41%) of subjects reported being risk averse, 10% (6%, 24%) were risk neutral, and 47% (47%, 35%) were risk prone in Experiment 1 (Experiment 2—Simultaneous Ambiguity, Experiment 3–Simultaneous Unambiguity).

[b]73% (79%, 67%) of subjects reported being ambiguity averse, 10% (3%, 22%) were ambiguity neutral, and 17% (18%, 11%) were ambiguity prone in Experiment 1 (Experiment 2—Simultaneous Ambiguity, Experiment 2—Simultaneous Unambiguity).

with ambiguous returns (e.g., 17–25%) being both greater than or equal to and less than a precise return of the unambiguous option (e.g., 20% IRR). Hence, their project selections should not be affected by their likelihood assessments.

The Simultaneous–Ambiguity study used the same precise (10 vs. 20%) and ambiguous (7 to 15% vs. 17 to 25%) IRRs as did Experiment One. For the Simultaneous–Unambiguity study, both projects contained precise IRRs that differed by one point. One project used the same precise IRRs (i.e., 10 and 20%) employed in both Experiment One (Sequential) and the Simultaneous–Ambiguity study while the IRRs for the second project was the midpoint of the ambiguous IRRs in the other two studies (i.e., 11% and 21%). For the Simultaneous–Unambiguity study we will refer to the project with the lower return as the ULR project and the higher return as the UHR project.

3.2. Results

3.2.1. Manipulation checks. Recall from Experiment One that two questions were asked to elicit managers' personal financial position within the company and their perception of an acceptable IRR for the case. Similar to what was reported in the manipulation check in Experiment One, our results show that for the Simultaneous–Ambiguity study, the mean score of personal financial position in a gain condition (7.05) is significantly higher than that in a loss condition (4.30) ($F(1, 29) = 32.79$, $p \leq .000$). Similarly, for the Simultaneous–Unambiguity study, the mean score of personal financial position in a gain condition is significantly different from that in a loss condition (6.86 vs. 4.14; $F(1, 26) = 24.32$,

$p \leq .000$). Regarding the average acceptable IRR, for the Simultaneous–Ambiguity study the average acceptable IRR in the gain condition (19.52) was higher than that in the loss condition (12.09). This difference is statistically significant ($F(1, 30) = 163.08$, $p \leq .000$). We also observed a similar result for the Simultaneous–Unambiguity condition: the average acceptable IRR in the gain condition was significantly higher than that in the loss condition (18.86 vs. 12.69; $F(1, 26) = 68.96$, $p \leq .000$). Again, the manipulation of gain and loss condition was successful.

3.2.2. Test of H1.3.1 (information presentation mode). H1.3.1 predicts that the information presentation mode will not affect managers' self-serving bias in good times or their firm-value maximization tendency in bad times. Table 5 presents descriptive statistics for subjects' choice behaviors, their subjective probabilities, and preference scores in Experiment Two. Panel A of Table 5 shows that in the gain condition, 58% (19/33) chose the unambiguous ULR option when information was presented simultaneously; however, it is not significantly less than the 63% we observed earlier in the Sequential condition ($z = .4052$, $p < .347$) after all of the information was made available. Recall that, in the Sequential condition, 40% (10/25) of those who believed the IRR_{AHMR} was greater than or equal to the expected IRR_{ULR} continued to select the AHMR (see Table 2). In comparison, a higher percentage of managers (61% or 14/23) who believed the IRR_{AHMR} was greater than or equal to the expected IRR_{ULR} selected the AHMR in the Simultaneous condition. This suggests that when the information is presented sequentially, the initial project selection exhibits a self-serving bias. These managers indicated that there was a higher probability that this project would have an IRR that was greater than the unambiguous project. Presumably these managers believe the project with an ambiguous IRR has a symmetric distribution resulting in an excellent opportunity for them to achieve an IRR of 21 percent or higher. But when non-financial information is made available then both the sequential and simultaneous conditions find managers more likely to select the project that indicates a self-serving bias. At this point they are not concerned about a decrease in the IRR because it is greater than the target IRR and this project will allow them to include personal concerns in the decision. Furthermore, all eight subjects who believed the IRR_{ULR} was higher than the projected IRR_{AHMR} selected the ULR project for implementation.

As shown in Panel A of Table 5, in the loss condition 25 (78%) of the subjects did not choose the option favored by the interpersonal information, a slight five percentage points less than that in the Sequential condition (83%). And, these two differences are not significant ($z = .4979$, $p < .3121$). Our further analyses show that, in the loss condition 23 of 27 subjects (85%) acted in a firm-value maximizing manner, i.e., they believed the projected IRR_{AHMR} was greater than or equal to IRR_{ULR} and selected the AHMR project for implementation. This statistic is similar to that (92% or 22/24) in the Sequential condition. On the other hand, three of the subjects (11%) believed the projected IRR_{AHMR} was greater than or equal to IRR_{ULR} but selected the ULR project.

The above results show that there are no differences in managers' choice behaviors when the information is presented sequentially or simultaneously. Therefore, H1.3.1 was supported.

Table 5. Descriptive statistics for subjects' subjective probabilities, choice behaviors, and preference scores in both gain and loss conditions experiment two: Simultaneous information (H 1.3.1: information presentation mode)

	Experiment two–simultaneous information					Experiment one—sequential
	Percentage of subjects selecting the project					
	Probability is higher that the $AHMR_{IRR}$ is $\geq$20% in a gain (10% in a loss)	Probability is higher that the $AHMR_{IRR}$ is <20% in a gain (10% in a loss)	Probability is .50 that AHMR is $\geq$20% in a gain (10% in a loss)	Total	Preference score* mean (s.d.)	Percentage of subjects selecting the project
			Panel A. Ambiguity study			
Gain condition						
AHMR^{+}(17–25% IRR)	14 (42%)			14 (42%)	2.71 (1.14)	37%
ULR (20% IRR)	9 (27%)	8 (24%)	2 (6%)	19 (58%)	7.55 (.83)	63%
Total	23 (70%)	8 (24%)	2 (6%)	33 (100%)	5.50 (2.61)	100%
Loss condition$^{\delta}$						
AHMR (7–15% IRR)	23 (72%)	2 (6%)		25 (78%)	2.48 (.82)	83%
ULR (10% IRR)	3 (9%)	1 (3%)	2 (6%)	6 (19%)	6.92 (.92)	13%
Indifference	1 (3%)	0 (0%)	0 (0%)	1 (3%)	5.00 (0)	3%
Total	27 (84%)	3 (9%)	2 (6%)	32 (100%)	3.40 (1.95)	100%
			Panel B. Unambiguity study			
Gain condition						
UHR (21% IRR)				13 (45%)	2.58 (1.12)	
ULR (20% IRR)				16 (55%)	7.97 (.94)	
Total				29 (100%)	5.55 (2.91)	
Loss condition						
UHR (11% IRR)				17 (59%)	2.18 (.88)	
ULR (10% IRR)				12 (41%)	7.40 (.95)	
Total				29 (100%)	4.34 (2.76)	

$^{+}$AHMR: ambiguous higher midpoint return; UHR: unambiguous higher return; ULR: unambiguous lower return.
*1 = definitely choose the AHER or UHR option; 9 = definitely choose the ULR option.
$^{\delta}$One subject did not provide a probability estimate but selected the AHMR project for implementation.

3.2.3. Additional analyses. We ran regression analyses to determine what variables influenced the subjects' final decision in the Simultaneous–Ambiguity condition. As seen in Panel B of Table 3, similar to what was reported in Experiment One, both the interpersonal information and probability estimate affect managers' project selection in the gain condition.

That is, the more influential the interpersonal information and the higher the probability that the IRR_{AHMR} is greater than IRR_{ULR}, the more likely the individual will choose to implement the ULR project. However, in the loss condition, managers' project selection was only influenced by the interpersonal information. Presumably, the managers in both the sequential and simultaneous conditions recognize that neither project in the loss condition would reach the target IRR by the company. With no hope of achieving this target, managers' project selection is not influenced by the probability estimate provided for the ambiguous project.

We also compared the preference scores between two information presentation modes since the more extreme the score is, the stronger tendency a manager has to choose one of the two projects. Our ANOVA results show that under the gain condition and when the ULR project was selected, the average preference score is marginally significantly higher in the Simultaneous condition than in the Sequential condition (7.55 vs. 7.06, $F(1, 36) = 3.77$, $p < .06$). However, there is no significant difference in preference score when the managers chose the AHMR project (3.05 vs. 2.71, $F(1, 23) = .673$, $p < .420$). Similarly, in the loss condition there was no significant difference in preference scores when managers chose either the ULR (6.75 vs. 6.92, $F(1, 8) = .049$, $p < .831$) or AHMR project (2.81 vs. 2.42, $F(1, 49) = 1.958$, $p < .168$). In sum, these results support H1.3.1.

3.2.4. Test of H1.3.2 (simultaneous–unambiguity). Recall that H1.3.2 predicts that when both projects have unambiguous returns, managers will place more weight on interpersonal information (i.e., more selecting the ULR project) in the gain condition but place more weight on firm-value maximization (i.e., more selecting the UHR project) in a loss condition.

As shown in Panel B of Table 5, in the gain condition even with the unambiguous nature of the return, 55% (16/29) of the managers selected the ULR project and their average (standard deviation) preference score is 7.97 (0.94). In comparison, for those who chose the UHR project (45%), their average preference score is quite low (2.58). Furthermore, the managers' tendency to maximize their self-interest can also be seen by the overall average preference score (5.55), which is higher than the median point of 5.0.

Conversely, in the loss condition managers seems to place more weight on firm-value maximization, evidenced by their overall average preference score (4.34) being below the midpoint of 5.0. Specifically, we find 59% (17/29) of the subjects selecting the UHR project, maximizing the firm-value, and having a relatively low average preference score (2.18). On the other hand, those managers (41%) who chose the ULR project, promoting self-interest, have a high average preference score (7.40). Therefore, these results support H1.3.2.

Since the proportion choosing each option was close to 50 percent in both the gain and loss conditions, we examined the within-subject data further. Results of the additional analyses are summarized in Table 6. As shown in Table 6, there are actually seven who switched from maximizing self-interest in the gain condition to maximizing firm value in the loss condition. The plurality of participants chose maximizing the firm value in both a gain and loss decision (10 of the 29 responded in this manner). Note that nine were interested in satisfying their self-interest in both the gain and loss condition.

Table 6. Choices categorized by firm-value versus self-interest maximization in the unambiguity study of experiment two: Simultaneous information.

		Loss condition		
		Firm-value maximization (UHR)	Self-interest maximization (ULR)	Preference score
Gain condition	Firm-value maximization (UHR)	10 (34%)	3 (10%)	2.58 ($n = 13$)
	Self-interest maximization (ULR)	7 (24%)	9 (31%)	7.97 ($n = 16$)
	Preference Score	2.18 ($n = 17$)	7.40 ($n = 12$)	$n = 29$

As discussed earlier, in the gain condition the majority of managers selected the project that promotes their own self-interest. Specifically, 63% of managers in the Sequential condition (see Table 2), 58% in the Simultaneous–Ambiguity condition, and 55% in the Simultaneous–Unambiguity conditions (see Table 5) chose the project appearing to maximize self-interest. Regarding the loss condition, we found that 13% of managers in the Sequential condition, 19% in the Simultaneous–Ambiguity condition, and 41% in the Simultaneous–Unambiguity condition chose the project that is consistent with promoting self-interest. These results suggest that in the loss condition and when the information is ambiguous, a great majority of subjects are more likely to choose the project that appears to maximize the firm value. Perhaps, managers may feel they have a chance of coming close to the target IRR. However, when returns are unambiguous and it is impossible for managers to achieve the target return (i.e., in the Unambiguity condition), more managers select the project that promotes their own self-interest; possibly selecting the project that benefits the manager personally such as maintaining a "networking connection" for that manager. For example, selecting a co-worker or friend's project for implementation should result in a positive influence on the relationship between the manager and co-worker or friend. This co-worker or friend may be more willing to provide the manager future support for other business and career decisions.

4. General discussion

This study was conducted to learn how ambiguity and timing of interpersonal information affect a capital budgeting decision in a gain and a loss condition. While field research indicates that interpersonal information is taken into consideration when making a capital budget decision, this study shows the condition in which the interpersonal information is received actually influences the capital budget decision. In a gain condition, managers

exhibit an information bias, appearing to unduly consider personal information and this tendency holds whether the information is ambiguous or unambiguous. On the other hand, in a loss condition they have a tendency to maximize the firm value. Furthermore, our results show that managers' behavior choices are not influenced by whether the information is presented sequentially or simultaneously.

Our findings have significant managerial implications. In many corporations lower-level managers are expected to evaluate all capital budgeting proposals and rank them on their importance to their department. Therefore, it is important for upper-level managers to recognize how the projects' returns and interpersonal information can influence the lower-level managers' ranking decision. This study identifies conditions under which lower-level managers may choose capital budgets based on their self-interests. Recall we found that when outcomes were in the gain domain, the majority ranked the option with a lower IRR but a good personal benefit higher. In contrast, when outcomes were in the loss domain, this option was ranked lower. When establishing investment goals, it may be necessary for upper management to change their management control system. For example, when considering the adoption of new technology, rather than base the investment goal on the return of the project, upper management may elect to use the reduction in start up time as an important measure for success. This would result in the manager selecting the project with the highest return while working to successfully implement this technology as rapidly as possible and hopefully minimize any effect of interpersonal information. Therefore, our findings could help upper management to minimize the conditions that encourage managers to promote their own self-interest over the firm's interest.

This information can also be used by upper management to develop a system that specifically states the items that are to be considered throughout the capital budgeting process. For example, this system could include comments about the project that justify the projected costs across the project's life cycle, an explanation of how the strategy of the company is affected, a review of non-financial quantitative and qualitative factors, further explanation of the financing aspect, and a post-investment audit of the project. Through the use of a project status report, upper management could be certain that lower-level managers are focusing on those factors the company finds relevant when making a capital budget decision.

An additional idea that could mitigate the use of interpersonal information to make a capital budget decision would be the development and implementation of ethical guidelines for the company. Booth and Schulz (2004) studied the ethical environment and escalation of commitment to project evaluation decisions. Their results indicate that, in the presence of an ethical environment, student subjects had a tendency to discontinue failing projects, avoiding the error of considering sunk costs. Consequently, the presence of a Code of Ethics or a highly ethical work environment may result in the manager ignoring the interpersonal information and instead making a decision using the returns of the project.

While this study provides additional insight into the capital budgeting process in a gain and a loss condition, there are some limitations that need to be addressed. The capital budgeting decision is extremely complicated due to the excessive amount of information involved. This study only provided two pieces of information when making this decision, the internal rate of return of the projects and one piece of interpersonal information. A

key question is "How does the influence of interpersonal information in a capital budget decision change as additional, relevant information is made available to the managers?"

These studies were designed so there would be a one percentage point difference between the ambiguous and unambiguous returns of the projects. This relatively small one point difference may have made it easier for managers to promote their own self-interest by selecting the project with the lower return. But as this project return difference becomes larger, is there some point in which the managers will recognize the need to maximize firm value while ignoring the interpersonal information?

In this study the interpersonal information was always associated with the projects having the precise return. Additional research needs to be completed to see the effect of interpersonal information on the ambiguous projects in both a gain and loss condition. And finally, there are additional organizational factors that should be considered when making a capital budgeting decision. One factor that could be considered would be the effect of closer monitoring of the capital budget process. If the manager were required to periodically report to his/her superior the current status of the process and the information used when making the decision, might this mitigate the results found in this study? A second factor would be the role of time pressure on this decision. If the managers had a limited amount of time to make their project decision, what information would be used? Would a time constraint automatically limit the use of interpersonal information?

In this study we used managers as subjects. Unlike those studies using student subjects, it is very difficult to recruit managers with the required work experience to participate in our experiments. So we had 92 managers in total participate in our three experiments: 30 for the Sequential experiment; 33 for the Simultaneous–Ambiguity experiment, and 29 for the Simultaneous–Unambiguity experiment. While we are confident with general conclusions drawn from our findings, future studies can refine our study by increasing the sample size.

References

Berry, A. J. (1984). "The Control of Capital Investment," *Journal of Management Studies* 21(1), 61–81.

Booth, P. and A. K.-D. Schulz. (2004). "The Impact of an Ethical Environment on Managers' Project Evaluation Judgments Under Agency Problem Conditions," *Accounting, Organizations and Society* 29(5/6), 473–488.

Bower, J. L. (1986). *Managing the Resource Allocation Process* 2nd ed. Boston: Harvard Business School Press.

Bowman, E. H. (1982). "Risk Seeking by Troubled Firms," *Sloan Management Review* 23(4), 33–42.

Curley, S. P. and J. F. Yates. (1985). "The Center and Range of the Probability Interval as Factors Affecting Ambiguity Preferences," *Organizational Behavior and Human Decision Processes* 36, 273–287.

Demski, J. S. (1997). *Managerial Uses of Accounting Information*, Kluwer Academic Publsihers.

Einhorn, H. J. and R. M. Hogarth. (1985). "Ambiguity and Uncertainty in Probabilistic Inference," *Psychological Review* 92(4), 433–461.

Fatemi, A. M., J. S. Ang, and J. H. Chua. (1983). "Evidence Supporting Shareholder Wealth Maximization in Management Controlled Firms," *Applied Economics* 15, 49–60.

Feltham, G. A. and J. Xie. (1994). "Performance measure congruity and Diversity in Multi-Task Principal/Agent Relations," *The Accounting Review* 69(3) 429–453.

Gonzales-Vallejo, C., A. Bonazzi, and A. J. Shapiro. (1996). "Effects of Vague Probabilities and of Vague Payoffs on Preference: A Model Comparison Analysis," *Journal of Mathematical Psychology* 40, 130–140.

Heerema, D. L. and R. L. Rogers. (1991). "Is Your Cost Accounting System Benching Your Team Players?" *Management Accounting* (Sept.), 35–40.

Ho, J. L. Y., L. R. Keller, and P. Keltyka. (2002). "Effects of Outcome and Probabilistic Ambiguity on Managerial Choices," *Journal of Risk and Uncertainty* 24(1), 47–74.

Ho, J. L. Y., L. R. Keller, and P. Keltyka. (2001). "Managers' Variance Investigation Decisions: An Experimental Examination of Probabilistic and Outcome Ambiguity," *Journal of Behavioral Decision Making* 14, 257–278.

Ho, J. L. Y. and S. C. Vera-Munoz. (2001). "Opportunism in Capital Budget Recommendations: The Effects of Past Performance and Its Attributions," *Decision Sciences* 32(3), 423–447.

Hogarth, R. M. and H. Kunreuther. (1989). "Risk, ambiguity and insurance," *Journal of Risk and Uncertainty* 2, 5–35.

Horngren, C. T., G. Foster, and S. M. Datar. (1997). *Cost Accounting*, 9th edition. Englewood Cliffs, NJ: Prentice Hall.

Hsee, C. K. (1995). "Elastic Justification: How Tempting But Task-Irrelevant Factors Influence Decisions," *Organizational Behavior and Human Decision Processes* 62(3), 330–337.

Hsee, C. K. (1996). "Elastic Justification: How Unjustifiable Factors Influence Judgments," *Organizational Behavior and Human Decision Processes* 66(1), 122–129.

Kachelmeier, S. J. and M. Shehata. (1994). "Examining Risk Preferences Under High Monetary Incentives," *The American Economic Review* (September), 1105–1106.

Kahneman, D. and A. Tversky. (1979). "Prospect Theory: An Analysis of Decision Under Risk," *Econometrica* 47, 263–291.

Kahneman, D. and A. Tversky. (1984). "Choices, Values and Frames," *American Psychologist* 29(4), 3441–350.

Keppel, G. (1991). *Design and Analysis* 3rd edition, Englewood Cliffs, NJ: Prentice-Hall, Inc.

Kida, T., K. Moreno, and J. F. Smith. (2001). "The Influence of Affect on Managers' Capital Budgeting Decisions," *Contemporary Accounting Research* 18(3), 477–495.

Kleinmuntz, B. and D. Kleinmuntz. (2003). "Multiobjective Capital Budgeting in Not-for-Profit Hospitals and Healthcare Systems," Working paper. University of Illinois.

Kuhn, K. M. and D. V. Budescu. (1996). "The relative Importance of Probabilities, Outcomes, and Vagueness in Hazard Risk Decisions," *Organizational Behavior and Human Decision Processes* 68, 301–317.

Kunreuther, H. (1989). "The Role of Actuaries and Underwriters Insuring Risks: The Case of Environmental Pollution Liability Coverage," *Risk Analysis* 9, 319–328.

Kunreuther, H., J. Meszaros, R. M. Hogarth, and M. Spranca. (1995). "Ambiguity and Underwriter Decision Processes," *Journal of Economic Behavior and Organization* 26, 337–352.

Laughhunn, D. J., J. Payne, and R. Crum. (1980). "Managerial Risk Preferences for Below-Target Returns," *Management Science* 26(12), 1238–1249.

Moreno, K., T. Kida and J. F. Smith. (2002). "The Impact of Affective Reactions on Riskyh Decision Making in Accounting Contexts," *Journal of Accounting Research* 40(5), 1331–1350.

Morse, D. C. and J. L. Zimmerman. (1997). *Managerial Accounting*, Chicago: Irwin.

Mukherjee, T. K. and G. V. Henderson. (1987). "The Capital Budgeting Process: Theory and Practice," *Interfaces* 17(2), 78–90.

Oliver, B. L. (1972). "A Study of Confidence Interval Financial Statements," *Journal of Accounting Research* 10, 154–166.

Pinches, G. E. (1982). "Myopia, Capital Budgeting and Decision Making," *Financial Management* (Autumn), 6–19.

Raiborn, C. A., J. T. Barfield, and M. R. Kinney. (1999). *Managerial Accounting*, 3rd ed., Cincinnati: South-Western College Publishing.

Reimann, B. C. 1990. "A Session for Students of Shareholder Value Creation," *Planning Review* (May-June), 42–44.

Ruhl, J. M. and S. S. Cowen. (1992). "Breaking the Barriers to Value Creation," *Management Accounting* (March), 44–47.

Russo, J.E., M.G. Meloy, and T.J. Wilks. (2000). "Predecisional Distortion of Information by Auditors and Salespersons," *Management Science* 46, 13–27.

Scapens, R. W. and J. T. Sale. (1981). "Performance Measurement and Formal Capital Expenditure Controls in Divisionalized Companies," *Journal of Business Finance and Accounting* 8, 3.

Thackray, J. (1985). "America's Management Mischief," *Management Today* (Feb.)(80–84), 112–117.
Viscusi, W. K. and H. Chesson. (1999). "Hopes and Fears: The Conflicting Effects of Risk Ambiguity," *Theory and Decision* 47, 153–178.
Viscusi, W. K. and W. A. Magat. (1992). "Bayesian Decisions with Ambiguous Belief Aversion," *Journal of Risk and Uncertainty* 5, 371–387.
Zimmerman, J. (1997). *Accounting for Decision Making and Control*, 2nd edition, Chicago, IL: Irwin-McGraw-Hill.