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Title of Dissertation: RELATIVE PERFORMANCE EVALUATION: THE EFFECTS OF CONTRACT TYPE AND FEEDBACK ON AGENT EFFORT AND AGENT RISK SELECTION

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Date submitted to Graduate Board: 9/25/96

Accepted by the Graduate Board of Temple University in partial fulfillment of the requirements for the degree of **Doctor of Philosophy.**

Date 11/26/96 (Dean of Graduate School)

RELATIVE PERFORMANCE EVALUATION: THE EFFECTS OF CONTRACT TYPE AND FEEDBACK ON AGENT EFFORT AND AGENT RISK SELECTION

A Dissertation

Submitted to

the Temple University Graduate Board

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of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

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by

Ainun Na'im

January, 1997

ABSTRACT

RELATIVE PERFORMANCE EVALUATION: THE EFFECTS OF CONTRACT TYPE AND FEEDBACK ON AGENT EFFORT AND AGENT RISK SELECTION

by Ainun Na'im

Doctor of Philosophy

Temple University, 1997

Major Advisor: Professor Roland Lipka Ph.D.

This study examines the effects of contract types (relative performance evaluation (RPE) vs. profit sharing (PS)) and feedback signs (negative vs. positive feedback) on agent effort, and the effects of contract types, feedback and task environments (dual vs. single task) on agent risk selection. This study hypothesizes that a RPE contract and negative feedback result in higher effort and risk preferences than a PS contract and positive feedback. For the task environment, agents with single tasks are predicted to have higher risk preferences than those in dual task environment.

Two experiments involving graduate business students were conducted to test the hypotheses. This study found that contract types and feedback sign affect agent effort independently. Agents who have RPE contracts or negative feedback exert greater effort and select higher risk than agents who have PS contracts or positive feedback. However, contract type interacts with task environment affecting agent risk selection. Under RPE contracts, agent risk selections are not significantly affected by task environments, while under PS contracts they are significantly affected by the task environments.

ACKNOWLEDGMENTS

I would like to thank my dissertation committee members, Roland Lipka (Chair), David Ryan, Janice Mereba, Damaraju Raghavarao, and Larry Krafft for their guidance and insightful comments. I also would like to thank Professor Michael Goetz, Roland Lipka and Marco Malandra for giving me access to their graduate students during class time. I also appreciate the helpful comments provided by the accounting workshop participants at Temple University. Finally I would like to thank Professor Heibatollah Sami for his guidance during my study at Temple University.

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CHAPTER 1

INTRODUCTION

Performance evaluation systems play important roles for motivating managers to exert effort and to take risks. Types of compensation contracts (e.g., relative performance evaluation (RPE) and profit sharing (PS)) and control feedback have become important issues in performance evaluation because they may affect agent effort and agent risk selection.[1] Field studies indicate that superiors attempt to motivate their agents by different types of compensation contracts and control feedback (Maher 1987; Merchant 1989). Three lines of literature address the relationships between those aspects of performance evaluation systems and manager effort and risk selection separately: agency theory, social learning theory and prospect theory.[2] Using these theories, this study adds to the performance evaluation and incentive contracting literature with specific focus on the effects of (1) contract type (RPE and PS); (2) dual task and multiagent environments; and (3) feedback sign, on manager effort and risk selection in decentralized, multidivisional firms.

This study contributes to the literature in four respects. First, evidence is provided on the Demski and Sappington (1987) proposition about the effects of a dual task

[1] RPE refers to a compensation contract that evaluates managers based on their performance compared to the average performance of their group, while PS refers to a compensation contract that evaluates managers based on a preset standard (Frederickson 1992; Chow and Haddad 1991).

[2] For examples, Holmström (1979, 1982) and Holmström and Milgrom (1994), among others, represent agency theory studies that address managers' effort and risk selection. In organizational theory and psychology, Ilgen et al. (1979), Locke et al. (1981) and Latham and Locke (1991) represent studies in psychology that address the effects of feedback on managers' effort, while Kahneman and Tversky (1979) provide an analysis about the effects of feedback (a term similar to an individual's position compared to a reference point) on risk selection.

environment on agent risk selection. Demski and Sappington proposed that single task agents (i.e., agents whose task is just to select an investment) are more risk seeking than dual task agents (i.e., agents whose task is not only to select an investment, but also to search for information about investment opportunities). There is no empirical study that examines this proposition. This study attempts to fill this void. This study examines the effect of task environment (single task vs. dual task) in RPE and PS contractual settings.

Second, extending the works of Frederickson (1992), this study examines the interaction effects between contract type and feedback sign on agent effort. The relationship between feedback sign and effort have been examined extensively in the psychology and organizational behavior literature, but its application in accounting has not been done (Luckett and Eggleton 1991). Third, extending Chow and Haddad (1991), this study examines if feedback sign affect agent risk selection as explained in Kahneman and Tversky's (1979) prospect theory. Finally, since this study extends the works of Frederickson (1992) and Chow and Haddad (1991), those studies are 'replicated' using a modified experimental setting in this study. This replication is conducted to provide benchmarks for the extensions of those studies.

1.1. The Multiagent Environment

Principal-agent analytical studies have shown the importance of multiagent and dual task environments in the agency relationship. Baiman and Demski (1980), Demski and Kreps (1982) and Holmström (1980, 1982) propose that relative performance evaluation (RPE) is an optimal system that induces agent effort and risk sharing in multiagent environments. In RPE contracts, each agent's performance is compared across

agents. Since agents face common uncertainty, the comparison allows superiors to filter out the common uncertainty effects from the evaluation of the agents so that superiors can better infer each agent's effort level than if there was no such peer based comparative information.

Empirical studies have been done on the RPE hypothesis. However, the results are mixed. For example, Frederickson (1992) provides experimental evidence about the dominance of the RPE over the PS contract in exerting agent effort. Maher (1987) reports a case study that provides field evidence about the use of RPE for division manager performance evaluation. Also, Gibbons and Murphy (1990) and Janakiraman et al. (1990), in their studies about CEO performance evaluation, find support for the RPE hypothesis. However, Antle and Smith (1986) find mixed results, and Jensen and Murphy (1990) do not find support for the hypothesis that RPE is an optimal system. These mixed results suggest the importance of considering an omitted variable such as the dual task environment in an agency setting. The first objective of the current study attempts to answer this inquiry.

1.2. The Dual Task Environment

Demski and Sappington (1987) and Lambert (1986) suggest that in a dual task environment, a contract type that attempts to motivate managers in one task may have adverse effects on another task. For example, in a decentralized organization, executive officers (the principals) may delegate the tasks of seeking project opportunities and investment selection to division managers (the agents). In this situation, division managers have two related and sequential tasks: (1) exerting effort to seek information

about project opportunities and (2) selecting an investment project from the opportunities found. Motivating agents to exert effort by applying a risky incentive structure (i.e., relating the compensation to the output which is a function of effort, investment selection and a state of nature) may result in induced moral hazard (IMH) in the investment selection task. One IMH implication is that dual task managers exhibit higher risk averse selection than single task managers do (Demski and Sappington, 1987). The reason is that agents perceive that bad outcomes from risky investments may be attributed by uninformed superiors as a consequence of agent low effort.[3] To avoid the bad outcome and the attribution, agents tend to select low risk projects.[4]

There is no empirical study that examines this IMH proposition. Furthermore, empirical studies have tested the RPE hypotheses (i.e., the effects of RPE contract on agent effort (Frederickson 1992) and on agent risk selection (Chow and Haddad 1991)), but they have not considered the potential effects of IMH. Since most agents face dual task and multiagent situations, examining the IMH phenomenon may provide more insights about the effects of RPE on agent effort and risk selection (Frederickson 1992). This study attempts to investigate the interaction effect between contract type and task environment on agent risk selection.

[3] This argument is similar to that of attribution theory (Mitchell et al. 1981). However, while attribution theory focuses on superiors' judgments about the cause of an outcome, principal agent theory focuses on the effects of agents' perception about the superiors' attributions on the behavior of agents.

[4] This may increase the asymmetry between principal and agent risk preferences. The implications of the asymmetry on organizations are discussed in Jensen and Meckling (1976).

1.3. The Effects of Feedback Sign on Agent Effort

Social learning theory (Festinger 1954; Bandura 1977; Ilgen et al. 1979; Kluger et al. 1994, among others) suggests that feedback plays a critical role in human motivational processes.[5] Since both RPE and PS contract based performance evaluation systems have feedback implications for managers, considering the behavioral effects of the feedback is important. Most formal economics models do not consider the behavioral aspects of the feedback implied in performance evaluation systems. Holmström (1982) explicitly states that the benefit of RPE is that it can reveal information about common uncertainty, but he does not consider the behavioral aspects of RPE. The second objective of this study is to examine the effects of feedback sign that exist in performance evaluation systems on agent effort.

Luckett and Eggleton (1991) suggest the importance of feedback in an organization's management accounting and control system. Luckett and Eggleton's review study on feedback concludes that, although feedback has been extensively examined in the psychology literature, it has received scant attention in the accounting literature. This dissertation attempts to fill this void.

Under RPE contracts, agents receive feedback about the extent to which they perform compared to their peers. This comparison may show that an agent's performance is below (negative feedback) or above (positive feedback) that of the comparison group.[6]

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[5] Feedback is defined in this study as information about individual performance compared to a standard (Podsakoff and Farh 1989).

[6] Without RPE, agents may self-evaluate themselves by looking at their peers. However, explicit and objective feedback such as that from the RPE system may have a higher degree of saliency than that of implicit feedback (Bandura and Cervone, 1987).

On the other hand, under PS contracts agents only receive feedback about their own actual outcomes (e.g., whether they perform above or below a standard). Previous studies in social psychology and organizational behavior (Taylor et al. 1984; Bandura and Cervone 1983; Podsakoff and Farh 1989; and Kluger et al. 1994) indicate that the characteristics of feedback such as feedback source and sign affect individual effort and performance. They suggest that effort levels following negative feedback are greater than those following positive feedback. Furthermore, feedback generated from an RPE contract may have different effects on agent effort from that generated from a PS contract due to differences in credibility and saliency. For that reason, this study addresses the effects of feedback sign and their interaction with contract type on agent effort.

1.4. The Effects of Feedback Sign on Agent Risk Selection

The third objective of this study is to examine the effects of feedback on agent risk selection as explained by prospect theory. Kahneman and Tversky (1979) suggest that the extent to which individuals are more or less risk averse depends upon their position compared to a reference point. Individuals demonstrate risk averse behavior if they are above the reference point, and risk seeking behavior if they are below the reference point. In investment and budgeting decisions, Fishburn (1977), Payne et al., (1980, 1981) and Kim (1992) indicate that feedback such as an average performance of peers can be the reference point. Previous studies indicate that RPE managers receive the feedback information about the peer average performance and their position compared to the average, while PS managers receive feedback information about their own

performance compared to an absolute preset standard (Frederickson 1992; Chow and Haddad 1991).

This study does not attempt to explore the contrast between principal agent theory and prospect theory. On the contrary, it does attempt to examine if they are complementary to each other. Assuming that there are both continuous contextual individual risk preferences and psychological risk attitudes (Chow and Haddad 1991), this study predicts that managers are more risk averse when they are in gain situations than when they are in loss situations Feedback sign may determine the gain or loss situations perceived by RPE and PS managers. As a consequence managers may demonstrate greater risk seeking behavior when they receive negative feedback and less risk seeking behavior when they receive positive feedback.

Similar feedback exists in both RPE and PS systems. However, feedback salience may be different between RPE and PS based feedback. Ilgen et al. (1979) and Greller and Parsons (1995), among others, suggest that different characteristics of feedback such as sources and sign may have different effects on human behavior. Based on these findings, this study predicts that there are interaction effects between the feedback sign and contract type on agent risk selection.

1.5. Summary of the Results and Organization of the Dissertation

Two laboratory experiments involving graduate business students were conducted to test the hypotheses. Experiment one tested hypotheses regarding the effect of contract type and feedback sign on effort levels, while experiment two tested hypotheses regarding the effect of contract type, feedback sign and task environment on risk

selection. The results are: (1) significant main effects for contract type and feedback sign on both effort levels and risk selection, and (2) a significant main effect of task environments on risk selection. The interaction effect between contract type and task environments on risk selection is significant, whereas the other interaction effects are not significant.

The rest of the dissertation is organized as follows. The next chapter presents the literature review and the development of hypotheses. Chapter three describes the research method to test the hypotheses. Chapter four discusses the results and analysis, and chapter five provides the conclusions, the limitations of the findings and potential extensions of the study.

CHAPTER 2

LITERATURE REVIEW AND DEVELOPMENT OF HYPOTHESES

This study extends RPE studies (especially those of Frederickson 1992 and Chow and Haddad 1991) by incorporating the effects of feedback sign on the relationship between contract type and agent effort, and the effects of dual task environment and feedback sign on the relationship between contract type and agent risk selection. Risky investment decisions of dual task managers under different types of contracts are compared with those of single task managers. This chapter reviews the literature and derives the hypotheses regarding those relationships.

2.1. The Effect of Contract Type on Agent Effort and Risk Selection in a Single Task Environment

This section reviews previous studies that examined the effects of contract type on agent effort and risk selection in a single task environment. Hypotheses about the effects of RPE and PS contracts on agent effort and risk selection are derived following the review. These hypotheses, tested in previous studies (Frederickson 1992; Chow and Haddad 1991), are reexamined to provide benchmarks for the extensions in this study. Peter (1993) suggests the importance of replication in accounting (experimental) studies. In addition, the use of a different setting and contract parameters in this study (due to the inclusion of new variables) adds to the importance of the replication.

2.1.1. The effect of contract type on agent effort in a single task environment

Agency theory proposes that, under a multiagent and a common uncertainty situation, relative performance evaluation (RPE) contracts result in higher effort than do

profit sharing contracts (PS). This is because RPE contracts can reduce agency problems such as the free rider, moral hazard and adverse selection by separating each agent's responsibility and revealing common uncertainty information (Holmström 1982). In situations in which risk neutral principals employ risk and effort averse agents, each agent's output is a function of effort, common uncertainty and specific uncertainty. Applying RPE can reveal information about common uncertainty so that it can provide more information about agent effort than that provided by each agent's output alone (PS). This additional information, consistent with principal agent theory (Holmström 1979; Shavell 1979), results in more efficient contracting.

The PS and RPE compensation contracts can be specified, respectively, as follows

$$m_{pi} = F + j\,(x_i - \times_i), \text{ and} \qquad (1)$$

$$m_{ri} = F + j\,(x_i - \bar{x}_i) \qquad (2)$$

where,

m_{pi} = salary for agent i under PS system,
m_{ri} = salary for agent i under RPE system,
F = fixed portion of salary, with $F \leq m_{pi} \leq 2F$ under PS, and $F \leq m_{ri} \leq 2F$ under RPE,
j = percentage of bonus.
x_i = value of outcome for agent i,
$\times_i$ = a preset standard or an expected value of outcome for agent i, and
$\bar{x}_i$ = average outcome of agent i's comparison group.

In both RPE and PS, there are a base and a maximum level of compensation as commonly found in practice (Healy 1985). In this study, the base (F) and the maximum ($2F$) levels are developed based on those used by Frederickson (1992) and Chow and Haddad (1991).

Based on the contract type (equations 1 and 2), agents under PS and RPE are expected to choose effort levels that maximize their expected utilities as follows:

$$\text{PS: } E(U) = E[U_i\{F+j(x_i - \times_i)\}-V_i(h_i)] \text{ and} \quad (3)$$

$$\text{RPE: } E(U) = E[U_i\{F+j(x_i - \bar{x}_i)\}-V_i(h_i)], \quad (4)$$

where U_i is a function of agent i's utility of compensation, and $V_i(h_i)$ is a function of agent i's disutility of effort. Under RPE, agent i receives a bonus or penalty based upon the difference between his or her performance (x_i) compared to the group average ($\bar{x}_i$). This process allows principals to identify the common uncertainty faced by the agents. In addition, the comparison induces competition among the agents as they try to avoid penalties and to earn bonuses. Frederickson (1992) provides empirical experimental evidence that RPE contracts result in higher effort levels than do PS contracts. The first hypothesis of this study reexamines this proposition (Holmström 1982) by replicating Frederickson (1992).[7] The replication is conducted to increase the external validity of the findings due to different experimental settings and to provide a benchmark for the extension of the study.

H_1: Effort levels of managers under RPE contracts are higher than those under PS contracts.

2.1.2. The effect of contract type on agent risk selection in a single task environment

Holmström (1982) proposes that RPE contracts can result in greater risk taking behavior than PS contracts. Given unobservability, PS contracts used to induce effort may result in inefficient risk sharing, while optimal risk sharing can be maintained in

[7] All the hypotheses in this study are stated in the alternative form.

RPE contracts. In PS contracts, the agent i's outcome, x_i, is a function of effort and the state of nature:

$$x_i = f(h_i, s), \qquad (5)$$

where h_i is agent i's effort and s is the state of nature. Since x_i is uncertain, it is a noisy signal of h_i. Hence, contracts of the form $m_i = F + j\ (x_i - x_i)$ that imposes risk on risk averse agents are inefficient risk sharing contracts between principals and agents (Holmström 1980).[8]

In RPE contracts, the principals seek to maximize net expected profit subject to two constraints: each agent receives an expected utility at least equal to that of the next best alternative. and each agent's action is a best response to the other agents' actions under a certain sharing rule. Holmström (1982) proves that the sharing rule based upon each agent's output and the weighted average of all agents' performance measures is optimal, because the average peer performance measure captures the relevant information about common uncertainty (theorem 8, Holmström 1982). Thus, the optimal sharing rule under RPE implies that RPE agents demonstrate more risk seeking behavior than PS agents do.

Chow and Haddad (1991) examine Holmström's (1982) proposition in an experiment involving graduate students. They examine whether RPE contracts force higher risk seeking behavior than do PS contracts. Consistent with Holmström's proposition, Chow and Haddad found that under high uncertainty, RPE subjects demonstrate higher risk seeking behavior than do PS subjects. The second hypothesis of

[8] See equation 1 above for explanation of this type of contract.

this study, replicating Chow and Haddad (1991) examines the effects of performance evaluation contracts on agents' risk selection.

H2: RPE managers demonstrate higher risk seeking behavior than do PS managers.

2.2. The Effect of the Dual Task Environment on Agent Risk Selection

Demski and Sappington (1987) and Lambert (1986) show that a dual task environment can result in the agents making different risk selection from those made by agents in a single task environment. Similarly, Holmström and Milgrom (1994) prove that in a multidimensional task environment, incentive contracts that focus on a single dimension can deteriorate another dimension of the task.[9] Demski and Sappington (1987) model a dual task environment using division managers who have planning and implementation contracts. In this study, dual task division managers are contracted to find information about alternative investments and to select an investment project.

The Demski and Sappington model assumes that: (1) the principals are risk neutral and the agents are risk averse; (2) perfect communication between the principals and agents is costly; and (3) there is a set of effort levels where each feasible level ($h \in H$), if chosen, provides alternative project opportunities ($y \in Y_n$) that inform agents to choose an action ($a \in A$) to select a project.[10] Only agents observe effort levels ($h \in H$), investment opportunities ($y \in Y_n$), and their investment choices ($a \in Y_n$). Both agents and

[9] For example, an incentive system based upon product quantity may result in lower product quality, and an incentive system that focuses on product quality may impose higher cost of equipment maintenance and repair (Holmström and Milgrom 1994).

[10] The term $h \in H$ means an effort level h is a subset of all possible effort levels H. Hereafter all capital letters in the terms indicate all possible alternatives of the lower case terms that precede them.

principals observe the actual random outcome ($x \in X$). The model also assumes that the principals have objective functions to maximize the expected value of random outcomes (x) less payments to the agents (m). If $s \in S$ is the state of nature, and $a \in A$ is an investment selected by the agents, the outcomes model is $x \in X$ via $x = x(s,a)$ where X, S, and A are finite. Agents and principals initially share homogeneous beliefs about the random state of nature represented by the probability mass function $\pi(s) > 0$ for all $s \in S$.

The contracting and transaction process between dual task agents and principals is illustrated in figure 1 and explained as follows: (1) managers' compensation as a function of outcome, $m(x)$, is specified; (2) managers commit to an effort level, $h \in H$, observe alternative projects, $y \in Y_n$, and take an action selecting a project, $a \in A$; (3) outcomes $x \in X$ are observed by both managers and principals; and (4) managers are compensated.

Based on these assumptions and transaction processes, principals attempt to maximize their utility according to the objective function and its related constraints as follows (Demski and Sappington 1987):

$$\text{PO: Maximize}_{m,\, a_y,\, n} \sum_y \pi(y \mid h) \sum_x [x - m(x)] f(x \mid a_y, y, h) \qquad (6)$$

subject to:

$$\text{IR: } \sum_y \pi(y \mid h) \sum_x U(m(x), h) f(x \mid a_y, y, h) \geq \hat{U}, \qquad (7)$$

$$\text{IS: } \sum_y \pi(y \mid h) \sum_x U(m(x), h) f(x \mid a_y, y, h) \geq \sum_y \pi(y \mid h') \sum_x U(m(x), h') \cdot$$

$$f(x \mid \hat{a}_y, y, h'), \quad \forall \hat{a}_y \in A, \quad \forall h' \neq h, \qquad (8)$$

$$\text{AS: } \sum_x U(m(x), h) f(x \mid a_y, y, h) \geq \sum_x U(m(x), h) f(x \mid \tilde{a}_y, y, h)$$

$$\forall \tilde{a}_y \neq a_y \qquad (9)$$

$$\text{EL: } h_{\min} \leq h \leq h_{\max} \qquad (10)$$

where, π is principals' and agents' homogeneous beliefs about the state of nature, m is agents' compensation, U is agents' utility, $\hat{U}$ is an alternative utility available from alternative employment compensation, h' is alternative effort committed by agents, $\hat{a}$ and $\tilde{a}$ are alternative investment selected given different principals' employment policy (i.e., job and organizational design and incentive contracts), $f(x \mid a_y, y, h)$ denotes the induced distribution on $x \in X$ when a_y is implemented upon the observation of opportunities y, and other terms are as defined in the previous paragraphs.

The solution to the principal objective function (PO) is second best where there is uncertainty and information asymmetry.[11] In this situation, principals attempt to maximize total expected output net of the compensation paid to the agents. The objective function subject to three constraints: individual rationality (IR), information selection (IS), action selection (AS), and effort level (EL). The IR constraint guarantees agents' minimum expected utility levels, otherwise they will quit and choose another employer. The IS constraint ensures that agents will exert effort level h, and the AS constraint ensures that agents, having exerted h and observed signal y, prefer to select the desired investment project a_y. As partitions of the incentive compatibility constraint that exist in a standard single task agency model, IS and AS constraints mean that given the incentive schedule

[11] Under uncertainty and information asymmetry, the first best solution (Pareto optimal) can not be achieved. Using certain contracts that are tied to agents' outcomes can increase principals' welfare, but it can not eliminate agent effort aversion and risk aversion. This situation is called the second best solution in analytical studies.

and employment policy from the principals, the agents will pick the best selection for themselves and the principals. Principals do not determine agent selection directly. Rather, they influence agent selection by applying certain policies such as organizational design and incentive contracts, so that agent selection maximize not only agent but also principal utility.

The effort level constraint (EL) means that agents can not work for less than minimum effort level (h_{min}) because, while shirking is costly to detect, extreme shirking is not. Agents also can not work for more than the maximum level (h_{max}) due to their limited capacity. In addition, exerting effort more than a maximum level is too costly for the agents.

Demski and Sappington (1987) show that the AS constraint binds in the solution of PO when the incentive structure is to motivate the agents to choose the desired effort level h. This means the induced moral hazard problem is present in the project selection.[12] The risky incentive structure that motivates h spills over to the project selection because agents may wish to avoid bad signals about the preceding task that result from the outcomes of selecting a risky project. Lambert (1986), Holmström and Ricart I Costa (1986), Dye (1992) and Holmström and Milgrom (1994) address different dual task settings. Their results, however, do not contradict Demski and Sappington (1987).

[12] Proposition 1 (Demski and Sappington 1987, p. 76).

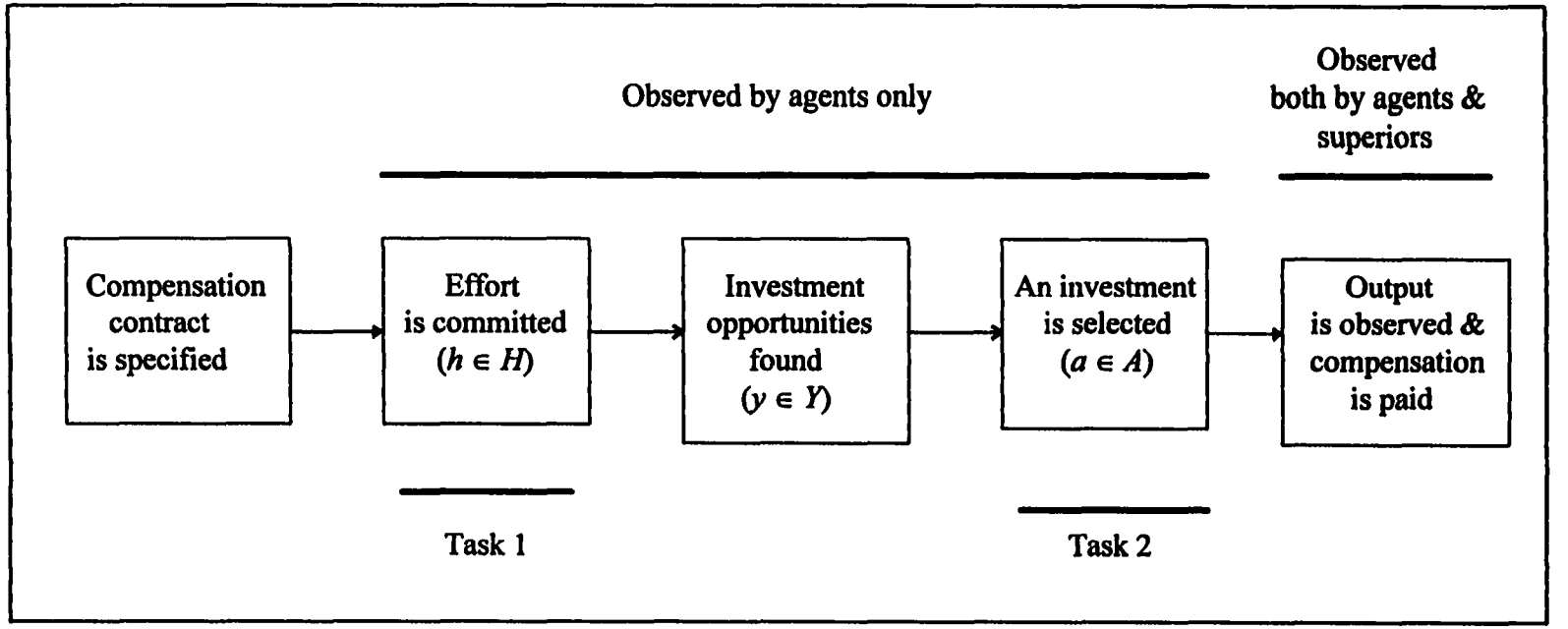

Figure 1. Transaction process between principals and agents in a dual task environment

Based on Demski and Sappington (1987), division managers who have dual tasks such as seeking investment project opportunities and selecting one of the projects are hypothesized to choose less risky projects. In contrast, division managers who have a single task, for example those who are provided with project opportunities from a research and development division and their job is just to select the project, choose riskier projects.

H3: Dual task managers demonstrate lower risk seeking behavior than do single task managers.

2.3. The Interaction Effect Between Contract Type (RPE vs. PS) and Task Environment (Dual vs. Single Task) on Agent Risk Selection

In RPE contracts, agent output is not the only source of information about effort and investment selection. RPE contracts also provide peer average performance information (see equation 2) that indicates information about common uncertainty faced by the agents. In this situation, agents may have a perception that their performance is evaluated by superiors based upon not only their own output but also the common uncertainty condition derived from the peer output average information. As a consequence, the average information may mitigate bad signals about agent effort given that agents exert a high effort level and select a risky project.

In contrast, in PS contracts, agent output is the only source of information about the agent effort and investment selection. In addition, the distribution of outputs do not necessarily follow the first order stochastic dominance assumption where the higher effort committed and riskier project selected may result in a lower output (Lambert 1986).

In this situation the induced moral hazard in investment selection may exist meaning that agents may select a less risky project even if they exert higher effort and they have profitable but riskier projects in their selection set.

Considering the effects of RPE and PS contracts above, it is expected that RPE contracts mitigate induced moral hazard in investment selection, while PS contracts do not. Thus, there are interaction effects between contract type and task environment on agent risk selection. Figure 2 illustrates that the difference in risk seeking behavior between dual task and single task managers is lower in RPE than that in PS contracted managers.

H4: There is an interaction effect between contract type and task environments so that the difference in risk seeking behavior between dual task and single task managers is lower in RPE than that in PS contracts.

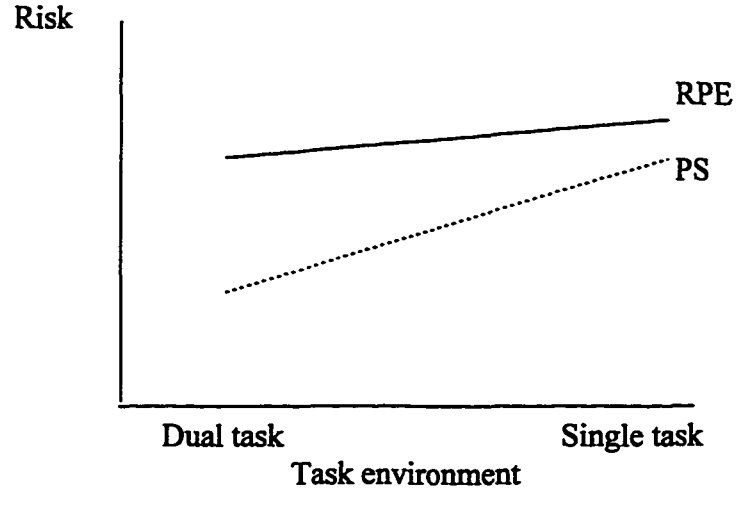

Figure 2. The expected effects of contract type and task environment on agent risk selection (hypotheses 2, 3 and 4).

2.4. The Effect of Feedback Sign

This section reviews the organizational theory and psychology literature about the effects of feedback sign on individual performance and applies the theories in an agency setting. In this setting, feedback is analyzed for its effects on agent effort and risk selection. Two theories are reviewed: social learning theory and prospect theory that discuss the effects of feedback on effort and risk selection, respectively.

2.4.1. The effect of feedback sign on agent effort

PS and RPE agents receive different types of feedback. PS agents receive feedback about their performance compared to a preset standard, whereas RPE agents receive feedback about their performance compared to group average performance. As a consequence of these comparisons, both PS and RPE agents may receive positive (i.e., the performance is above the standard) or negative feedback (i.e., the performance is below the standard).

Social learning theory suggests that the feedback sign may affect individual effort. Bandura and Cervone (1983), Podsakoff and Farh (1989), and Greller and Parson (1995), among others, provide empirical evidence that negative feedback is associated with higher performance. One explanation is that negative feedback creates self-dissatisfaction that serves as a motivational inducement for enhanced effort (Bandura and Cervone 1983).

However, effort is not necessarily a monotonically increasing function of the discrepancy between negative feedback and expected performance. If performance is

continuously below standard, agents may perceive that the principal's expectations are not attainable and agents may reduce their effort. Young et al. (1993) provide empirical evidence indicating that groups that are provided with feedback that they are just above or just below a preset standard outperform groups with feedback indicating that they are high above or high below the standard.

The relationship between feedback and effort may be explained by arousal theory (Pinder 1984; Kluger et al. 1994; Latham and Locke 1991). Kluger et al. using a quasi-experimental approach, found that comparison of individual performance with the peer average yields cognitive appraisals of feedback sign. The feedback sign has a monotonic effect on harm/benefit appraisal (pleasantness), and have a curvilinear U-shaped effect on arousal. Studies about the effects of arousal on effort indicate that certain levels of arousal such as those in moderate levels can drive individuals' effort (Pinder 1984). Thus, feedback affects effort through the arousal effect.

Based on these findings in social learning theory, this study hypothesizes that feedback sign affects agent effort in that agents with negative feedback subsequently demonstrate a higher levels of effort than do agents with positive feedback.

Hs: Agents who receive negative feedback exert higher effort than do agents who receive positive feedback.

Research on feedback also indicates that the feedback source may have different motivational effects (Ilgen et al. 1979; Podsakoff and Farh 1989; Luckett and Eggleton 1991). Regarding the contract type applied, RPE managers receive peer performance based comparative outcome feedback from the system, while PS managers receive an

absolute preset standard (non-peer performance) based comparative outcome feedback. The peer performance based comparative and absolute standard based comparative feedback may be different in that the peer performance based comparative feedback is more accurate and has higher credibility and saliency than that of the absolute standard based feedback.

Podsakoff and Farh (1989) provide evidence of the effects of feedback saliency and credibility on individual performance in a general social setting. Podsakoff and Farh measured feedback credibility and saliency by providing their subjects with peer based (high credibility) and absolute based (low credibility) comparative performance information. Subjects who had peer based comparative performance information were considered as having high credibility feedback, while those who had absolute based comparative performance information were considered as having low credibility feedback. They found that feedback provided in the form of peer based comparative performance information is more effective to increase performance than feedback provided in the form of absolute based comparative information.

This study attempts to examine the effect of feedback saliency in an accounting setting. The RPE contract has different feedback information from that of the PS contract. The RPE contract provides peer performance based comparative feedback while the PS contract provides an absolute comparative feedback. Since these two types of feedback have different degrees of saliency and credibility, this study predicts that there is an

interaction effect between contract type and feedback sign on agent effort. The expected relationships are presented in figure 3.

$H_{5(a)}$: Contract type interacts with feedback sign so that the difference between RPE agent effort and PS agent effort is greater when the feedback sign is negative than when it is positive.

$H_{5(b)}$: Under RPE contracts, agents who receive negative feedback subsequently exert higher effort than do agents who receive positive feedback.

$H_{5(c)}$: Under PS contracts, agents who receive negative feedback subsequently exert higher effort than do agents who receive positive feedback.

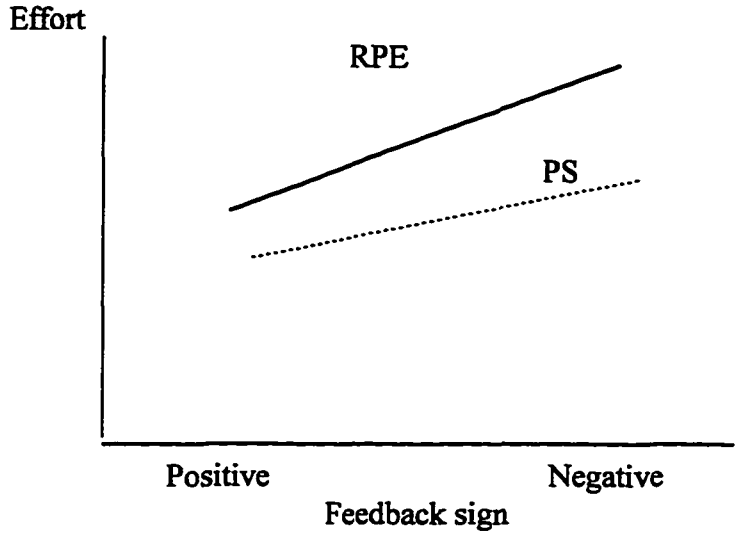

Figure 3. The expected effects of feedback sign on agent effort (hypotheses 5a, 5b, and 5c).

2.4.2. The effect of feedback sign on agent risk selection

The effects of feedback on agent risk selection may be explained by prospect theory. The most relevant feature of prospect theory in this study is that a reference point affects risk selection (Kahneman and Tversky 1979; Tversky and Kahneman 1981; Payne

et al. 1980, 1981; Kim 1992). The theory suggests that individuals are risk averse when they are above the reference point (a gain or a positive feedback situation) but are risk seeking when they are below the reference point (a loss situation).[13]

The effectiveness of peer average performance as a reference point has been documented in previous studies (Fishburn 1977; Payne et al. 1980, 1981; Kim 1992).[14] Payne et al. (1980, 1981) find that the concept of a target return as a reference point is an important factor in determining business managers' risk selection. Kim (1992) demonstrates that information about individual positions compared to a group average affect risky budget choices. Relying on such works, RPE and feedback can provide the reference point for agents so that agents who have positive feedback perceive that they are in a gain domain and become more risk averse while those who have negative feedback perceive that they are in a loss domain and become more risk seeking. Individuals who have negative feedback choose a risky investment because the reward associated with successful investment is sufficiently large to make up for underachievement in the previous period. Thus, it is predicted that agents in gain domains will tend to be more risk averse and those in loss domains will tend to be more risk seeking. The next hypothesis predicts the effect of feedback sign on agent risk selection.

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[13] For example, in Kahneman and Tversky's (1979) experiment, in a game (3,000) vs. (4,000, .80), individuals tend to choose (3,000) rather than the latter. However in a (-3,000) vs. (-4,000, .80) game, individuals tend to choose (-4,000, .80).

[14] The use of peer average as a reference point is different from that suggested by benchmarking literature (e.g., Camp 1989; Sweeney 1994) that suggest the use of the best performance as the reference point. However, Holmström (1982) suggests that the use of the best performance as a reference point can not efficiently reveal information about common uncertainty. In addition, the benchmarking literature tends to focus on the use of the best performer as a benchmark to build organizational values, while this study focuses on the use of information and feedback to influence agent effort and risk selection.

H6: Agents with negative feedback seek more risk than do agents with positive feedback.

Managers with PS or RPE contract receive absolute feedback in terms of the deviation of their actual division net income from a standard (Merchant 1989; Chow and Haddad 1991). The feedback may provide a frame such that agents who receive net income above the standard (positive feedback) perceive that they are in a gain domain, while those who are below the standard perceive that they are in a loss domain. Hence the PS and RPE agents whose position is above the standard tend to be more risk averse while those whose position is below the standard tend to be more risk seeking. However, since the degree of saliency and credibility of the RPE and PS based feedback is different, there may be an interaction effect between contract type and feedback on agent risk selection. Figure 4 illustrates that the difference between the levels of risk chosen by RPE and those chosen by PS managers is greater when the managers receive negative feedback than that when they receive positive feedback.

H7: There is an interaction effect between contract type and feedback sign on agent risk selection so that the difference between RPE and PS agent risk selection is higher when there is negative feedback than when there is positive feedback.

In summary, this study tests two groups of hypotheses: (1) the effects of contract type and feedback sign on agent effort, and (2) the effects of contract type, feedback sign and task environments on agent risk selection. The hypotheses are summarized in table 1.

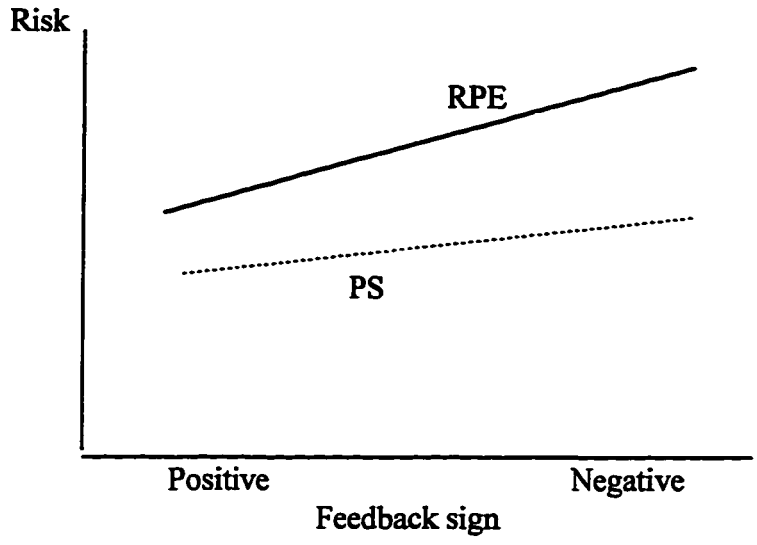

Figure 4. The expected effects of contract type and feedback sign on agent risk selection (hypothesis 7).

Table 1. The List of the Hypotheses

Hypothesis	Independent variable	Dependent variable	Expectation
1	Contract type (RPE vs. PS)	Effort levels	Effort levels of agents under RPE contract > Effort levels of agents under PS contract.*
2	Contract type (RPE vs. PS)	Risk selection	Risk levels selected by agents under RPE contract > Risk levels selected by agents under PS.**
3	Task environment (Dual vs. Single tasks)	Risk selection	Risk levels selected by single task agents > Risk levels selected by dual task agents.
4	Interaction between Contract type and Task environment	Risk selection	The difference in risk levels between dual task and single task agents under RPE < The difference in risk levels under PS.

Table 1. (continued)

Hypothesis	Independent variable	Dependent variable	Expectation
5	Feedback sign (positive vs. negative)	Effort levels	Effort levels of agents with negative feedback > Effort levels of agents with positive feedback.
5(a)	Interaction between contract type and feedback sign	Effort levels	The difference between RPE agent effort and PS agent effort under negative feedback < the difference under positive feedback.
5(b)	Feedback sign (positive vs. negative) under RPE	Effort levels	Under RPE contract, effort levels of agents with negative feedback > Effort levels of agents with positive feedback.
5(c)	Feedback sign (positive vs. negative) under PS	Effort levels	Under PS contract, effort levels of agents with negative feedback > Effort levels of agents with positive feedback.

Table 1. (continued)

Hypothesis	Independent variable	Dependent variable	Expectation
6	Feedback sign	Risk selection	Agents who have negative feedback tend to be more risk seeking than do agents who have positive feedback.
7	Interaction between Contract type and Feedback sign	Risk selection	The difference in risk selection between RPE and PS agents under negative feedback > The difference in risk selection under positive feedback.

* This hypothesis replicates Frederickson's (1992) study.
** This hypothesis replicates Chow and Haddad's (1991) study.

CHAPTER 3

RESEARCH METHOD

Two experiments involving graduate business students were conducted to test the hypotheses.[15] The first experiment tested the effects of contract type and feedback sign on agent effort, while the second experiment tested the effects of task environments, contract type, and feedback sign on agent risk selection. The design of the first experiment was a 2^2 factorial design. The first factor was contract type (two levels: RPE and PS) and the second factor was feedback sign (two levels: positive and negative). The design of the second experiment was a 2^3 factorial design, with the first two factors being the same as those of the first experiment, and the third factor was the task environments (two levels: dual tasks (effort and investment selection) and a single task (investment selection only)).

The subjects who made an effort level decision in the first experiment were subsequently asked to make an investment selection. These subjects represent the dual task subjects in the second experiment that tested the second group of hypotheses (agent risk selection). All of the factors are randomly assigned between subjects.[16] Figures 5 and 6 illustrate the assignment of the subjects to each factor.

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[15] Demski and Kreps (1982) suggested the use of laboratory experiments for testing the analytical research results. The use of laboratory experiments have advantages (e.g., high internal validity) and weaknesses (e.g., low external validity). Swieringa and Weick (1982) provide a detailed discussion of the use of laboratory experiments in accounting research.

[16] The between subjects design is used for the following reasons: (1) maintaining consistency with the previous studies being extended, and (2) obtaining the comparability between the response scale of dual task and single task subjects. The use of between subject design has advantages and disadvantages (e.g., power of analysis, and external and internal validity). Panny and Reckers (1987) and Schepanski et al. (1992) provide a detailed discussion about the use of between and within subject design in accounting research.

	Between subjects treatment	
Treatment group	Contract type	Feedback sign
1	RPE	Positive
2	RPE	Negative
3	PS	Positive
4	PS	Negative

Figure 5. The design of experiment one (the effects of contract type and feedback sign on agent effort)

	Between subjects treatment		
Treatment group	Task environments	Contract type	Feedback sign
1	Dual tasks	RPE	Positive
2	Dual tasks	RPE	Negative
3	Dual tasks	PS	Positive
4	Dual tasks	PS	Negative
5	Single task	RPE	Positive
6	Single task	RPE	Negative
7	Single task	PS	Positive
8	Single task	PS	Negative

Figure 6. The design of experiment two (the effects of contract type, task environment and feedback sign on agent risk selection).

Figure 5 illustrates that in the first experiment there were four experimental groups (of dual task subjects) who have different contract type and feedback sign. The subjects were asked to respond to the effort level and the risk level decisions. Their responses on the effort level decisions were used to test the effort hypotheses, while their responses on the risk level decisions were used to test the risk selection hypotheses. In the second experiment, there were eight experimental groups who had different contract type,

feedback sign, and task environments (figure 6). The second experiment asked the subjects to respond to the investment selection decisions. The subjects assigned in the first experiment became the dual task group in the second experiment in that they responded to investment selection decisions after they had responded to the effort decision in the first experiment. This group was compared to the single task group that consisted of subjects who made a risk selection decision only to test the task environment hypothesis (hypothesis 3).

In the dual task environment, the subjects played the role of division managers who had the responsibility of finding the information about investment opportunities and selecting one investment project from the opportunities found. On the other hand, in the single task situation the subjects played the role of division managers who were provided with investment opportunities from another division (i.e., research and development division) and their task was just to select an investment project.

The data about agent effort and risk selection were analyzed using analysis of variances (ANOVA). The analysis assumed that the dependent variables are normally distributed and homoscedastic. Wilk-Shapiro statistic was used to test the normality while Hartley's and Bartlett-Box tests were conducted to check the homoscedasticity assumption (Kirk 1982; Keppel 1991).

Analysis of effect sizes were also used to compare the results of this study (especially regarding hypotheses one and two) to those of Frederickson (1992) and Chow and Haddad (1991). Effect sizes (see appendix A for a more detailed explanation of effect

sizes) indicate the extent to which the phenomenon is present in the population, or the degree to which the null hypothesis is false (Cooper and Hedges 1994). Rosenthal and Rosnow (1991) suggest the use of effect sizes to compare two or more studies to check whether the studies are in agreement in the direction and size of the effect. The effect sizes are measured using the 'r' measure suggested by Rosenthal and Rosnow, and the comparison was conducted based on the Fisher *z* statistic.[17]

3.1. Measurement of the Dependent Variables

This section discusses the measurement of the dependent variables: agent effort and agent risk selection. Agent effort is measured by the number of investment opportunities that agents attempt to search, while agent risk selection is measured, following Chow and Haddad (1991), by the degree of operating leverage of the selected investment.

3.1.1. Agent effort

In this study, effort is measured by the quantity of resource capacity (e.g., time and expertise) agents want to exert to search for information about investment opportunities. The resource capacity is measured using an equivalent number of outputs, in this case the attempted number of investment opportunities. The subjects determine the number of investment opportunities they attempt to find (units of effort) ranging from 5 - 15. They must search at least 5 units because, considering managers' effort in practice,

[17] The mechanic of the computation of effect sizes and the comparison of the effect sizes using Fisher *z* score can be found in Rosenthal and Rosnow (1991) and Rosenthal (1991).

very low levels of effort are easily detected by the principal's information system. The subjects were told that searching for less than 5 projects is unacceptable.

The number of investment opportunities actually found ranges from 4 to 15 depending upon the effort level exerted and the actual state of nature which was determined randomly by the computer process. These investment opportunities were used as the basis for an investment selection decision which then resulted in net income. Thus, effort together with investment selection affected net income. This model is consistent with that explained in Demski and Sappington (1987) whose propositions guide the induced moral hazard hypotheses tested in this study.

The output based effort measure, although similar to that used by Frederickson (1992), is different. This study uses the number of investment opportunities selected as output, while Frederickson's study used product quantity as output. The use of investment opportunity based outputs in this study is to facilitate the measurement of dual task and single task decision.

The outputs based effort measure is consistent with the agency theory definition of effort for three reasons: (1) subjects have control over the number of opportunities they want to find, (2) the higher the number of units of capacity committed by the agents, the greater the number of expected investment opportunities found; and (3) agents incur disutility from their effort (Baiman 1982, 1990; Frederickson 1992).

The utilities for compensation and disutilities of effort are induced using the Berg, Daley, Dickhaut and O'Brien (1986) technique. This technique transforms a value of

compensation determined based upon a compensation contract $m(x)$ into a utility value using a concave utility function $U(m)$. The disutility of effort is induced based upon a convex cost function, $V(h)$. The net value of utility (utility of compensation deducted by disutility of effort) then is used to determine the subjects' rewards. The utility and disutility functions are induced to follow the economic explanation that agents maximize their net utility. Compensation, the inducement of risk averse behavior and the actual incentives are explained in more detail in the manipulation of independent variables and experimental procedures (described below).

3.1.2. Agent risk selection

The dependent variable agent risk selection refers to the degree to which agents select low or high risk investments on a single continuous measure: the degree of operating leverage (DOL) of the investment chosen by the subjects in the investment selection decision. DOL is the extent to which an investment project uses fixed cost compared to variable cost (Garrison 1988). The higher the DOL, the higher the fixed cost of a project. A high DOL project is considered riskier than a low DOL project because the high DOL project's net income fluctuates more than that of the low DOL project (Chow and Haddad 1991). DOL is also a determinant of market beta (Kim and Lipka 1991; Huffman 1989). Further, DOL is an important variable in new manufacturing technology investment that has high fixed cost (Kaplan and Atkinson 1989).

The number of investment alternatives that are available to the subjects in the experiment depends on the subjects' effort decision and an actual state of nature. The

subjects may decide to exert effort in the range of five to fifteen. The number of investment alternatives actually found range from four to the number of alternative investments searched. Further, the associated DOLs of the alternative investments found vary in the range of 2 to 5.50 in increments of 0.25 (i.e., 2.25, 2.50, 2.75 ... 5.50). This range is comparable to that used by Chow and Haddad (1991) and is comparable to many industry DOLs.

3.2. Measurement of the Independent Variables

This section discusses the measures of independent variables: contract type (RPE and PS), task environments (single-task and dual task situations), and feedback sign. Except for task environments, the measures are developed based on the modification of previous studies (i.e., Frederickson (1992) and Chow and Haddad (1991) for the contract type, and Young et al. (1993) and Podsakoff and Farh (1989) for the feedback sign).

3.2.1. Contract type

This study examines the effect of contract type, i.e. relative performance evaluation (RPE) and profit sharing (PS) contracts on agent effort and risk selection. RPE and PS are measured using the following compensation contracts:

$$m_{pi} = 25000 + 25\% (x_i - \times_i), \text{ and} \quad (11)$$

$$m_{pi} \leq 50000 \quad (12)$$

$$m_{ri} = 25000 + 25\% (x_i - \bar{x}_i), \text{ and} \quad (13)$$

$$m_{ri} \leq 50000. \quad (14)$$

where m_{ri} and m_{pi} are the total compensation for RPE and PS subjects respectively, x_i is agent i's net income, $\bar{x}_i$ is the average of agent i's comparison group, and $\times$ is a preset standard which is the expected value of agent i's division net income. These measures are used following Chow and Haddad (1991).

The subjects' experimental compensation above indirectly determines their actual incentives as the participants. The actual incentives are determined using the Berg et al. (1986) method that induces risk averse behavior in the subjects. This is explained in the experimental procedure below.

3.2.2. Task environment

Task environment refers to whether agents face single or dual tasks. In the single task, subjects faced only one decision problem while in the dual task setting the subjects are faced with more than one problem. In the dual task situation, subjects were provided with two decisions: how much effort to exert and what risky investment to select. Both decisions affect the net income. The effort decision was always provided first because agents naturally should exert effort first to search for information. This procedure is consistent with Demski and Sappington (1987) and Lambert (1986). In this study, subjects should commit to a level of effort equivalent to searching for at least five investment opportunities and to a maximum of fifteen investment opportunities. After exerting their effort (by entering the selected number in the computer), the subjects received the actual investment opportunities found. The number of investment opportunities found was determined randomly. The possible number ranged from four to

the number of opportunities searched (effort) with each number having the same chance. The associated DOLs for the actual opportunities found are randomly assigned based on the range from 2 to 5.5 (in increments of 0.25).

The single task situation was operationalized by providing subjects with a preselected set of investment opportunities from which they had to make an investment selection. The number of investment opportunities available to the single task subjects were matched from the opportunities found by the dual task subjects, for comparability to the dual task experiment. This scenario eliminates the induced moral hazard problem and makes the risk-return trade off the only problem faced by the agents.

3.2.3. Feedback sign

Feedback was manipulated by telling the subjects their prior period's performance. Subjects assigned in negative (positive) feedback treatment were told that they did not (did) perform well in the previous period in that their division net income was below (above) the standard. PS subjects were told if their decisions in the previous period resulted in net income below (negative feedback) or above (positive feedback) a preset standard net income. The relevance of the use of a preset standard in practice can be found in Merchant (1989).

For RPE subjects, they were told whether their decisions in the previous period resulted in net income above (positive feedback) or below (negative feedback) the group's average net income. Payne et al. (1980, 1981) provide justification for the use of

the group average as meaningful feedback and framing for managers. They documented the results of an experiment where managers react to the average profit of their group.

3.3. Administration of the Experiment

This section discusses the administration of the experiment, including the process of recruitment, incentives, experimental tasks, and the manipulation of the uncertainty condition. The uncertainty condition is maintained at a high level for all treatment groups because Frederickson (1992) and Chow and Haddad (1991) report that the theoretical relationships such as the effects of RPE and PS contracts on agent effort and risk selection are different when there is high uncertainty. However, they found that in certainty conditions, those contract types are less relevant.

3.3.1. The subject selection and task assignment

The subjects were recruited from graduate business students in accounting, finance and management courses. The experiments were conducted in a computer laboratory class room. The potential subjects were told by the experimenter about the investment game (with actual cash prize) the subjects would do in the experiment, the estimated time needed, the schedule and the location of the experiment. The subjects were also told that their participation was voluntary and confidential.

The experiments were conducted in fifteen sections. The subjects were assigned randomly among the treatments. Most of the RPE subjects were assigned to groups that consisted of four members.[18] These groups were used to facilitate the measurement of

[18] There is one group that had five subjects. Previous studies vary in the size of the groups. For example, Frederickson (1992) used three person groups of RPE subjects, while Young et al. (1993) used four person groups.

each RPE subject's performance that was determined based upon the group average performance.

3.3.2. The experimental procedure

The experiments used the following procedure (figure 7). First, the subjects received a handout that explained the task environment, the investment opportunities the dual task subjects should find (the first experiment), the concept of degree of operating leverage (DOL), the experimental compensation, and the incentives (prizes) the participants could get through the prizewheel in the experiment (appendix B and C). Second, after the subjects understood the task, the concept of DOL and their incentives, they were asked to practice. They were permitted to practice for two times. This practice case allowed the subjects to familiarize themselves with the use of the computerized procedures in the experiment and the process of the investment game. After the practice session, the subjects were asked to answer some questions to check their understanding of the experimental tasks.

At the third step, the subjects performed the actual experiment by making the effort and risky investment decisions. The actual experiments started with the subjects receiving feedback about their performance in a previous period. Having received the feedback, the dual task subjects were asked to make an effort and a risk level selection and the single task subjects were asked to make a risk level selection only. Actual performance was determined by the effort and the risk selection decisions as well as actual state of nature that was manipulated using a computerized randomization to

Dual task subjects	Both dual task and single task	Single task subjects
	1.1. Read the instructions. 1.2. See the prizewheel demonstration. 2. Do the practice (one or two times). 3. Answer the questions for checking their understanding about the task. 4. Redo the reading and practice if it is necessary (having incorrect answer in step 3). 5. Do the actual experiment.	
	5.1. FEEDBACK IS PROVIDED	
5.2. Choose the effort level.		**5.2. Not applicable.**
5.3. Find the investment opportunities.		5.3. The investment opportunities are provided.
	5.4. Select an investment from the opportunities available.	
	6. Individual and group average net income (NI) are computed. The compensation is determined based upon individual and standard (for PS) and group NI (for RPE). 7. Winning area is determined based upon the utility value of NI and disutility value of effort (for dual task subjects). 8. Answer the exit questionnaire.	
	9. The prizewheel is spun, the prize is paid, and the subjects are thanked and dismissed.	

Figure 7. Experimental procedure

resemble a high uncertainty situation (explained below). After the subjects selected an investment, the computer reported performance (net income) and the hypothetical compensation that affect the subject probability of winning in the lottery. The lottery was used to determine the subjects' actual incentives for participating in the experiment (the detail of the lottery is explained below). Upon completion of the experiment, the subjects were asked to fill out the exit questionnaire (appendix D). Then the drawing for the lottery took place, and the subjects were compensated based on the result of the lottery.

The experiment that tested the hypotheses about the effects of feedback sign and contract type on agent effort was conducted first, followed by the experiment that tested the hypotheses about the effects of feedback sign, contract type and task environments on agent risk selection. The investment opportunities found by subjects in the first experiment were used as the response scale of the dependent variable agent risk selection. This procedure was conducted to maintain the comparability between dual task and single task risk level responses. Figure 7 illustrates these experimental procedures. The procedures were tested first in a pilot study using a similar process.[19] The procedures and protocols of the experiments were also reviewed and certified by the Research Review Committee of the Institutional Review Board at Temple University for the protection of human subjects.

[19] The pilot study was conducted involving eight graduate, seven undergraduate and one non-matriculated students. The pilot checked if the feedback manipulation, contract measures and the instructions were effective and understandable to the subjects. The subjects in the pilot study were asked to do the same task as those in the actual experiment, and were asked whether they understood the instructions and experimental task as expected. Instructions that were perceived by the subjects as ambiguous and/or misleading were revised.

3.3.3. The subjects' incentives

Actual incentives are determined using the Berg et al. (1986) method that induces risk behavior in experimental subjects. In this experiment the subjects are induced to exhibit risk averse behavior and to maximize their net utility by relating their actual incentives with a utility function of salary $U(m)$ and disutility function of effort $V(h)$:

$$U = 473.47 - 473.47e^{(-0.001m/35)}, \quad (15)$$

$$V = e^{315*h} \quad (16)$$

Consistent with the agent risk averse assumption of principal agent theory, the concave utility and convex disutility functions (equations 15 & 16) induce risk and effort averse behavior in the subjects. The procedure is also consistent with previous studies (Frederickson 1992; Kirby 1992).[20] The disutility function of effort was applied only to dual task subjects who had effort level choices. The single task subjects whose only task was to make an investment choice were not induced with effort aversion because investment selection has no cost in this experiment (Demski and Sappington 1987; Dye 1992).

Berg et al.'s method converted the experimental point outcomes to a lottery with a particular probability of winning a preferred dollar-dominated prize (g_1, \$10), and a residual probability of winning a less preferred dollar-dominated prize (g_2, \$6). The

[20] The subjects may be motivated to perform in the experiment by converting their performance directly to cash. However, since the performance is stochastically related to the subjects' actions, the subjects' actions are also influenced by their preference ordering for lotteries. In this situation Berg et al.'s method can be used to control for the subjects' risk attitudes. Selto and Cooper (1990) suggest that the risk inducement may not be effective especially when the experimental task is complex. Post experimental manipulation checks are used in this study, as suggested by Selto and Cooper (1990), to test the effectiveness of the risk inducement.

conversion was done by arranging the possible point outcomes in the experiment on the circumference of the prizewheel according to the risk averse utility and effort averse disutility functions (equations 15 and 16). The wheel was then used to determine whether the subjects won prize g_1 or g_2 by spinning the wheel spinner. If the spinner stopped in the area between 0 and the number of points the subjects had received, they won the preferred prize; otherwise they won the less preferred prize. The conversion of the subjects' salary into points and the arrangement of the points the subjects may have on the circumference of the prizewheel are presented in the conversion table and prizewheel in the experimental instructions (table 4 and figure 1 of appendixes B and C).

3.3.4. The manipulation of environmental uncertainty

All the subjects in all treatments faced the high uncertainty environment. Frederickson (1992) and Chow and Haddad (1991) have documented the significant effects of high environmental uncertainty on agent effort and risk selection respectively in agency settings. The high environmental uncertainty was manipulated following a procedure used by Chow and Haddad (1991) and Kirby (1991). This study used a computerized process to simplify the experimental procedure and to save time.

Consistent with equation 10, the minimum effort was set at five investment searches and the maximum was set at fifteen. As explained above (see the measurement of effort), the subjects were allowed to select an effort level ranging from five to fifteen. The actual minimum number of investment opportunities actually found was set at four, while the actual maximum number would be equal to the number of investment

opportunities searched. Thus, if a fifteen level was chosen, the possible outcomes were 4, 5, ... 15, with each outcome equiprobable (8.3% in this case). The outcomes could never exceed the chosen level of effort.

In the single task environment, only investment selection decisions were made. The subjects were provided with the investment project opportunities that resulted from the randomization process and effort decision of the dual task subjects. This process was conducted to maintain the comparability of the response scale of the single task to dual task groups. After subjects decided their investment project selection, the computer determined the net income based upon the risk level selected and randomized actual state of nature. The states of nature range from 0.5 (poor economic conditions) to 1.5 (good economic condition) in increments of 0.1, and each possibility had the same chance (i.e., 0.9 %) of occurrence.

CHAPTER 4

RESULTS

This chapter reports the preliminary and the statistical analyses for testing the hypotheses. The preliminary analyses describe the subjects participating in the experiments, the results of manipulation checks, and the characteristics of the data regarding the dependent variables in experiment one and experiment two: agent effort and agent risk selection respectively. The statistical analyses report and discuss the results of testing the hypotheses regarding the agent effort and agent risk selections.

4.1. Preliminary Analysis: Subject Demographics, Manipulation Checks and Data Characteristics

Tables 2 and 3 present the sample selection and demographic data of the subjects respectively. There were 97 graduate business students who participated in the experiments. From the sample of 97, 49 were assigned to dual task groups and 48 were assigned to single task groups. All of the 49 dual task subjects answered correctly the manipulation check regarding effort aversion. However, four dual task and two single task subjects failed the risk aversion manipulation check (question 3 in the exit questionnaire).[21] Thus the final samples are 49 subjects for experiment one and 91 subjects for experiment two (table 2).

[21] The four failed dual task subjects were eliminated in risk selection analysis, but they were not eliminated from the effort decision analysis because the ex-ante manipulation check on effort aversion indicates their responses on effort decisions are valid.

Table 2. The Selection of the Subjects

Total subjects				97
Dual task subjects		49		
Answering incorrectly the manipulation check for effort aversion		0		
Answering incorrectly the manipulation check for risk aversion		4		
Total subjects for effort hypotheses	(49-0)			49
Dual task subject group in risk hypothesis testing	(49-4)		45	
Single task subjects		48		
Answering incorrectly the manipulation check for risk aversion		2		
Single task subjects in the risk hypothesis testing	(48-2)		46	
Total subjects for risk hypotheses	(45+46)			91

Table 3. Subject Demographics

Total subjects		97
Demographics:		
Gender:		
Male	43%	
Female	57%	
Age (average in years)	29.4	
Major:		
Accounting	22%	
Finance	23%	
Marketing	20%	
Management	18%	
Others (including non-declared major)	17%	
Work experience (average in years)	4.2	
Minimum work experience (in years)	0	
Maximum work experience (in years)	9	

Table 3 indicates that the subjects consist of 43 % male and 57 % female. The subjects' majors are: accounting (22%), finance (23%), marketing (20%) management (18%), and others (17%). The subjects' work experiences range from 0 to 9 years. The average is 4.2 years. The subjects in experiment one were distributed into four experimental groups while the subjects in experiment two were distributed into eight experimental groups. Table 4 presents the number of subjects, average (unadjusted) response scores and the distribution characteristics (normality) of the data regarding the dependent variables (effort and risk selection) using the Wilk-Shapiro test for each experimental group. The descriptive statistics indicate that subjects under profit sharing (PS) contracts and positive feedback demonstrate the lowest level of effort (7.08), while subjects under relative performance evaluation (RPE) contract and negative feedback demonstrate the highest level of effort (11.25). Those under PS and negative feedback have an effort level of 8.73, and those under RPE and positive feedback indicate an effort level of 8.63.

Regarding risk selections, subjects in the single task environment groups generally selected higher levels of risk than those selected by subjects in the dual task groups (table 4). The lowest risk is selected by the dual task, PS and positive feedback group (2.79), whereas the highest risk is selected by the dual task, RPE and negative feedback group (4.52). The latter is higher than that of the similar group in single task environment (4.38).

Table 4. Descriptive Statistics

Dual tasks				Single task			
PS		RPE		PS		RPE	
Positive feedback	**Negative feedback**	**Positive feedback**	**Negative feedback**	**Positive feedback**	**Negative feedback**	**Positive feedback**	**Negative feedback**
Effort:							
n = 12	n = 13	n = 12	n = 12				
E = 7.08	E = 8.73	E = 8.63	E = 11.25	N/A	N/A	N/A	N/A
$\sigma^2 = 2.99$	$\sigma^2 = 9.22$	$\sigma^2 = 11.25$	$\sigma^2 = 7.11$				
$W_E = .92$	$W_E = .94$	$W_E = .88$	$W_E = .90$				
($p = .32$)	($p = .48$)	($p = .15$)	($p = .20$)				
Risk:							
n = 12	n = 11	n = 11	n = 11	n = 12	n = 11	n = 11	n = 12
R = 2.79	R = 3.07	R = 3.50	R = 4.52	R = 3.60	R = 3.93	R = 3.59	R = 4.38
$\sigma^2 = .49$	$\sigma^2 = .83$	$\sigma^2 = 1.30$	$\sigma^2 = .54$	$\sigma^2 = 1.64$	$\sigma^2 = 1.40$	$\sigma^2 = 1.35$	$\sigma^2 = .96$
$W_R = .89$	$W_R = .89$	$W_R = .93$	$W_R = .92$	$W_R = .90$	$W_R = .92$	$W_R = .93$	$W_R = .91$
($p = .13$)	($p = .15$)	($p = .43$)	($p = .39$)	($p = .23$)	($p = .38$)	($p = .44$)	($p = .25$)

Notes:
E = Average (unadjusted) effort score.
R = Average (unadjusted) score for risk selection.
W_E = The Wilk-Shapiro statistic for effort scores.
W_R = The Wilk-Shapiro statistic for risk selection scores.
Hartley's F test for effort: ratio of the highest to the lowest variances = (3.76), F max = 5.67 (df = 4, 11).
Hartley's F test for risk: ratio of the highest to the lowest variances = 3.35, F max = 7.87 (df = 8, 11).

ANOVA analysis assumes that the data are normally distributed and homoscedastic. The Wilk-Shapiro test is used to test if the dependent variables in each cell are normally distributed, while Hartley's F test is used to indicate if the variances are homogeneous (Kirk 1982; Keppel 1991). The Wilk-Shapiro's *W* statistic across the groups and the Hartley's *F* statistic indicate that the data meet the normality and homoscedasticity assumption, respectively (table 4).

The Wilk-Shapiro *W* statistic can be used to test the normality assumption with small samples. A *W* score close to 1 indicates that the null hypothesis that a sample is derived from a normally distributed population can not be rejected. Hartley's F test which can be used to test the homoscedasticity assumption is conducted by comparing the ratio of the highest and lowest variance among the cells to the F value at F max table. The degrees of freedom are p (the number of all variances) and n - 1 (the number of observations in each cell minus one). The ratio is less than the value at the F max table ($3.76 < 5.67$ and $3.35 < 7.87$ for effort and risk selection, respectively), meaning that the null hypothesis of homogeneous variances can not be rejected.[22]

The results of the manipulation checks indicate that the instructions were perceived as moderately easy to understand by the subjects. The mean rating on the degree of difficulty is 5.77 out of 1 (very difficult) to 7 (very easy) range. The subjects also felt that there was not much pressure in performing the experimental tasks. The subjects completed the experimental tasks including the practice section in about 20

[22] Testing the homogeneity of variances using the Bartlett-Box statistic provides a similar result.

Table 5. The results of manipulation checks

Questions	Average score
1. How difficult did you find the experimental task?	
Very difficult 1 2 3 4 5 6 7 Very easy	5.77
2. Do you agree or disagree with the following statements:	
2a " I felt pressured performing the task."	
Strongly disagree 1 2 3 4 5 6 7 Strongly agree	1.85
2b. The information about my previous performance affects my subsequent decisions.	
Strongly disagree 1 2 3 4 5 6 7 Strongly agree	5.44
2c. It was important to me to compete with other division managers.	PS subjects: 3.17 RPE subjects: 4.20
Strongly disagree 1 2 3 4 5 6 7 Strongly agree	($t_{df=89} = 3.75, p = 0.00$)
2.d. As the salary increases, the probability of winning the lottery increasing at a decreasing rate.	
Strongly disagree 1 2 3 4 5 6 7 Strongly agree	6.5

PS = Profit sharing.
RPE = Relative performance evaluation.

minutes. Table 5 provides the detailed results of the manipulation checks. The responses to questions about the subjects' perception on feedback and contracts (questions 2b and 2c, table 5) indicate that the manipulations of feedback and contract types were effective. The subjects generally agreed that information about previous performance affected their subsequent decisions. The average score was 5.44 out of a 1 (strongly disagree) to 7 (strongly agree) scale.

The subjects' perceptions about the importance of competing was significantly different (table 5, question number 2c, $t_{df=89} = 3.75$, p two-tailed = 0.001) between subjects with the relative performance evaluation contracts (4.20) from that of subjects with the profit sharing contracts (3.17). However, the RPE subject score of 4.20 out of a 1 (strongly disagree) to 7 (strongly agree) range indicates that they do not strongly agree that competing with other managers was important. Finally, the answers on question 2d indicate that the subjects understand that as the salary increases, the probability of winning the lottery increases at a decreasing rate. The average score is 6.5 out of 1 (strongly disagree) to 7 (strongly agree).

4.2. Tests of Hypotheses

This study tested two groups of hypotheses. The first group of hypotheses, tested in experiment one, examine the effects of contract types and feedback on agent effort (hypotheses 1, 5, 5a, 5b, and 5c). The second group of hypotheses, tested in experiment two, examine the effects of contract types, task environments and feedback on agent risk

selection (hypotheses 2, 3, 4, 6a, 6b, and 6c). The sections below discuss the results of each experiment.

4.2.1. Experiment one: The effects of contract type and feedback sign on agent effort (hypotheses 1, 5, 5a, 5b, and 5c)

The results of the main and interaction effects of contract types and feedback on agent effort are presented in table 6. The comparison of cell means are presented in table 7.[23] The results indicate that the effects of contract type (RPE vs. PS) on agent effort (hypothesis one), is highly significant ($F_{df=1,45} = 7.37$, $p = 0.009$). The comparison of means (table 7) shows that the direction of the effect is as predicted. Subjects with RPE contracts demonstrated a higher level of effort (9.92) than subjects with PS contracts (7.85), ($t_{df=47} = 2.72$, p one-tailed = 0.005).

Table 6 also reports that feedback signs (hypothesis 5) have a significant effect on agent effort ($F_{df=1,45} = 7.60$, $p = 0.008$). The comparison of means in table 7 indicates that the direction of the effect is consistent with the expectation. Negative feedback results in higher agent effort (9.93) than that of positive feedback (7.83) with $t_{df=47}=2.76$, p one-tailed = .004.

The interaction effect between contract types and feedback signs is not significant (table 6, $F_{df=1,45} = 0.56$, $p = 0.46$). Thus, the null of hypothesis 5a can not be rejected. This means that the main effects of each factor (contract types and feedback signs) can be considered independently of one another.

[23] The cell means reported in this table and in other tables following the ANOVA results are adjusted for the different number of observations in each cell.

Comparing cell means indicate that feedback signs are more effective with RPE contracts than with PS contracts. RPE subjects with negative feedback exerted significantly higher effort (11.25) than did RPE subjects with positive feedback (8.58). This supports hypothesis 5b (table 7, $t_{df=47} = 2.452$, p one-tailed = .009). For PS contracts (hypothesis 5c), subjects with negative feedback did not significantly exert higher effort (8.62) than did subjects with positive feedback (7.08), with $t_{df=47} = 1.44$, p one-tailed = .079 (table 7).

One potential explanation for the higher level of effectiveness of feedback signs for RPE over PS subjects is that RPE based feedback is more sensitive to individual arousal than PS based feedback. Individual arousal has been documented by previous

Table 6. ANOVA Results: the Effects of Contract Type and Feedback Sign on Agent Effort (Hypotheses 1, 5 and 5a)

Dependent variable: Agent effort					
Hypothesis	**Independent variable**	**Sum of Squares**	**Degrees of Freedom**	**F**	***p***
1	Contract type	52.29	1	7.37	.009
5	Feedback sign	53.92	1	7.60	.008
5a	Contract type by feedback sign	3.94	1	.56	.460
	Model	109.15	3		
	Error	319.16	45		
					$R^2 = .25$

Table 7. Comparison of Means of Agent Effort by Contract Types and Feedback Signs (Hypotheses 5b and 5c)

Contract types	Feedback signs		Row means	t-test of differences*
	Positive	Negative		*p*- values (associated hypothesis)
RPE	8.58	11.25	9.92	2.45 .009 (hypothesis 5b)
PS	7.08	8.62	7.85	1.44 .079 (hypothesis 5c)
Column means	7.83	9.93		2.76 .004 (hypothesis 5)
t-test of differences *p*-values (associated hypothesis)	1.38 .087	2.47 .010	2.72 .005 (hypothesis 1)	

* One-tailed test
RPE: Relative performance evaluation
PS: Profit sharing

The results of the effects of contract type on agent effort corroborate Frederickson's (1992) study. Table 8 presents the summary statistics for the current study and the previous studies. The comparable effect sizes of this study (r = .38) and Frederickson's (r = .36) indicates consistency between the two studies in both the direction and the size of the effect. The two studies are not significantly different (Z =.007, p one-tailed = .473).[24] Considering that this study used different parameters in contract types, utility function (for inducing the risk averse behavior), and effort aversion function (for inducing effort averse behavior) in the experimental stimuli from those of Frederickson, the result indicates that the effect of contract types on agent effort is robust to differences in the experiments.

The results of the effect of feedback sign on agent effort are consistent with Podsakoff and Farh's (1989) study. However, the latter has higher effect sizes. The effect size of RPE feedback in this study (r= .46) is lower than the effect size of high credibility feedback in Podsakoff and Farh (r = .70) , with Z = 1.34, p one-tailed = .090 (table 8). Similarly, the effect size of PS feedback (.29) is lower than that of low credibility feedback in Podsakoff and Farh (.57), with Z = 1.27, p one-tailed = .101. Thus, this study is in agreement with Podsakoff and Farh's in terms of the direction of the effect of

[24] The Z statistic indicates if two studies have different results. The statistic is constructed based on the differences of the effect size of each study being compared, after the effect size is transformed into a Fisher z score (Rosenthal and Rosnow 1991).

Table 8. Comparison of the Current Study and the Previous Studies

	This study	Frederickson (1992)	Chow and Haddad (C&H) (1991)	Podsakoff and Farh (P&F) (1989)
Dependent variable	Agent effort Agent risk selection	Agent effort	Agent risk selection	Performance
Independent variables	Contract types Feedback signs Task environments	Contract types Degrees of common uncertainty	Contract types Degrees of uncertainty	Feedback signs Feedback credibility
Results:				
Effect sizes				
The effect of contract type:				
On agent effort	r = 0.38	r = .36	N/A	N/A
Compared to Frederickson's	$Z = .01, p = .471$			
			High uncertainty;	N/A
On agent risk	Single task; r = .11	N/A	r = .63	
Compared to C & H's	$Z = 2.41, p = .008$			
				N/A
	Dual task; r = .48,	N/A		
Compared to C & H's	$Z = .86, p = .194$			
The effect of feedback signs:	On agent effort: RPE; r = .46	N/A	N/A	On performance: High credibility;
Compared to P&F's, high credibility feedback	$Z = 1.34, p = .090$			r = .70
Compared to P&F's, low credibility feedback	PS; r = .29 $Z = 1.27, p = .101$			Low credibility; r = .57

feedback signs, but not in the size of the effect. The difference in experimental setting between this study and Podsakoff and Farh's may explain this result.

4.2.2. Experiment two: the effects of contract type, task environment and feedback sign on agent risk selection (hypotheses 2, 3, 4, 6, and 7)

The effects of contract type, task environment and feedback sign on agent risk selection are examined using ANOVA. The results are presented in table 9. Tests of hypothesis 2 indicate that the effect of contract types on agent risk selection is significant (table 9, $F_{df=1,83} = 9.12$, $p = 0.003$). The comparison of means between PS agents and RPE agents indicates that the direction is as predicted (table 10). The mean of risk levels for RPE agents (4.00) is higher than that for PS agents (3.35) and is highly significant ($t_{df=89} = 3.01$, p one-tailed = 0.002). However, since there is a significant interaction effect of contract types and task environments, the contract type and task environment can not be interpreted independently (see discussion below).

Tests of hypothesis 3 examine if the task environments (single vs. dual task) affect agent risk selection. As expected, the result provides support for the hypothesis that single task agents are more risk seeking than dual task agents (table 9, $F_{df=1,83} = 3.40$, $p = .069$). The comparison of means in table 10 shows that the average levels of risk taken by single task and dual task agents are 3.88 and 3.48 respectively. The difference is significant ($t_{df=89} = 1.84$, p one-tailed = 0.034).

The interaction effect of contract type and task environment on agent risk selection is significant (table 9, $F_{df=1,83} = 4.11$, $p = 0.046$), and supports hypothesis 4.

Table 9. ANOVA Results. The Effects of Contract Type, Task Environment, and Feedback Sign on Agent Risk Selection

Dependent variable: agent risk selection

Hypothesis	Independent variable	Sum of Squares	Degrees of Freedom	F	*p*
2	Contract type	9.71	1	9.12	.003
3	Task environment	3.62	1	3.40	.069
4	Contract type by task environment	4.38	1	4.11	.046
6	Feedback sign	8.40	1	7.89	.006
6a	Contract type by feedback sign	2.13	1	2.00	.160
-	Task environment by feedback sign	.06	1	.06	.808
-	Contract type by task environment by feedback sign	.14	1	.13	.719
	Model	28.83	7	3.87	.001
	Error	88.38	83		
					$R^2 = 0.25$

Table 10. Comparison of Means of Agent Risk Selection by Contract Type and Task Environment

Contract types	Task environments		Row means	t-test of differences*
	Single task	Dual task		*p*-values (associated hypothesis)
RPE	3.98	4.02	4.00	.13 .448 (hypothesis 4)
PS	3.77	2.93	3.35	2.75 .004 (hypothesis 4)
Column means	3.88	3.48		1.84 .034 (hypothesis 3)
t-test of differences* *p*-values (associated hypothesis)	.71 .241	3.55 .000	3.01 .002 (hypothesis 2)	

* One-tailed test
RPE: Relative performance evaluation
PS: Profit sharing

Because the interaction of contract types and agent risk selection is significant, the main effects of the variables can not be interpreted independently (Keppel 1991). The effect of one variable depends on the level of the other. Comparisons of means in table 10 show that the effects of task environment is higher under PS than that under RPE. Figure 8 illustrates this. PS subjects in single task groups select risk levels (3.77) that are significantly higher (p = .003) than that selected by PS subjects in dual task groups (2.93). For RPE subjects, risk levels of single task groups (3.98) are not significantly different (p = 0.448) from those of dual task groups (4.02).

The interaction between task environment and contract type can also be examined from the contract type perspective. The difference in risk levels between RPE (4.02) and PS subjects (2.93) is significant only when subjects are in the dual task environment ($t_{df=43}$ = 3.55, p one-tailed = 0.000). In single task environments, the difference of risk levels between RPE (3.98) and PS subjects (3.77) is not significant (table 10, $t_{df=44}$ = .71, p one-tailed = 0.241).

The results indicate that Chow and Haddad's (1991) finding that RPE contracts result in higher agent risk selections than PS contracts can only be 'replicated' in dual task, but not in single task situations. The effect size of RPE in dual task situations found in this study (r=.48) is comparable to the effect of RPE (without considering the task environments) found in Chow and Haddad's (r=.63) with Z = 2.41, p one-tailed = .194 (table 8). For the single task situations, this study found a significantly smaller effect

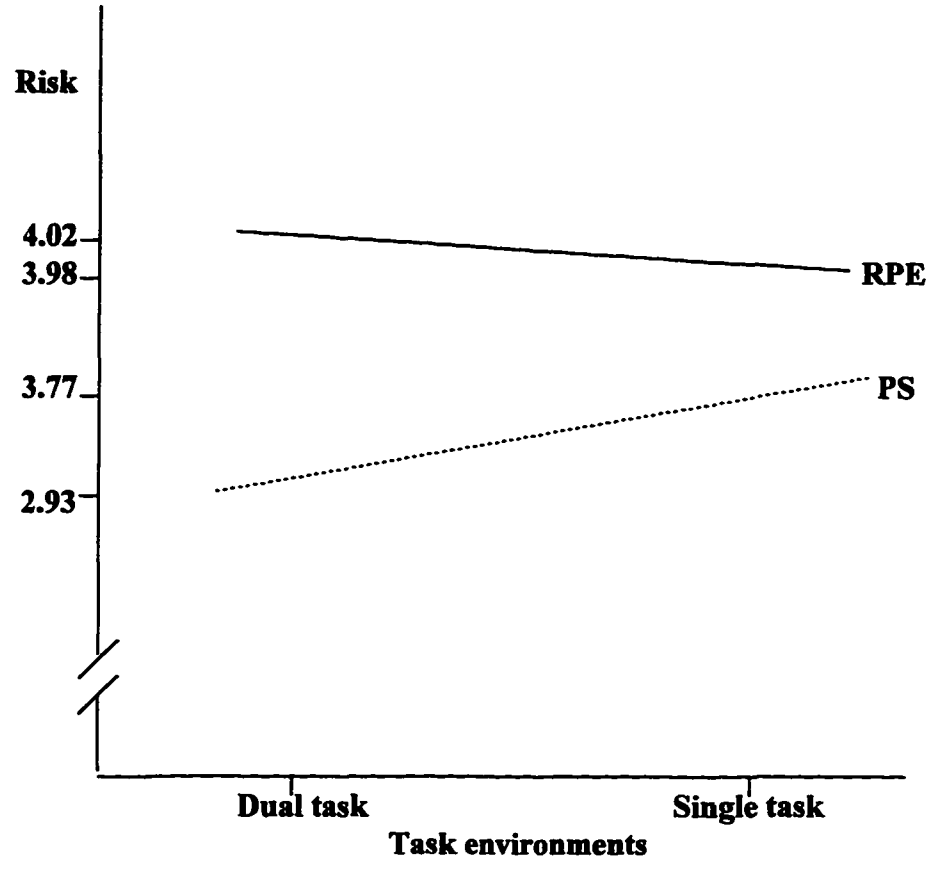

Figure 8. The Interaction effect between contract type and task environment on agent risk selection.

size (r = .11) than that found in Chow and Haddad's (r = .63) with $Z = .86$, p one-tailed = .008.

An interpretation of this result is that the RPE contract may reduce the moral hazard and agent risk aversion exist in dual task environments. Under the PS contract and the dual task situation, agents tend to be risk averse to prevent the superiors' perception that a bad outcome (from a risky project) is a result of low agent effort. Since in RPE contracts agent performance is compared to the peer average, superiors may not perceive that a bad outcome is a result of a low effort. This is because the peer average can reveal information about common uncertainty for principals.

The effect of feedback signs on agent risk selection is significant (table 9, $F_{1,83} = 7.89$, $p = 0.006$), supporting hypothesis 6. The interaction effect of contract types and feedback signs on agent risk selection is not significant (table 9, $F_{1,82} = 2.00$, $p = 0.160$) at conventional levels. Thus, hypothesis 7 is not supported, and feedback signs affect agent risk selection independent of the types of contracts.

In summary, this study found some empirical, experimental evidence about the effects of contract type and feedback sign on agent effort, and the effects of contract types, feedback sign and task environment on agent risk selection. Except for the interaction between contract type and task environment, the interaction effects are not significant.

CHAPTER 5

CONCLUSION

This chapter provides the conclusions of the study, discusses implications of the findings, and offers reasons why some of the hypotheses are not supported. Limitations about the findings and potential extensions of the study are also discussed.

5.1. The Effects of Contract Type and Feedback Sign on Agent Effort

The main effects of contract types and feedback signs on agent effort are significant, but the interaction effect of the two variables is not significant (table 6). RPE contracted agents exert higher effort than do PS contracted agents. Similarly, agents with negative feedback demonstrate higher effort than do agents with positive feedback. The findings about the main effects of contract types and feedback signs on agent effort are consistent with Frederickson's (1992). The findings indicate that the effects of contract types and feedback signs are robust across different contract parameters and experimental stimuli.

The findings about the effects of feedback signs on agent effort are in agreement with Podsakoff and Farh's (1989) in the direction of the effects, but not in the size of the effect. This study found lower effect sizes of feedback signs than those found in Podsakoff and Farh's. One potential explanation for this is the role of incentives in the experimental setting. While subjects in this study were provided with monetary incentives, subjects in the Podsakoff and Farh were not. Monetary incentives may reduce intrinsic motivation of individuals (Pinder 1984).

An implication of these findings in practice is that agents react to negative feedback by increasing their effort. However, this conclusion should be considered with caution. Feedback characteristics such as consistency, relevance, and magnitude have been observed to affect effort and performance (Ilgen et al. 1979; Podsakoff and Farh 1989; Luckett and Eggleton 1991).

Other concerns are about the complexity of reward and performance evaluation systems applied in practice and the personality characteristics of individuals. Companies may use multiple rewards in their performance evaluation system, such as financial and non-financial rewards and objective and subjective evaluation (Huber et al. 1987; Baker et al. 1994; Ittner et al. 1995). These factors may interact with RPE contracts that use financially based measures of performance. Regarding personality characteristics, self esteem and locus of control may affect individual reaction to feedback (Taylor et al. 1984). Further studies should address these variables.

5.2. The Effects of Contract Type, Task Environment and Feedback Sign on Agent Risk Selection

The main effects of contract types, task environments, and feedback signs on agent risk selection are significant (table 9). Agents who have an RPE contract, a single task, or receive negative feedback demonstrate higher risk selections than do agents with a PS contract, dual tasks, or who receive a positive feedback, respectively (table 10 and 11). The significant effect of contract types is consistent with Chow and Haddad (1991). The effect of task environment (dual vs. single task) is consistent with and provides empirical evidence for Demski and Sappington's (1987) proposition. The significant

effect of feedback sign on risk selection indicates the complementarity of agency and prospect theory: even when agents are risk averse, their risk preferences still vary according to the feedback signs.

The interaction effect between contract type and task environment is significant, but the other interactions are not significant (table 9). The significant interaction between contract types and task environment means that the two independent variables must be examined jointly. Looking at the cell means of agents' risk selection according to the contract types and task environment (table 10) indicates that the task environment factor is effective only when the contract type is profit sharing (PS). Under the PS contract, single task agents chose a higher level of risk selection than dual task agents. The evidence also indicates that RPE contracts may reduce agent risk aversion resulting from the dual task environment.

The interaction of contract types and feedback sign is not significant. One potential reason for this result is that the feedback manipulation is not effective enough to be perceived differently by RPE from that of PS subjects. Both RPE and PS subjects were provided with the feedback that their performances were above (positive) or below (negative) the average of the RPE group or the preset standard for PS. This manipulation may drive the result. Another reason is that the use of a between subject design in the experiment can reduce the power of the test of interaction(Kirk 1982).

An implication of the results in practice is that RPE contracts can be used to induce agent risk behavior. Superiors may also use RPE contracts to reduce agency costs

in dual task and multiagent environments. However, some other factors are worth noting in interpreting this result and its implication. The first is about individual risk attitudes. Previous studies indicate that individual risk behavior is a dimension of personality variables and may affect individual decisions (Young 1985). Although this study applied a procedure to induce risk averse behavior (i.e., the Berg et al. method), individual risk attitudes may affect the effectiveness of the procedure. In addition, Selto and Cooper (1990) suggest that there is no procedure to guarantee that the induction of risk behavior is effective. Thus, this study may be extended by considering the effects of risk attitudes as a dimension of a personality variable.

Second, caution should be taken regarding the construct validity of the dependent variable of effort. This study uses a specific measure of effort that focuses on cost. Other experimental studies that measure effort use a setting where the subjects perform certain activities such as building toys, solving puzzles, memorizing and recalling a number of terms, and some other thinking activities (Young et al. 1993; Haka and Ravenscroft 1993; Johnson and Payne 1985). Further studies may consider these types of effort.

Third, care should be taken with respect to the external validity of the findings. Feedback is a complex phenomenon. The psychology and organizational behavior literature indicate that the effect of feedback on individual behavior may depend on contextual factors, such as sources, types, consistency and frequency of feedback messages (Ilgen et al. 1979; Luckett and Eggleton 1991).

5.3. Conclusion, Limitations and Extensions

In sum, this study meets its objectives in these respects. First, empirical evidence was provided on Demski and Sappington's (1987) proposition that single task agents are more risk seeking than dual task agents. Second, the effects of feedback signs persist in an agency setting, but at smaller sizes than those in general social setting. Third, prospect theory complements agency theory in that even if agents are risk averse, their risk selections still vary depending upon feedback signs.

Finally, while the works of Frederickson (1992) and Chow and Haddad (1991) are replicated, this study finds that contract types interact with task environment affecting risk selection. Contract type affects risk selections in dual task, but not in single task environments. Since RPE contracts have been found to be used in actual practice (Maher 1987, Merchant 1989), this finding provide some more explanation and contingencies about the effectiveness of the RPE.

There are four limitations worth noting. First, this study uses certain types of tasks and standard-based pay contracts and parameter values for performance evaluation. Changing these types of contracts and parameter values may change individual responses. Second, managers are evaluated not only for determining their pay but also for other purposes such as promotion and training which are not considered in this study (Huber et al. 1987). These other types of evaluation may also affect manager effort and risk selection. Third, student responses in a single period decision and single or dual task situation in the experiment may not resemble actual manager responses in multiperiod

and multitask situations. Fourth, the average RPE subject response scores on the question 2c (that competing to other managers is important) indicate an indifferent scores (4.20). The levels of pressure (question 2a) also indicate a low score (1.85). These may indicate that the subjects may not sufficiently internalize the manipulation of RPE contracts.

Principal agent theory has been extended analytically to include factors such as job design and technology. Hemmer (1995) suggests that different job designs and technology affect agent effort and productivity. Hemmer showed that the cooperative team approach is effective for enhancing agent effort and productivity in a multistage, high technology manufacturing setting relative to that of an assembly line approach. Hemmer's analysis is consistent with that of Young et al. (1993) and Itoh (1992). The current study defines the dual task environment as two sequential decision tasks. This study should be extended to other job situations such as described in Hemmer (1995).

Replications, experiments using professionals, and case studies examining the practice in actual organizations can be conducted to extend this study. Kaplan and Atkinson (1989) suggest that case studies are important to increase the relevance of management accounting studies. Replications and experiments using professionals can reduce possible noise that exists in the experiment and increase the external validity of the findings (Peters 1993).

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APPENDIX A

DESCRIPTION OF EFFECT SIZE

Rosenthal and Rosnow (1991) and Rosenthal (1991) suggest the use of effect size measure (in addition to significance testing) to analyze the results of studies in behavioral science. This study uses the effect size measure to compare the results to those of previous studies. The measure refers to the magnitude of the relationship in the population, or the degree of departure from the null hypotheses. The measure is important because it indicates the size of effect being hypothesized, since significant (non-significant) statistical tests do not necessarily imply large (small) effects. The effect size measure is developed based on two pieces of information: the statistical significance and the size of study.

In general, effect size, significance test, and size of study relate in the following manner:

Significance test = Size of effect x Size of study.

In t and F test, this relationship can be shown, respectively, as:

$$t = (r/(\sqrt{1 - r^2})) \times \sqrt{df}, \text{ and}$$

$$F = r^2/(1 - r^2) \times df \text{ error}$$

where r is the effect size, t and F are measures of significance tests (with df numerator = 1, and df error = df total - df between).

From those relationships, the effect size is computed for t (r_t) and F test (r_f), respectively, as follows:

$$r_t = \sqrt{(t^2/(t^2 + df))}, \text{ and}$$

$$r_f = \sqrt{(F\ (df_{between}) / (F(df_{between})) + df \text{ error}}$$

APPENDIX B

INSTRUCTIONS FOR THE DUAL TASK SUBJECTS*

- Thank you for taking part in this experiment. Your participation is appreciated and is important for the success of this study. This experiment asks you to act as a division manager who has to make an effort level and an investment selection decision.

- As the manager you will be paid based on your division net income compared to the standard $40,000 net income.

- **As the manager you will be paid based on your division net income compared to the average net income of all divisions in your group.**

- Your decisions will affect your net income and your probability to win a higher prize in a lottery played in the experiment. The greater your effort to search for information is, the higher your personal cost will be, but the more likely it is that you will have more investment opportunities. The more investment opportunities you have, the greater chance you can get more investment alternatives to select to get higher net income. The higher net income increases your probability to win a lottery, while the higher cost of effort reduces your probability to win the lottery. You will get a $10 prize if you win, otherwise you will get $6.

- During the course of this experiment feel free to write any comments on the blank space of this instruction sheet, or to use the space to make any calculation you need. You can also use a calculator to make any calculations you feel would be beneficial.

- Please do not discuss your strategy or performance with other participants during the course of the experiment.

- Please ask any and all questions you have to the experimenter by raising your hand. The experimenter will answer your questions.

* PS and RPE subjects receive different instructions. The differences are indicated in shaded sentences, with RPE instructions printed in larger fonts.
Feedback signs are provided in the computer screen when the subjects do the actual experiment. This is to prevent the possibility of the subjects making a strategy in response to the feedback received during the practice section.

Your job

Assume that you are the manager of Division A in XYZ Company. Top management authorizes and provides you a budget to make an investment project. Thus, as the manager you have two tasks: (1) to search for information about investment opportunities and (2) to select one investment from the opportunities you find.

You can search to find up to fifteen investment opportunities. However, you have to search for at least five investment opportunities, otherwise the top management will find out that you are not performing your job. There is also uncertainty such that you will not always actually find the number of investment opportunities you attempted.

The investment opportunities have the same expected total cost, expected revenue and expected net income. The only difference is their cost structure, or their composition of variable and fixed cost. This is also called the **degree of operating leverage** (DOL). The higher the DOL of a project is, the riskier it is the project. Under good economic conditions (for example, when sales increase), higher DOL projects have higher net income than do lower DOL projects. On the other hand, in bad economic conditions, higher DOL projects have lower net income. Table 1 below illustrates a low and a high DOL project.

Table 1. Degree of operating leverage and its association with net income

Expected Revenue and Costs	Low DOL project	High DOL project
Total revenues (TR)	$250,000	$250,000
Variable costs (VC)	$170,000	$30,000
Contribution margin (CM) = (TR) - (VC)	$80,000	$220,000
Fixed costs (FC)	$40,000	$180,000
Net income (NI)	$40,000	$40,000
Degree of Operating leverage = (CM)/(NI)	2	5.5

Under good economic conditions, for example, if sales increase by 25%, the higher DOL project has a higher increase in net income (137.5%) than does the low DOL project (50%). Similarly, under bad economic conditions, if sales decrease by 50%, the high DOL project has a higher decrease in net income than does the low DOL project. Table 2 on the following page illustrates this.

The uncertainty situation

You face uncertainty so that you do not always find investment opportunities you search for. You have the capacity to search for five to fifteen investment opportunities. You can not exert an effort level by searching for less than five because your superior will find out that you did not perform your job. For any effort level you select, the actual

Table 2. The relationship among DOL, sales increase or decrease on net income

DOL	Good economic conditions (Sales increase by 25%)	Bad economic conditions (Sales decrease by 25%)
Low DOL project (DOL = 2)	Net income increases by 50% (DOL x % change in sales) 2 x 25%	Net income decreases by 50% (DOL x % change in sales) 2 x -25%
High DOL project (DOL = 5.5)	Net income increases by 137.5% (DOL x % change in sales) 5.5% x 25%	Net income decreases by 137.5% (DOL x % change in sales) 5.5% x -25%

number of viable investment opportunities you find will range from four to the number you attempted, with each number having the same chance. Thus, if you attempt to find seven investment opportunities, you may actually find four, five, six, or seven opportunities. Higher effort will result in higher possibility of getting more investment opportunities available for you to select. However, the more the effort level you spend, the higher it is the cost of your effort.

Having exerted effort, you find a number of investment opportunities with the same expected revenue and net income. However, their DOLs differ. Your next task is to select an investment project based on the opportunities you found. Your actual net income will be determined based on you investment selection and an actual economic condition as illustrated in the example below. The actual economic condition fluctuates so that your actual revenues may decrease or increase in the range of 50% to 150% from the expected. Based on the company forecast, the average DOL of the industry is 3.75 and the expected profit of your division is $40,000.

Suppose you search for six investment opportunities and only find five viable projects as illustrated in the following table 2.

Table 3. The list of investment opportunities found

Opportunities found		Expected				
No.	DOL	TR	VC	CM	FC	NI
1	2 (LOW)	$250,000	$170,000	$80,000	$40,000	$40,000
2	2.25	$250,000	$160,000	$70,000	$50,000	$40,000
3	2.50	$250,000	$150,000	$60,000	$60,000	$40,000
4	2.75	$250,000	$140,000	$50,000	$70,000	$40,000
5	5.50(HIGH)	$250,000	$30,000	$220,000	$180,000	$40,000

If the economic condition is very good where the sales increases by 50%, and you select a project with DOL = 2 (Project no. 1), the net income of the new project is $80,000, an increase of 100 %, or $40,000, from the expected (computed as 2 x 50% x $40,000). However, if you select a project with DOL = 5.5 (Project no. 5) the net income is $150,000 an increase of 275%, or $110,000, from the expected (computed as 5.5 x 50% x $40,000).

In the effort and investment selection process, **it is only you who knows your level of effort, the probability of finding the opportunities, your project selection, and the probability of the actual results of your projects**. Top management only knows your net income.

Your compensation

As the manager, your compensation is tied to your division's net income compared to the expected net income ($40,000). You are paid a base salary of $25,000. If your division can achieve a higher net income than the expected ($40,000), you will also be paid a 25 percent bonus of the difference between your division's net income and the expected net income ($40,000). However, your compensation each period can not be higher than $50,000. Thus, if your division net income in a period is less than $40,000 you get a base salary of $25,000. On the other hand if your division net income is $140,000 or higher, your total compensation for that period is $50,000.

As the manager, your compensation is tied to the net income of your division relative to the average net income of the four divisions in your company that share common uncertainty with yours. You are paid a base salary of $25,000. If your division net income is higher than the average, you will also be paid a 25% bonus of the deviation of your division net income from the average net income of the four divisions. The information about the average net income will be provided to you. There is an upper limit of your pay, where the total compensation can not be higher than $50,000.

You will work for one period in the actual experiment. Your compensation in the period will be converted to the cash incentives that you can get via a prizewheel. If you win on the prizewheel, you will receive $10, and if you lose on the prizewheel, you will receive $6. The spinner will be spun at the end of the period, if it stops in your "win" area, you win $10. If the spinner stops outside your "win" area, you win only $6.

The size of your "win" area is determined in two steps. First, your total compensation is converted into degrees, so that it can be placed on the prizewheel.

Second, the size of 'the win" area calculated in the first step is reduced by your cost for exerting effort in searching for the investment opportunities. The conversion of salary and cost into degrees is shown in the compensation and cost conversion on the following page (table 4). The conversion process will indicate that the higher your compensation, the larger your "win" area (and thus the higher the probability of winning), but the higher your effort for finding investment opportunities the smaller your "win" area.

For example, if you exert a total effort of 5 units and get a total compensation of $25,000, your win area will be:

- Conversion of your salary: 242 degrees
- Conversion of your effort cost: 5 degrees
- Your "win" area is from 0 to (242 - 5) = 237 degrees.

If the wheel is spun clockwise and it stops in the area between 0 and 237, say the wheel stops at 230 degree mark, you win and receive $10, otherwise you lose and get $6 (see figure 1 panel (a) on the next page).

Another example, if you exert a total effort of 10 units and get a total compensation of $40,000, your win area will be:

- Conversion of your salary: 322 degrees
- Conversion of your effort cost: 23 degrees
- Your "win" area is from 0 to (322 - 23) = 299 degrees.

If the wheel is spun clockwise and it stops in the area between 0 and 299 degree, you win and receive $10, otherwise you get $6 (see figure 1 panel (b) on the next page).

Now, if you feel that you understand the explanation above, you can proceed to the practice stage. Otherwise please ask your questions to the experimenter.

Table 4. Conversion Table

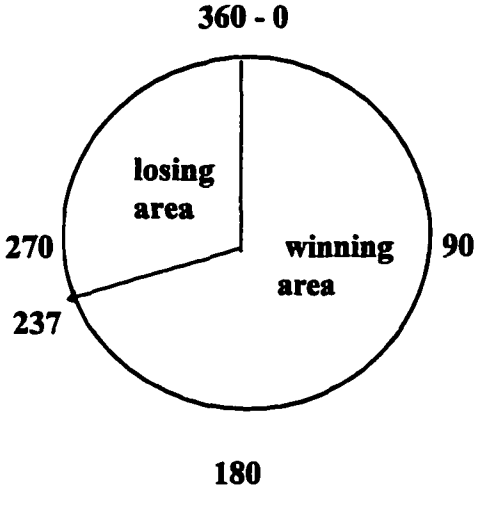
A. From Compensation to degrees

Compensation	Degrees
25,000	242
27,500	258
30,000	273
32,500	286
35,000	299
37,500	311
40,000	322
42,500	333
45,000	343
47,500	352
50,000	360

B. From Effort to degrees

Effort	Degrees
5	5
6	7
7	9
8	12
9	17
10	23
11	32
12	44
13	60
14	82
15	113

(a) Winning area of 237 degrees



(b) Winning area of 299 degrees

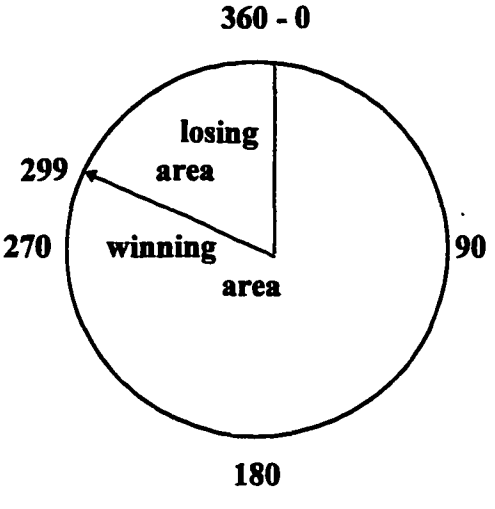


Figure 1. Prizewheel

Practice stage

In the practice stage you will do the following:

1. Choose the effort level you want from 5 to 15 as described above.
2. After choosing your effort level, you will get a number of investment opportunities. The number of investment opportunities depends on the effort level you choose and some uncertainties which is determined randomly by the computer.
3. You select an investment project from the available opportunities.
4. The computer will determine the state of nature and calculate and report the net income.
   You will be provided by the experimenter with the information about your group average net income. Please enter the average information in the indicated box (explained in the computer screen) so that the computer can compute your compensation.
5. Your salary and your "win" area in the prize wheel is determined by the computer. In the practice stage, you will not be actually paid. You will be paid in the actual experiment.

Now you can start the practice by exactly following the instructions below and on the computer screen:

1. Please run on Windows 3.0 or higher.
2. Insert the program disk in drive a or drive b.
3. Click File bar at the top left side of the screen and chose and click the Run button.
4. In the run dialog box type a: PLAY (or b: PLAY if the disk is in drive b) and then press the ENTER-key or click on the OK button.
   In the run dialog box type a: PRACTICE (or b: PRACTICE if the disk is in drive b) and then press ENTER-key or click OK button.
5. Follow the instructions on the screen.
6. When finished, leave the disk in drive a and the Windows program manager open. You can repeat the practice one more time.

Checking your understanding to the experiment

Before you proceed to the actual experiment, please answer the following questions by circling the correct answer.

1. A higher DOL project indicates higher risk.	TRUE	FALSE
2. In a bad economic condition, the higher DOL project has a higher net income than the lower DOL project has.	TRUE	FALSE
3. Increasing the effort level may not only give you more investment opportunities, but also reduces your winning area	TRUE	FALSE
4. The larger your winning area, the greater your expected prize	TRUE	FALSE

The experimenter will give you the correct answers for those questions. If your answers are correct, you are ready to do the actual experiment. If you are ready, please ask for the instruction for the actual experiment. If not, please look back at the instructions in the previous pages or ask the experimenter (by raising your hand) to find out why your answer is incorrect.

Actual stage

This stage is an actual experiment where your performance will determine the prize you can get through the lottery. In this actual stage, you will do the following:

1. Assume you are at the beginning of a new period and just receiving a feedback about your performance in the previous period (the feedback is shown on the screen).
2. Choose the effort level you want from 5 to 15.
3. After choosing your effort level, you will be provided with investment opportunities.
4. Select an investment project from the available opportunities.
5. The computer will determine the state of nature, calculate and report the net income. The net income report is automatically sent to your superior.
   You will be provided by the experimenter with the information about your group's average net income. Please enter the average information in the indicated box (explained in the computer screen) so that the computer can compute your total salary.

7. Your compensation is determined by the computer.

8. Some instructions are presented in the computer screen. Please follow those instructions.

To start, please follow these procedures:

1. On the windows screen, under program manager with the disk in drive a or b, click **File** bar at the top left side of the screen, then choose and click the **Run** selection.
2. In the run dialog box type a: START (or b: START if the disk is in drive b) and then press the ENTER-key or click on the OK button, and follow the instructions on the screen.
2. In the run dialog box type a: INVEST (or b: INVEST if the disk is in drive b) and then press the ENTER-key or click the **OK** button, and follow the instructions on the screen.

APPENDIX C
INSTRUCTIONS FOR THE SINGLE TASK SUBJECTS*

- Thank you for taking part in this experiment. Your participation is appreciated and is important for the success of this study. This experiment asks you to act as a division manager who has to make an investment selection decision.

- As the manager you will be paid based on your division net income compared to the standard $40,000 net income.
- As the manager you will be paid based on your division net income compared to the average net income of all divisions in your group.

- Your decisions will affect your net income and your probability to win a higher prize in a lottery played in the experiment. The higher net income increases your probability to win a lottery. You will get a $10 prize if you win, otherwise you will get $6.

- During the course of this experiment feel free to write any comments on the blank space of this instruction sheet, or to use the space to make any calculation you need. You can also use a calculator to make any calculations you feel would be beneficial.

- Please do not discuss your strategy or performance with other participants during the course of the experiment.

- Please ask any and all questions you have to the experimenter by raising your hand. The experimenter will answer your questions.

* PS and RPE subjects receive different instructions. The differences are indicated in shaded sentences, with RPE instructions printed in larger fonts.
Feedback signs are provided in the computer screen when the subjects do the actual experiment. This is to prevent the possibility of the subjects making a strategy in response to the feedback during the practice section.

Your job

Assume that you are the manager of Division A in XYZ Company. Top management authorizes and provides you a budget to make an investment project by selecting one investment from the investment opportunities provided to you by the research and development division.

The investment opportunities have the same expected total cost, expected revenue and expected net income. The only difference is their cost structure, or their composition of variable and fixed cost. This is also called the **degree of operating leverage** (DOL). The higher the DOL of a project is, the riskier is the project. Under good economic conditions (for example, when sales increase), higher DOL projects have higher net income than do lower DOL projects. On the other hand, in bad economic conditions, higher DOL projects have lower net income. The following table 1 illustrates a low and a high DOL project.

Table 1. Degree of operating leverage and its association with net income

Expected Revenue and Costs	Low DOL project	High DOL project
Total revenues (TR)	$250,000	$250,000
Variable costs (VC)	$170,000	$30,000
Contribution margin (CM) = (TR) - (VC)	$80,000	$220,000
Fixed costs (FC)	$40,000	$180,000
Net income (NI)	$40,000	$40,000
Degree of Operating leverage = (CM)/(NI)	2	5.5

Under good economic conditions, for example, if sales increase by 25%, the higher DOL project has a higher increase in net income (137.5%) than does the low DOL project (50%). Similarly, under bad economic conditions, if sales decrease by 25%, the high DOL project has a higher decrease in net income than does the low DOL project. Table 2 illustrates this.

Table 2. The relationship among DOL, sales increase or decrease and net income

DOL	Good economic conditions (Sales increase by 25%)	Bad economic conditions (Sales decrease by 25%)
Low DOL project (DOL = 2)	Net income increases by 50% (DOL x % change in sales) 2 x 25%	Net income decreases by 50% (DOL x % change in sales) 2 x -25%
High DOL project (DOL = 5.5)	et income increases by 137.5% (DOL x % change in sales) 5.5% x 25%	Net income decreases by 137.5% (DOL x % change in sales) 5.5% x -25%

The uncertainty situation

You will be provided with a number of investment opportunities with the same expected revenue and net income. However, their DOLs differ. Your task is to select an investment project based on the opportunities available to you. Your actual net income will be determined based on your investment selection and an actual state of nature representing the economic condition. Your actual net income will be determined based on your investment selection and an actual economic condition as illustrated in the example below. The actual economic condition fluctuates so that your actual revenues may decrease or increase in the range of 50% to 150% from the expected. Based on the company forecast, the average DOL of the industry is 3.75 and the expected profit of your division is $40,000.

Suppose you are provided with five viable projects as illustrated in table 3.

Table 3. The list of investment opportunities you found

Opportunities found		Expected				
No.	DOL	TR	VC	CM	FC	NI
1	2 (LOW)	$250,000	$170,000	$80,000	$40,000	$40,000
2	2.25	$250,000	$160,000	$70,000	$50,000	$40,000
3	2.50	$250,000	$150,000	$60,000	$60,000	$40,000
4	2.75	$250,000	$140,000	$50,000	$70,000	$40,000
5	5.50(HIGH)	$250,000	$30,000	$220,000	$180,000	$40,000

If the actual state of nature is 1.5 (meaning that sales increases by 50%) and you select a project with DOL = 2 (Project no. 1), the net income of the new project is $80,000, an increase of 100 %, or $40,000, from the expected (computed as 2 x 50% x $40,000). However, if you select a project with DOL = 5.5 (Project no. 5) the net income is $150,000 an increase of 275%, or $110,000, from the expected (computed as 5.5 x 50% x $40,000).

In the effort and investment selection process, **it is only you who knows your level of effort, the probability of finding the opportunities, your project selection, and the probability of the actual results of your projects.** Top management only knows your net income.

Your compensation

As the manager, your compensation is tied to your division's net income compared to the expected net income ($40,000). You are paid a base salary of $25,000. If your division can achieve a higher net income than the expected ($40,000), you will also be paid a 25 percent bonus of the difference between your division's net income and

the expected net income ($40,000). However, your compensation each period can not be higher than $50,000. Thus, if your division net income in a period is less than $40,000 you get a base salary of $25,000. On the other hand if your division net income is $140,000 or higher, your total salary for that period is $50,000

As the manager, your compensation is tied to the net income of your division relative to the average net income of the four divisions in your company that share common uncertainty with yours. You are paid a base salary of $25,000. If your division net income is higher than the average, you will also be paid a 25% bonus of the deviation of your division net income from the average net income of the four divisions. The information about the average net income will be provided to you. There is an upper limit of your pay, where the total compensation can not be higher than $50,000.

You will work for one period in the actual experiment. Your compensation in the period will be converted to the cash incentives that you can get via a prizewheel. If you win on the prizewheel, you will receive $10, and if you lose on the prizewheel, you will receive $6. The spinner will be spun at the end of the period, if it stops in your "win" area, you win $10. If the spinner stops outside your "win" area, you win only $6.

The size of your "win" area is determined based upon your total compensation. The total compensation is converted into degrees, so that it can be placed on the prizewheel according the conversion table (table 4). The conversion process will indicate that the higher your compensation, the larger your "win" area, and thus the higher the probability of winning.

For example, if you get a total compensation of $25,000, your win area will be 242 degrees. If the wheel is spun clockwise and it stops in the area between 0 and 242, say the wheel stops at 230 degree mark, you win and receive $10, otherwise you lose and get $6 (see figure 1 panel (a) on the next page).

Another example, if you get a compensation of $40,000, your win area will be 322 degrees. If the wheel is spun clockwise and it stops in the area between 0 and 322 degree, you win and receive $10, otherwise you get $6 (see figure 1 panel (b) on the next page).

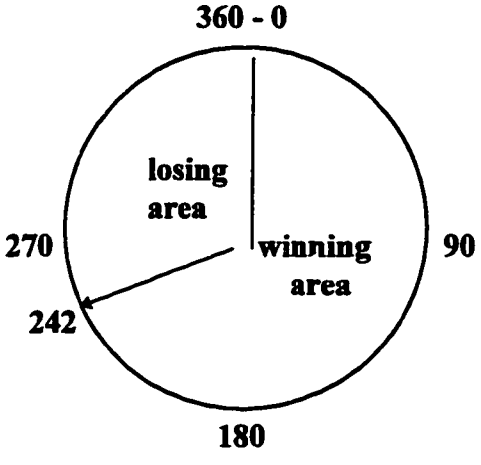
Now, if you feel that you understand the explanation above, you can proceed to the practice stage. Otherwise please ask your questions to the experimenter.

Table 4. Conversion Table

From Compensation to degrees

Compensation	Degrees
25,000	242
27,500	258
30,000	273
32,500	286
35,000	299
37,500	311
40,000	322
42,500	333
45,000	343
47,500	352
50,000	360

(a) Winning area of 242 degrees



(b) Winning area of 322 degrees

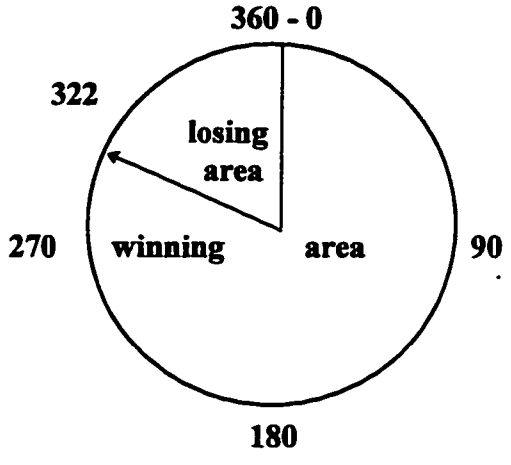


Figure 1. Prizewheel

Practice stage

In the practice stage you will do the following:

1. You will be provided with a number of investment opportunities.
2. Select an investment project from the available opportunities.
3. The computer will determine the state of nature and calculate and report the net income.
   You will be provided by the experimenter with the information about your group average net income. Please enter the average information in the indicated box (explained in the computer screen) so that the computer can compute your compensation.
4. Your salary and your "win" area in the prize wheel is determined by the computer. In the practice stage, you will not be actually paid. You will be paid in the actual experiment.

Now you can start the practice by exactly following the instructions below and on the computer screen:

1. Please run on Windows 3.0 or higher.
2. Insert the program disk in drive a or drive b.
3. Click File bar at the top left side of the screen and chose and click the Run button.
4. In the run dialog box type a: PLAY (or b: PLAY if the disk is in drive b) and then press the ENTER-key or click on the OK button.
   In the run dialog box type a: PRACTICE (or b: PRACTICE if the disk is in drive b) and then press ENTER-key or click OK button.
5. Follow the instructions on the screen.
6. When finished, leave the disk in drive a and the Windows program manager open. You can repeat the practice. You can repeat the practice one more time.

Checking your understanding to the experiment

Before you proceed to the actual experiment, please answer the following questions by circling the correct answer.

1. A higher DOL project indicates higher risk.	TRUE	FALSE
2. In a bad economic condition, the higher DOL project has a higher net income than the lower DOL project has.	TRUE	FALSE
3. In a good economic condition, the lower DOL project has a higher net income than the higher DOL project does.	TRUE	FALSE
4. The larger your winning area, the larger your expected prize.	TRUE	FALSE

The experimenter will give you the correct answers for those questions. If your answers are correct, you are ready to do the actual experiment. If you are ready, please ask for the instruction for the actual experiment. If not, please look back at the instructions in the previous pages or ask the experimenter (by raising your hand) to find out why your answer is incorrect.

Actual stage

This stage is an actual experiment where your performance will determine the prize you can get through the lottery. In this actual stage, you will do the following:

1. Assume you are at the beginning of a new period and just receiving a feedback about your performance in the previous period (the feedback is shown on the screen).
2. Choose the effort level you want from 5 to 15.
3. After choosing your effort level, you will be provided with investment opportunities.
4. Select an investment project from the available opportunities.
5. The computer will determine the state of nature, calculate and report the net income. The net income report is automatically sent to your superior.
   You will be provided by the experimenter with the information about your group's average net income. Please enter the average information in the indicated box (explained in the computer screen) so that the computer can compute your total salary.
6. Your compensation is determined by the computer.
7. Some instructions are presented in the computer screen. Please follow those instructions.

To start, please follow these procedures:

1. On the windows screen, under program manager with the disk in drive a, click **File** bar at the top left side of the screen, then choose and click the **Run** selection.
2. In the run dialog box type a: START (or b: START if the disk is in drive b) and then press the ENTER-key or click on the OK button, and follow the instructions on the screen.
3. In the run dialog box type a: INVEST (or b: INVEST if the disk is in drive b) and then press the ENTER-key or click on the **OK** button, and follow the instructions on the screen.

APPENDIX D
EXIT QUESTIONNAIRE

Please complete the following questions as a final step in the experiment. Your participation in the experiment and your cooperation in providing the following information is sincerely appreciated.

Major:_____
Gender: (Check one) Male _____ Female _____
Age: _____ years.
Work experience in management related area: _____ years.

Please circle the number on each of the following scales that reflects your feelings about the question.

1. How difficult did you find the experimental task ?
Very difficult 1 2 3 4 5 6 7 Very easy

2. Do you agree or disagree with the following statements:

2a " I felt pressured performing the task."
Strongly disagree 1 2 3 4 5 6 7 Strongly agree

2b. "The information about my previous performance affects my subsequent decisions."
Strongly disagree 1 2 3 4 5 6 7 Strongly agree

2c. "It was important to me to compete with other division managers."
Strongly disagree 1 2 3 4 5 6 7 Strongly agree

2d. As the salary increases, the probability of winning the lottery increases at a decreasing rate.
Strongly disagree 1 2 3 4 5 6 7 Strongly agree

3. If in the experiment you have the alternatives below, which one would you choose: (check one)? (For the single task subjects this question is provided without effort factor, and the alternative two lotteries have the same expected value).

_____ Exerting effort 5 units and having 50% probability to earn $40,000 and 50% probability to earn $25,000
_____ Exerting effort 10 units and having $40,000 for sure.
_____ I am indifferent between the two lotteries above.