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UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

THE EFFECTS OF FUNCTIONAL FIXATION
ON RELATIVE PERFORMANCE EVALUATIONS

A Dissertation

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

Doctor of Philosophy

By

MARGARET N. BOLDT

Norman, Oklahoma

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THE EFFECTS OF FUNCTIONAL FIXATION
ON RELATIVE PERFORMANCE EVALUATIONS

A Dissertation APPROVED FOR THE
SCHOOL OF ACCOUNTING

BY

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ABSTRACT

Relative performance evaluations require evaluators to assess managers' performance levels, relative to the performance of other managers who face the same operating conditions. When accounting-based performance measures are used for relative performance evaluations, evaluators must filter out the effects of common factors that differentially affect those measures. Research has demonstrated that accounting information users frequently exhibit functional fixation by fixating on accounting measures and failing to adequately adjust their decision processes when the method of calculation and/or the outcome of an accounting measure changes. This study uses a relative performance evaluation task to investigate the hypothesis that the degree of bias from functional fixation varies with context.

The direction of a change in performance measure outcomes (increase versus decrease) and ambiguity (high versus low) were manipulated in a 2 X 2 between-participants experiment. Participants were business students in graduate accounting classes. The participants

played the role of an evaluator in a multi-divisional firm. Each condition of the task supplied historical return on investment percentages and evaluation scores for the prior five years. In addition, the task supplied the expected return on investment percentage and evaluation score for the upcoming period. Then, a common factor that differentially affected return on investment percentage for each division was described along with the actual return on investment percentages. The difference between the actual and expected return on investment percentages was entirely attributable to the common factor. The difference between expected and elicited evaluation scores measured the degree of bias from functional fixation in each evaluation.

The results indicate that the degree of bias in evaluations varies with the direction of change in performance measure outcomes. Specifically, the hypothesis that bias is greater when performance measures decrease was generally supported. The manipulation check for ambiguity revealed that participants did not perceive

a difference in the two ambiguity conditions. Still, the hypothesis that bias is greater in more ambiguous contexts was partially supported. The implication is that management accountants should provide evaluators with performance measures that remove the effects of common factors.

I. INTRODUCTION

Prior analytical research (e.g., Holmstrom 1979; Lazear and Rosen 1981) has demonstrated the benefits of using relative performance evaluation when it is costly to measure each manager's effect on firm profitability. Further, survey research (Reece and Cool 1978; Dean, Joye and Blayney 1991) has found that many manufacturing companies rely on accounting-based relative performance measures in evaluations¹. The implementation of relative performance evaluation requires evaluators to make judgments about a manager's performance, relative to the performance of peers who faced similar conditions. Specifically, the effects of common factors (e.g., economic booms or busts that affect the entire firm) should be filtered out of managers' evaluations (Holmstrom 1979; Diamond and Verrecchia 1982).

Accounting research (e.g., Ashton 1976; Lockett, Briers, and Chow 1995) has shown that decision makers often suffer from functional fixation, the inability "to

¹See Appendix I for a discussion on the evolution of the relative performance evaluation hypothesis.

look behind the labels attached to accounting numbers..." (Bloom, Elgers, and Murray 1984, p. 1). That is, decision makers functionally fixate on accounting measures and persist in reacting the same way to data when some change has made this reaction inappropriate. Functional fixation, in turn, may prevent evaluators from filtering out the effects of common factors when accounting-based performance measure outcomes are differentially affected by common factors (e.g., return on investment percentages when divisions have different degrees of operating leverage). Further, psychology research has shown that the direction of a change (e.g., a gain or loss) (Kahneman and Tversky 1979; Tversky and Kahneman 1992) and the amount of ambiguity in the decision making environment (Einhorn and Hogarth 1985) affect individual decisions. Therefore, the effects of functional fixation on performance evaluations may vary with the direction of change in performance measure outcomes and the level of ambiguity.

If evaluators do not filter out the effects of common factors when evaluating managers, then the provision and use of peer performance measures may not be useful. For example, suppose the Federal Reserve raises interest rates. In turn, fewer consumers purchase new homes and require new household durable products. As a result, a household durables manufacturing firm experiences a firm-wide sales decline so that all divisions' sales decline by the same percentage. Further, this firm utilizes relative performance evaluation and generally relies on return on investment percentage² as a primary performance measure. If evaluators properly apply relative performance evaluation, then the effect of the sales decline that is attributable to the Federal Reserve's action should be filtered out of managers' evaluations. However, a fixated evaluator will continue to assess managers' performance levels based on their relative return on investment percentages, even though the divisions' return on investment percentages are not

²Return on investment percentage is defined throughout this paper as: $\text{Income}/\text{Investments}$.

equally affected by the sales decline because of differing degrees of operating leverage, average contribution margin ratios, etcetera.

This study uses an experiment to investigate whether the effects of functional fixation vary in different contexts. Two independent variables³ are manipulated: (1) the direction of change in the performance measure outcomes (increase versus decrease) and (2) the level of ambiguity (high versus low). The experiment requires participants to review a performance measure history and an evaluation history for several divisional managers. In addition, expected performance measure outcomes and evaluations for the upcoming period are provided. Then, a common factor, which differentially affects accounting-based performance measure outcomes for the divisions, is described. Importantly, participants are provided with

³The two independent variables were chosen from a large set of possible context variables (e.g., risk, feedback, size of organization, etcetera) because psychology research allows for directional hypotheses. The existence of bias from functional fixation in various contexts has been well documented in the accounting literature (see Appendix II). This study examined how this bias varies in different contexts.

enough information to assess that the difference between expected and actual performance measure outcomes is entirely attributable to the common factor. Finally, evaluations of the divisional managers are elicited.

The difference between elicited and expected evaluations assess the effect of functional fixation in each treatment condition. The results support the hypothesis that evaluations are more affected by functional fixation when performance measure outcomes decrease rather than increase. Next, although the effect was not significant for all evaluations, the results suggest that extremely ambiguous contexts affect the degree of bias from functional fixation in elicited evaluations.

The remainder of this paper proceeds as follows. Section II develops the hypotheses. Section III describes the method while the fourth section discusses the results. Finally, Section V provides some concluding remarks and discusses implications of the findings.

II. THEORY AND HYPOTHESES

Functional Fixation⁴

Psychology research (Duncker 1945; Birch and Rabinowitz 1951; Adamson and Taylor 1954; Flavell, Cooper and Loiselle 1958; Glucksberg and Danks 1967) has shown that individuals functionally fixate on the use of an object and are slow to discover new uses for it. Specifically, psychology researchers have investigated the behavior of individuals attempting to find new uses for objects (e.g., candles, boxes, matches, tacks) after undergoing training with the object for some other use (see Ashton 1976 for a review of this literature or Appendix II of this paper). In accounting, Ijiri, Jaedicke and Knight (1966) speculated that functional fixation may prevent decision makers from adjusting to changes in accounting methods. Several accounting studies (Ashton 1976; Chang and Birnberg 1977; Swieringa, Dyckman and Hoskin 1979; Dyckman, Hoskin and Swieringa 1982; Bloom, Elgers and Murray 1984; Barnes and Webb 1986; Hand

⁴See Appendix II for a literature review of functional fixation research.

1990; Lockett, Briers and Chow 1995) have investigated extensions of this hypothesis and found that some decision makers fixate on accounting measures.

Chang and Birnberg (1977) delineate two distinct varieties of functional fixation. First, decision makers may not adjust their decisions when the method used to calculate the data changes. An inability to adjust to a LIFO-FIFO switch would provide evidence of this first type of data fixity. Second, decision makers may not respond to a change in outcome when the method of calculation does not change. An example of this second type of functional fixation would be an inability to adjust decisions when cost standards change. Chang and Birnberg (1977) found evidence that decision makers have difficulty adjusting to a change in outcome (i.e., the second type of functional fixation).

While a firm rarely changes its method of calculating a particular performance measure, common factors frequently lead to changes in performance measure outcomes. For example, economy-wide booms and busts

affect divisional net income levels and return on investment percentages that are then used in performance evaluations. Hence, evaluators reviewing performance measure outcomes may react inappropriately if they fixate on the accounting-based outcomes. That is, evaluators may fail to adequately adjust performance evaluations when performance measure outcomes change because of a common factor. The above discussion leads to the first hypothesis:

H₁₀: When a common factor causes a change in performance measure outcomes, functional fixation will not bias evaluations of managers.

H_{1A}: When a common factor causes a change in performance measure outcomes, functional fixation will bias evaluations of managers.

Framing

The extent of bias in performance evaluations may vary with the direction of change in performance measures. Psychology research (Kahneman and Tversky 1979; Tversky and Kahneman 1992) has demonstrated that individuals' value functions have different shapes for gains and losses. In Kahneman and Tversky's Prospect

Theory (1979), value functions have two arguments: (1) the initial asset position, or reference point, and (2) the magnitude of change from the initial position. Changes in value framed as gains, or increases relative to the reference point, follow a concave utility function while changes in value framed as losses, or decreases relative to the reference point, follow a convex utility function. Further, decision makers exhibit loss aversion (Tversky and Kahneman 1992) which implies that decreases and increases of the same magnitude do not lead to equal amounts of change in utility; the loss in utility from a decrease is greater than the gain in utility from an increase. Hence, decision makers may react differently to increases and decreases in performance measure outcomes.

The different shapes for gain and loss value functions do not necessarily imply that evaluators are more or less likely to fixate on accounting measure outcomes. However, the framing of a change in performance measure outcomes may cause fixated evaluators to respond differently to increases and decreases. Lipe (1993)

investigated the outcome effect using a task that required subjects to evaluate, on an interval scale, a subordinate's variance investigation decision. Her results demonstrated that evaluations were affected by how evaluators framed the investigation decision's consequences; evaluators penalized decision makers more when expenditures associated with the decision were framed as losses than when they were framed as costs. Specifically, the outcome effect predicts that evaluators who fixate on performance measure outcomes will penalize managers more for perceived decreases than they reward managers for perceived increases. The second hypothesis is as follows:

H₂₀: When a common factor causes a change in performance measure outcomes, the bias evident in evaluations when the performance measure outcomes increase is equal to the bias evident in evaluations when the performance measure outcomes decrease.

H_{2A}: When a common factor causes a change in performance measure outcomes, the bias evident in evaluations when the performance measure outcomes increase is less than the bias evident in evaluations when the performance measure outcomes decrease.

Ambiguity

The variability of historical performance measures may also impact the degree of bias from functional fixation in performance evaluations. Highly variable performance measure histories (i.e., there has been a wide range, both over time and between divisions, of divisional performance measure outcomes in the past) are ambiguous because they report dissimilar signals about performance to the evaluator. Thus, highly variable performance histories do not allow evaluators to rule out sets of distributions for future performance measure outcomes as implausible. For example, consider two divisions that operate in comparable contexts. One has generated return on investment percentages that have varied between 20% and 30% over the last ten years. The other division has earned return on investment percentages that have varied from 0% to 50% over the same time period. When considering the probability that return on investment percentage will be some value in the coming evaluation period, evaluators can eliminate distributions

that include values below 20% and between 31% and 50% for the first division. In contrast, these distributions cannot be eliminated as implausible for the second division.⁵ That is, evaluators are more uncertain about the appropriate distribution to utilize in the case of the second division. This second-order uncertainty makes the context more ambiguous for evaluators of the second division. Ambiguity, in turn, may affect the degree of bias from functional fixation in performance evaluations.

Einhorn and Hogarth (1985) argue that high ambiguity leads to weak expectations and, hence, surprise at an unexpected outcome is unlikely. Thus, when the performance measure history is highly variable,

⁵To see how risk differs from ambiguity, consider a third division in the same operating environment. The third division has generated either 0% or 50% return on investment in each of the last ten years. Although, the third division's data indicates more risk than the first division, it does not create a more ambiguous situation for evaluators than the first division. All but a few distributions, those distributions containing the values 0% and 50%, can be eliminated as implausible when generating probabilities of current period performance measure outcomes occurring. That is, there is "certainty about the uncertainty" (Einhorn and Hogarth 1985) for the third situation.

evaluators may not be surprised by the change in performance measure outcomes. As a result, these evaluators may not consider how the performance measures are generated and, thus, are more likely to fixate on performance measure outcomes.

In contrast, low ambiguity leads to strong expectations and surprise at an unexpected result is likely. Einhorn and Hogarth (1985) do not predict how decision makers will resolve this surprise. However, they do provide evidence that decision makers use simulation processes to assess the underlying generating process and make judgments under ambiguity. Intuitively, this simulation process may lead evaluators who are surprised at unexpected outcomes to consider various reasons for the change in outcomes. In turn, these evaluators are more likely to recognize that the performance measure outcomes changed because of factors affecting all managers. Thus, evaluators in an environment with low ambiguity should exhibit less bias from functional

fixation in a high ambiguity context. Formally, the third hypothesis is as follows:

H₃₀: When a common factor causes a change in performance measure outcomes, the bias in evaluations when performance measure outcomes are more ambiguous is equal to the bias in evaluations when performance measure outcomes are less ambiguous.

H_{3A}: When a common factor causes a change in performance measure outcomes, the bias in evaluations when performance measure outcomes are more ambiguous is greater than the bias when performance measure outcomes are less ambiguous.

III. METHOD

Overview

The experiment provided participants with background information about the firm as well as historical performance measure outcomes (i.e., return on investment percentages) and evaluations for several divisional managers. In addition, the task presented expected evaluations and performance measure outcomes for the upcoming period. After seeing actual performance measure outcomes, subjects were asked to evaluate the divisional managers for the period.

Participants

The task was distributed during class meeting times to 129 graduate business students who were enrolled in graduate accounting courses at two universities. Graduate business students, rather than managers at one or a few organizations, were selected to serve as participants so that company-specific evaluation procedures would not confound the results.

The analysis that follows was performed on data collected from 96 participants (24 in each cell of the design). Of the 129 participants who completed the instrument, 13 were dropped because they erroneously indicated that return on investment percentage was equal to Sales/Operating Leverage or Sales/Investments. Of the remaining 116 participants, 12 were excluded because they were unable to calculate degree of operating leverage (5 participants) or correctly indicate whether their task's return on investment percentages had increased or decreased (7 participants). Finally, to obtain an equal number of observations in each cell, 8 participants were

randomly chosen for exclusion. Table 1 summarizes how the 96 participants used in the analysis were determined.

The participants had an average of 4 years of work experience and, on average, had "rarely" or "sometimes" been involved with the evaluation of others in a business environment. Participants listed a wide variety of undergraduate majors with the largest grouping (40 participants) falling in the non-business category. More men (59) than women (37) participated. Also, 19 participants (20%) revealed that they had taken the Test of English as a Foreign Language which indicates that English is not their first language. Table 2, Panels A through D presents a summary of these non-theoretical variables. MANOVA confirmed that none of these non-theoretical variables have a significant effect on the dependent measure. Thus, the analysis was performed on the pool of data collected from the 96 participants described above.

Task

Appendix III contains the instruments used in the study and Appendix IV contains a description of the pilot study used in developing the final version of the task.

The task first briefly describes a fictional company and asks subjects to play the part of an evaluator in a household durables (e.g., washing machines, refrigerators, etcetera) manufacturing firm. Then, the instrument describes the use of return on investment percentage as a performance measure and explains that return on investment percentage, as provided in the task, may not always perfectly describe managers' performance levels. Next, participants reviewed a five year history of return on investment percentages for each of five divisions (Dishwashers Division, Stoves and ovens Division, Small Appliances Division, Washing Machines Division and Refrigerators Division).

After reviewing the return on investment percentage history, participants viewed the expected return on investment percentages for the upcoming period. In

addition to evaluations for the five prior years, the expected evaluation score for the upcoming period was provided. Participants then learned that the Federal Reserve unexpectedly changed interest rates and that this event led to all of the divisions experiencing a percentage change in sales. As a result, the divisions' return on investment percentage outcomes differed from the expected percentages. Actual return on investment percentage outcomes were then provided and participants were asked to evaluate the divisional managers on an interval scale (1 is labeled "Low" and 10 is labeled "High"). Finally, each participant completed a post-experimental questionnaire and responded to manipulation checks of the independent variables.

Design

A 2 X 2 between-participants experiment was used to test the hypotheses. The manipulated independent variables are: (1) the direction of change in performance measure outcomes (increase in return on investment percentages versus decrease in return on investment

percentages) and (2) the level of ambiguity (highly variable versus less variable history of return on investment percentages).

Independent Variables. The direction of change in performance measure outcome was manipulated by varying whether the Federal Reserve's action raised or lowered interest rates. Increase condition participants were told that the Federal Reserve lowered interest rates and that, as a result of the Federal Reserve's action, all divisions experienced a 15% increase in sales. Decrease condition participants learned that the Federal Reserve increased interest rates resulting in a corresponding 15% decrease in sales for all divisions.

Ambiguity was manipulated by varying the range of deviations around a line where return on investment percentage is the dependent variable and period is the independent variable. The lines for both the high and low ambiguity conditions have a slope of 2; that is, both lines predict a 2% increase in return on investment percentage per period. For the low ambiguity condition,

deviations varying from -2% to +2% were randomly drawn to arrive at the return on investment percentages for each of the five periods. Deviations in the high ambiguity condition were randomly drawn from the range -10% to +10%.

Dependent Variable. Return on investment percentage was selected to serve as the performance measure because survey research (Reece and Cool 1978; Dean, Joye and Blayney 1991) has found that it is more widely used than other accounting-based performance measures like residual income. The expected return on investment percentages provided in the task were generated in the same manner as the historical return on investment percentages with the additional constraint that the implicit rank order of the expected return on investment outcomes be the same for both ambiguity conditions. The actual outcomes for divisional return on investment percentages reflect the expected return on investment percentages adjusted for the change in sales due to the Federal Reserve's action. Importantly, participants had enough information to

correctly assess that the difference between expected and actual return on investment percentages can be fully accounted for by the change in sales due to the Federal Reserve's action.

Prior years' evaluations and expected upcoming evaluations were determined by assigning a "5" to the division with the median return on investment percentage for a period and then assigning the remaining four divisions' evaluations so that the implicit rank order of the return on investment percentages was preserved. The difference between the expected evaluation score and the elicited evaluation score measures the bias from functional fixation.

IV. ANALYSIS AND RESULTS

Tests of Bias from Functional Fixation

The first hypothesis predicts that evaluators will fixate on performance measure outcomes and evaluate divisional managers based on outcomes that include effects from common factors. This hypothesis suggests that evaluators will fail to filter out the effect on

accounting-based measures from a firm-wide change in sales when arriving at evaluation scores. The difference between the expected return on investment percentages and the actual return on investment percentages were entirely attributable to the firm-wide change in sales. Thus, evaluators who are able to adapt their decision processes and not functionally fixate on the behavior of return on investment percentages would provide the same evaluation score as the expected evaluation score.

Deviations from the expected evaluation scores provide evidence that evaluators are not able to adjust their evaluation process when the accounting measures change (i.e., the measures contain effects from a factor that should not be included in the evaluation). The absolute values of the differences between expected and elicited evaluation scores are used for statistical tests. The absolute value is used because the increase/decrease manipulation for Hypothesis 2 led participants in the increase condition to provide higher evaluations while decrease condition participants

provided lower evaluations. Table 3 reports the means and standard deviations for the absolute value of the difference between expected and elicited evaluations for all five divisional managers across all conditions. The mean differences are significantly different from zero ($p < .0001$) for all divisions and across all conditions. Participants did not provide the expected evaluation scores. Thus, the null form of Hypothesis 1 is rejected and it can be concluded that participants' evaluations exhibited bias from functional fixation.

Tests of Framing and Ambiguity Hypotheses

Multivariate analysis of variance (MANOVA)⁶ was used to test Hypotheses 2 and 3 about framing and ambiguity. The dependent variable in the analysis is the vector of absolute values of differences between expected and elicited evaluation scores. Larger values in the elements of the vector indicate greater bias from functional fixation. The independent variables are the direction of

⁶The use of repeated measures tests, rather than an average of the differences, is consistent with the tests done in recent functional fixation experiments (see Lockett, Briers and Chow 1995).

change in performance measure outcomes (increase versus decrease) and the level of ambiguity (high versus low). **Framing Effects (Hypothesis 2).** Hypothesis 2 posits a relation between the direction of change in performance measure outcomes (increase versus decrease) and the extent of bias in elicited evaluations. Specifically, the differences are expected to be smaller when the return on investment percentages increase and larger when the outcomes decrease. Panel A of Table 4 presents the multivariate results. The direction of change in performance measure outcome was significant ($p < .0001$). Panel B reports univariate analyses to assess which divisional evaluation scores were affected by the direction of change in performance measure outcome manipulation. The size of the differences was significantly affected by the direction of change in performance measure outcomes for all five divisions ($p < .10$).

An examination of the means reported in Table 3 indicate that the results support the alternative

hypothesis that the deviations will be smaller when performance measure outcomes increase for the Dishwashers Division, Small Appliances Division and Refrigerators Division. The univariate results also indicate that the direction of change in performance measure outcomes is significant for the Stoves and Ovens Division and Washing Machines Division. However, the means in Table 3 show that the effect for these two divisions is in the opposite direction from the predicted result. This unexpected result may have occurred because the expected evaluation scores were on the low end of the response scale. On a ten point scale, the Stoves and Ovens Division had an expected evaluation score of "3" and the Washing Machines Division had an expected evaluation score of "1". Thus, functionally fixated participants were not able to provide responses that exhibited large amounts of bias in the decrease condition. In general, the results support the hypothesis that the direction of change in performance measure outcomes has an effect on

the degree of bias that functionally fixated decision makers will exhibit.

Ambiguity Effects (Hypothesis 3). Hypothesis 3 predicts that the level of ambiguity (low versus high) will have an effect on the size of the difference between elicited and expected evaluation scores. Differences are expected to be larger when ambiguity is higher. The MANOVA results in Panel A of Table 4 indicate that ambiguity has a significant effect on the size of the difference between elicited and expected evaluation scores ($p < .0824$).

The univariate results in Panel B indicate that ambiguity only has a significant effect ($p < .10$) on the differences in two divisions, Dishwashers Division ($p < .0255$) and Small Appliances Division ($p < .0994$). For these two divisions, the means in Table 3 are generally in the expected direction and indicate larger differences when ambiguity is high.

The lack of support for the hypothesis that bias from functional fixation will be greater when ambiguity

is high may be due to an ineffective manipulation of ambiguity. Despite pilot testing (see Appendix IV), subjects in the two ambiguity conditions indicated that they did not perceive significantly different degrees of variability in the data provided in the task ($p < .2097$). Thus, a more pronounced difference in the variability of the provided data may reveal a stronger effect from ambiguity.

The multivariate analyses in Panel A of Table 4 report a significant interaction among ambiguity and direction of change in performance measure outcomes ($p < .0185$). However, the univariate results in Panel B show that this interaction is only significant for the Dishwashers Division ($p < .0169$). For the Dishwashers Division, participants supplied similar scores across ambiguity conditions when performance measure outcomes increased and different scores across ambiguity conditions when there was a decrease in performance measure outcomes (mean for high ambiguity = 3.792 and mean for low ambiguity = 2.583 from Table 3). Because of

the significant interaction term for the Dishwashers Division, any inferences about the main effects for this division should be made cautiously.

V. CONCLUDING REMARKS AND IMPLICATIONS

For the last three decades, accounting researchers have strived to understand when functional fixation will affect decisions and how the bias from functional fixation can be mitigated. Consistent with psychology efforts at debiasing or mitigating bias (Fischhoff 1982), clarification of instructions or experimental stimuli has proven largely unsuccessful⁷. This study first demonstrates that bias from functional fixation exists in four decision contexts for a relative performance evaluation task. Then, it assesses whether the degree of bias from functional fixation varies with the context. The experiment manipulates two context variables: the direction of change in performance measure outcomes (increase versus decrease) and ambiguity (high versus low).

⁷See Appendix II for a review of prior research on functional fixation in accounting.

The results indicate that functional fixation leads to biased relative performance evaluation scores in the four contexts that are examined. Further, the hypothesis that the bias from functional fixation is greater when performance measures decrease is generally supported. The results also suggest that an extreme amount of ambiguity may affect the degree of bias from functional fixation. Although participants did not report differences in the perceived variability of the data provided in the tasks, the hypothesis that highly ambiguous contexts lead to greater bias in evaluation scores was supported for two out of five judgments made by participants. In contexts with either no ambiguity or very high ambiguity, then, differences in the degree of bias may be detectable for all judgments.

The current study focuses on two context variables. Other context variables, like risk and amount of data available, need to be investigated for a more thorough understanding of how context affects the bias from functional fixation. However, it is noteworthy that

evaluations were biased in all four contexts examined in this study. Future research, then, will reveal more insight by continuing efforts at finding contexts where the degree of bias varies rather than trying to demonstrate the non-existence of fixating behavior in some contexts.

Given that all elicited evaluations contained some bias, future research could direct efforts at developing an effective debiasing mechanism for contexts that lead decision makers to make biased judgments that are costly. Note, however, that the task in the current study told participants that simply relying on the accounting measure outcome was insufficient because factors that affect these measures should not necessarily be included in evaluations. Hence, future efforts at informing decision makers about the pitfalls of fixating on accounting measures and not appropriately adapting their decision process are not expected to be successful. Rather, the results from this study suggest that management accountants may need to supply decision makers

with measures that remove the effects of factors that should not be considered by decision makers. Fixated decision makers could then use these measures in the same way as they would be used in the absence of those factors. Of course, the particular accounting measure, decision, decision maker(s) and organization would all determine whether such a debiasing mechanism would meet the organization's cost-benefit criteria.

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TABLE 1

Determination of Participants Included in the Analysis

Participants who initially completed instruments	129
Participants who failed the Return on Investment Percentage manipulation check ^a	(13)
Participants who failed the Degree of Operating Leverage manipulation check ^b	(5)
Participants who failed the Direction of Change manipulation check ^c	(7)
Participants who were randomly eliminated to obtain an equal number of subjects in each cell	(8)
Final number of participants used in the analysis	96

^aThese participants erroneously indicated that return on investment percentage is equal to either Sales/Operating Leverage or Sales/Investments.

^bThese participants indicated a lack of understanding about the relation between Degree of Operating Leverage and Net Income by incorrectly answering the following: "A division with operating leverage of 2 and a sales increase of 10% will experience a ____% increase in net income."

^cThese participants were not able to correctly identify whether return on investment percentages had increased or decreased as a result of the Federal Reserve's action. That is, decrease (increase) condition participants indicated that they believed return on investment percentage had increased (decreased).

TABLE 2**Summary Statistics for Non-theoretical Variables**

Panel A: Descriptive statistics for participants' reported years' of work experience and experience with evaluating others

Variable	Mean	S.D.	Range
Years of experience in a business-related profession	4.021	4.901	0 to 23
Extent of involvement in the evaluation of others in a business environment	2.322	1.080	1 (Never) to 4 (Frequently)

Panel B: Summary of participants' undergraduate majors

Major Area for Undergraduate Degree	Number
Accounting	15
Finance	10
Marketing	7
Management	16
Economics	8
Other	40
Total number of participants	96

Panel C: Summary of participants' gender

Gender	Number (Percent)
Male	59 (61.5%)
Female	37 (38.5%)

Panel D: Summary of participants' reported test experience*

Test	
Graduate Management Admissions Test (GMAT)	90
Graduate Record Examination (GRE)	13
Law School Admissions Test (LSAT)	17
Test of English as a Foreign Language (TOEFL)	19
No tests reported	6

* Some participants reported taking more than one test.

TABLE 3
Test for General Functional Fixation Effects
(Hypothesis 1)
Means* and (Standard Deviations) for
|Expected Score - Elicited Score|
for all Divisions and All Treatment Conditions

Treatment Condition

Division	Increase in Performance Measures / Low Ambiguity n = 24	Decrease in Performance Measures / Low Ambiguity n = 24	Increase in Performance Measures / High Ambiguity n = 24	Decrease in Performance Measures /High Ambiguity n = 24
Dishwashers	1.875 (1.329)	2.583 (1.412)	1.833 (1.307)	3.792 (0.932)
Stoves and Ovens	2.625 (1.689)	2.333 (1.494)	2.792 (1.641)	1.458 (1.532)
Small Appliances	1.500 (1.103)	2.917 (1.692)	2.292 (1.459)	3.167 (1.786)
Washing Machines	4.125 (2.365)	2.750 (2.069)	4.083 (2.376)	2.625 (2.261)
Refrigerators	1.333 (0.963)	1.708 (1.654)	1.417 (1.060)	1.958 (1.160)

*All of the reported means are significantly different from zero ($p < .0001$). The probability of obtaining spurious significant results is somewhat higher than .0001 because of the number of tests being performed. For alpha = .0001, the probability of making one or more Type I errors is .002 (Kirk, 1982, p. 102).

TABLE 4
Analysis of Effects from Context Variables
(Hypotheses 2 and 3)

Dependent Variable:

|Expected Score - Elicited Score| for each divisional evaluation

Panel A: Multivariate Results

Independent Variable	F-Value	p-Value ^a
Ambiguity	2.0276	.0824
Direction of Change in Performance Measure Outcomes	9.2984	.0001
Ambiguity X Direction of Change in Performance Measure Outcome	2.8837	.0185

^aBased on Wilks' criterion.

TABLE 4
Analysis of Effects from Context Variables
(Hypotheses 2 and 3)

Dependent Variable:

|Expected Score - Elicited Score| for each divisional evaluation

Panel B: Univariate Results

Division	Independent Variable	df	Mean Square	F-Value	p-Value ^a
Dishwashers	Ambiguity	1	8.167	5.15	.0255
	Direction of Change	1	42.667	26.93	.0001
	Ambiguity X Direction of Change	1	9.375	5.92	.0169
Stoves and Ovens	Ambiguity	1	3.010	1.19	.2783
	Direction of Change	1	15.844	6.26	.0141
	Ambiguity X Direction of Change	1	6.510	2.57	.1122
Small Appliances	Ambiguity	1	6.510	2.77	.0994
	Direction of Change	1	31.510	13.41	.0004
	Ambiguity X Direction of Change	1	1.760	0.75	.3889
Washing Machines	Ambiguity	1	0.167	0.03	.8577
	Direction of Change	1	48.167	9.34	.0029
	Ambiguity X Direction of Change	1	0.042	0.01	.9286
Refrigerators	Ambiguity	1	0.667	0.43	.5113
	Direction of Change	1	5.042	3.29	.0731
	Ambiguity X Direction of Change	1	0.167	0.11	.7424

^aReported p-values are for the customary one-tailed F-tests for each of the overall null hypotheses. This reporting format is consistent with the contemporary practice of treating the entire family of interesting contrasts associated with each treatment and interaction as the conceptual unit for the error rate (Kirk, 1982, pp. 104-105)

APPENDIX I
EVOLUTION OF THE
RELATIVE PERFORMANCE EVALUATION HYPOTHESIS

Management accounting as a discipline provides firms with information that is useful for planning, decision making and controlling (Edwards and Newell 1994). To satisfy information requirements for controlling tasks, early management accounting scholars developed evaluation systems that compared current period performance to some standard performance level (Epstein 1973). In fact, profitability measures were being used to evaluate departments as early as the late 1700s. In addition, historical research (Johnson and Kaplan 1987) has found evidence that periodic cost information was used to compare workers in 19th century textile firms. Thus, the history of using accounting-based performance measures to evaluate employees' performance relative to the performance of other employees is several centuries old.

Currently, management accountants generally advocate that performance evaluation be based on employee performance compared to expected performance measure outcomes that are conditional on the state of nature. For example, management accounting educators teach students to compare divisions' actual performance measure outcomes with expected performance measure outcomes from a flexible budget that reflects actual activity during a period (see Horngren, Foster and Datar 1994). Evaluations based on such comparisons contain the implicit assumption that the manager's action is independent of the state of nature (i.e., the actual activity level). Analytical research (discussed below) has examined the more realistic setting where the manager's action affects the state of nature. Of course, observation of the manager's action (i.e., perfect monitoring of the manager's action) would allow for an optimal solution in this case.

Normative models. Given that perfect observation of the manager's action is generally infeasible, Holmstrom (1979) focuses his efforts on investigating the use of

imperfect information (signals) in improving contracting. His results provide a necessary and sufficient condition for imperfect information about either the manager's action or the state of nature to be valuable. He concludes that generally any information about the manager's action or the state of nature will improve contracting. Hence, accounting information that provides such information will generally improve contracting.

Then, Diamond and Verrecchia (1982) showed the optimality of filtering out the effects of common factors when using performance measures (e.g., stock returns) for contracting purposes. For example, the effect on a firm's stock return from a change in Gross National Product, a factor which affects the stock returns of many firms, should be estimated and filtered out of management contracts. Thus, an optimal contract (assuming that perfect observation of the manager's action is infeasible) evaluates managers on their performance measure outcomes, given the effects of common factors on performance measures.

Lazear and Rosen (1981) extended the use of conditional information about the state of nature to include the performance of peers who have similar responsibilities and face similar working conditions. Specifically, Lazear and Rosen (1981) demonstrate analytically that the use of relative performance evaluations within an organization frequently leads to the same efficient allocation of resources as evaluations based on individual outputs. For upper management positions, the use of relative performance evaluation may be preferable because of the costs involved in observing each manager's contribution to firm profit.

Empirical studies. Janakiraman, Lambert and Larcker (1992) rely on the above theories in defining the relative performance evaluation hypothesis. The hypothesis posits that it is beneficial to evaluate managers on their relative performance levels when all managers are affected by a common shock term. That is, contracts which remove these common factors from the

managers' performance levels will allow for better evaluation of those managers' actions.

Antle and Smith (1986) conducted an early accounting study to test the descriptive validity of the relative performance evaluation hypothesis. The authors use two performance measures, return on assets and return on common stock, to examine the relation between actual (observed) compensation for the three highest paid executives and relative and absolute performance measures. Relative return on assets and relative return on common stock were defined as the portion of these measures that were uncorrelated over time with an index of the industry average for these measures. In contrast, absolute return on assets and absolute return on common stock were measured as the annual reported values for these measures on Compustat. Antle and Smith (1986) describe their results as "mixed" because they are only able to find results consistent with the relative performance evaluation hypothesis for 16 out of 39 firms.

Gibbons and Murphy (1990) also attempted to empirically test whether compensation contracts were consistent with the use of relative performance evaluation. Their study used return on assets and security price return for performance measures. These authors suggest that their results are primarily consistent with the use of relative performance evaluation. However, Janakiraman, Lambert and Larcker (1992) criticize this study for focusing on security price return when annual bonus contracts are generally based on accounting-based performance measures. Further, Janakiraman et al. (1992) point out that the Gibbons and Murphy (1990) results for return on assets are inconsistent with the relative performance evaluation hypothesis.

Janakiraman, Lambert and Larcker (1992) essentially argue that these prior empirical studies did not employ properly specified models. They extend this prior work by using a nonlinear constraint involving the slope coefficients on firm performance and peer performance in

the compensation function and the slope coefficient of firm performance on peer performance. The authors argue that this testing procedure is more appropriate because the relative performance evaluation hypothesis predicts that the peer performance component is completely removed from firm performance that is used in determining compensation. The findings do not support the hypothesis that relative performance evaluation is used in determining cash compensation for chief executive officers.

All of the above empirical studies investigate the relative performance evaluation hypothesis as it relates to top managers of firms. Thus, peer performance is measured as industry performance. In contrast, Lazear and Rosen (1981) discuss the evaluation of multiple managers within a firm (i.e., divisional managers). While the above empirical tests of relative performance evaluation for top managers of firms (e.g., chief executive officers) do not indicate that the relative performance evaluation hypothesis is descriptive of actual contracts,

these studies do not preclude the use of relative performance evaluation within a firm. As discussed below, survey research suggests that organizations utilize both relative performance evaluation and accounting-based performance measures in the evaluation of divisional managers.

Practice. In contrast to evaluations based on individual managers meeting a pre-specified standard performance level (e.g., attaining a budgeted profit level, which is an absolute performance measure), relative performance evaluation only requires the observation of managers' relative contributions to firm profit. Dean, Joye and Blayney (1991) surveyed 2,094 Australian manufacturers about their use of performance measures in evaluating divisional managers. Of the 313 usable responses, 35 percent of firms reported using relative performance measures⁸ to some extent. Thus, a significant portion of firms require evaluators to filter

⁸Dean et al. (1991) define a relative performance measure as a measure used so that "[e]very divisional manager's performance is compared to that of other managers inside or outside of the firm."

out the effects of common factors when evaluating divisional managers.

Managerial accountants are interested in providing accounting-based information that facilitates the evaluation and comparison of managers, units, projects, etcetera within a firm. As a result, managerial accountants have traditionally provided accounting-based performance measures, like return on investment. Dean et al.'s (1991) survey found that 68% of firms reported using return on investment (or assets) to evaluate divisional managers at least some of the time. Further, Dean et al. (1991) conclude from their survey results that "[a]ccounting data unreservedly dominate managers' assessments of divisional performance" (p.24).

Managerial accounting research, then, should be concerned about evaluators' use of accounting-based performance measures when making evaluations of multiple divisional managers within a firm. Specifically, accounting-based performance measures, like net income and return on investment, can be differentially affected

by common factors because divisions have different degrees of operating leverage, contribution margin ratios, etcetera. Yet, many organizations expect evaluators to observe accounting-based performance measure outcomes, filter out the effects of common factors and provide unbiased evaluations of divisional managers' performance levels. The purpose of this study is to assess whether functional fixation interferes with evaluators' ability to achieve this objective in various contexts.

APPENDIX II

LITERATURE REVIEW ON FUNCTIONAL FIXATION

Duncker (1945) was the first to investigate functional fixation in psychology. He hypothesized that an individual's prior use of an object would interfere with his or her ability to discover new uses for the object. That is, the individual would fixate on a prior specialized function of the object and would not view the object as being useful in solving other problems.

Duncker (1945) and a subsequent study by Adamson (1952) tested this hypothesis by giving subjects a simple problem to solve with ordinary objects. For example, the "paperclip problem" (Duncker 1945; Adamson 1952) required subjects to attach four black cardboard squares to a bigger white square and hang the white square from an eyelet screwed into an overhead beam. Solution objects, including several paper clips, were made available to the subjects. To hang the large square from the eyelet, subjects needed to bend one of the paper clips and form a

hook. Adamson (1952) demonstrated functional fixation by comparing the time required to solve the problem for two groups of subjects, an "after pre-utilization" group and a control group. The "after pre-utilization" group had to attach the black squares to the larger white square with the paper clips while the control group received the black squares stapled to the white square. The subjects that used the paper clips for attaching white squares took significantly longer to see a paperclip as being useful in forming a hook.

In a related study, Birch and Rabinowitz (1951) showed that functional fixation occurs even when subjects acquire their experience with the object in a task unrelated to the problem-solving task. First, objects were given training with either an electrical switch or a relay. Then, subjects were asked to solve the two-cord problem⁹ with both the relay and the switch available as

⁹In the two-cord problem, the subject is required to tie together the ends of two cords that are suspended from the ceiling. The problem is that the distance between the cords makes it impossible to tie the cords together if the subject is holding one of the ends. The solution requires that a weight be attached to the end of one of

solution objects. All but two of the subjects chose to solve the problem using the object that they had not used during the training period.

Adamson and Taylor (1954) extended the Birch and Rabinowitz (1951) study and hypothesized that the passage of time between the training period and the problem-solving task would mitigate fixation. Adamson and Taylor (1954) used the same experimental task as Birch and Rabinowitz (1951) and manipulated the amount of time between the two activities. They found support for their hypothesis that functional fixation decreases with the passage of time.

Flavell, Cooper and Loiselle (1958) also tried to show that functional fixation can be mitigated. Specifically, Flavell et al. (1958) tested and found support for their hypothesis that functional fixation would decrease as the number of unusual functions experienced during the training period increased.

the cords. The cord with the weight attached can be set to swing which makes it possible to hold one cord and catch the swinging cord. Then, the two cords can be tied together very easily.

However, they were unable to show a "functional facilitation" effect. That is, subjects were not more likely to choose the object that they had seen used in a variety of ways. Rather, they were less likely to fixate on only one function for the object.

Ashton (1976) notes that the psychology experiments shared three common characteristics. First, all of the studies examined the behavior of subjects attempting to find a new way to use an object after receiving training. Second, the psychology studies investigated the fixation of individuals. Third, the psychology research looked at functional fixation on the uses of ordinary objects. Accounting research has extended the scope of functional fixation beyond the early work in psychology. Specifically, accounting research has investigated functional fixation on the use of accounting system outputs, or data, rather than the use of objects.

Ijiri, Jaedicke and Knight (1966) were the first to suggest that functional fixation may affect managerial decisions based on accounting data. Ijiri, et al. (1966)

extrapolated the results from the psychology studies and argued that accounting output, or data, may be viewed in the same way as the objects used in the psychology studies. They further hypothesized that decision makers who did not understand accounting would continue to use the output in the same way after the accounting method used to generate the output changed.

Many accounting studies (Ashton 1976; Chang and Birnberg 1977; Bloom, Elgers and Murray 1984) have subsequently recognized that the phenomenon described by Ijiri et al. (1966) differs from the functional fixation investigated in the psychology studies. The research in psychology examined fixation on the function of an object while Ijiri et al. (1966) speculate that accounting information users fixate on accounting outcomes. The distinction is not merely semantic. That is, psychology demonstrated functional fixation by showing that individuals did not use the same object when the problem solving environment changed. In contrast, Ijiri et al. (1966) argued that decision makers would continue to use

the same output when the method of calculation changed. That is, the accounting problem is not what changes in Ijiri et al.'s (1966) framework of functional fixation.

Ashton (1976) argued that the extrapolation of functional fixation to accounting could only be made within the context of a modified functional fixation framework. Specifically, Ashton (1976) investigated the extent to which decision makers altered their decision processes after an accounting change. Unfortunately, as Libby (1976) points out, Ashton's (1976) evidence of functional fixation is somewhat questionable because he also manipulated the suggested weighting of the output. As a result, it is impossible to discern if decision makers failed to adequately adjust their decision processes because of functional fixation or the change in weighting of the output.

Chang and Birnberg (1977) redefined functional fixation in accounting as "data fixity". They argued that the fixation concern in accounting is more related to the

theory of set in psychology¹⁰ than it is to functional fixation. In addition, Chang and Birnberg (1977) describe a new type of functional fixation such that decision makers do not respond to a change in the results when the method of calculation does not change. They investigated this variety of functional fixation and found evidence that decision makers have difficulty responding to a change in outcome when they should.

Several other studies (Bloom, Elgers and Murray 1984; Haka, Friedman and Jones 1986; Barnes and Webb 1986; Moon 1990) have contributed to a rich accounting literature on functional fixation by investigating the existence of functional fixation with different types of participants and accounting data. To date, very little has been done to investigate how, or in what contexts, the effects of functional fixation are mitigated or exacerbated. A notable exception is a recent study by

¹⁰Chang and Birnberg (1977) use Kagan and Havemann's (1976) definition of a psychological set. Set is the "preparatory readiness to make a particular response or a tendency to make a given response to a given stimuli." (Chang and Birnberg 1977, paraphrased from Kagan and Havemann 1976).

Luckett, Briers and Chow (1995) which investigated the effects of feedback and incentives on mitigating functional fixation. These authors sought to address the two primary criticisms of accounting functional fixation research: 1) participants are not aware of the problem because they do not receive feedback on their decisions and 2) participants are unwilling to put forth effort to adjust their decision processes without an incentive. Luckett et al. (1995) asked participants to make production output decisions for two products based on either a simple aggregate cost system or an activity-based costing system. Participants in the aggregate cost system were supplied with enough information to make the same "optimal" decisions as participants in the activity-based costing condition. The findings indicate that participants functionally fixated on the cost system data even when they had feedback and were given monetary incentives. This study hopes to expand the accounting literature on functional fixation by investigating

whether the effects of functional fixation differ in various contexts.

APPENDIX III

EXPERIMENTAL INSTRUMENTS

Four forms of the task were used to test the hypotheses. All four forms utilized the same fictional company information, divisions and common factor that affected actual return on investment percentages for the divisions. The forms differed, between-participants, on the level of ambiguity (high versus low) present in the historical information and the direction of change (increase versus decrease) in actual return on investment percentage outcomes during the evaluation period.

The first form presents participants with a return on investment percentage history that contains a low level of ambiguity and a common factor that causes an increase in return on investment percentages for all divisions during the evaluation period. Form 2 uses the same return on investment percentage history (i.e., low level of ambiguity) but describes a common factor which leads to a decrease in return on investment percentages for all divisions during the evaluation period. Form 3

shows a return on investment percentage history with a high level of ambiguity while the common factor causes an increase in return on investment percentages during the evaluation period. Finally, Form 4 uses the same history as Form 3 but describes a decrease in return on investment percentage during the evaluation period. Complete versions of all four forms are presented in this appendix.

FORM 1

LOW AMBIGUITY - INCREASE CONDITION

The low ambiguity-increase condition presented participants with historical return on investment percentages that contained a low level of ambiguity and a common factor which caused an increase in return on investment percentages during the evaluation period. Post-experimental manipulation checks assessed participants' perceptions of variability in the historical data and knowledge that return on investment percentages had increased during the evaluation period.

The instrument was distributed in two envelopes. Envelope 1 contained three pages. The first page described a fictional company and the participant's role as an evaluator. The second page presented a five year history of return on investment percentages and evaluations for five divisional managers. In addition, the expected return on investment percentage and evaluation for the upcoming period was provided. All of this information was presented in both tabular and

graphical form. The third page describes a common factor that caused the actual return on investment percentages for all divisions to be higher than expected. The third page also elicited the participant's evaluations for the five divisional managers.

Envelope 2 contained two pages of demographic and manipulation check questions.

Informed Consent Form
University of Oklahoma
School of Accounting

This is a study being conducted by Margaret Boldt from the School of Accounting. The purpose of this study is to investigate how people make evaluation decisions using managerial accounting information. The results of this study may have implications for future research in human judgment and decision making as well as future accounting research.

While your participation in this study is greatly appreciated, it is entirely voluntary. You will not be penalized in any way by failure to participate. The task should take about 15 minutes to complete. Individual performance will remain completely confidential and results from the study will only be reported at the aggregate level.

If you have questions concerning this experiment following your participation, please feel free to contact Margaret Boldt at (405) 325-4221 for further information. I will also be more than happy to discuss the results of the study with you.

Thank you very much for your participation.

I, _____ (print your name), hereby agree to participate in the above detailed experiment. I retain the right to discontinue participation at any time during the experiment with no adverse consequences. I understand that I am free to refuse to participate and to withdraw from the experiment at any time without prejudice to me. I also understand that, if I am participating in this experiment to obtain course credit and I decide to withdraw from participating, I might not get the course credit associated with the experiment.

Signature

Date

ENVELOPE #1

Open this envelope first. When you have completed the packet inside this envelope, please place the packet inside and seal the envelope.

Assume you serve as Vice-President for a mid-sized manufacturer of household durables (e.g., refrigerators, washing machines, ovens, etc.). As part of your regular duties, you review and evaluate the performance of several division managers.

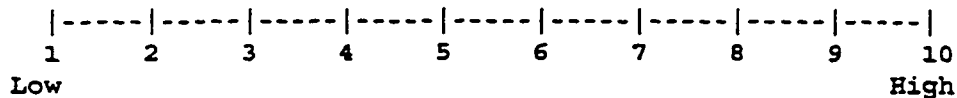
In the past, the firm has used return on investment (i.e., the ratio of net income over investments) as a basis for evaluating division managers. In general, higher return on investment indicates higher performance. However, the firm requires you to review data and assign evaluations because factors outside the managers' control can affect return on investment. Your task, then, is to assign evaluations that reflect managers' performance levels, given the circumstances that the managers worked under during the period.

The table below lists some information about the divisions. Although the investment levels vary, the age of the investments are approximately the same for all divisions. However, the degree of operating leverage differs across the divisions. The degree of operating leverage measures how a percentage change in sales will affect net income.

For example, a division with operating leverage of 2 and a sales increase of 10% will experience a 20% ($2 \times 10\%$) increase in net income.

	Dish- Washers	Stoves & Ovens	Small Appliances	Washing Machines	Refrigerators
Investment	\$400,000	\$1,000,000	\$950,000	\$750,000	\$800,000
Degree of Operating Leverage	1	4	6	5	4

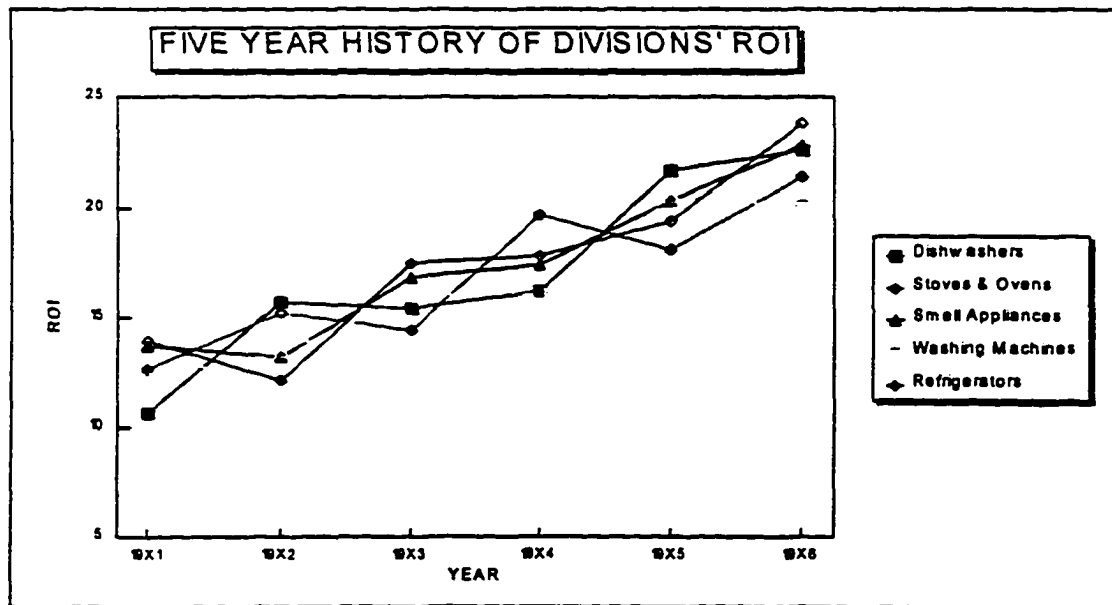
After reviewing carefully the information below, you will be asked to evaluate each division manager's performance level by circling a number on a scale of 1 to 10 as follows:



The table below lists the return on investment (ROI) and evaluation scores for each division manager over the last five years as well as the current ROI expectation for 19X6 performance.

Year		Dish- Washers	Stoves & Ovens	Small Appliances	Washing Machines	Refrigerators
19X1	ROI	10.6%	12.6%	13.7%	12.3%	13.9%
	Evaluation	2	5	7	4	8
19X2	ROI	15.7%	15.2%	13.2%	13.4%	12.1%
	Evaluation	8	7	4	5	2
19X3	ROI	15.4%	14.4%	16.8%	16.0%	17.5%
	Evaluation	4	3	6	5	7
19X4	ROI	16.2%	19.7%	17.4%	16.1%	17.8%
	Evaluation	3	8	5	2	6
19X5	ROI	21.7%	18.1%	20.3%	20.5%	19.4%
	Evaluation	8	2	5	6	4
Expected 19X6	ROI	22.6%	21.4%	22.8%	20.1%	23.8%
	Evaluation	5	3	6	1	7

The graph below depicts the return on investment achieved by each division over the last five years as well as the return on investment that each division is currently expected to achieve in 19X6.

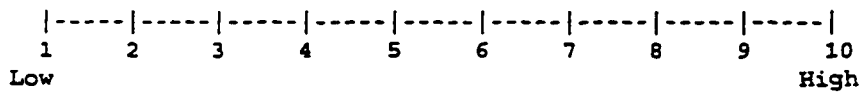


In fact, the Federal Reserve unexpectedly decreased interest rates early in 19X6. As a result, new home sales soared and the demand for household durables rose. Indeed, the decline in interest rates led to an unanticipated 15% increase in sales for all divisions. The table below lists the actual return on investment achieved by each division during 19X6.

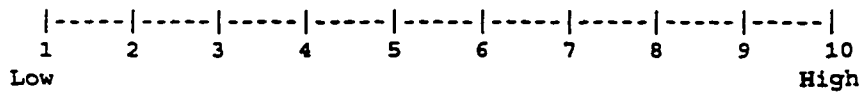
Year		Dish- Washers	Stoves & Ovens	Small Appliances	Washing Machines	Refrigerators
19X6	ROI	26.0%	34.2%	43.3%	35.2%	38.1%

Now that you have reviewed all of the information, please provide evaluations for all division managers by circling a number on the scales that follow.

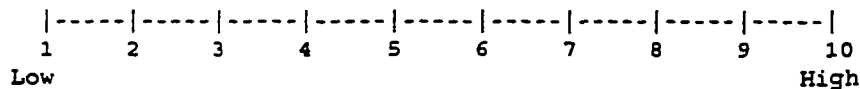
The 19X6 performance of the Dishwashers Division manager was:



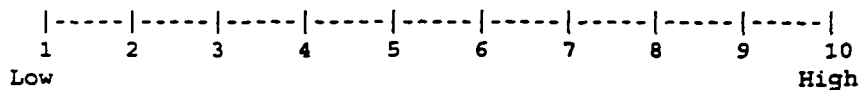
The 19X6 performance of the Stoves & Ovens Division manager was:



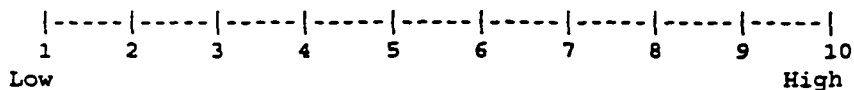
The 19X6 performance of the Small Appliances Division manager was:



The 19X6 performance of the Washing Machines Division manager was:



The 19X6 performance of the Refrigerators Division manager was:



ENVELOPE #2

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THANK YOU FOR YOUR PARTICIPATION!

Now that you have completed the task, I would like to know a little more about you. Your responses to the following items will remain confidential.

1. What is your gender? ☐ male ☐ female
2. Please indicate your educational background.
☐ Some college
☐ Bachelor's degree
☐ Some graduate school
☐ Master's degree (including law degrees) or higher
3. What was your undergraduate major area of study?
☐ Accounting
☐ Finance
☐ Marketing
☐ Management
☐ International Business
☐ Economics
☐ _____ (please list)
4. Which of the following tests have you taken? (Please check all that apply.)
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☐ MCAT ☐ LSAT
5. Approximately how many years of experience do you have in a business-related profession? _____
In what industry did you gain most of your business-related experience? _____
6. To what extent have you been involved in the evaluation of others in a business environment?
☐ Never
☐ Rarely
☐ Sometimes
☐ Frequently

7. The data provided for 19X1 through 19X5 seemed

1 2 3 4 5 6 7 8 9 10
Not at all Highly
Variable Variable

8. In making the evaluation decisions, to what extent did you consider the information provided in the table:

1 2 3 4 5 6 7 8 9 10
Not at all A lot

9. In making the evaluation decisions, to what extent did you consider the information provided in the graph:

1 2 3 4 5 6 7 8 9 10
Not at all A lot

10. The Federal Reserve's action during 19X6 led to an

___ Increase in return on investment
___ Decrease in return on investment

11. Which of the following is the ratio of return on investment (ROI)?

___ investments/net income
___ net income/investments
___ sales/operating leverage
___ sales/investments

12. A division with operating leverage of 2 and a sales increase of 10% will experience a _____% increase in net income.

13. In your opinion, what was the purpose of this experiment?

14. Were there any portions of this task that seemed unrealistic or odd to you?

FORM 2

LOW AMBIGUITY - DECREASE CONDITION

The low ambiguity-decrease condition presented participants with historical return on investment percentages that contained a low level of ambiguity and a common factor which caused a decrease in return on investment percentages during the evaluation period. Post-experimental manipulation checks assessed participants' perceptions of variability in the historical data and knowledge that return on investment percentages had decreased during the evaluation period.

The instrument was distributed in two envelopes. Envelope 1 contained three pages. The first page described a fictional company and the participant's role as an evaluator. The second page presented a five year history of return on investment percentages and evaluations for five divisional managers. In addition, the expected return on investment percentage and evaluation for the upcoming period was provided. All of this information was presented in both tabular and

graphical form. The third page describes a common factor that caused the actual return on investment percentages for all divisions to be lower than expected. The third page also elicited the participant's evaluations for the five divisional managers.

Envelope 2 contained two pages of demographic and manipulation check questions.

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University of Oklahoma
School of Accounting

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If you have questions concerning this experiment following your participation, please feel free to contact Margaret Boldt at (405) 325-4221 for further information. I will also be more than happy to discuss the results of the study with you.

Thank you very much for your participation.

I, _____ (print your name), hereby agree to participate in the above detailed experiment. I retain the right to discontinue participation at any time during the experiment with no adverse consequences. I understand that I am free to refuse to participate and to withdraw from the experiment at any time without prejudice to me. I also understand that, if I am participating in this experiment to obtain course credit and I decide to withdraw from participating, I might not get the course credit associated with the experiment.

Signature

Date

ENVELOPE #1

Open this envelope first. When you have completed the packet inside this envelope, please place the packet inside and seal the envelope.

Assume you serve as Vice-President for a mid-sized manufacturer of household durables (e.g., refrigerators, washing machines, ovens, etc.). As part of your regular duties, you review and evaluate the performance of several division managers.

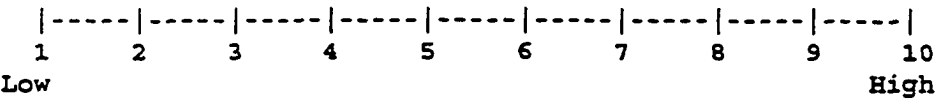
In the past, the firm has used return on investment (i.e., the ratio of net income over investments) as a basis for evaluating division managers. In general, higher return on investment indicates higher performance. However, the firm requires you to review data and assign evaluations because factors outside the managers' control can affect return on investment. Your task, then, is to assign evaluations that reflect managers' performance levels, given the circumstances that the managers worked under during the period.

The table below lists some information about the divisions. Although the investment levels vary, the age of the investments are approximately the same for all divisions. However, the degree of operating leverage differs across the divisions. The degree of operating leverage measures how a percentage change in sales will affect net income.

For example, a division with operating leverage of 2 and a sales increase of 10% will experience a 20% (2 X 10%) increase in net income.

	Dish- Washers	Stoves & Ovens	Small Appliances	Washing Machines	Refrigerators
Investment	\$400,000	\$1,000,000	\$950,000	\$750,000	\$800,000
Degree of Operating Leverage	1	4	6	5	4

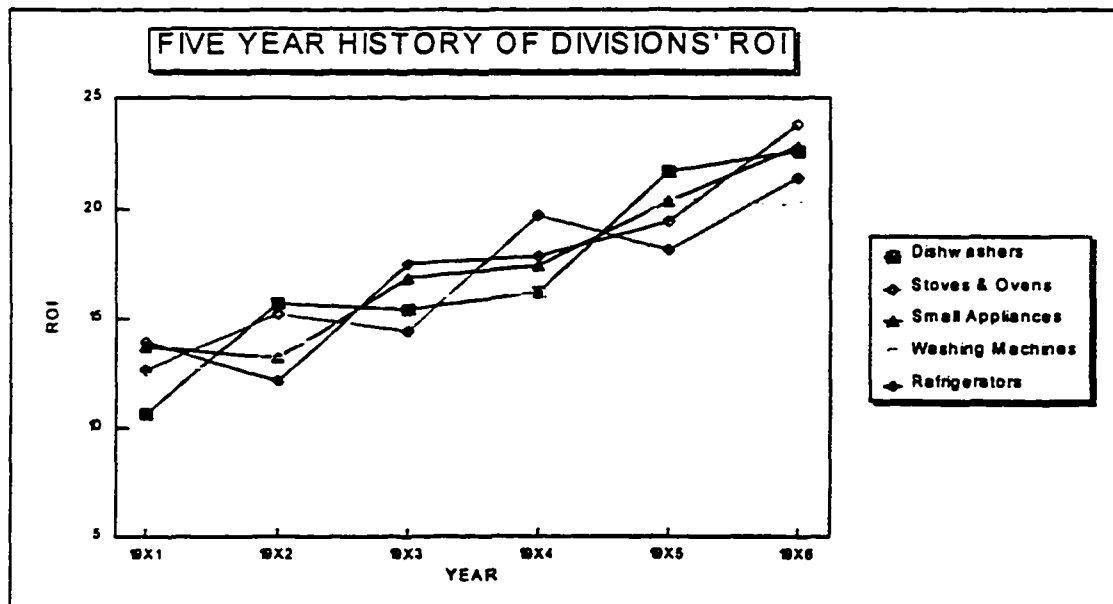
After reviewing carefully the information below, you will be asked to evaluate each division manager's performance level by circling a number on a scale of 1 to 10 as follows:



The table below lists the return on investment (ROI) and evaluation scores for each division manager over the last five years as well as the current ROI expectation for 19X6 performance.

Year		Dish- Washers	Stoves & Ovens	Small Appliances	Washing Machines	Refrigerators
19X1	ROI	10.6%	12.6%	13.7%	12.3%	13.9%
	Evaluation	2	5	7	4	8
19X2	ROI	15.7%	15.2%	13.2%	13.4%	12.1%
	Evaluation	8	7	4	5	2
19X3	ROI	15.4%	14.4%	16.8%	16.0%	17.5%
	Evaluation	4	3	6	5	7
19X4	ROI	16.2%	19.7%	17.4%	16.1%	17.8%
	Evaluation	3	8	5	2	6
19X5	ROI	21.7%	18.1%	20.3%	20.5%	19.4%
	Evaluation	8	2	5	6	4
Expected	ROI	22.6%	21.4%	22.8%	20.1%	23.8%
19X6	Evaluation	5	3	6	1	7

The graph below depicts the return on investment achieved by each division over the last five years as well as the return on investment that each division is currently expected to achieve in 19X6.

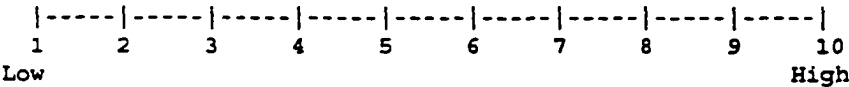


In fact, the Federal Reserve unexpectedly decreased interest rates early in 19X6. As a result, new home sales soared and the demand for household durables rose. Indeed, the decline in interest rates led to an unanticipated 15% increase in sales for all divisions. The table below lists the actual return on investment achieved by each division during 19X6.

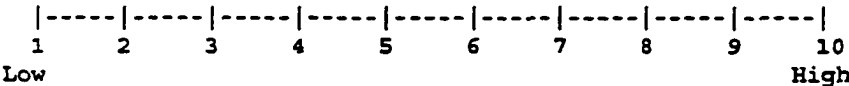
Year		Dish- Washers	Stoves & Ovens	Small Appliances	Washing Machines	Refrigerators
19X6	ROI	19.2%	8.6%	2.3%	5.0%	9.5%

Now that you have reviewed all of the information, please provide evaluations for all division managers by circling a number on the scales that follow.

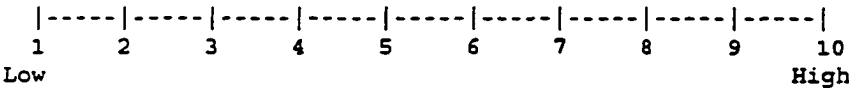
The 19X6 performance of the Dishwashers Division manager was:



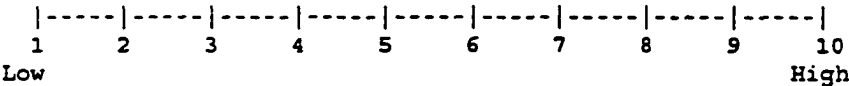
The 19X6 performance of the Stoves & Ovens Division manager was:



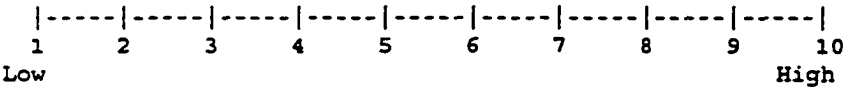
The 19X6 performance of the Small Appliances Division manager was:



The 19X6 performance of the Washing Machines Division manager was:



The 19X6 performance of the Refrigerators Division manager was:



ENVELOPE #2

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THANK YOU FOR YOUR PARTICIPATION!

Now that you have completed the task, I would like to know a little more about you. Your responses to the following items will remain confidential.

1. What is your gender? ☐ male ☐ female
2. Please indicate your educational background.
☐ Some college
☐ Bachelor's degree
☐ Some graduate school
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3. What was your undergraduate major area of study?
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☐ Economics
☐ _____ (please list)
4. Which of the following tests have you taken? (Please check all that apply.)
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6. To what extent have you been involved in the evaluation of others in a business environment?
☐ Never
☐ Rarely
☐ Sometimes
☐ Frequently

7. The data provided for 19X1 through 19X5 seemed

1 2 3 4 5 6 7 8 9 10
Not at all Highly
Variable Variable

8. In making the evaluation decisions, to what extent did you consider the information provided in the table:

1 2 3 4 5 6 7 8 9 10
Not at all A lot

9. In making the evaluation decisions, to what extent did you consider the information provided in the graph:

1 2 3 4 5 6 7 8 9 10
Not at all A lot

10. The Federal Reserve's action during 19X6 led to an

___ Increase in return on investment
___ Decrease in return on investment

11. Which of the following is the ratio of return on investment (ROI)?

___ investments/net income
___ net income/investments
___ sales/operating leverage
___ sales/investments

12. A division with operating leverage of 2 and a sales increase of 10% will experience a _____% increase in net income.

13. In your opinion, what was the purpose of this experiment?

14. Were there any portions of this task that seemed unrealistic or odd to you?

FORM 3

HIGH AMBIGUITY - INCREASE CONDITION

The high ambiguity-increase condition presented participants with historical return on investment percentages that contained a high level of ambiguity and a common factor which caused an increase in return on investment percentages during the evaluation period. Post-experimental manipulation checks assessed participants' perceptions of variability in the historical data and knowledge that return on investment percentages had increased during the evaluation period.

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Signature

Date

ENVELOPE #1

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In the past, the firm has used return on investment (i.e., the ratio of net income over investments) as a basis for evaluating division managers. In general, higher return on investment indicates higher performance. However, the firm requires you to review data and assign evaluations because factors outside the managers' control can affect return on investment. Your task, then, is to assign evaluations that reflect managers' performance levels, given the circumstances that the managers worked under during the period.

The table below lists some information about the divisions. Although the investment levels vary, the age of the investments are approximately the same for all divisions. However, the degree of operating leverage differs across the divisions. The degree of operating leverage measures how a percentage change in sales will affect net income.

For example, a division with operating leverage of 2 and a sales increase of 10% will experience a 20% ($2 \times 10\%$) increase in net income.

	Dish- Washers	Stoves & Ovens	Small Appliances	Washing Machines	Refrigerators
Investment	\$400,000	\$1,000,000	\$950,000	\$750,000	\$800,000
Degree of Operating Leverage	1	4	6	5	4

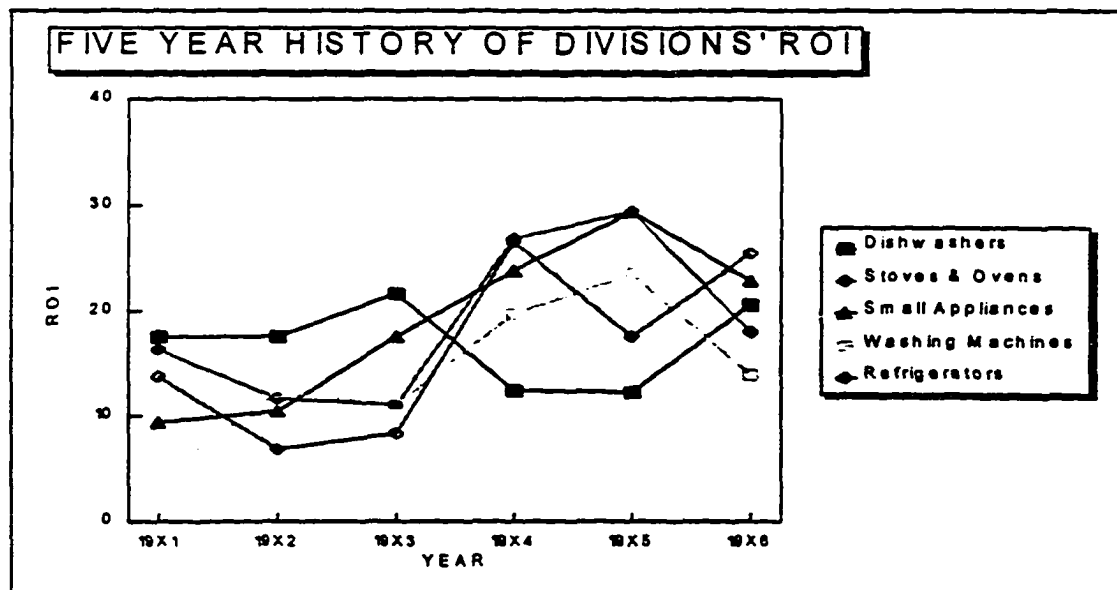
After reviewing carefully the information below, you will be asked to evaluate each division manager's performance level by circling a number on a scale of 1 to 10 as follows:

-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1	2	3	4	5	6	7	8	9	10
Low									High

The table below lists the return on investment (ROI) and evaluation scores for each division manager over the last five years as well as the current ROI expectation for 19X6 performance.

Year		Dish- Washers	Stoves & Ovens	Small Appliances	Washing Machines	Refrigerators
19X1	ROI	17.5%	16.3%	9.4%	4.3%	13.8%
	Evaluation	8	7	3	1	5
19X2	ROI	17.5%	11.7%	10.4%	12.3%	6.9%
	Evaluation	10	5	3	6	1
19X3	ROI	21.7%	11.0%	17.5%	11.1%	8.3%
	Evaluation	10	4	7	5	2
19X4	ROI	12.4%	26.8%	23.8%	19.6%	26.4%
	Evaluation	1	7	5	3	6
19X5	ROI	12.3%	29.4%	29.3%	23.4%	17.6%
	Evaluation	1	7	6	5	3
Expected	ROI	20.5%	18.0%	22.9%	14.0%	25.4%
19X6	Evaluation	5	3	6	1	7

The graph below depicts the return on investment achieved by each division over the last five years as well as the return on investment that each division is currently expected to achieve in 19X6.

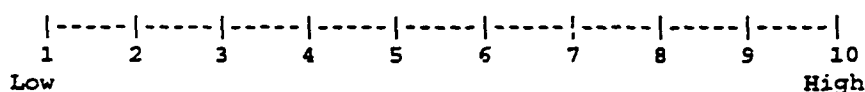


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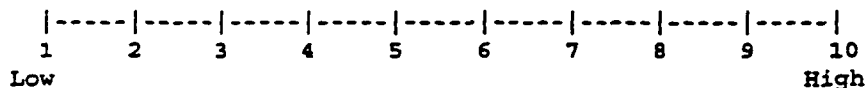
Year		Dish- Washers	Stoves & Ovens	Small Appliances	Washing Machines	Refrigerators
19X6	ROI	23.6%	28.8%	43.5%	24.5%	40.6%

Now that you have reviewed all of the information, please provide evaluations for all division managers by circling a number on the scales that follow.

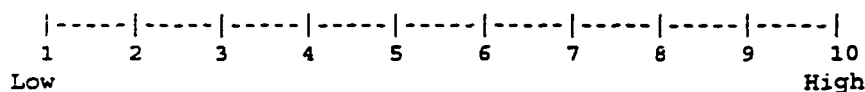
The 19X6 performance of the Dishwashers Division manager was:



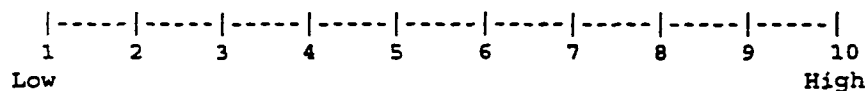
The 19X6 performance of the Stoves & Ovens Division manager was:



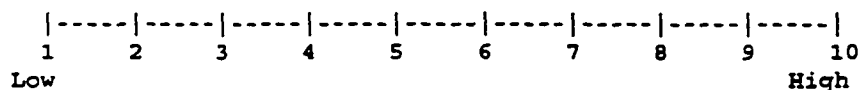
The 19X6 performance of the Small Appliances Division manager was:



The 19X6 performance of the Washing Machines Division manager was:



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ENVELOPE #2

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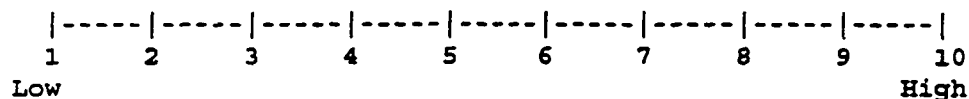
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Investment	\$400,000	\$1,000,000	\$950,000	\$750,000	\$800,000
Degree of Operating Leverage	1	4	6	5	4

After reviewing carefully the information below, you will be asked to evaluate each division manager's performance level by circling a number on a scale of 1 to 10 as follows:



Please Note

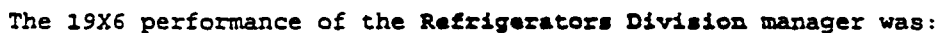
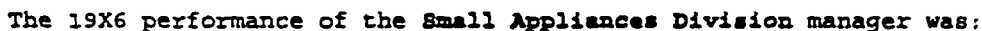
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author or university. Filmed as received.

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UMI

Year		Dish- Washers	Stoves & Ovens	Small Appliances	Washing Machines	Refrigerators
19X6	ROI	17.4%	7.2%	2.3%	3.5%	10.2%

The 19X6 performance of the Dishwashers Division manager was:



ENVELOPE #2

Open this envelope only after you have sealed envelope #1. When you have completed the packet inside this envelope, please place the packet inside and seal the envelope. After you have sealed this envelope, return all of your materials to the experimenter.

THANK YOU FOR YOUR PARTICIPATION!

Now that you have completed the task, I would like to know a little more about you. Your responses to the following items will remain confidential.

1. What is your gender? ☐ male ☐ female
2. Please indicate your educational background.
☐ Some college
☐ Bachelor's degree
☐ Some graduate school
☐ Master's degree (including law degrees) or higher
3. What was your undergraduate major area of study?
☐ Accounting
☐ Finance
☐ Marketing
☐ Management
☐ International Business
☐ Economics
☐ _____ (please list)
4. Which of the following tests have you taken? (Please check all that apply.)
☐ GMAT ☐ GRE ☐ TOEFL
☐ MCAT ☐ LSAT
5. Approximately how many years of experience do you have in a business-related profession? _____
In what industry did you gain most of your business-related experience? _____
6. To what extent have you been involved in the evaluation of others in a business environment?
☐ Never
☐ Rarely
☐ Sometimes
☐ Frequently

7. The data provided for 19X1 through 19X5 seemed

1-----2-----3-----4-----5-----6-----7-----8-----9-----10
Not at all Highly
Variable Variable

8. In making the evaluation decisions, to what extent did you consider the information provided in the table:

1-----2-----3-----4-----5-----6-----7-----8-----9-----10
Not at all A lot

9. In making the evaluation decisions, to what extent did you consider the information provided in the graph:

1-----2-----3-----4-----5-----6-----7-----8-----9-----10
Not at all A lot

10. The Federal Reserve's action during 19X6 led to an

____ Increase in return on investment
____ Decrease in return on investment

11. Which of the following is the ratio of return on investment (ROI)?

____ investments/net income
____ net income/investments
____ sales/operating leverage
____ sales/investments

12. A division with operating leverage of 2 and a sales increase of 10% will experience a _____% increase in net income.

13. In your opinion, what was the purpose of this experiment?

14. Were there any portions of this task that seemed unrealistic or odd to you?

APPENDIX IV

PILOT STUDY DESCRIPTION AND RESULTS

Subjects

A total of 64 instruments were distributed to Cost Accounting students at a large state university. Several instruments were unusable because of incomplete responses (9 participants), failed manipulation checks (6 participants) and unsigned consent forms (1 participant). Cost Accounting students were chosen to serve as pilot study participants because their accounting background should make them more knowledgeable about accounting-based performance measures and, therefore, less likely to exhibit bias from functional fixation in this task. For pilot participants with usable instruments, 97% were accounting majors and 65% had at least some prior experience with evaluating others. The participants had an average of 2 years work experience in business-related professions.

Results

All four cells were included in the pilot study. To assess whether the instrument generated data consistent with the hypotheses, the sum of the absolute values of differences between elicited and the provided evaluations was calculated for each subject. Although statistical tests were not appropriate for the pilot sample, the table below indicates that the cell means are consistent with the conjectures of Hypotheses 1, 2 and 3.

Elicited evaluations are not the same as expected evaluations which indicates a bias from data fixity (Hypothesis 1), the bias is greater when return on investment outcomes increase (Hypothesis 2) and the bias is greater in a more ambiguous environment (Hypothesis 3). Further, participants in the High Ambiguity condition perceived more variability in the data than participants in the Low Ambiguity condition. The average response to the manipulation check regarding variability in the data for High Ambiguity participants was 6.8 compared to an average response of 5.8 for Low Ambiguity participants.

Summary of Pilot Study Results

Condition	Number	Mean	S.D.
Low Ambiguity - Increase	8	12.63	3.50
Low Ambiguity - Decrease	10	16.70	4.88
High Ambiguity - Increase	10	13.00	3.60
High Ambiguity - Decrease	9	20.44	5.54

Changes for the Task Used in the Main Study

Two changes were made to the instrument after the pilot study and before distribution to participants in the main study. First, expected evaluation scores were changed so that they were the same for all versions of the task. This change was necessary to collect responses that could be meaningfully compared among conditions. Second, two questions were added to the exit questionnaire to assess participants' ability to calculate return on investment percentage and their understanding of the relation between degree of operating leverage and changes in net income. These questions were

added to eliminate ignorance as a plausible alternative explanation for responses that are consistent with functional fixation.