PROSPECT THEORY AS AN EXPLANATION FOR THE OBSERVED CHARACTERISTICS OF THE RETURNS-EARNINGS RELATION

by

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The final copy of this thesis has been examined by the signators, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above mentioned discipline.

ABSTRACT

Dehning, Bruce Nelson (Ph.D., Business Administration)

Prospect Theory as an Explanation for the Observed Characteristics of the Returns-Earnings Relation

Thesis directed by Associate Professor Marlys Gascho Lipe

Empirical evidence suggests that the returns-earnings relation has a few particular properties. These include a nonlinear returns-earnings relation, an underreaction to earnings announcements, and a stronger reaction to "bad news" than "good news." In this study, I propose and test a behavioral theory for these characteristics of the returns-earnings relation in the laboratory. The primary contributions of this study are twofold. The first is a theoretical explanation of nonlinearity, underreaction, and an asymmetric response to earnings announcements. The second contribution is a test of whether prospect theory holds in an investment context, where valuation includes future earnings and uncertainty. The results should be useful to both capital markets and judgment and decision making researchers. The results are somewhat mixed. As predicted, the response per unit of surprise decreases as the absolute value of unexpected earnings increase (nonlinear returns-earnings relation). However, the subjects overreacted to earnings surprises, and the reaction to gains was more than the reaction to losses.

DEDICATION

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CHAPTER

I. Introduction

Research on the relation between returns and earnings has a long history. Early work by Ball and Brown (1968) demonstrated that accounting earnings are related to stock price (returns), although the financial statements themselves are not a timely source of information. This returns-earnings relation has been the subject of numerous studies since that time (e.g. Beaver, Clark, and Wright [1979], Kormendi and Lipe [1987], Collins and Kothari [1989], Lipe [1990], Ball and Kothari [1991], Easton and Harris [1991]). Empirical evidence suggests that this relation has a few particular properties. These include a nonlinear returns-earnings relation (Freeman and Tse [1992]), an underreaction to earnings announcements (Bernard and Thomas [1989]), and an asymmetric response to earnings announcements (Sankaraguruswamy [1996], Basu [1997]). In this study, I propose and test a behavioral theory for these characteristics of the returns-earnings relation.

This study tests some of the properties of the returns-earnings relation in the laboratory. An experimental setting provides certain advantages over an archival study. These are primarily due to the control and measurement possible in experiments that are not possible with archival data. The theory proposed is one of individual decision making. In the laboratory, measurement is made on an individual level, which is difficult using archival data.

Kahneman and Tversky (1979) propose prospect theory as an alternative to expected utility theory. Empirical evidence supports prospect theory as being a better description of observed behavior than expected utility theory (Kahneman and Tversky [1979], Tversky and Kahneman [1986]). Other researchers have mentioned prospect

theory as a potential explanation for observed market phenomena. For example, Burgstahler and Dichev (1997) find management's behavior in avoiding earnings decreases and losses consistent with prospect theory. Sankaraguruswamy (1996) proposes prospect theory as an explanation for observed patterns of earnings response coefficients (ERC's).

I show that prospect theory provides an explanation for some empirically observed characteristics of the returns-earnings relation and provides predictions that are best suited to initial examination in the laboratory. The primary contributions of this study are twofold. The first is a theoretical explanation of nonlinearity, underreaction, and an asymmetric response to earnings announcements. The second contribution is to test prospect theory in an investment context, where valuation includes future earnings and uncertainty. The results should be useful to both capital markets and judgment and decision making researchers.

The results of the study are somewhat mixed. As predicted by prospect theory, the response per unit of surprise decreases as the absolute value of unexpected earnings increase (nonlinear returns-earnings relation). However, contrary to prospect theory, the reaction to gains was more than the reaction to losses, and the subjects overreacted to earnings surprises. Observed overreaction is primarily due to a large reaction to small gains and losses.

The remainder of the paper is organized as follows: First, section two contains a discussion of the observed characteristics of the returns-earnings relation. That is followed in section three by a discussion of prospect theory as an explanation for these characteristics. Section four contains a discussion of the impact of individual investors

on market phenomena. Section five covers the experiment and results. Section six discusses possible contributions of this research, and suggestions for further research.

II. Characteristics of the Returns-Earnings Relation

II. 1. Nonlinear Returns-Earnings Relation

Beaver, Clark and Wright (1979) were the first to document a nonlinear returns-earnings relation empirically. There have been several studies recently (e.g., Freeman and Tse [1992], Cheng, Hopwood, and McKeown [1992], Das and Lev [1994], Qi [1995], Subramanyam [1996]) that examine the possible reasons for nonlinearity. Freeman and Tse (1992) examine the returns-earnings relation and propose an S-shape for this relation that is convex for "bad news" and concave for "good news." They find that a nonlinear model has more explanatory power than a linear model, and provides a better explanation for the observed difference between ERC's and P/E ratios. Their primary explanation for their findings is earnings persistence. Persistence in earnings decreases as the magnitude of unexpected earnings increases.

Das and Lev (1994) conduct a variety of tests examining nonlinearity, and conclude that persistence does not account for all the observed nonlinearity. They also find that some nonlinearity exists in the relation between returns and earnings levels, and that the returns-cash flows relation is also nonlinear. After examining multiple alternative explanations for nonlinearity, they are unable to fully explain the relation, concluding that there is a yet-to-be-discovered explanation for nonlinearity.

Focusing on information precision, Subramanyam (1996) shows in an analytical model how the market's uncertainty regarding this precision can lead to an

S-shaped returns-earnings relation. He proposes that accounting earnings are a noisy, but unbiased signal. The market associates decreased precision with higher absolute unexpected earnings, and discounts noisier signals more heavily, leading to an S-shaped returns-earnings relation.

A common technique found in many archival returns-earnings studies is the use of the "unexpected earnings response regression model." Cheng, Hopwood, and McKeown (1992) find that the use of this linear model when a nonlinear model is more appropriate might cause researchers to draw erroneous conclusions. They find pronounced nonlinearity in the returns-earnings relation, evidenced by coefficients of determination (R^2s) which double or triple when the regressor is transformed using various methods.[1] This provides additional motivation for developing theory that predicts not only the shape of the relation, but also the underlying cause of the nonlinearity.

II. 2. Under/Overreaction to Earnings

There is continuing debate among researchers regarding whether the stock market underreacts (Bernard and Thomas [1989], [1990], Freeman and Tse [1989], Bhushan [1994]) or overreacts (DeBondt and Thaler [1985], [1987]). Bernard (1993) discusses this apparent contradiction in detail and concludes that the initial reaction to earnings announcements is too small, and corrected over a period of at least six months. He also proposes that an underreaction to accounting earnings does not preclude a general overreaction of the market away from fundamental values. The present study contributes to this discussion by observing whether individual investors

underreact or overreact to unexpected earnings.

Similar to nonlinearity, underreaction has certain characteristics. Foster, Olsen and Shevlin (1984) find that underreaction varies inversely with firm size, and Bhushan (1994) finds that underreaction is inversely related to trading costs. Bernard and Thomas (1989) find that underreaction is increasing in absolute unexpected earnings. This study will test whether underreaction by individual investors is increasing in absolute unexpected earnings.

Note that underreaction that is increasing in the absolute value of unexpected earnings is one explanation for a nonlinear returns-earnings relation. First consider the theoretical response to small, medium, and large earnings surprises of equal persistence. Assuming that earnings follow a random walk (ARIMA (0,1,0)), ceteris paribus, the theoretical ERC will be the same for small, medium, and large earnings surprises of equal persistence. See Collins and Kothari (1989) for a summary of the theoretical responses under different ARIMA assumptions. For example, suppose that in theory, returns should increase by 10% in response to a 1% shock in earnings (ERC = 10) but for small, medium, and large earnings surprises, the observed ERC's are 9, 7, and 5, respectively. This is consistent with underreaction, and a nonlinear returns-earnings relation.

However, it is possible that the theoretical ERC equals 10, but for small, medium, and large earnings surprises the observed ERC's are 15, 13, and 11 respectively. This still leads to a nonlinear returns-earnings relation, but there is overreaction, not underreaction.

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[1] Qi (1995) extends this work, and generally supports their findings.

If the persistence of the earnings surprise decreases as the magnitude of the earnings surprise increases, the returns-earnings relation will most likely be nonlinear, with ERC's which decrease as the magnitude of unexpected earnings increase (Freeman and Tse [1992]). An example of this would be theoretical ERC's of 9, 7, and 5 for small, medium, and large earnings surprises. If the observed ERC's are 9, 7, and 5 there would be a nonlinear returns-earnings relation, but without underreaction or overreaction. Therefore a nonlinear returns-earnings relation and underreaction are distinct characteristics to be examined. A summary of this example can be found in Table 1.

Table 1
Example of Under/Overreaction and Nonlinearity as Distinct Characteristics of the Returns-Earnings Relation to be Examined

	Theoretical ERC			Observed ERC				
Case	Small UE	Medium UE	Large UE	Small UE	Medium UE	Large UE	Under/Over-reaction?	Nonlinear Returns-Earnings Relation?
1.	10	10	10	9	7	5	Under	Yes
2.	10	10	10	15	13	11	Over	Yes
3.	9	7	5	9	7	5	None	Yes

UE = Unexpected Earnings
ERC = Earnings Response Coefficient

Case 1: UE of equal persistence, theoretical ERC is 10 for all unexpected earnings.
Case 2: UE of equal persistence, theoretical ERC is 10 for all unexpected earnings.
Case 3: Persistence decreases (and therefore theoretical ERC's) as the magnitude of unexpected earnings increases.

II. 3. Asymmetric Response to Earnings Announcements

Research in the area of earnings response coefficients has recently focused on the possibility of a different market reaction to "good news" (positive earnings surprises) and "bad news" (negative earnings surprises). This work includes studies by

Hayn (1995), Sankaraguruswamy (1996), Penno (1996), Basu (1997), and Burgstahler and Dichev (1997).

In an extensive test of asymmetric reaction to earnings surprises, Sankaraguruswamy (1996) finds that the ERC's for "bad news" exceed the ERC's for "good news." Controlling for firms with negative earnings per share (EPS) strengthens his results. He also finds similar results when controlling for uncertainty of information possessed by managers, amount of pre-announcement information possessed by the firm, prior precision of earnings, and persistence of earnings. Analytical work by Penno (1996) demonstrates that if the quality of information is endogenous to the firm, then firms with poor prospects will choose more precise disclosures than firms with good prospects. This leads to a model where there is a stronger reaction to "bad news" than to "good news." Sankaraguruswamy (1996) points out that as presented, Penno's (1996) model is difficult to test empirically but is a possible explanation for his findings. He proposes prospect theory as an alternative explanation.

Basu (1997) examines "good news" and "bad news" as both positive and negative earnings per share, and positive and negative unexpected earnings. He presents results that appear to contradict those of Sankaraguruswamy (1996). He finds that ERC's for both measures of "good news" exceed ERC's for both measures of "bad news." He theorizes that due to the conservatism in accounting earnings, "good news" is more persistent than "bad news." This increased persistence leads to a greater reaction to "good news." The theory does not address the reaction to earnings surprises of equal persistence, so it is not directly comparable to Sankaraguruswamy

(1996), who controls for persistence.

If market reaction to "bad news" is stronger than to "good news," management may avoid "bad news" (earnings decreases or losses) through earnings management. Burgstahler and Dichev (1997) support this notion. They show that distributions of annual earnings changes are bell-shaped and smooth, except in the region around zero. There appear to be a disproportionate number of positive earnings surprises, and a lack of negative earnings surprises in this region. They conclude that management manipulates earnings using cash flow from operations and changes in working capital to avoid earnings decreases.

This study examines "good news" and "bad news" relative to earnings expectations (positive and negative earnings surprises). Hayn (1995) and Basu (1997) examine "good news" and "bad news" as positive and negative EPS. Hayn (1995) finds that ERC's for positive earnings are higher, and contain more explanatory power for returns, than negative earnings. She attributes this to the shareholder's liquidation option, i.e., shareholders do not have to suffer losses indefinitely. Basu (1997) also finds a stronger reaction to positive earnings. He bases his findings on the conservatism principle, that losses are more timely, recognized immediately, and therefore less persistent than positive earnings. The primary difference in this study is that only positive earnings are examined, gains and losses are measured relative to expectations, and persistence is controlled for through both the design of the experiment and in the regression equations.

II. 4. Summary

Previous research has found that the market reaction to unexpected earnings is nonlinear, that there is underreaction, and the reaction to "bad news" is stronger than the reaction to "good news." This study attempts to explain these empirical findings through prospect theory, a theory of individual decision making. The theory is then tested in an experiment using individual investors.

III. Theory Development

III. 1. Prospect Theory

For years, decision making under risk has been modeled by expected utility theory (EUT). Kahneman and Tversky (1979) proposed prospect theory (PT) as an alternative to EUT, based on their observations of violations of EUT in the laboratory and everyday life. Prospect theory differs from EUT in several ways. The basic premise of EUT is that the overall utility of a prospect is the expected utility of its outcomes:

$$U(x_1,p;x_2,(1-p)) = pu(x_1) + (1-p)u(x_2) \quad (1)$$

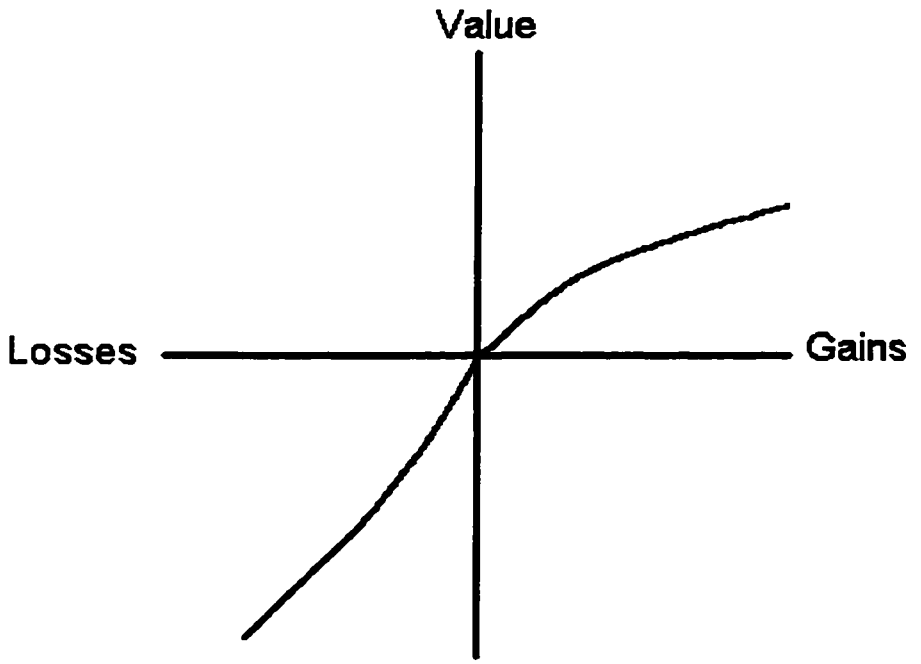
Where:

p = The probability of outcome x_1.
u = The decision maker's utility function.
x_1, x_2 = Outcomes: final asset states.

Decisions are made based on final asset states, rather than gains or losses from the current state. Most economic applications of EUT assume risk aversion, so the utility function, u, is concave ($u''<0$).

In contrast, prospect theory proposes that people make decisions based on gains and losses measured with respect to an initial reference point. The values that influence decisions are changes in wealth, rather than final states. The value function assigned to these gains and losses is generally concave for gains and convex for losses, and usually steeper for losses than for gains. For an example of a hypothetical value function, see Figure A.

Figure A
Hypothetical Prospect Theory Value Function



This gives us the basic prospect theory equation for regular prospects:[2]

$$V(x,p;y,q) = \pi(p)v(x) + \pi(q)v(y) \quad (2)$$

Where:

π = The decision maker's weighting function.
p = The probability of outcome x.
q = The probability of outcome y.
v = The decision maker's value function.
x, y = Outcomes: changes in wealth.

Decision making as modeled by prospect theory occurs in two stages. In the first stage, decision makers frame the problem. At this time the reference point is established and gains and losses are determined relative to that reference point. Then probabilities are assigned to each outcome. According to prospect theory, decision makers do not use strict probabilities when making decisions regarding gains and losses. Probabilities are subject to a weighting function. The weighting function proposed by Kahneman and Tversky (1979) is nonlinear, in that it overweights small probabilities and underweights moderate and high probabilities.

Recent work in prospect theory has made some minor changes to the weighting and value functions, but the basic theory remains the same. Cumulative prospect theory (Tversky and Kahneman [1992]) has been shown to work under conditions of risk and uncertainty. One change from earlier versions of prospect theory is that people are shown to be risk-averse for gains of high probability and losses of low probability, and risk-seeking for gains of low probability and losses of high probability.

In the second stage of the prospect theory decision making process, the

[2] A prospect is considered regular if either $p+q<1$ or $x \geq 0 \geq y$ or $x \leq 0 \leq y$.

decision maker assesses the value of the outcomes and chooses accordingly. Outcomes framed in the first stage are measured relative to an initial reference point. Thus, decisions are made based on changes in wealth, i.e., gains and losses, and not final states. The value function assigned to these gains and losses is generally concave for gains and convex for losses; and it is also steeper for losses than for gains.

III. 2. Prospect Theory as an Explanation for Observed Characteristics of the Returns-Earnings Relation

The prospect theory value function is concave for gains and convex for losses, and steeper for losses than for gains. When taken together, certain studies (e.g. Bernard and Thomas [1989], Freeman and Tse [1992], Sankaraguruswamy [1996], Das and Lev [1994]) have found the returns-earnings relation to have the same basic characteristics. This is the fundamental reason for prospect theory as an explanation for four of the empirically observed characteristics of the returns-earnings relation that are examined in this study.

The first empirical characteristic of this relation is nonlinearity. As the absolute value of unexpected earnings increases, the response to a unit of surprise (i.e., the ERC) decreases. The second characteristic is underreaction. There tends to be an initial underreaction to earnings announcements, suggesting that the market does not fully incorporate all of the information contained in earnings into price. The third characteristic is that underreaction is increasing in the absolute value of unexpected earnings. The fourth empirically observed characteristic is an asymmetric response to earnings announcements, however, the direction of the asymmetry is still under debate. Although the evidence is mixed, it appears that there is a greater reaction to "bad

news" (earnings decreases) than "good news" (earnings increases). Basu (1997) reports contradictory findings. He finds that ERC's for "good news" are greater than ERC's for "bad news." He posits that this is due to positive earnings surprises being more persistent than negative earnings surprises. For earnings surprises of equal persistence, there appears to be no predicted difference in response to positive and negative earnings surprises. Therefore, the reaction would be the same to an unexpected gain and unexpected loss of equal persistence.

In this study, positive unexpected earnings will be referred to as gains, and negative unexpected earnings will be referred to as losses. In prospect theory, gains and losses are measured relative to a reference point. Assuming the decision maker's reference point is expected EPS, positive unexpected earnings are a gain, and negative unexpected earnings are a loss. Negative EPS are not considered in this study.

It has been demonstrated that the returns-earnings relation is most likely nonlinear. Empirical research has shown that the market's response decreases as the magnitude of unexpected earnings increase. This leads to a nonlinear returns-earnings relation. Prospect theory explains this nonlinearity due to the characteristics of the value function. The basic prospect theory equation was shown in equation (2). Applying this to the stock price valuation process yields the following expression:

$$\text{Ex-Ante Price} = \text{R.P.} + \pi(p_G)v(G_{EA}\times(1+1/r)) + \pi(p_L)v(L_{EA}\times(1+1/r)) \quad (3)$$

Where:

R.P. = The decision maker's reference point, based on expected earnings.

π = The decision maker's weighting function.

p_G = The probability that reported earnings will be higher than expected earnings.

p_L = The probability that reported earnings will be lower than expected earnings.

v = The decision maker's value function.

G_{EA} = Unexpected gain under consideration ex-ante.

L_{EA} = Unexpected loss under consideration ex-ante.

$G_{EA}\times(1+1/r)$ = Increase in fundamental value due to possible unexpected gain.

$L_{EA}\times(1+1/r)$ = Decrease in fundamental value due to possible unexpected loss.

Equation (3) is an ex-ante model of price based on the decision maker's reference point, expected earnings, possible unexpected earnings, value function, and weighting function. After earnings are announced, there is an adjustment in price due to new information.

Applying prospect theory to the ex-post price adjustment results in equation (4) for an unexpected gain or loss. First, price is adjusted directly by the full amount of the earnings surprise. This is due to the fact that there is no longer any uncertainty with regard to this amount.[3] There is an additional adjustment due to the effect of a persistent earnings surprise on future periods' earnings. For an unexpected gain or loss, the ex-post price is:

[3] It is possible to model the uncertainty surrounding accounting earnings as a signal for comprehensive income or economic earnings. In this simplified case, accounting earnings are assumed to be an unbiased, noiseless signal about the current period's earnings broadly defined. There is uncertainty only in the future prospects of the firm and the persistence of the earnings surprise.

$$\text{Ex-Post Price} = EAP + UE + \pi(p_P)v(P \times UE \times 1/r) + \pi(1-p_P)v(0) \quad (4)$$

Where:

EAP = The decision maker's reference point, in this case the Ex-Ante Price (Equation 3).

UE = The amount of unexpected earnings.

π = The decision maker's weighting function.

p_P = The probability that the portion of the earnings surprise thought to be persistent is in fact persistent.

v = The decision maker's value function.

P = The percentage of the unexpected earnings believed to be persistent.

r = The decision maker's discount rate.

The effect of earnings being announced is to change the price by the amount of unexpected earnings, plus the value function applied to the uncertain discounted future earnings. The decision maker judges a percentage (P) of the earnings surprise to be persistent with an expected probability of p_P. This probability is subject to the weighting function, and the uncertain effect on future periods is subject to the value function.

The current earnings surprise (UE) is no longer subject to the value function, because there is no more risk or uncertainty regarding this amount. The increase or decrease in future earnings due to the persistence of unexpected earnings are discounted using the decision maker's discount rate, and are subject to the decision maker's value function.

Due to the nonlinearity of the value function (concave for gains, convex for losses), future uncertain earnings are impounded into price at a decreasing rate. This suggests that earnings response coefficients (ERC's) will decrease as unexpected gains and losses increase. This is true holding persistence constant. If decision makers judge persistence to decrease with the magnitude of the earnings surprise, there will be

a second effect as P in (4) is revised downward for larger gains and losses.[4]

The above discussion leads directly to the second characteristic of the returns-earnings relation that is explained by prospect theory. That is the observation that as absolute unexpected earnings increase, the amount of underreaction increases. This result can be explained by the value function. Examining equation (4), one can see that only the current portion of the earnings surprise is incorporated into price at full value. The value function is applied to future discounted earnings due to uncertainty about that future amount. Because the value function is concave (convex) for gains (losses), as the magnitude of unexpected earnings increase, the portion of the future earnings impounded into price decreases.

Prospect theory not only explains nonlinearity and underreaction, but also provides an asymmetrical response to gains and losses. The value function theorized by prospect theory is steeper for losses than for gains, so losses have more of an impact on decisions. Therefore, the future discounted earnings amounts for losses will be impounded into price more than the future discounted earnings amounts for gains.[5]

III. 3. Numerical Examples – Prospect Theory

To illustrate the prospect theory valuation process, numerical examples are presented in this section. Table 2 contains a summary of these results.

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[4] This study was designed so that there is no relation between persistence, the magnitude of the earnings surprise, and whether the earnings surprise was a gain or a loss. The actual correlation between persistence and the absolute value of unexpected earnings in the experiment was -.048, p=.656 (two-tailed). For loss subjects the correlation was .048, p=.754 (two-tailed) and for gain subjects the correlation was -.138, p=.365 (two-tailed).

[5] In prospect theory, the value function for losses is steeper than the value function for gains, so for an unexpected loss (UL) and an unexpected gain (UG), $|UL| = |UG|$, $|v(UL \times 1/r)| > |v(UG \times 1/r)|$.

Table 2
Predicted Unexpected Earnings-Underreaction and Unexpected Earnings-Earnings Response Coefficient Relation (Prospect Theory)

Unexpected Gain or Loss	REACTT	ERC
-$1.00	-$5.79	3.31
-$0.75	-$3.98	3.80
-$0.50	-$2.22	4.66
-$0.25	-$0.56	6.84
$0.25	-$0.88	5.60
$0.50	-$2.60	3.90
$0.75	-$4.41	3.22
$1.00	-$6.27	2.83

Where:
REACTT ≡ amount of under/overreaction measured relative to theoretical value (- if underreaction, + if overreaction)
ERC ≡ change in price ÷ unexpected earnings

The examples are based on equations (3) and (4). Starting with an expected EPS of $4.50 and uncertainty regarding an unexpected gain or loss of $0.25, an ex-ante price was set according to equation (3). Potential unexpected earnings were then provided, and updates in the price were determined by applying prospect theory (equation (4)). The pattern in ERC's shows that they are larger for losses than for gains, decreasing in the absolute value of unexpected earnings, and that the ERC's for losses decrease faster than the ERC's for gains. Underreaction was also calculated, and Table 2 shows that underreaction is increasing in absolute unexpected earnings, and there is more underreaction for gains than for losses.[6]

To demonstrate prospect theory, a few assumptions have to be made. The first is a functional form for the weighting function and value function. Following Newman

[6] The general results in Table 2 are not affected by the choice of probabilities, discount rates, expected gains/losses, reference point, etc., as long as they are within reasonable limits.

(1980), the value function will be defined as:

for gains: $v(x) = x^{1/3}$; $x>0$

for losses: $v(y) = (2\times y)^{1/3}$; $y<0$

Note that this function satisfies concavity for gains, convexity for losses, and is steeper for losses than for gains. The weighting function will be defined as:

$\pi(p) = 0.1 + 0.9\times p^2$ for $0<p\leq 1$ but $\pi(p)=0$ at $p=0$

This weighting function is similar to the weighting function of prospect theory, and behaves correctly in the region used in these examples (underweighting moderate and high probabilities).

Equations (3), and (4) give the ex-ante price, and ex-post price for gains and losses.

$$\text{Ex-Ante Price} = \text{R.P.} + \pi(p_G)v(G_{EA}\times(1+1/r)) + \pi(p_L)v(L_{EA}\times(1+1/r)) \quad (3)$$

$$\text{Ex-Post Price} = EAP + UE + \pi(p_P)v(P\times UE\times 1/r) + \pi(1-p_P)v(0) \quad (4)$$

Equation (5) gives the theoretical price against which we can measure under/overreaction.

$$\text{Theoretical Ex-Post Price} = EAP + UE + (P\times UE\times 1/r) \quad (5)$$

Where:

EAP = The decision maker's Ex-Ante Price.
UE = The amount of unexpected gain or loss.
P = The persistence of the earnings surprise (percent, not probability).
r = The decision maker's discount rate.

The theoretical value in equation (5) is based on the assumption that transitory earnings surprises (P=0) have an ERC of one, and permanent earnings surprises (P=1) have an ERC of (1+1/r). So a transitory earnings surprise of one dollar increases price by one dollar, and a permanent earnings surprise of one dollar increases price by one

dollar, plus the present value of one dollar in perpetuity. For earnings surprises containing partially transitory earnings (0<P<1), the current period earnings are impounded into price at full value, but only the persistent portion of the earnings surprise affects future earnings. Therefore only the persistent portion of the earnings surprise (P×UE) is discounted in perpetuity (P×UE×1/r) and included in price.

The following assumptions were made regarding the values for the following examples:

Reference Point = \$40.00, based on expected EPS of \$4.00
Probability of a permanent \$0.25 unexpected gain (p_G) = 50%
Probability of a permanent \$0.25 unexpected loss (p_L) = 50%
The value functions and weighting functions are according to the description above.
The discount rate chosen was r = 11.1%, so 1/r = 1/.111 = 9, and (1+1/r) = 10.
Assume that 90% (P=.90) of the unexpected portion of earnings is believed to permanent with a probability of 95% (p_P=.95).

The Ex-Ante Price (EAP) is:

EAP = 40.00 + [.1+(.9)(.50^2)][(.25×10)^1/3]+[.1+(.9)(.50^2)][(-.25×10×2)^1/3]
EAP = 40.00 + (.33)(1.36)+(.33)(-1.71)
EAP = 40.00 + (.45)+(-.56)
EAP = \$39.89

If actual earnings are \$4.25, there is a \$0.25 unexpected gain.
This results in an Ex-Post Price (EPP):

EPP = 39.89 + .25 + [.1+(.9)(.95^2)][(.9×.25×9)^(1/3)] + 0
EPP = 39.89 + .25 + [.91][1.27]
EPP = 39.89 + .25 + 1.15
EPP = \$41.29

Underreaction can be measured relative to a control group or a theoretical value. For example, if a control group set a price of \$42.50, under/overreaction relative to the control group (REACTC) would be computed as follows.

REACTC = \$41.29 - \$42.50
REACTC = -\$1.21

To determine the theoretical valuation price, we need to set some level for P, the perceived persistence of the earnings surprise. Assuming the estimate of persistence is

90%, than the theoretical price (TEPP) is set according to equation (5).[7]

TEPP = 39.89 + .25 + (.90 × .25 × 9)
TEPP = $42.17

Therefore the under/overreaction relative to the theoretical price (REACTT) is

REACTT = $41.29 - $42.17
REACTT = -$0.88

The earnings response coefficient (ERC) is:

ERC = (41.29 - 39.89)/.25
ERC = 5.60

If actual earnings are $3.75, there is a $0.25 unexpected loss.
This results in an Ex-Post Price:

EPP = 39.89 + (-.25) + [.1+(.9)(.95^2)][(.9×(-.25)×9×2)^(1/3)] + 0
EPP = 39.89 + (-.25) + [.91][-1.59]
EPP = 39.89 + (-.25) + (-1.45)
EPP = $38.19

Again, the theoretical price is set according to equation (5).

TEPP = 39.89 + (-.25) + (.90 × (-.25) × 9)
TEPP = $37.62

Therefore the under/overreaction relative to the theoretical price is

REACTT = $38.18-37.62
REACTT = -$0.56

The earnings response coefficient is:

ERC = (38.18 - 39.89)/(-.25)
ERC = 6.84

If actual earnings are $4.50, there is a $0.50 unexpected gain.
This results in an Ex-Post Price:

EPP = 39.89 + .50 + [.1+(.9)(.95^2)][(.9×.50×9)^(1/3)] + 0
EPP = 39.89 + .50 + [.91][1.59]
EPP = 39.89 + .50 + 1.45
EPP = $41.84

Again, assuming P=.9, the theoretical price is set according to equation (5).

TEPP = 39.89 + .50 + (.90 × (.50) × 9)
TEPP = $44.44

[7] In the experiment, each subject's estimate of persistence will be used in calculating the theoretical value and under/overreaction for that subject.

Therefore the under/overreaction relative to the theoretical price is

REACTT = $41.84 - $44.44

REACTT = -$2.60

The earnings response coefficient is:

ERC = (41.84 - 39.89)/.50

ERC = 3.90

If actual earnings are $3.50, there is a $0.50 unexpected loss.

This results in an Ex-Post Price:

EPP = 39.89 + (-.50) + [.1+(.9)(.95^2)][(.9×(-.50)×9×2)^(1/3)] + 0

EPP = 39.89 + (-.50) + [.91][-2.01]

EPP = 39.89 + (-.50) + (-1.83)

EPP = $37.56

Again, assuming P=.9, the theoretical price is set according to equation (5).

TEPP = 39.89 + (-.50) + (.90 × (-.50) × 9)

TEPP = $35.34

Therefore the under/overreaction relative to the theoretical price is

REACTT = $35.34 - $37.56

REACTT = -$2.22

The earnings response coefficient is:

ERC = (37.56 - 39.89)/(-.50)

ERC = 4.66

Similar calculations were done for earnings surprises from -$1.00 to $1.00.

The results can be seen in Table 2, and Figure B and Figure C. As shown in the examples above, prospect theory predicts that the returns-earnings relation is nonlinear, there is underreaction to earnings, and more reaction to losses than to gains. Figure D is a graph of the predicted returns-earnings relation.

Figure B
Graph of the Predicted Unexpected Earnings–Underreaction Relation (Prospect Theory)

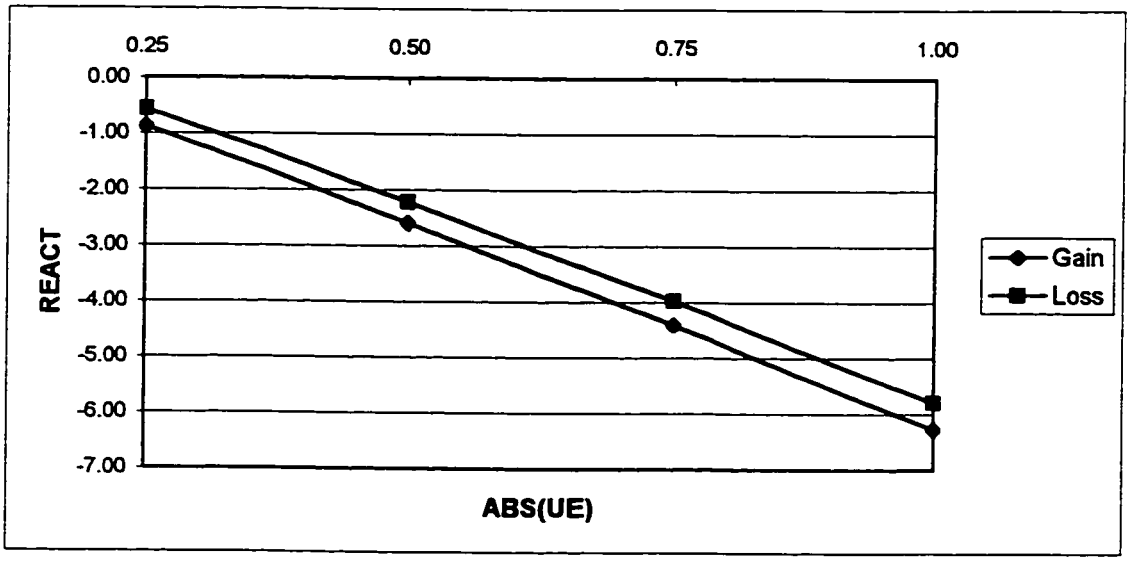


Figure C
Graph of the Predicted Unexpected Earnings–Earnings Response Coefficient Relation (Prospect Theory)

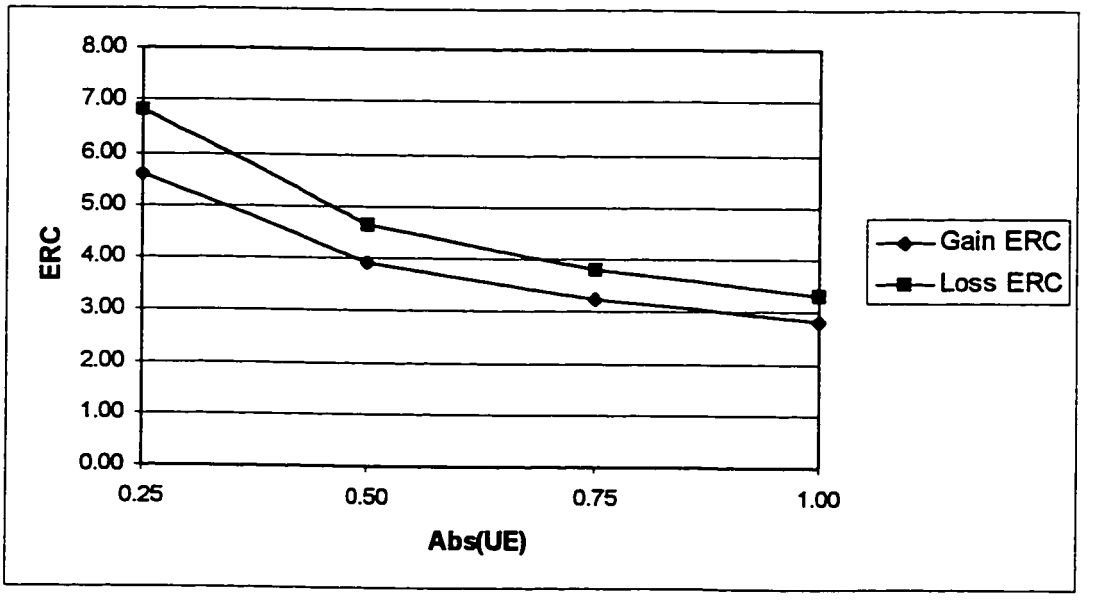
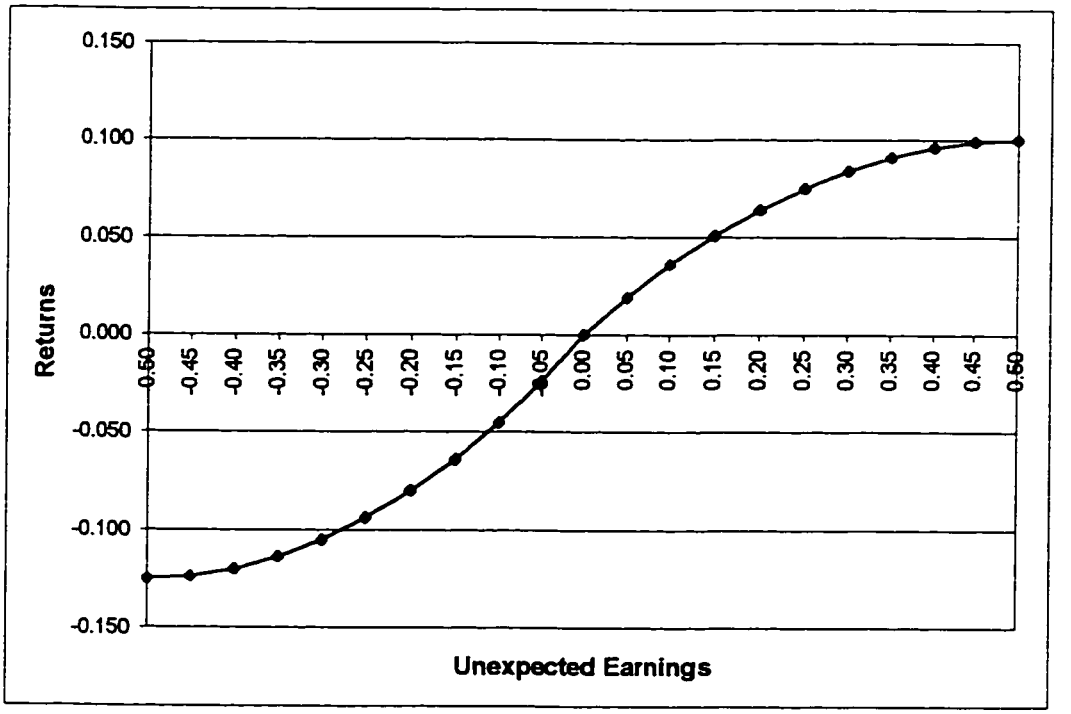


Figure D
Graph of the Predicted Returns–Earnings Relation



III. 4. Hypotheses

The hypotheses tested in this study follow directly from the discussion and examples above. There are four primary characteristics of the returns-earnings relation observed in archival research that are tested. These are nonlinearity in the returns-earnings relation (**H2**), underreaction to unexpected earnings (**H5**), underreaction that increases as the absolute value of unexpected earnings increase (**H7**), and an asymmetrical response to unexpected earnings (**H1**).

Prospect theory makes two additional predictions that will also be tested. The first is that the amount of underreaction for gains is more than that for losses (**H6**). The second is an interaction, that ERC's for losses will decrease faster (as absolute unexpected earnings increase) than ERC's for gains (**H3**). These predictions are shown graphically in Figure B and Figure C. These predictions are new, that is, they are not known to hold empirically. The final hypothesis to be tested has to do with persistence. As the perceived persistence of earnings surprises increases, ERC's will increase (**H4**). Therefore, there are seven hypotheses to be tested (each stated in the alternative form):[8]

H1: Earnings response coefficients for losses will be larger than ERC's for gains.
H2: Earnings response coefficients will decrease as absolute unexpected earnings increase.
H3: Earnings response coefficients for losses will decrease at a faster rate as absolute unexpected earnings increase than ERC's for gains.
H4: Earnings response coefficients will increase as the persistence of the earnings surprise increases.
H5: There will be underreaction to unexpected earnings.

[8] In the hypotheses, "gains" refers to positive unexpected earnings, and "losses" refers to negative unexpected earnings.

H6: There will be more underreaction to unexpected earnings for gains than for losses.

H7: Underreaction to unexpected earnings will increase as absolute unexpected earnings increase.

III. 5. Anchoring and Adjustment

Although prospect theory appears promising as an explanation for market phenomena, it is not the only judgment model that has been called upon as an explanation. Anchoring and Adjustment (Tversky and Kahneman [1974]) has also been presented as a potential explanation for at least some of the characteristics of the returns-earnings relation and underreaction (Bernard [1993]). The basics of Anchoring and Adjustment (A&A) are simple. Decision makers make adjustments from some initial value (the anchor) to reach a final value. It has been demonstrated empirically (Tversky and Kahneman [1974]) that, on average, the amount of adjustment is insufficient. It is possible that, in capital markets, investors anchor on the value of the firm based on expected earnings. Then, when actual earnings are announced, the adjustment in firm value is insufficient.

III. 6. Numerical Examples – Anchoring and Adjustment

Although A&A appears on the surface to provide an alternative explanation to prospect theory, closer examination reveals that this is not the case. The results of examples below are found in Table 3.

Table 3
Predicted Unexpected Earnings-Underreaction and Unexpected Earnings-Earnings Response Coefficient Relation (Anchoring and Adjustment)

Unexpected Gain or Loss	REACT	ERC
-$1.00	-$5.00	5.00
-$0.75	-$3.75	5.00
-$0.50	-$2.50	5.00
-$0.25	-$1.25	5.00
$0.25	-$1.25	5.00
$0.50	-$2.50	5.00
$0.75	-$3.75	5.00
$1.00	-$5.00	5.00

Where:
REACT ≡ amount of under/overreaction (- if underreaction, + if overreaction)
ERC ≡ change in price ÷ unexpected earnings

They demonstrate that the only characteristics of the returns-earnings relation explained by A&A are the presence of underreaction, and that the underreaction is increasing with larger absolute earnings surprises. The predictions for A&A are the same as prospect theory for hypotheses five and seven. Anchoring and Adjustment does not predict a difference in ERC's or underreaction for gains and losses, or ERC's which decrease as absolute unexpected earnings decrease (hypotheses one, two, three and six).

The following assumptions are made in the Anchoring and Adjustment numerical examples:

1. The Ex-Ante Price is the fundamental price (EPS times P/E) based on expected earnings.
2. There is an insufficient reaction to earnings surprises due to the fact that decision makers are anchored on the Ex-Ante price.
3. This underreaction will be modeled as:

Ex-Post Price = (Fundamental Price + Ex-Ante Price)/2

For example, consider an Ex-Ante Price of $40.00, based on expected earnings of $4.00, and a P/E ratio of 10. If actual earnings of $4.25 are announced, fundamental value is $42.50. The Ex-Post Price (EPP) therefore is:

EPP = ($40.00 + $42.50)/2
EPP = $41.25

This gives an underreaction (REACT) of $1.25:

REACT = $41.25 - $42.50
REACT = -$1.25

And an earnings response coefficient (ERC) of 5.00:

ERC = ($41.25 - $40.00)/.25
ERC = 5.00

Now consider if actual earnings of $3.75 are announced, fundamental value is $37.50. The Ex-Post Price therefore is:

EPP = ($40.00 + $37.50)/2
EPP = $38.75

This gives an underreaction of -$1.25:

REACT = $37.50 - $38.75
REACT = -$1.25

And an earnings response coefficient of 5.00:

ERC = ($38.75 - $40.00)/(-.25)
ERC = 5.00

If actual earnings of $4.50 are announced, fundamental value is $45.00. The Ex-Post Price therefore is:

EPP = ($40.00 + $45.00)/2
EPP = $42.50

This gives an underreaction of $2.50:

REACT = $42.50 - $45.00
REACT = -$2.50

And an earnings response coefficient of 5.00:

ERC = ($42.50 - $40.00)/.50
ERC = 5.00

Now consider if actual earnings of $3.50 are announced, fundamental value is $35.00. The Ex-Post Price therefore is:

EPP = ($40.00 + $35.00)/2
EPP = $37.50

This gives an underreaction of $2.50:

REACT = $35.00 - $37.50

REACT = -$2.50

And an earnings response coefficient of 5.00:

ERC = ($37.50-$40.00)/(-.50)

ERC = 5.00

Table 3 contains the underreaction and earnings response coefficients for earnings surprises of -$1.00 to $1.00. Figure E and Figure F display graphs of the results.

Figure E
Graph of the Predicted Unexpected Earnings–Underreaction Relation (Anchoring and Adjustment)

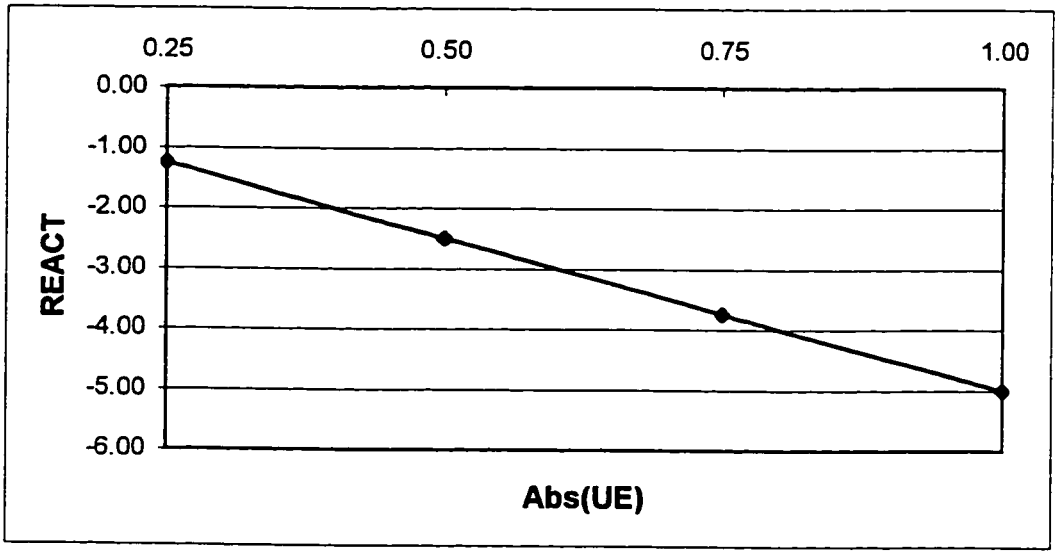
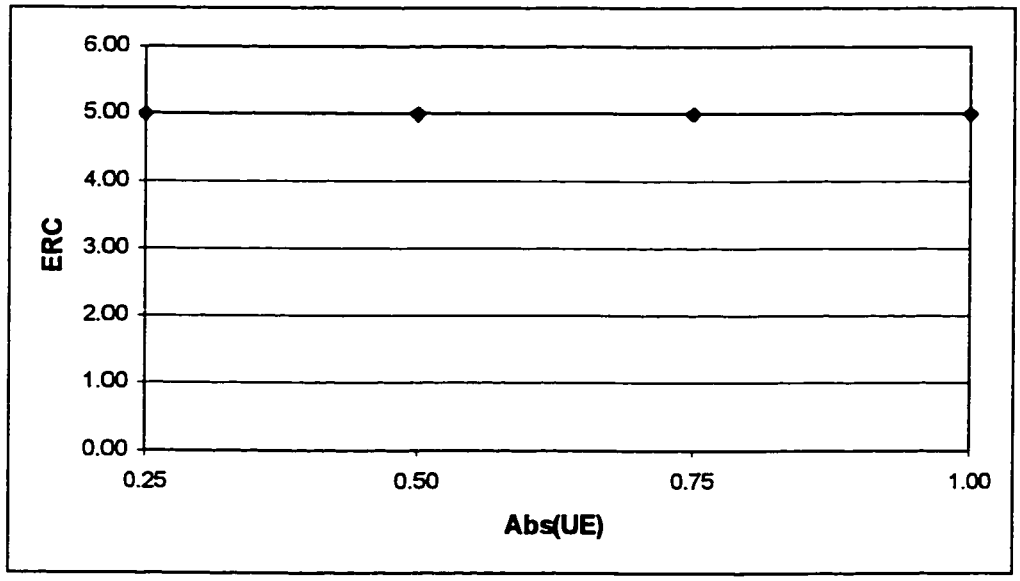


Figure F
Graph of the Predicted Unexpected Earnings–Earnings Response Coefficient Relation (Anchoring and Adjustment)



IV. The Impact of Individual Investors on Market Phenomena

A common criticism of experimental work in financial accounting is that the marginal investor determines prices, not market participants as a whole. Thus, for any individual judgment phenomenon to affect market prices, the marginal investor would have to behave as predicted. Recent work showing that individual investors can affect prices may indicate that marginal investors are subject to the same judgmental effects as other individuals. Two recent papers demonstrate theoretically how individuals (noise traders) affect prices.

Shefrin and Statman (1994) show in an analytical model how noise traders (who commit cognitive errors) and information traders (who are free from cognitive errors) interact in the marketplace. They develop a comprehensive framework, and analyze the effect of noise traders on price efficiency, volatility, return anomalies, volume, and noise trader survival. Their model allows the representative trader (price setter) to be a noise trader when noise trading errors do not average to zero. In addition, when prices are inefficient, old information continues to affect prices.

Schleifer and Summers (1990) develop a theory of noise trading that better explains observed market phenomena than the efficient markets hypothesis. In their theory, some investors (noise traders) are not rational (i.e., non-fundamental) and they affect prices if their sentiment is correlated (so they do not cancel each other out). They also demonstrate that it is not always possible to eliminate mispricing through arbitrage because arbitrage is risky and not without some costs. In fact, they demonstrate that it is sometimes in the best interest of rational investors to act in a manner similar to noise traders. They also find that noise traders bear a

disproportionate amount of risk. Therefore, noise traders can earn substantial returns, which allow them to remain in the market. Thus, it is possible that mispricing can persist due solely to noise traders.

These effects have been demonstrated empirically in an experimental setting, and using market data. Experimental markets work by Ganguly et al. (1994), Camerer (1987) and Camerer et al. (1989) demonstrate that bias, errors, and mispricing at the individual level may not be arbitraged away by more sophisticated investors. Ganguly et al. (1994) find that in an experimental market, prices are biased when biased traders have the highest expected payoffs and, unexpectedly, even when unbiased traders had the highest expected payoffs. They conclude that individual judgments can have a substantial affect on market prices. Camerer (1987) and Camerer et al. (1989) also show that markets do not always eliminate biases, and can even make them worse.

In an experimental setting, Maines and Hand (1996) show that decision makers' improper incorporation of correlations in quarterly earnings might result in underreaction to new information. This could align investors' bias in a way that would lead to mispricing.

Archival studies using market data by Bhushan (1994), Hand (1990), Ritter (1988), and Lakonishok and Maberly (1990) provide ample evidence to support the theoretical and experimental work of individuals affecting price. Bhushan (1994) demonstrates the effect of the individual investor on markets; he presents an explanation for post-earnings-announcement drift where unsophisticated investors trade in a stock after earnings are announced. Sophisticated market participants anticipate earnings, so they do not trade around earnings announcements. The

unsophisticated investors misprice the stock, and the mispricing is not arbitraged away due to transactions costs and opportunity costs of arbitrageurs.

Arguments similar to those made by Bhushan can be found in Hand (1990). He shows another example of unsophisticated investors having an effect on market prices. His theory relies on the "Extended Functional Fixation Hypothesis (EFFH)." The EFFH is an intermediate theory between perfectly efficient markets and functionally fixated markets. In this theory, as holdings by unsophisticated investors increase, the likelihood increases that unsophisticated investors set stock prices. He shows that unsophisticated investors could be the cause of the inappropriate price reaction to accounting gains from debt-equity swaps.

Ritter (1988) shows that the best explanation for the "January Effect" is the buying and selling behavior of individual investors. This is especially true in smaller stocks. This is similar to the results of Lakonishok and Maberly (1990). They demonstrate that the "Weekend Effect" might be due to the trading pattern of individual investors.

From theoretical models to empirical evidence, it appears that individual investors can have a significant effect on prices. If investors at an individual level behave as predicted by prospect theory, it follows that the patterns individuals demonstrate in setting prices could show up at the market level. This study proposes to demonstrate that the empirically observed characteristics of the returns-earnings relation fit with predictions made by prospect theory, and then tests to see if those predictions hold in an experimental setting.

V. Experiment

V. 1. Advantages of an Experiment

The theory presented could be tested in a quasi-experimental archival study or in an experiment. There are some advantages and disadvantages of both, but an experiment prevails when all issues are considered. The theory presented is a theory of individual decision making. The first advantage of an experiment is that an experiment allows testing of the theory on an individual level. An archival study uses aggregate market data. Another advantage is that an experimental setting allows the repeated release of information followed by measurement. This offers more conclusive evidence on the effect of particular information on decisions. In addition, an experiment allows the examination of behavior at various stages of the decision process. An archival study only allows the researcher to observe the outcomes of decisions, and usually not on an individual level. The phenomena in question have already been observed in capital markets. The intent of the study is to provide a possible explanation for the observed findings.

The second advantage of an experiment is controllability. Specifically, it allows one to control for missing variables and alternative explanations. For example, Kormendi and Lipe (1987) and Collins and Kothari (1989) show that firm-specific factors might cause ERC's to vary across firms. Sankaraguruswamy (1996) attempts to control for losses, quality of manager's information, pre-announcement disclosure of information, the prior precision of earnings, and firm-specific characteristics. Most of these are measured using some form of proxy, and control may be unsatisfactory. In an experiment, more alternative explanations and confounding effects are ruled out

than is possible in an archival study, because it is possible to set up an experimental design using only one firm. Holding factors constant for all subjects controls for each of the above possible confounding effects. This study is designed to control for earnings persistence, firm growth prospects, earnings predictability, and risk in a way that is not possible in an archival study.

An experiment also allows more precise measurement of certain variables. For example, a clean measure of under/overreaction is provided through use of a control group. This measure is not easily obtained in an archival study. In addition, in a traditional archival study, a model for earnings expectations must be formed to calculate the unexpected portion of earnings. In an experiment, subjects can be asked to disclose their earnings expectation.[9] This allows for an unexpected earnings measure which may be more precise and have less noise than in an archival study.

Other variables such as returns can also be measured with more precision in an experiment. In an archival study, assumptions must be made, such as when earnings become known to the market and the size of the window used to cumulate returns. In an experiment, by giving information to the subjects in steps and making measurements along the way, these assumptions are unnecessary. This precision in measuring variables can reduce "errors in variables" problems that are common in archival studies.

V. 2. Procedures

The experiment has two stages. In the first stage, subjects made a fundamental-value stock pricing decision based on earnings forecasts. In stage two,

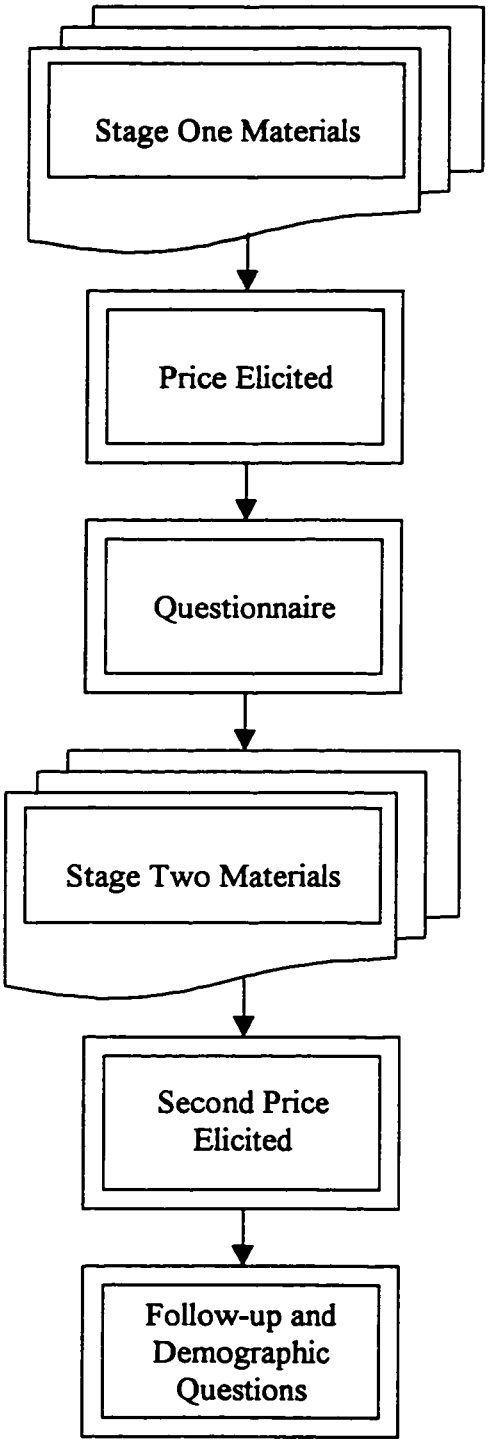
the subjects made a stock pricing decision based on actual earnings. By manipulating actual earnings, price reactions to unexpected gains and losses of various sizes are tested. A control group is used to set baseline prices to measure under/overreaction. In addition, under/overreaction is measured relative to a theoretical model.

Except for the control groups used to set the baseline prices, the same subjects are used to test all seven hypotheses. The primary differences in the tests being run are the dependent variables. For tests of the earnings response coefficient hypotheses (**H1** through **H4**), the dependent variable is ERC's. Earnings response coefficients are computed by dividing the change in price by the amount of unexpected earnings. For the tests of the underreaction hypotheses (**H5** through **H7**), the dependent variable is a measure of under/overreaction. Two measures of under/overreaction were used (variables REACTC and REACTT). The first (REACTC) is under/overreaction measured relative to a control group that received only actual earnings. The second measure of under/overreaction (REACTT) compares each subject's price with the theoretical price calculated using the subject's own discount rate and estimate of earnings persistence.

The experiment was presented to subjects as a fundamental-value stock pricing decision. Subjects were asked to assess the value of a share of stock in a company. A flowchart of the experimental procedure can be found in Figure G.

[9] This must be done in an unobtrusive way, however, so as not to put undue emphasis on earnings.

Figure G
Experimental Procedure



In the first stage of the experiment, subjects were given background information about the company and its industry, the company's financial information, including five prior years of earnings data, and an earnings forecast for the current year.[10] Three analyst reports were also included in the experimental materials. These reports included an earnings forecast for the current year. Because subjects might discount the earnings forecast made by management, two of the analysts' forecasts were slightly above management's forecast and one was slightly below management's forecast. This approach is intended to validate management's forecast and help establish the subject's reference point. The reference point was measured at a later time to reduce demand effects bias.[11]

Other materials in stage one included industry information for each year, including industry earnings, selected financial ratios and P/E multiples. After reviewing the materials, subjects were asked the value of a share of stock of this company. For a list of the materials included in stage one and stage two of the experiment, see Table 4.

[10] No quarterly earnings information was given, because it has been shown in an experiment (Maines and Hand [1996]) and an archival study (Ball and Bartov [1996]) that the market improperly uses information contained in the time-series properties of quarterly earnings. This study is posing a more general question of underreaction to unexpected earnings.

[11] For a discussion of demand effects bias, see Appendix 1.

Table 4
Materials for Stage One and Stage Two of the Experiment

Stage One Materials	Stage Two (and Control Group) Materials
• Company Background Information	• Company Background Information
• Industry Background Information	• Industry Background Information
• Five Prior Years Earnings Data	• Five Prior Years Earnings Data
• Industry Earnings and P/E Multiples	• Industry Earnings and P/E Multiples
• Management's Forecast of Earnings for the Current Year, 3 Analyst Forecasts of Earnings for the Current Year	• Earnings Announcement with Actual Earnings for the Current Year

Next, two tasks were performed. The first task provided the subjects with a list of the items contained in the experiment (background material, management's discussion, industry information, prior earnings information, forecasted EPS, etc.). Subjects were asked to rank from one to five the items that they used the most in calculating the suggested offer price. This confirms that earnings were used in valuing the firm. According to the subjects' responses, the income statement was the item used most when establishing value.

The second task asked the subjects to forecast Sales, Net Income, and EPS for the current year. Asking for a forecast of sales was to avoid putting any unusual emphasis on earnings by having subjects forecast more than just earnings. In addition to making the forecasts, the subjects were asked to rate how confident they were about each forecast. Each subject's forecast of EPS is the measure of expected earnings for that subject. The strength of this expectation should be related to their confidence in their prediction. The validity of the measure of expected earnings should increase as the subject's confidence increases. The mean response to "Confidence in Your Forecast" on a seven point scale with 1 = Not at all and 7 = Completely was 4.05 (std. dev. = 1.25), and the median was 4.00.

After the subjects determined the price and performed the above tasks, they were given updated material with the current year's actual earnings replacing the earnings forecasts. All other materials were identical to those received in the first stage. Subjects then suggested a new price for the company's stock.

V. 3. Design

Underreaction has been shown in archival studies to increase as absolute unexpected earnings increase. Earnings response coefficients have been shown in archival studies to decrease as absolute unexpected earnings increase. Therefore, to test the hypotheses in question, the amount of unexpected earnings was varied between subjects. Approximately half of the earnings surprises are an increase in earnings (gains) and half of the earnings surprises are a decrease (losses). The magnitude of the earnings surprise was varied between subjects within realistic (market observed) limits.

One suggestion from prior empirical work is that the returns-earnings relation is nonlinear due to the transitory nature of large unexpected earnings (Freeman and Tse [1992]). Although Das and Lev (1994) concluded that transitory items only explain a portion of the nonlinearity; it is important in this experiment to control for the permanent or transitory nature of earnings. Since the underreaction hypotheses require that at least a portion of the earnings surprise be persistent, the experiment attempts to make the earnings surprise persistent, and equally persistent across all levels of actual earnings.

To do this, the firm chosen was one that has struggled financially in recent years but which had just signed a new contract to distribute its products in Europe. A

successful venture into European markets would lead to unexpected gains, a failure would lead to more financial difficulty and unexpected losses. Thus the gains and losses would be expected to continue into the future, and not be entirely transitory. To measure persistence, a post-experimental questionnaire was used that included questions regarding the subjects' beliefs about the persistence of the earnings surprise. The average persistence of the earnings surprises was 54%, and was not significantly larger (p=.222) for unexpected gains (mean=.570, std. dev.=.236) than for unexpected losses (mean=.512, std. dev.=.208). This measure of persistence can be used to control for the subjects' beliefs about the persistence of unexpected earnings across earnings surprises or to provide additional insights regarding the effect of perceived persistence on valuation.

In stage one of the experiment, the earnings forecasts were the same for all subjects (management's forecast of EPS was $1.50, analysts' forecasts were $1.55, $1.45, and $1.52). In stage two, actual earnings were varied between subjects. Relative to the earnings forecast, there are three levels of gains (actual earnings above management's forecast, EPS = $1.65, $1.80, $1.95) and three levels of losses (actual earnings below management's forecast EPS = $1.35, $1.20, $1.05). In addition, one group of subjects received actual earnings equal to management's forecast. The goal was to provide enough variability in actual earnings that there is a large range of unexpected gains and losses (actual earnings minus expected earnings). The ERC's are calculated as a change in the subject's forecast of firm value (value of one share of stock) divided by unexpected earnings. Unexpected earnings are calculated as actual earnings minus the subject's individual forecast of earnings (not management's

forecast or analysts' forecasts). It is possible that no two subjects' earnings forecasts will be alike; in that case there will be as many levels of the independent variables as there are subjects.

Two tests of under/overreaction are performed. The first dependent variable used to test the underreaction hypotheses is the amount of under/overreaction relative to fundamental firm value. A control group that did not participate in stage one of the experiment established the fundamental value. By necessity, there are seven control groups, one for each level of actual earnings. These subjects did not receive the first stage materials, which contain the earnings forecast. Instead they received only the stage two materials, which are identical to the stage one materials, except actual earnings replaced the earnings forecasts. The firm value that this group of subjects set for a share of stock serves as a baseline to measure the amount of under/overreaction by the experimental group.

For the experimental subjects in the gain condition (actual earnings above the subject's forecast), the subject's price minus the baseline amount set by the control group is the amount of under/overreaction. For subjects in the loss condition (actual earnings below the subject's forecast), the baseline amount set by the control group minus the subject's price is the amount of under/overreaction. This makes underreaction a negative measure for all subjects, and overreaction a positive number for all subjects. An example of this can be found in section **III. 3**.

The second dependent variable used to test under/overreaction is the subjects' appraisal of firm value relative to theoretical firm value (calculated using actual subject

data). If subjects set the price in stage two according to economic theory,[12] the price for an unexpected gain or loss should be:

$$\text{Theoretical Ex-Post Price} = EAP + UE + (P \times UE \times 1/r) \quad (5)$$

Where:

EAP = The decision maker's Ex-Ante Price
UE = The amount of unexpected gain or loss.
P = The persistence of the earnings surprise.
r = The decision maker's discount rate.

After receiving actual earnings, each subject was asked to rate the probability of the permanence of the earnings surprise. This probability will be used as the persistence of the earnings surprise. The discount rate is inferred from the P/E ratio from the price set by the subject in stage one. For subjects in the gain condition, the subject's price minus the theoretical amount is the amount of under/overreaction. For subjects in the loss condition, the theoretical amount minus the subject's price is the amount of under/overreaction. This makes underreaction a negative measure for all subjects, and overreaction a positive number for all subjects. An example of this can be found in section **III. 3**.

In summary, the experiment first provided subjects with an earnings forecast and other information. Then they were asked to determine the price of a share of stock of the company. Subjects then received actual earnings per share, indicating a persistent earnings surprise that varied across subjects. A second price was then elicited. A follow-up questionnaire was administered that included a question on the subject's belief about the persistence of the earnings surprise and various demographic questions.

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[12] See section **III. 3.** for further discussion.

V. 4. Subjects

Various studies, theoretical (Schleifer and Summers [1990]), analytical (Shefrin and Statman [1994]), experimental (Ganguly et al. [1994], Camerer [1987], and Camerer et al. [1989]), and empirical (Bhushan [1994], Hand [1990], Ritter [1988], and Lakonishok and Maberly [1990]) have demonstrated that prices can be influenced by sophisticated and unsophisticated investors (i.e., noise traders). Ideally, subjects for this experiment would be users of financial statements who have some experience in fundamental analysis and investing. In an attempt to capture as large a group of these subjects as possible, the subjects used are individuals who are members of a national investing organization. The task itself is fairly realistic. Investors make security valuation decisions based on information similar to the materials used in this study. This gives the experiment some amount of generalizability to capital markets. For a discussion of the impact of individual investors on market phenomena, see section **IV**.

The experiment was mailed to 1,000 members of the national investing organization. One week after the experiments were mailed out, follow-up postcards were sent. Two weeks after the postcards were mailed, additional sets of materials were sent to the non-respondents, and follow-up postcards were mailed to that group after another week. The overall response rate was 26%. Of the 261 responses, 135 were in the control group and 126 in the experimental group. Of these, 63 were unusable due to missing information.[13] For a breakdown of the number of subjects in each group and test, see Table 5.

Table 5
Number of Responses in Each Category

	Experimental Group		Control
	REACT	ERC	Group
Total	126	126	135
Data Missing	27	27	36
Total Useable	99	99	99
UE=0	6	6	0
Outliers	2	3	0
Regression	91	90	99

There were 261 total responses out of 1,000 mailed out (26%). A response was considered unusable if data were missing (price, EPS forecast or persistence), unexpected earnings were equal to zero, or the residual value in the regression was outside of 3 standard deviations (outliers). That resulted in 91 subjects in the REACT regressions, 90 subjects in the ERC regressions, and 99 subjects used to set the control group values to measure REACTC.

In a questionnaire following the experiment, various demographic questions were asked. The typical respondent to the experiment uses a discount broker,[14] has $50,000 to $100,000 (median amount) invested in individual stocks (not mutual funds),[15] considers him/herself a successful investor, but only average in sophistication, and "beats the market" 48% of the time (self-reported).

V. 5. Regression Models

Three regression models are used to test the seven hypotheses: one model for the hypotheses relating to the earnings response coefficients, and two for the hypotheses relating to underreaction. The following are the three models, along with interpretations for the coefficients in each model, and specific predictions for the

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[13] A response was considered unusable if the first or second stock price forecast, EPS forecast, or estimate of persistence was missing.
[14] 54% use a discount broker, 23% a full-service broker, 11% trade online, and 11% invest using other means.

coefficients in each model as provided by theory. The regression for hypotheses one through four is:

$$ERC = b_0 + b_1G + b_2ABS(UE)_{MD} + b_3(G \times ABS(UE)_{MD}) + b_4PERSIST_{MD} + b_5(G \times PERSIST_{MD}) + e \quad (6)$$

for losses (G = 0):

$$ERC = b_0 + b_2ABS(UE)_{MD} + b_4PERSIST_{MD} + e \quad (7)$$

for gains (G = 1):

$$ERC = (b_0+b_1) + (b_2+b_3)ABS(UE)_{MD} + (b_4+b_5)PERSIST_{MD} + e \quad (8)$$

Where:

ERC	≡ change in price ÷ unexpected earnings
G	≡ 1 if UE are positive (gain), 0 if UE are negative (loss)
$ABS(UE)_{MD}$	≡ absolute value of unexpected earnings, mean deviated[16]
$PERSIST_{MD}$	≡ subject's estimate of the persistence of UE, mean deviated
e	≡ disturbance term (error)

The coefficients in the regression can be interpreted as follows:

b_0:	intercept for losses at the mean value of unexpected earnings
b_0+b_1:	intercept for gains at the mean value of unexpected earnings
b_1:	difference in intercepts
b_2:	slope of $ABS(UE)_{MD}$ for losses
b_2+b_3:	slope of $ABS(UE)_{MD}$ for gains
b_3:	difference in slopes for $ABS(UE)_{MD}$ between gains and losses
b_4:	slope of $PERSIST_{MD}$ for losses
b_4+b_5:	slope of $PERSIST_{MD}$ for gains
b_5:	difference in slopes for $PERSIST_{MD}$ between gains and losses

[15] Eight respondents have over $500,000 invested in individual stocks, five respondents have over $1,000,000 invested in individual stocks, and seven respondents have no holdings in individual stocks.

[16] To mean deviate a variable, the mean of that variable is subtracted from every observation. The purpose of mean deviating a variable is to provide a more powerful and relevant test of the intercept in a regression equation. See Judd and McClelland (1989) for a thorough discussion.

Hypotheses	Predictions
H1: Earnings response coefficients for losses will be larger than ERC's for gains.	$b_1<0$
H2: Earnings response coefficients will decrease as absolute unexpected earnings increase.	$b_2<0$; $b_2+b_3<0$
H3: Earnings response coefficients for losses will decrease at a faster rate as absolute unexpected earnings increase than ERC's for gains.	$b_3>0$
H4: Earnings response coefficients will increase as the persistence of the earnings surprise increases.	$b_4>0$; $b_4+b_5>0$

There are two regressions to test hypotheses five through seven. The dependent variable in the first regression is under/overreaction measured relative to a control group. The first regression equation is:

$$REACTC = b_0 + b_1G + b_2ABS(UE)_{MD} + b_3(G\times ABS(UE)_{MD}) + b_4PERSIST_{MD} + b_5(G\times PERSIST_{MD}) + e \quad (9)$$

for losses (G = 0):

$$REACTC = b_0 + b_2ABS(UE)_{MD} + b_4PERSIST_{MD} + e \quad (10)$$

for gains (G = 1):

$$REACTC = (b_0+b_1) + (b_2+b_3)ABS(UE)_{MD} + (b_4+b_5)PERSIST_{MD} + e \quad (11)$$

Where:

REACTC	≡ amount of under/overreaction measured relative to a control group (- if underreaction, + if overreaction)
G	≡ 1 if UE are positive (gain), 0 if UE are negative (loss)
$ABS(UE)_{MD}$	≡ absolute value of unexpected earnings, mean deviated
$PERSIST_{MD}$	≡ subject's estimate of the persistence of UE, mean deviated
e	≡ disturbance term (error)

The coefficients in the regression can be interpreted as follows:

b_0: intercept for losses at the mean value of unexpected earnings
b_0+b_1: intercept for gains at the mean value of unexpected earnings
b_1: difference in intercepts
b_2: slope of $ABS(UE)_{MD}$ for losses
b_2+b_3: slope of $ABS(UE)_{MD}$ for gains
b_3: difference in slopes for $ABS(UE)_{MD}$ between gains and losses
b_4: slope of $PERSIST_{MD}$ for losses
b_4+b_5: slope of $PERSIST_{MD}$ for gains
b_5: difference in slopes for $PERSIST_{MD}$ between gains and losses

The second regression for testing hypotheses five through seven has

under/overreaction measured relative to a theoretical value as the dependent variable.

The second regression equation is:

$$REACTT = b_0 + b_1G + b_2ABS(UE)_{MD} + b_3(G \times ABS(UE)_{MD}) + e \quad (12)$$

for losses (G = 0):

$$REACTT = b_0 + b_2ABS(UE)_{MD} + e \quad (13)$$

for gains (G = 1):

$$REACTT = (b_0+b_1) + (b_2+b_3)ABS(UE)_{MD} + e \quad (14)$$

Where:

REACTT ≡ amount of under/overreaction measured relative to theoretical value (- if underreaction, + if overreaction)
G ≡ 1 if UE are positive (gain), 0 if UE are negative (loss)
$ABS(UE)_{MD}$ ≡ absolute value of unexpected earnings, mean deviated
e ≡ disturbance term (error)

The coefficients in the regression can be interpreted as follows:

b_0: intercept for losses at the mean value of unexpected earnings
b_0+b_1: intercept for gains at the mean value of unexpected earnings
b_1: difference in intercepts
b_2: slope of $ABS(UE)_{MD}$ for losses
b_2+b_3: slope of $ABS(UE)_{MD}$ for gains
b_3: difference in slopes for $ABS(UE)_{MD}$ between gains and losses

There are no hypotheses regarding persistence in the REACT regressions.

Persistence is included as an independent variable in the REACTC regression to

control for the differences in the perceived persistence of the earnings surprise between subjects. In the REACTT regression, persistence is used to calculate the dependent variable, and therefore is not included as an independent variable.

Hypotheses	Predictions
H5: There will be underreaction to unexpected earnings.	$b_0<0$; $b_0+b_1<0$
H6: There will be more underreaction to unexpected earnings for gains than for losses.	$b_1<0$
H7: Underreaction to unexpected earnings will increase as absolute unexpected earnings increase.	$b_2<0$; $b_2+b_3<0$

V. 6. Results

V. 6. a. Summary of the Subjects' Responses

A summary of the control groups' responses is in Table 6. There were 99 useable control group responses. There was fairly even distribution of subjects per level of EPS. The fewest number of subjects at a particular level was 12, at EPS=$1.20, and the most was 16, at EPS=$1.35. There was quite a bit of variance in the control group's responses. The average price was $25.90, with a standard deviation of 9.34. Standard deviations per level of earnings ranged from a low of 6.10 (EPS=$1.65) to a high of 13.22 (EPS=$1.95).

Table 6
Control Group Responses by Actual Earnings per Share

EPS =	$1.05	$1.20	$1.35	$1.50	$1.65	$1.80	$1.95	Total
No. of Subjects	13	12	16	15	13	15	15	99
Mean Price	$23.32	$22.79	$23.59	$26.97	$21.95	$30.40	$30.91	$25.90
Std. Dev.	9.71	7.26	7.37	6.79	6.10	9.60	13.22	9.34
Mean P/E	22.21	18.99	17.47	17.98	13.30	16.89	15.85	17.47
Std. Dev.	9.25	6.05	5.46	4.53	3.70	5.33	6.78	6.36
Regression Values	$21.71	$23.09	$24.46	$25.84	$27.22	$28.59	$29.97	$25.84
Revised Means	$22.03	$22.79	$23.59	$26.97	$28.78	$30.40	$30.91	$26.50

Mean Price is the mean value of one share of stock for all control subjects at that level of earnings.
Mean P/E is the mean price-earnings ratio of all control subjects at that level of earnings.
Regression Values are predicted values based on a regression of Mean Prices on EPS (see section **V. 7. e.**).
Revised Means are the mean values for the control subjects, except for EPS=$1.05 where a price-earnings regression predicted value was used, and EPS=$1.65 where the average P/E for EPS=$1.50 and EPS=$1.80 was used to determine price. See section **V. 7. e.** for a discussion of the modified control group values.

A summary of the experimental groups' responses is in Table 7 and Table 8. Table 7 has EPS (subjects' forecasts of earnings per share in stage one), Ex-Ante Price (subjects' value of one share in stage one), and Ex-Post Price (subjects' value of one share in stage two) by level of actual earnings. Unlike the control group responses, there was not an even distribution of subjects per level of EPS. The fewest number of subjects at a particular level was five, at EPS=$1.35, and the most was 18, at EPS=$1.90. There was quite a bit of variance in the experimental group's responses. The average ex-ante price was $24.04, with a standard deviation of 8.09. Standard deviations per level of earnings ranged from a low of 6.46 (EPS=$1.95) to a high of 12.63 (EPS=$1.20). The average ex-post price was $24.04, with a standard deviation of 10.48. Standard deviations per level of earnings ranged from a low of 6.73

(EPS=$1.35) to a high of 16.21 (EPS=$1.20).

Table 7
Experimental Group Responses by Actual Earnings per Share

EPS =	$1.05	$1.20	$1.35	$1.50	$1.65	$1.80	$1.95	Total
No. of Subjects	15	13	5	7	15	17	18	90
EPS Forecast	$1.50	$1.50	$1.59	$1.57	$1.64	$1.50	$1.47	$1.53
Std. Dev.	.08	.02	.06	.02	.09	.05	.08	.02
Ex-Ante Price	$23.43	$24.53	$25.73	$23.27	$24.68	$24.02	$23.49	$24.04
Std. Dev.	7.36	12.63	7.00	9.22	7.88	7.18	6.46	8.09
Ex-Post Price	$18.04	$21.84	$23.81	$24.98	$27.01	$29.04	$32.99	$26.01
Std. Dev.	7.81	16.21	6.73	7.42	9.20	6.85	7.88	10.48

EPS Forecast is the subjects' mean forecast of actual EPS at the end of stage one.
Ex-Ante Price is the subjects' mean forecast of the value of one share of stock at the end of stage one.
Ex-Post Price is the subjects' mean forecast of the value of one share of stock at the end of stage two.

Table 8 contains descriptive statistics of the following variables: Ex-Ante Price (subjects' value of one share in stage one), Ex-Post Price (subjects' value of one share in stage two), ERC, REACTC, REACTT, P/E1 (price-earnings ratio in stage one), P/E2 (price-earnings ratio in stage two), and PERSIST. In stage one, the subjects' average forecast of EPS was $1.53, the average P/E ratio was 16.00, and the average price was $24.04. In stage two, the average P/E ratio was 16.57, the average price was $26.01, and the average persistence was 54.08%. The average ERC was 16.29, the average overreaction relative to the control group (REACTC) was $2.05, and the average overreaction relative to theoretical value (REACTT) was $1.26.

Table 8
Experimental Group Responses

Variable	Mean	Std. Dev.	Minimum	Maximum
Ex-Ante Price	$24.04	8.09	3.20	54.50
Ex-Post Price	$26.01	10.48	3.00	66.60
ERC	16.29	33.46	-75.40	200.00
REACTC	$2.05	8.28	-15.40	28.05
REACTT	$1.26	5.91	-21.40	18.98
PE1	16.00	6.07	2.21	50.00
PE2	16.57	5.49	2.50	30.95
PERSIST	54.08	22.28	10.00	100.00

Ex-Ante Price is the subjects' mean forecast of the value of one share of stock at the end of stage one.
Ex-Post Price is the subjects' mean forecast of the value of one share of stock at the end of stage two.
ERC is the change in earnings from the subject's forecast in stage one to actual earnings in stage two, divided by the change in price from ex-ante price to ex-post price.
REACTC is the amount of under/overreaction measured relative to the control group.
REACTT is the amount of under/overreaction measured relative to theoretical value.
PE1 is the price in stage one divided by the subject's estimate of EPS.
PE2 is the price in stage two divided by the actual EPS from stage two.
PERSIST is the subjects' mean estimate of the persistence of the earning surprise.

V. 6. b. Manipulation Checks

The responses to the experiment were examined to see if the experimental manipulation and controls had been effective. The first examination is to see if subjects followed directions. When subjects received the materials in the mail, Envelope #1 was labeled "Open this envelope first." Envelope #2 was labeled "Open other envelope first." If subjects did not follow directions, and looked at the information in the second envelope before answering the questions in the first envelope, the controls were not effective. To test this, the responses to the questions in the first envelope were compared to the information contained in the second envelope. If the controls were effective, there should be no relation between the

answers to the questions in the first envelope and the information contained in the second envelope.

Examining the responses in Table 7, it appears the controls were mostly effective. There is no relation between the ex-ante price and the EPS information contained in envelope two. The only possible failure of the controls is the group that received envelope two containing actual EPS of $1.65. The EPS forecast for this group is $1.64 (std. dev. .09). There is no relation between the EPS forecast from envelope one and actual EPS from envelope two in any of the other six levels of actual earnings. One conclusion is that the $1.64 forecast is coincidentally close to actual EPS of $1.65 due to noise in the subjects' responses. This is confirmed when the responses to the experiment are examined on an individual basis, and no subject in that condition had an EPS forecast of exactly $1.65. The mean of the group is higher mainly due to one subject who forecast EPS of $2.80. When that subject is removed, the mean is $1.55.

Overall, six subjects' forecasts in envelope one were the same as the actual earnings in envelope two. Five of these subjects predicted EPS=$1.50, which was management's forecast of EPS. Overall, 29 subjects predicted EPS=$1.50. Purely by chance, we would expect approximately 4 of these to receive actual earnings of $1.50. Therefore it is of no concern that five of these subjects received actual EPS=$1.50. The sixth subject that correctly predicted actual EPS predicted EPS=$1.80. These six subjects are not included in the analysis, because an ERC can not be calculated, and they can not be classified into a gain or loss condition.

To test the effectiveness of the EPS manipulation, the individual responses to

the experiment were examined. If the manipulation was not effective, there would be no relation between change in price and unexpected earnings. Therefore, the ERC's in the experiment would be approximately half positive (change in price in the same direction as the change in earnings), and half negative (change in price in the opposite direction as the change in earnings). In the experiment, 75.6% of the ERC's are greater than zero, which is significantly greater than 50% at p=.000 (see Table 9). It appears that the manipulation of EPS was effective.

Table 9
Earnings Response Coefficient Manipulation Check

	N	%
ERC<0	8	8.9%
ERC=0	14	15.6%
ERC≤0	22	24.4%
ERC>0	68	75.6%*
ERC≥0	82	91.1%*
Total	90	100.0%

*Significantly greater than 50% at p=.000

The number and percentage of ERC's less than, equal to, and greater than zero for the experimental subjects. If earnings were not used in valuing the stock, approximately half the ERC's would be less than or equal to zero.

V. 6. c. Tests of ERC Characteristics

For further examination, regression analysis was performed on the responses to the experiment. To control for the undue influence of outliers, observations with residuals outside of three standard deviations were deleted (three observations). Results of the first regression can be found in Table 10, and a graph in Figure H. Hypothesis 1 states that the ERC's for losses will be larger than the ERC's for gains. ERC's for gains were larger than ERC's for losses (b_1=21.78, p=.999).

Hypothesis 2 states that as the absolute value of unexpected earnings increase,

the response per unit of surprise will decrease. Hypothesis 2 was not supported for losses (b_2=11.59, p=.694), but is supported for gains (b_2+b_3=-57.77, p=.002). Hypothesis 3 predicts that ERC's for losses will decrease faster than ERC's for gains. However, ERC's for gains decreased faster than ERC's for losses (b_3=-69.36, p=.989).

Hypothesis 4 predicts that the response per unit of surprise will increase as the perceived persistence of the surprise increases. Hypothesis 4 is not supported for losses (b_4=17.41, p=.216), and for gains the reaction is in the opposite direction (b_4+b_5=-48.02, p=.992).

Table 10
Results of Tests of H1, H2, H3, H4

$$ERC = b_0 + b_1G + b_2ABS(UE)_{MD} + b_3(G\times ABS(UE)_{MD}) + b_4PERSIST_{MD} + b_5(G\times PERSIST_{MD}) + e$$

Variable	Coefficient	Predicted Sign	Parameter Estimate	Standard Error	t	Sig t
Intercept (losses)	b_0	+	6.96	4.59	1.52	**.067**
Intercept (gains)	b_0+b_1	+	28.74	4.57	6.29	**.000**
G	b_1	- (H1)	21.78	6.48	3.36	.999
$ABS(UE)_{MD}$ (losses)	b_2	- (H2)	11.59	22.77	.51	.694
$ABS(UE)_{MD}$ (gains)	b_2+b_3	- (H2)	-57.77	18.90	-3.06	**.002**
$G\times ABS(UE)_{MD}$	b_3	+ (H3)	-69.36	29.59	-2.34	.989
$PERSIST_{MD}$ (losses)	b_4	+ (H4)	17.41	22.05	.79	.216
$PERSIST_{MD}$ (gains)	b_4+b_5	+ (H4)	-48.02	19.55	-2.46	.992
$G\times PERSIST_{MD}$	b_5	?	-65.43	29.47	-2.22	***.029**

*All tests are one-tailed except those noted with an asterisk.

R Square	.226
Adjusted R Square	**.179**

Analysis of Variance

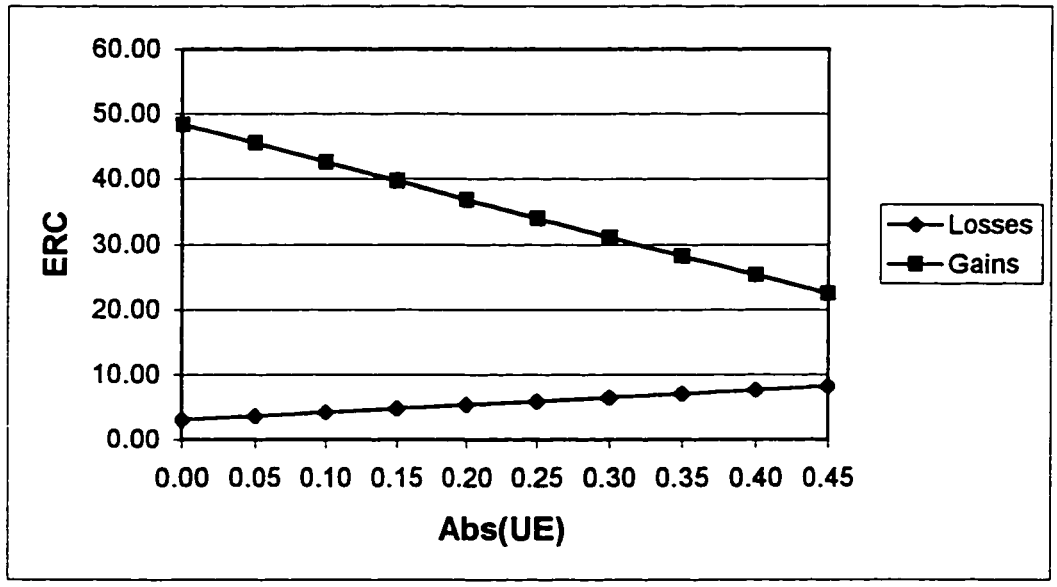
	DF	Sum of Squares	Mean Square
Regression	5	22470.32	4494.06
Residual	84	77151.34	918.47

F = 4.89 Signif F = **.001**

Where:

ERC	≡ change in price ÷ unexpected earnings
G	≡ 1 if UE are positive (gain), 0 if UE are negative (loss)
$ABS(UE)_{MD}$	≡ absolute value of unexpected earnings, mean deviated
$PERSIST_{MD}$	≡ subject's estimate of the persistence of UE, mean deviated
e	≡ disturbance term (error)

Figure H
Results of the Earnings Response Coefficient Regression



V. 6. d. Tests of Under/Overreaction

The first test of hypotheses five through seven has under/overreaction measured against a control group as the dependent variable (REACTC). The results of this regression are in Table 11, and a graph of the results in Figure I. To control for the undue influence of outliers, observations with residuals outside of three standard deviations were deleted (two observations).

The subjects did not behave as predicted by prospect theory. It was theorized that due to the value function, subjects would discount future earnings, and not incorporate them into price at full expected value. It appears that subjects might have

overreacted to the earnings surprises. Relative to the control group, subjects overreacted (for losses b_0=2.59, p=.982, and for gains, b_0+b_1=2.09, p=.953). Prospect theory predicts more underreaction for gains than for losses. There was no significant difference in the reaction to losses and gains (b_1=-.50, p=.387), Hypothesis six is not supported. Hypothesis seven predicts that the amount of underreaction will increase as the absolute value of unexpected earnings increase. Although the subjects overreacted, for gains the overreaction was decreasing as the absolute value of unexpected earnings increased (b_2+b_3=-12.17, p=.009). Hypothesis seven is not supported for losses (b_2=.95, p=.564).

Table 11
Results of Tests of H5, H6, H7
(Original Control Group)

$$REACTC = b_0 + b_1G + b_2ABS(UE)_{MD} + b_3(G\times ABS(UE)_{MD}) + b_4PERSIST_{MD} + b_5(G\times PERSIST_{MD}) + e$$

Variable	Coefficient	Predicted Sign	Parameter Estimate	Standard Error	t	Sig t
Intercept (losses)	b_0	- (H5)	2.59	1.22	2.13	.982
Intercept (gains)	b_0+b_1	- (H5)	2.09	1.23	1.70	.953
G	b_1	- (H6)	-.50	1.73	-.29	.387
$ABS(UE)_{MD}$ (losses)	b_2	- (H7)	.95	5.85	.16	.564
$ABS(UE)_{MD}$ (gains)	b_2+b_3	- (H7)	-12.17	5.07	-2.40	**.009**
$G\times ABS(UE)_{MD}$	b_3	?	-13.12	7.74	-1.70	***.094**
$PERSIST_{MD}$ (losses)	b_4	+	-1.36	5.76	-.24	.593
$PERSIST_{MD}$ (gains)	b_4+b_5	+	-9.20	5.25	-1.75	.958
$G\times PERSIST_{MD}$	b_5	?	-7.83	7.80	-1.01	*.318

*All tests are one-tailed except those noted with an asterisk.

R Square	.089
Adjusted R Square	**.035**

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	5	549.67	109.93
Residual	85	5626.64	66.20

F = 1.66 Signif F = .153

Where:

REACTC ≡ amount of under/overreaction measured relative to a control group (- if underreaction, + if overreaction)

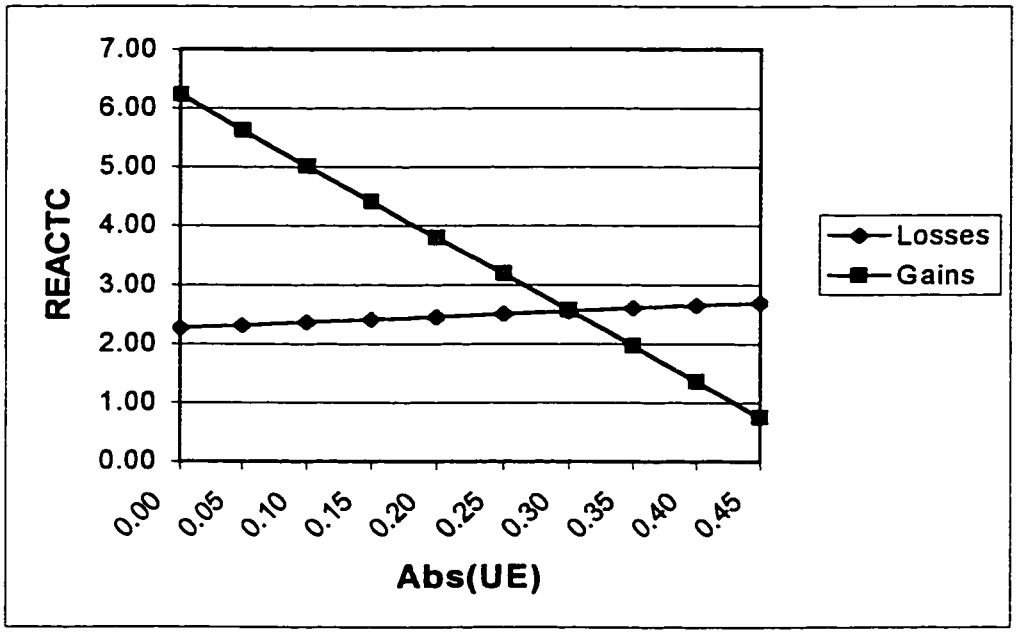
G ≡ 1 if UE are positive (gain), 0 if UE are negative (loss)

$ABS(UE)_{MD}$ ≡ absolute value of unexpected earnings, mean deviated

$PERSIST_{MD}$ ≡ subject's estimate of the persistence of UE, mean deviated

e ≡ disturbance term (error)

Figure I
Results of the Under/Overreaction Regression – Under/Overreaction Measured Relative to the Original Control Group



The second test of under/overreaction has under/overreaction measured against an economic model of price as the dependent variable (REACTT). The results of this regression are in Table 12, and a graph of the results in Figure J. To control for the undue influence of outliers, observations with residuals outside of three standard

deviations were deleted (two observations). Relative to the theoretical value, subjects did not underreact to losses (b_0=-.12, p=.442), but overreacted to gains (b_0+b_1=2.94, p=.999). Relative to theoretical value, the overreaction is larger for the gain subjects than the reaction by subjects who received unexpected losses (b_1=3.06, p=.995). Hypothesis seven predicts that the amount of underreaction will increase as the absolute value of unexpected earnings increase. Although the subjects overreacted, for gains the overreaction was decreasing as the absolute value of unexpected earnings increased (b_2+b_3=-12.08, p=.000). Hypothesis seven is not supported for losses (b_2=-1.79, p=.325).

Overreaction to unexpected earnings fits with the theory of DeBondt and Thaler (1985), that investors overweight recent information and underweight base rate data. In addition, overweighting recent information and underweighting base rate data is consistent with the findings of Ganguly et al. (1994).

Table 12
Results of Tests of H5, H6, H7
(Theoretical Value)

$$REACTT = b_0 + b_1G + b_2ABS(UE)_{MD} + b_3(G \times ABS(UE)_{MD}) + e$$

Variable	Coefficient	Predicted Sign	Parameter Estimate	Standard Error	t	Sig t
Intercept (losses)	b_0	- (H5)	-.12	.81	-.15	.442
Intercept (gains)	b_0+b_1	- (H5)	2.94	.82	3.59	.999
G	b_1	- (H6)	3.06	1.15	2.65	.995
$ABS(UE)_{MD}$ (losses)	b_2	- (H7)	-1.79	3.92	-.46	.325
$ABS(UE)_{MD}$ (gains)	b_2+b_3	- (H7)	-12.08	3.37	-3.58	**.000**
$G \times ABS(UE)_{MD}$	b_3	?	-10.30	5.17	-1.99	***.050**

*All tests are one-tailed except those noted with an asterisk.

R Square	.176
Adjusted R Square	**.148**

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	554.42	184.81
Residual	87	2593.63	29.81

F = 6.20 Signif F = **.001**

Where:

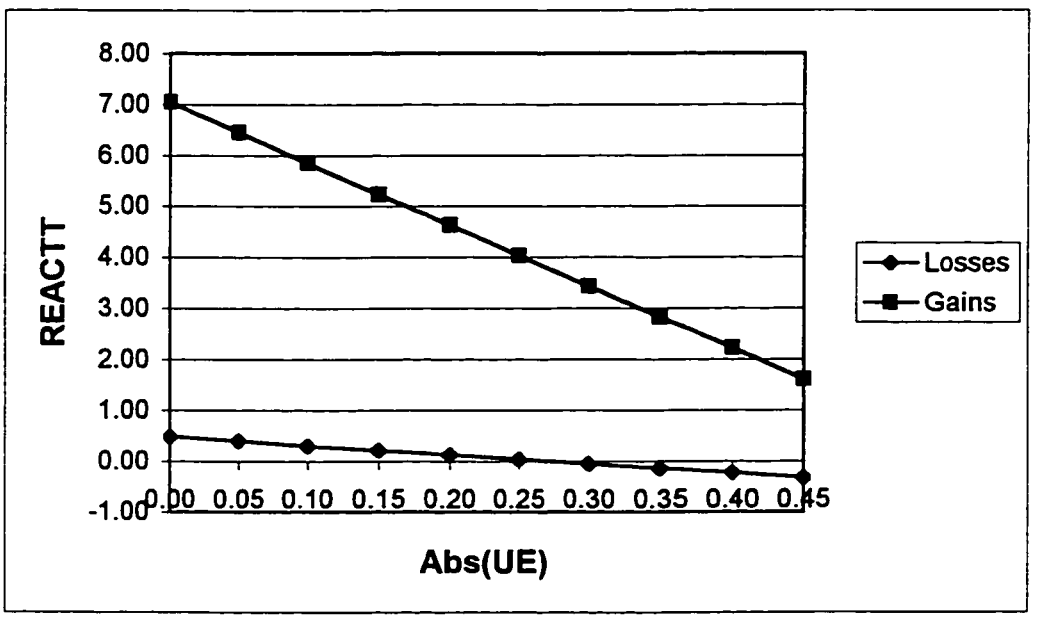
REACTT ≡ amount of under/overreaction measured relative to theoretical value (- if underreaction, + if overreaction)

G ≡ 1 if UE are positive (gain), 0 if UE are negative (loss)

$ABS(UE)_{MD}$ ≡ absolute value of unexpected earnings, mean deviated

e ≡ disturbance term (error)

Figure J
Results of the Under/Overreaction Regression – Under/Overreaction Measured Relative to Theoretical Value



V. 7. Post Hoc Analysis

V. 7. a. Test of Nonlinearity in the ERC Regression

It appears that there may be some nonlinearity in the earnings response coefficients (see graph of ERC's in Figure C). Note that this is different from the nonlinearity being tested in Hypothesis 2. Nonlinearity in the returns-earnings relation shows up in ERC's which decrease as the absolute value of unexpected earnings increase. Nonlinearity in ERC's is an additional prediction of prospect theory. In an effort to test for nonlinearity, an additional regression was run. In this regression, an additional independent variable was added, the square root of the absolute value of unexpected earnings. Note that this is only one possible form that nonlinearity could take, however, it is the most likely form because the graph of ERC's in Figure C shows that the ERC's are convex for absolute unexpected gains and absolute unexpected losses.

The results of the nonlinearity regression can be found in Table 13. For losses, the ERC's did not exhibit nonlinearity (b_4=70.45, p=.799), but ERC's for gains did exhibit this pattern (b_4+b_5=-322.01, p=.000). The other results were substantively the same as the regression without the nonlinearity components. A graph of the UE-ERC relation from Table 13 can be found in Figure K. For comparison, the graph of the predicted UE-ERC relation from section **III. 3.** can be found in Figure C. It appears as though Prospect Theory does a good job of explaining the response to unexpected gains, but not unexpected losses. That is possibly due to the shareholder's liquidation option discussed below.

Table 13
Tests of Nonlinearity in the Earnings Response Coefficient Regression

$$ERC = b_0 + b_1G + b_2ABS(UE)_{MD} + b_3(G \times ABS(UE)_{MD}) + b_4ABS(UE)^{(1/2)}_{MD} + b_5(G \times ABS(UE)^{(1/2)}_{MD}) + b_6PERSIST_{MD} + b_7(G \times PERSIST_{MD}) + e$$

Variable	Coefficient	Predicted Sign	Parameter Estimate	Standard Error	t	Sig t
Intercept (losses)	b_0	+	6.91	4.22	1.64	**.053**
Intercept (gains)	b_0+b_1	+	30.82	4.24	7.27	**.000**
G	b_1	- (H1)	23.91	5.99	3.99	.999
$ABS(UE)_{MD}$ (losses)	b_2	?	-50.76	76.92	-.66	*.511
$ABS(UE)_{MD}$ (gains)	b_2+b_3	?	167.13	58.26	2.87	***.005**
$G \times ABS(UE)_{MD}$	b_3	?	217.89	96.49	2.26	***.027**
$ABS(UE)^{(1/2)}_{MD}$ (losses)	b_4	-	70.45	83.62	.84	.799
$ABS(UE)^{(1/2)}_{MD}$ (gains)	b_4+b_5	-	-322.01	79.61	-4.05	**.000**
$G \times ABS(UE)^{(1/2)}_{MD}$	b_5	?	-392.46	115.46	-3.40	***.001**
$PERSIST_{MD}$ (losses)	b_6	+ (H4)	19.49	20.45	.95	.172
$PERSIST_{MD}$ (gains)	b_6+b_7	+ (H4)	-35.85	18.25	-1.96	.974
$G \times PERSIST_{MD}$	b_7	?	-55.35	27.41	-2.02	***.047**

*All tests are one-tailed except those noted with an asterisk.

R Square	.359
Adjusted R Square	**.304**

Analysis of Variance

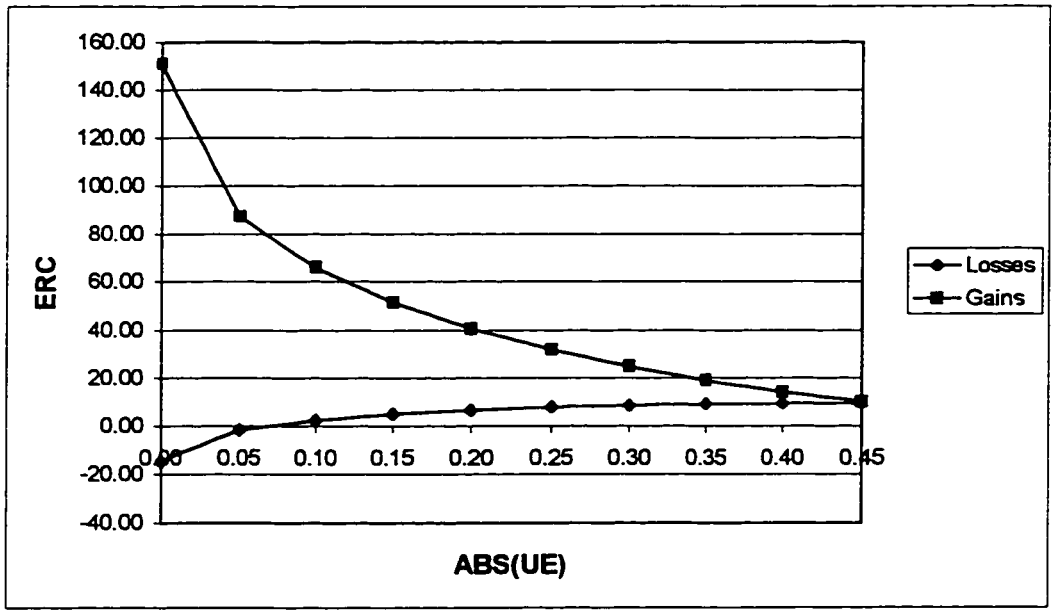
	DF	Sum of Squares	Mean Square
Regression	7	35763.84	5109.12
Residual	82	63857.82	778.75

F = 6.56 Signif F = .000

Where:

ERC	≡ change in price ÷ unexpected earnings
G	≡ 1 if UE are positive (gain), 0 if UE are negative (loss)
$ABS(UE)_{MD}$	≡ absolute value of unexpected earnings, mean deviated
$ABS(UE)^{(1/2)}_{MD}$	≡ square root of the absolute value of unexpected earnings, mean deviated
$PERSIST_{MD}$	≡ subject's estimate of the persistence of UE, mean deviated
e	≡ disturbance term (error)

Figure K
Results of the Nonlinear Earnings Response Coefficient Regression



V. 7. b. Shareholder's Liquidation Option

In the tests of the ERC hypotheses, the reaction to unexpected losses was not as predicted by prospect theory. The reaction to losses was less than the reaction to gains, and not decreasing as absolute unexpected earnings increased. It is possible this is due to the shareholder's liquidation option creating a floor for the loss subjects' responses. Ideally, unexpected gains and losses in the experiment would have approximately the same persistence. This was achieved in the stimuli by selecting a troubled company with a new opportunity to take their product overseas. However, using a troubled company might have led to a problem in the loss condition, due to a floor effect of the liquidation value of the firm. It is apparent that something should be done to control for proximity to liquidation value in the regression equation.

In a related returns-earnings relation paper, Hayn (1995) discusses the information content of losses (negative EPS). She argues that shareholders do not have to suffer losses indefinitely because they have a liquidation option, and price will never drop below liquidation value (market value of net assets). Although Hayn discusses losses as negative EPS, under certain conditions the theory might hold in the context of losses measured relative to earnings expectations. For example, for firms with current market value relatively close to liquidation value.

When the price of a stock is at or close to liquidation value, the response to unexpected gains and unexpected losses will be quite different from when the price is significantly above liquidation value (LV). When a firm has an unexpected loss, investors should not lower the price below liquidation value. Thus, for unexpected losses, ERC's will be relatively smaller as price (based on expected earnings)

approaches liquidation value. Price will be the greater of the present value of earnings and the liquidation value (Hayn [1995]). Thus, if the unexpected gain does not increase the present value of earnings so that it is greater than LV, price remains at LV, and the ERC is zero. Therefore, for unexpected gains, ERC's will be relatively smaller when price (based on expected earnings) is at liquidation value.

Following Hayn (1995), the price of a share of stock can be determined by a firm's earnings using the following simple model:

$$\begin{aligned} MV &= k \times EPS \quad \text{for} \quad EPS \geq EPS^* \\ &= LV \quad \text{for} \quad EPS < EPS^* \end{aligned}$$

Where:

$MV =$	Share price.
$k =$	Earnings multiplier.
$EPS =$	Expected earnings per share in perpetuity.
$LV =$	Liquidation value per share.
$EPS^* =$	$LV \div k$
$LV \div k =$	Level of expected earnings below which the liquidation option explained below is triggered.

As earnings decrease and approach EPS*, the probability of triggering the liquidation option increases. As this probability increases, the correlation coefficient between MV and EPS approaches zero. The implication for earnings surprises is that there may be no reaction to an unexpected gain or unexpected loss when actual EPS are less than EPS*. Therefore when EPS are less than EPS*, earnings are not value relevant.

Obviously unexpected gains and losses may differ in value relevance, because an unexpected gain will increase EPS, increasing the likelihood that EPS exceeds EPS*, while an unexpected loss decreases EPS and decreases the likelihood that EPS exceeds EPS*. A simple numerical example can be constructed to demonstrate this.

Assume k = 15, EPS = \$1.60, and LV = \$23.00. Then

$$MV = \begin{cases} 15 \times \$1.60 = \$24.00 & \text{for } EPS \geq EPS^* \\ \$23.00 & \text{for } EPS < EPS^* \end{cases}$$

Since EPS* = \$23.00 ÷ 15 = \$1.53, the first condition above holds (i.e., MV=\$24.00).

Now consider an unexpected loss of \$0.05. The price drops to \$23.25 (15 × \$1.55), and the ERC is 15. However, if the unexpected loss was \$0.10, price only decreases to \$23.00 (liquidation value), and the ERC is 10. Thus, as EPS decreases, there is less response per unit of surprise.

A similar example can be constructed for unexpected gains. Assume k = 15, EPS = \$1.45, and LV = \$23.00. Then

$$MV = \begin{cases} 15 \times \$1.45 = \$21.75 & \text{for } EPS \geq EPS^* \\ \$23.00 & \text{for } EPS < EPS^* \end{cases}$$

Since EPS* = \$23.00 ÷ 15 = \$1.53, the second condition above holds (i.e., MV=\$23.00).

Now consider an unexpected gain of \$0.05. The price remains at \$23.00, and the ERC is 0. However, if the unexpected gain was \$0.10, price increases to \$23.25 (15 × \$1.55), and the ERC is 2.5.

Following the same theory, on average, the response per unit of surprise will be larger for unexpected gains than for unexpected losses. This is because gains increase the probability that EPS ≥ EPS*. Losses increase the probability that EPS < EPS* where responses are bounded by liquidation value, which reduces ERC's. Therefore, the average response to an unexpected gain will be larger than the average response to an unexpected loss. Note that this is the exact opposite of what is predicted by prospect theory. However, it is only in the region near liquidation value

that this becomes an issue.

V. 7. c. Ex-Ante Price as a Dummy Variable

In an attempt to control for proximity to liquidation value, a dummy variable (EAPD) was constructed. The dummy variable was given a value of zero when the ex-ante price is below the median price, and a value of one when the ex-ante price is above the median price.[17] The new independent variable was added to the original ERC regression, along with the appropriate interactions. The results of the regression can be found in Table 14, and graphs of Table 14 in Figure L and Figure M. When ex-ante price is below median value, ERC's should be less than when ex-ante price is above median value. In addition, some of the hypotheses, as predicted by Prospect Theory, may not hold. For example, if ex-ante price is close to liquidation value, there will be a stronger reaction to gains than to losses, due to the floor effect.

The results of the regression do not agree with the theory that ERC's will decrease as ex-ante price approaches liquidation value. There was no significant difference in ERC's above and below median value (for losses, b_2=-.47, p=.521, and for gains, b_2+b_3=-2.28, p=.609). As expected, when ex-ante price is below median value, ERC's for gains were significantly larger than ERC's for losses (b_1=17.00, p=.029). However, above median value, ERC's for gains were also larger than ERC's for losses (b_1+b_3=15.18, p=.966). Hypothesis two states that ERC's will decrease as the absolute value of unexpected earnings increase. This was never true for losses, only true for gains when ex-ante price was higher than median value ($b_4+b_5+b_6+b_7$=

-258.25, p=.000). So controlling for the level of ex-ante price does not do a good job of explaining results that are contrary to prospect theory.

Table 14
Liquidation Value Regression, with Ex-Ante Price as a Dummy Variable

$$ERC = b_0 + b_1G + b_2EAPD + b_3(G\times EAPD) + b_4ABS(UE)_{MD} + b_5(G\times ABS(UE)_{MD}) + b_6(EAPD\times ABS(UE)_{MD}) + b_7(G\times EAPD\times ABS(UE)_{MD}) + b_8PERSIST_{MD} + b_9(G\times PERSIST_{MD}) + b_{10}(EAPD\times PERSIST_{MD}) + b_{11}(G\times EAPD\times PERSIST_{MD}) + e$$

Variable	Coefficient	Predicted Sign	Parameter Estimate	Standard Error	t	Sig t
Intercept (losses, EAP<Md)	b_0	+	8.32	7.04	1.18	.120
Intercept (gains, EAP<Md)	b_0+b_1	+	25.32	5.28	4.80	.000
Intercept (losses, EAP>Md)	b_0+b_2	+	7.85	5.23	1.50	.069
Intercept (gains, EAP>Md)	$b_0+b_1+b_2+b_3$	+	23.03	6.35	3.63	.000
G (EAP<Md)	b_1	+	17.00	8.80	1.93	.029
G (EAP>Md)	b_1+b_3	- (H1)	15.18	8.23	1.85	.966
G×EAPD	b_3	-	-1.82	12.05	-.15	.440
EAPD (losses)	b_2	+	-.47	8.77	-.05	.521
EAPD (gains)	b_2+b_3	+	-2.28	8.26	-.28	.609
G×EAPD	b_3	-	-1.82	12.05	-.15	.440
$ABS(UE)_{MD}$ (losses, EAP<Md)	b_4	-	59.94	42.24	1.42	.920
$ABS(UE)_{MD}$ (gains, EAP<Md)	b_4+b_5	-	-19.70	18.12	-1.09	.140
$ABS(UE)_{MD}$ (losses, EAP>Md)	b_4+b_6	- (H2)	-5.76	23.25	-.25	.403
$ABS(UE)_{MD}$ (gains, EAP>Md)	$b_4+b_5+b_6+b_7$	- (H2)	-258.25	49.87	-5.18	.000
G×ABS(UE) (EAP<Md)	b_5	+	-79.64	45.96	-1.73	.956
$G\times ABS(UE)_{MD}$ (EAP>Md)	b_5+b_7	+ (H3)	-252.49	55.02	-4.59	.999
$G\times EAPD\times ABS(UE)_{MD}$	b_7	+	-172.85	71.69	-2.41	.991
$EAPD\times ABS(UE)_{MD}$ (losses)	b_6	-	-65.70	48.22	-1.36	.088
$EAPD\times ABS(UE)_{MD}$ (gains)	b_6+b_7	-	-238.55	53.06	-4.50	.000
$G\times EAPD\times ABS(UE)_{MD}$	b_7	-	-172.85	71.69	-2.41	.009
$PERSIST_{MD}$ (losses, EAP<Md)	b_8	+	41.33	27.43	1.51	.068
$PERSIST_{MD}$ (gains, EAP<Md)	b_8+b_9	+	-2.65	21.30	-.13	.549
$PERSIST_{MD}$ (losses, EAP>Md)	b_8+b_{10}	+ (H4)	-5.15	27.20	-.19	.575
$PERSIST_{MD}$ (gains, EAP>Md)	$b_8+b_9+b_{10}+b_{11}$	+ (H4)	-89.48	30.77	-2.91	.998
$G\times PERSIST_{MD}$ (EAP<Md)	b_9	0	-43.98	34.73	-1.27	*.209
$G\times PERSIST_{MD}$ (EAP>Md)	b_9+b_{11}	0	-84.32	41.07	-2.05	*.043
$G\times EAPD\times PERSIST_{MD}$	b_{11}	0	-40.34	53.79	-.75	*.456
$EAPD\times PERSIST_{MD}$ (losses)	b_{10}	0	-46.48	38.63	-1.20	*.233
$EAPD\times PERSIST_{MD}$ (gains)	$b_{10}+b_{11}$	0	-86.82	37.43	-2.32	*.023
$G\times EAPD\times PERSIST_{MD}$	b_{11}	0	-40.34	53.79	-.75	*.456

*All tests are one-tailed except those noted with an asterisk.

[17] Various options were considered for an appropriate dummy variable. Tests were performed with the split at book value, and the results were not significantly different from those reported here. The median split is reported, because when all variables are added to the regression, the book value dummy variable model is not full rank.

R Square	.455
Adjusted R Square	**.379**

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	45359.49	4123.59
Residual	78	54262.17	695.67

F = 5.93 Signif F = **.000**

Where:

ERC ≡ change in price ÷ unexpected earnings
G ≡ 1 if UE are positive (gain), 0 if UE are negative (loss)
EAPD ≡ 1 if ex-ante price is greater than median ex-ante price, 0 if ex-ante price is less than median ex-ante price
$ABS(UE)_{MD}$ ≡ absolute value of unexpected earnings, mean deviated
$PERSIST_{MD}$ ≡ subject's estimate of the persistence of UE, mean deviated
e ≡ disturbance term (error)

Figure L
Results of the Ex-Ante Price Dummy Variable Regression
Ex-Ante Price < Median

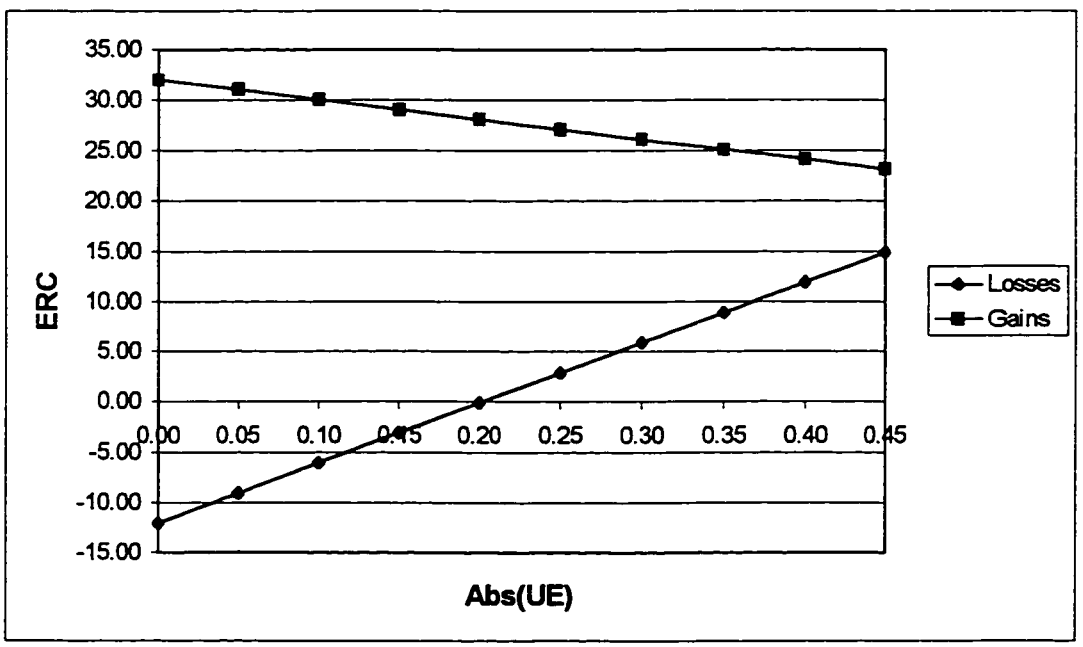
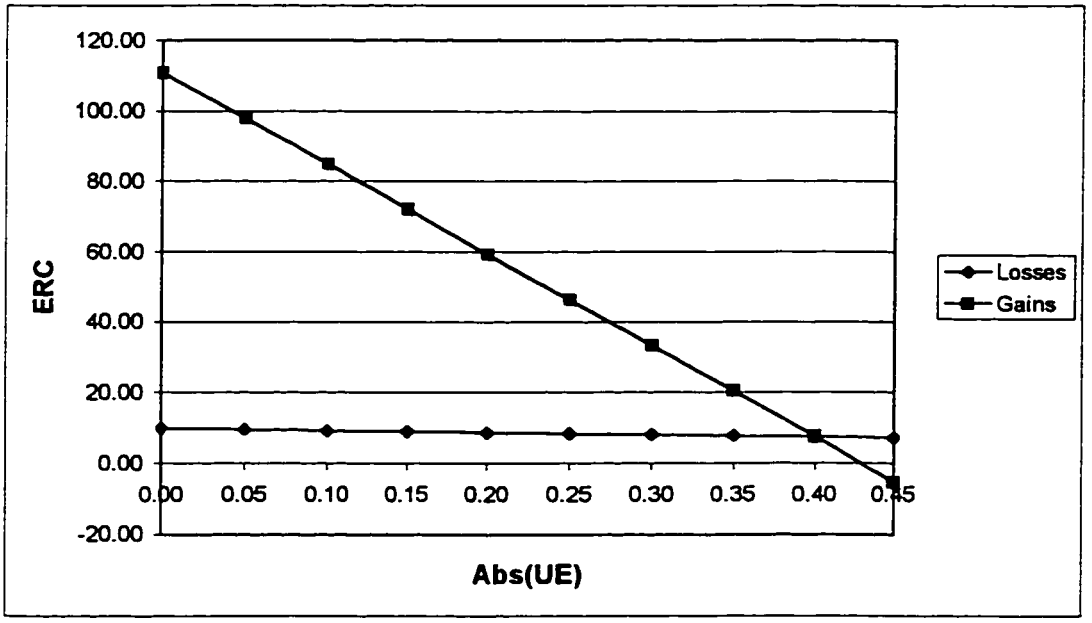


Figure M
Results of the Ex-Ante Price Dummy Variable Regression
Ex-Ante Price > Median



V. 7. d. Traditional Returns-Earnings Regression

To make this study comparable to other returns-earnings relation studies, an additional regression was run, in which both the dependent and independent variables were changed. This regression is similar to a traditional returns-earnings regression used in archival studies. The dependent variable is returns (change in price divided by ex-ante price) and the independent variables are similar to the variables in the other ERC regressions, scaled by ex-ante price. Unexpected earnings are used in place of the absolute value of unexpected earnings, and the square of unexpected earnings (sign preserving) is added to test for the nonlinear returns-earnings relation (Hypothesis 2). Additionally, persistence is assumed to interact with unexpected earnings, which is consistent with the findings of Kormendi and Lipe (1987). The results of this regression can be found in Table 15, and a graph of the results in Figure N.

Where possible, the original hypotheses were used to predict the sign of the regression coefficients. Hypothesis 2, which predicts a nonlinear returns-earnings relation was not supported for losses (b_4=-4.87, p=.295), but was supported for gains (b_4+b_5=-11.17, p=.012). Hypothesis 3 was not supported (b_5=-6.31, p=.731). Hypothesis 4 predicts that as persistence increases, ERC's increase. Hypothesis 4 was supported for losses (b_6=10.50, p=.096), but not for gains (b_6+b_7=4.27, p=.325). The results of the additional ERC regressions confirm the findings of the original ERC regression, increasing confidence in the results.

Examining the responses, it is apparent that some subjects overreacted to earnings announcements. In addition, some subjects performed simple mechanical calculations (Industry P/E × EPS) for both the earnings forecast and actual earnings. Both of these types of subjects acted in a manner inconsistent with prospect theory, possibly leading to the insignificant and contrary results of hypotheses one, three, and four.

Table 15
Traditional Returns-Earnings Regression

$$RET = b_0 + b_1G + b_2UE/P + b_3(G\times UE/P) + b_4(UE\times ABS(UE))/P + b_5(G\times(UE\times ABS(UE))/P) + b_6UE/P\times PERSIST_{MD} + b_7G\times(UE/P\times PERSIST_{MD}) + e$$

Variable	Coefficient	Predicted Sign	Parameter Estimate	Standard Error	t	Sig t
Intercept (losses)	b_0	0	-.05	.05	-.99	*.324
Intercept (gains)	b_0+b_1	0	.03	.08	.42	*.679
G	b_1	0	.09	.10	.87	*.385
UE/P (losses)	b_2	+	6.28	5.07	1.24	.109
UE/P (gains)	b_2+b_3	+	21.97	6.83	3.22	**.001**
G×UE/P	b_3	-	15.69	8.50	1.85	.966
(UE×ABS(UE))/P (losses)	b_4	- (H2)	-4.87	8.99	-.54	.295
(UE×ABS(UE))/P (gains)	b_4+b_5	- (H2)	-11.17	4.87	-2.29	**.012**
G×(UE×ABS(UE))/P	b_5	+ (H3)	-6.31	10.22	-.62	.731
UE/P×$PERSIST_{MD}$ (losses)	b_6	+ (H4)	10.50	7.99	1.31	**.096**
UE/P×$PERSIST_{MD}$ (gains)	b_6+b_7	+ (H4)	4.27	9.37	.46	.325
G×(UE/P×$PERSIST_{MD}$)	b_7	0	-6.23	12.31	-.51	*.614

*All tests are one-tailed except those noted with an asterisk.

R Square	.497
Adjusted R Square	**.454**

Analysis of Variance

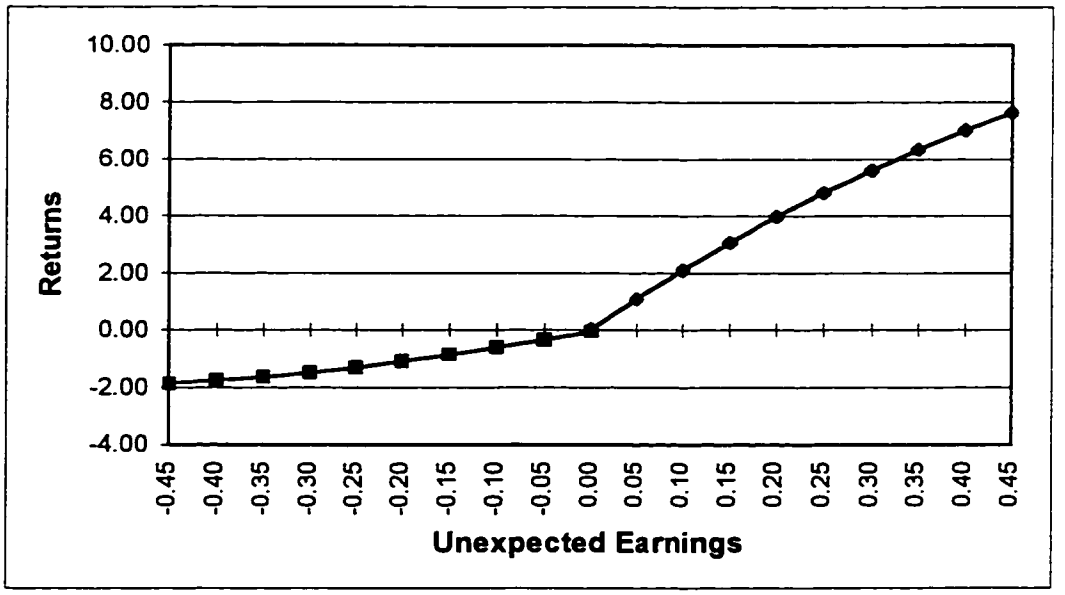
	DF	Sum of Squares	Mean Square
Regression	7	4.96	.71
Residual	82	5.03	.06

F = 11.56 Signif F = **.000**

Where:

RET	≡ change in price, scaled by ex-ante price
G	≡ 1 if UE are positive (gain), 0 if UE are negative (loss)
UE/P	≡ unexpected earnings, scaled by ex-ante price
(UE×ABS(UE))/P	≡ UE squared, sign preserving, scaled by ex-ante price
e	≡ disturbance term (error)

Figure N
Results of the Traditional Returns–Earnings Regression, Assuming Persistence at the Median Value (54%)



V. 7. e. Additional Tests of Under/Overreaction

In the test of under/overreaction relative to theoretical value, each subject's estimate of the persistence of the earnings surprise was used to calculate the dependent variable. If this probability has been underweighted due to the prospect theory weighting function, there might be a bias toward finding overreaction. As one test of under/overreaction without this possible bias, a regression was run with a different dependent variable. The new dependent variable is a theoretical value calculated assuming the probability of the earnings surprise being persistent is 100%. Overreaction relative to this measure would be free from possible bias due to prospect theory. The results of this regression can be found in Table 16.

Relative to the new theoretical value, the loss subjects underreacted (b_0=-2.41, p=.010). Relative to the new theoretical value, the gain subjects did not significantly

overreact or underreact (b_0+b_1=.19, p=.574). Hypothesis 6 predicts more underreaction for gain subjects than loss subjects, Hypothesis 6 was not supported (b_1=2.60, p=.962). Hypothesis 7 predicts that underreaction will be larger in magnitude (more negative) as absolute unexpected earnings increase. Hypothesis 7 is supported for losses (b_2=-7.72, p=.062), and for gains the under/overreaction is decreasing as unexpected earnings increase (b_2+b_3=-42.04, p=.000).

The results from the original under/overreaction regression (Table 12) were overreaction for gains, and no under/overreaction for losses (see Section **V. 6. d.**). It appears that the persistence measures supplied by the subjects were not biased due to prospect theory, but that the gain subjects did not discount their valuations for partially transitory earnings surprises (persistence less than 100%). Another plausible explanation is that the discount rates used by the gain subjects decreased in stage two due to the growth prospects of the firm, but that is not supported by P/E ratios which decreased from stage one to stage two, from 16.73 to 16.45.

Table 16
Results of Tests of H5, H6, H7, Using New Theoretical Value Where Persistence = 100%

$$REACTT_N = b_0 + b_1G + b_2ABS(UE)_{MD} + b_3(G\times ABS(UE)_{MD}) + e$$

Variable	Coefficient	Predicted Sign	Parameter Estimate	Standard Error	t	Sig t
Intercept (losses)	b_0	- (H5)	-2.41	1.02	-2.36	**.010**
Intercept (gains)	b_0+b_1	- (H5)	.19	1.03	.19	.574
G	b_1	- (H6)	2.60	1.45	1.80	.962
$ABS(UE)_{MD}$ (losses)	b_2	- (H7)	-7.72	4.94	-1.56	**.062**
$ABS(UE)_{MD}$ (gains)	b_2+b_3	- (H7)	-42.04	4.24	-9.91	**.000**
$G\times ABS(UE)_{MD}$	b_3	?	-34.32	6.51	-5.27	***.000**

*All tests are one-tailed except those noted with an asterisk.

R Square	.538
Adjusted R Square	**.522**

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	4789.43	1596.48
Residual	87	4110.16	47.24

F = 33.79 Signif F = **.000**

Where:

$REACTT_N$ ≡ amount of under/overreaction measured relative to theoretical value where persistence = 100% (- if underreaction, + if overreaction)

G ≡ 1 if UE are positive (gain), 0 if UE are negative (loss)

$ABS(UE)_{MD}$ ≡ absolute value of unexpected earnings, mean deviated

e ≡ disturbance term (error)

A change in price-earnings (P/E) ratios from stage one to stage two in the experiment is an additional way to check for under/overreaction. An increase in P/E ratios for the gain subjects would have been compelling evidence for overreaction, as would a decrease in P/E ratios for loss subjects. However, the P/E ratio for gain subjects decreased on average, and the P/E ratio for loss subjects increased on average. A summary of these results can be found in Table 17.

The mean (std. dev.) P/E ratio in stage one for all subjects was 16.00 (6.07). For loss subjects, the mean (std. dev.) was 15.28 (5.08), for gain subjects the mean (std. dev.) was 16.73 (6.91). In stage two, the overall mean (std. dev.) was 16.57 (5.49). For loss subjects, the mean (std. dev.) was 16.69 (6.31), for gain subjects the mean (std. dev.) was 16.45 (4.58). No definitive conclusion can be drawn regarding under/overreaction from these results.

Table 17
Price-Earnings Ratios, by Stage and Gain or Loss Condition

	P/E Stage 1 Mean (Std. Dev.)	P/E Stage 2 Mean (Std. Dev.)
Loss Subjects	15.28 (5.08)	16.69 (6.31)
Gain Subjects	16.73 (6.91)	16.45 (4.58)
Overall	16.00 (6.07)	16.57 (5.49)

P/E Stage 1 is the price in stage one divided by the subject's estimate of EPS.
P/E Stage 2 is the price in stage two divided by the actual EPS from stage two.

A summary of the change in P/E ratios from stage one to stage two can be found in Table 18. For the gain subjects, 23 increased, 21 decreased and one did not change. For the loss subjects, 27 increased, 16 decreased and 3 did not change. No conclusion can be drawn regarding under/overreaction from these results, although it appears more gain subjects might have overreacted than loss subjects. This is only a weak conclusion however, because using P/E ratios to gauge under/overreaction is dependent upon the persistence of the earnings surprise.

Table 18
Change in Price-Earnings Ratio from Stage One to Stage Two, by Gain or Loss Condition

	Decreased	No Change	Increased
Loss Subjects	16	3	27
Gain Subjects	21	1	23
Overall	37	4	50

There also might have been spurious findings in the under/overreaction regression with under/overreaction measured relative to the control subjects' estimate of price. The values used for the control group prices at the seven levels of actual EPS can be found in Table 6. Examining the mean values, it is apparent that not all of the control groups provided consistent responses. For example, the mean price at

EPS=$1.05 is $23.32, and at EPS=$1.35, the mean price is $22.79. It is not sensible that as earnings increase, price decreases. There is also odd behavior when EPS=$1.65. The mean value at EPS=$1.50 is $26.97, at EPS=$1.65, $21.95, and at EPS=$1.80, $30.40. An expected value for EPS=$1.65 is around $28.69, the average of the EPS=$1.50 and EPS=$1.80 values. Of course, subjects did not see multiple EPS levels so this inconsistency would not be apparent to them.

In an attempt to obtain a better set of control values, a regression was run on the seven mean control group values. The dependent variable in the regression was price, and the independent variable was EPS. Predicted values were then calculated using the parameter estimates from the regression output. The regression predicted values can be found in Table 6.

Using the predicted values from the regression as the fundamental value against which under/overreaction is measured, a regression was run. The results of this regression are in Table 19, and a graph of the results in Figure O. Similar to the first REACTC regression, the subjects did not behave as predicted by prospect theory. The primary difference in the results is a decrease in the amount of overreaction by the gain subjects. This can be attributed to the large increase in the predicted value for actual EPS=$1.65. The increase in value from the control group's mean value of $21.95 to the regression predicted value of $27.22 would primarily affect the gain subjects (the mean ex-ante forecast of EPS for the experimental group was $1.53).

Relative to the regression predicted values, subjects overreacted (for losses b_0=2.40, p=.976, and for gains, b_0+b_1=1.67, p=.914). Prospect theory predicts more underreaction to gains than to losses. There was no significant difference in the

overreaction to losses and gains (b_1=-.74, p=.333). Hypothesis seven predicts that the amount of underreaction will increase as the absolute value of unexpected earnings increase. Although the subjects overreacted, for gains the overreaction was decreasing as the absolute value of unexpected earnings increased (b_2+b_3=-7.06, p=.080). Hypothesis seven is not supported for losses (b_2=1.10, p=.576).

Table 19
Results of Tests of H5, H6, H7, Using Regression Predicted Values as the Control

$$REACTC_M = b_0 + b_1G + b_2ABS(UE)_{MD} + b_3(G\times ABS(UE)_{MD}) + b_4PERSIST_{MD} + b_5(G\times PERSIST_{MD}) + e$$

Variable	Coefficient	Predicted Sign	Parameter Estimate	Standard Error	t	Sig t
Intercept (losses)	b_0	- (H5)	2.40	1.19	2.02	.976
Intercept (gains)	b_0+b_1	- (H5)	1.67	1.21	1.38	.914
G	b_1	- (H6)	-.74	1.70	-.43	.333
$ABS(UE)_{MD}$ (losses)	b_2	- (H7)	1.10	5.74	.19	.576
$ABS(UE)_{MD}$ (gains)	b_2+b_3	- (H7)	-7.06	4.98	-1.42	**.080**
$G\times ABS(UE)_{MD}$	b_3	?	-8.17	7.60	-1.08	*.286
$PERSIST_{MD}$ (losses)	b_4	+	-2.72	5.66	-.48	.684
$PERSIST_{MD}$ (gains)	b_4+b_5	+	-8.62	5.15	-1.67	.951
$G\times PERSIST_{MD}$	b_5	?	-5.90	7.65	-.77	*.443

*All tests are one-tailed except those noted with an asterisk.

R Square	.056
Adjusted R Square	.000

Analysis of Variance

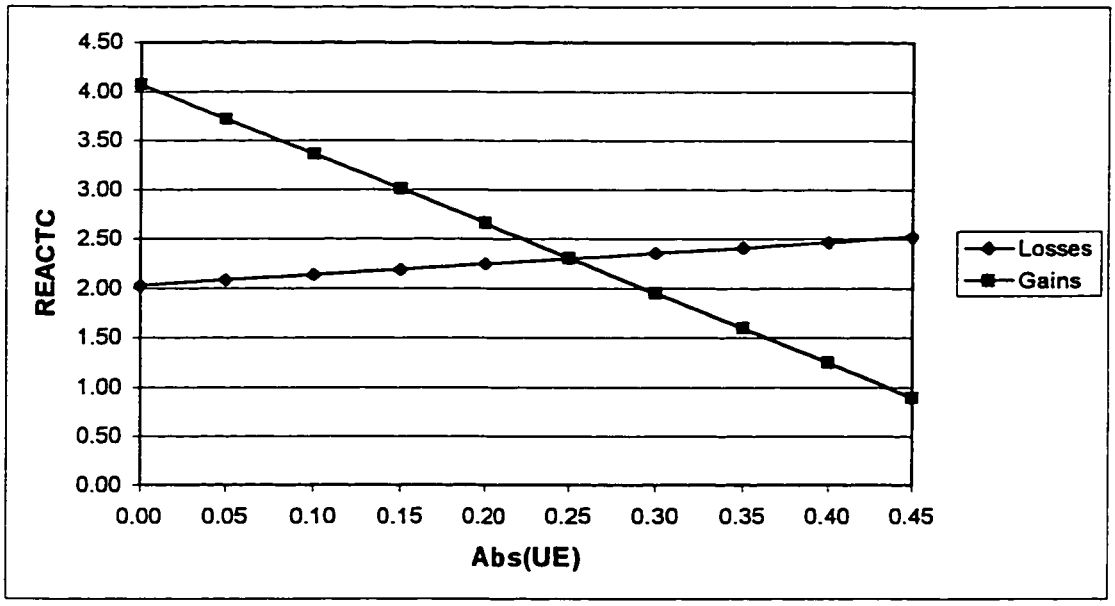
	DF	Sum of Squares	Mean Square
Regression	5	319.94	63.99
Residual	85	5420.48	63.77

F = 1.00 Signif F = .421

Where:

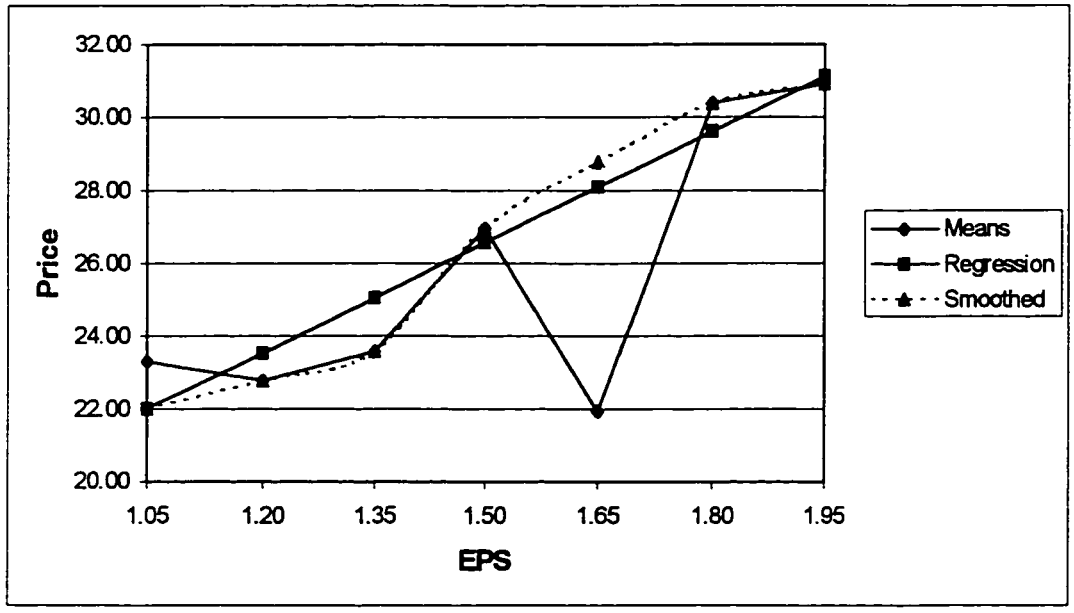
$REACTC_M$ ≡ amount of under/overreaction measured relative to a model of the control group responses (- if underreaction, + if overreaction)
G ≡ 1 if UE are positive (gain), 0 if UE are negative (loss)
$ABS(UE)_{MD}$ ≡ absolute value of unexpected earnings, mean deviated
$PERSIST_{MD}$ ≡ subject's estimate of the persistence of UE, mean deviated
e ≡ disturbance term (error)

Figure O
Results of the Under/Overreaction Regression – Under/Overreaction Measured Relative to a Regression Model of the Control Group's Responses



Although the regression may have provided more consistent control group values, it imposes linearity. In an attempt to find better control group values, various nonlinear functions were investigated. Except for the value for EPS=$1.65, the mean control group responses fit an approximate S-shape. A graph of the control groups responses can be found in Figure P. To approximate the S-shape, while maintaining as much of the original data as possible, two changes were made to the original responses. It was pointed out earlier that the responses at EPS=$1.05 and EPS=$1.65 appears inexplicable. To correct the response at EPS=$1.65, the average P/E for EPS=$1.50 and EPS=$1.80 was applied to EPS of $1.65. This results in a value of $28.78.

Figure P
Graph of the Control Group Responses



For the EPS=$1.05 group, a regression was run on the P/E ratios for all of the groups except EPS=$1.65 (the other odd group). The P/E ratio for EPS=$1.05 was

included in the regression to maintain as much information from the original responses as possible, and to avoid understating price for that level of earnings. The resulting regression coefficients were then used to set a value for EPS=$1.05 ($22.03). After the values at EPS=$1.05 and EPS=$1.65 are changed, the resulting control group prices fit an approximate S-shape which is convex below $1.50 and concave above $1.50.

A regression was run, with under/overreaction measured relative to the "smoothed" control group means. The results of this regression are in Table 20, and a graph of the results in Figure Q. Similar to the first two REACTC regressions, the subjects did not behave as predicted by prospect theory. The primary difference in the results is an increase in overreaction by the loss subjects, and a decrease in overreaction by the gain subjects.

Relative to the revised mean values, subjects overreacted to losses (b_0=2.73, p=.987) but not to gains (b_0+b_1=.22, p=.572). Prospect theory predicts more underreaction to gains than to losses. Relative to the control group, there was more overreaction to losses than to gains (b_1=-2.51, p=.072). Hypothesis seven predicts that the amount of underreaction will increase as the absolute value of unexpected earnings increase. Although the subjects overreacted, for gains the overreaction was decreasing as the absolute value of unexpected earnings increased (b_2+b_3=-6.47, p=.099). Hypothesis seven is not supported for losses (b_2=.73, p=.550).

Table 20
Results of Tests of H5, H6, H7, Using Revised Control Group Means Based on a Smooth S-Shaped Function

$$REACTC_R = b_0 + b_1G + b_2ABS(UE)_{MD} + b_3(G \times ABS(UE)_{MD}) + b_4PERSIST_{MD} + b_5(G \times PERSIST_{MD}) + e$$

Variable	Coefficient	Predicted Sign	Parameter Estimate	Standard Error	t	Sig t
Intercept (losses)	b_0	- (H5)	2.73	1.20	2.28	.987
Intercept (gains)	b_0+b_1	- (H5)	.22	1.21	.18	.572
G	b_1	- (H6)	-2.51	1.70	-1.47	**.072**
$ABS(UE)_{MD}$ (losses)	b_2	- (H7)	.73	5.75	.13	.550
$ABS(UE)_{MD}$ (gains)	b_2+b_3	- (H7)	-6.47	4.99	-1.30	**.099**
$G \times ABS(UE)_{MD}$	b_3	?	-7.20	7.61	-.95	*.347
$PERSIST_{MD}$ (losses)	b_4	+	-2.16	5.67	-.38	.648
$PERSIST_{MD}$ (gains)	b_4+b_5	+	-8.40	5.16	-1.63	.946
$G \times PERSIST_{MD}$	b_5	?	-6.24	7.66	-.81	*.418

*All tests are one-tailed except those noted with an asterisk.

R Square	.077
Adjusted R Square	**.022**

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	5	450.63	90.13
Residual	85	5435.45	63.95

F = 1.41 Signif F = .229

Where:

$REACTC_R$ ≡ amount of under/overreaction measured relative to revised control group mean responses (- if underreaction, + if overreaction)

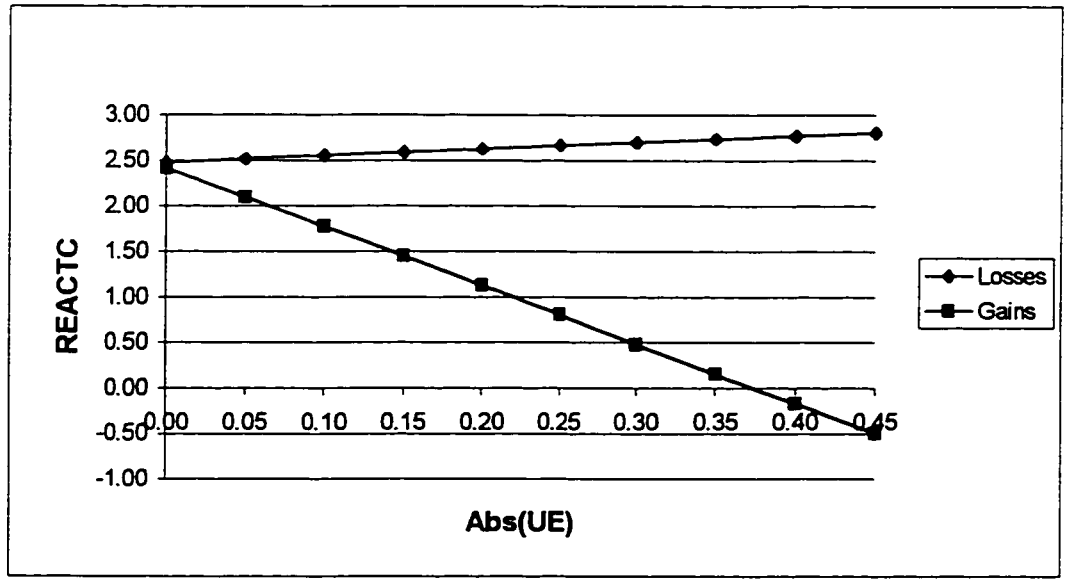
G ≡ 1 if UE are positive (gain), 0 if UE are negative (loss)

$ABS(UE)_{MD}$ ≡ absolute value of unexpected earnings, mean deviated

$PERSIST_{MD}$ ≡ subject's estimate of the persistence of UE, mean deviated

e ≡ disturbance term (error)

Figure Q
Results of the Under/Overreaction Regressions – Under/Overreaction Measured Relative to Smooth S-Shaped Revised Control Group Means



V. 8. Other Data Gathered

In addition to the results above, other information was obtained throughout the experiment. After making the first valuation decision, subjects were asked to rank the five items used most when establishing the value of the stock. In order, the top six items used the most were the Income Statement, Balance Sheet, Analysts' Forecasts of EPS, the firm's Financial Ratios, Industry Financial Ratios, and Industry Earnings Information. Table 21 has the complete results for this question, and a score for each item. The score is based on five points for listing the item first, four points for listing the item second, three points for listing the item third, two points for listing the item fourth, and one point for listing the item fifth.

Table 21
Experimental Group Response – Items used most when establishing value.

Item	Score*
Income Statement	217
Balance Sheet	175
Analysts' Forecasts of EPS	164
Natirat's Financial Ratios	146
Industry Financial Ratios	102
Industry Earnings Information	86
Statement of Cash Flows	79
Management's Forecast of EPS	75
Company History	70
Written Discussion of the Industry	70
Management Discussion and Analysis	57
Your Own Forecast of EPS	49
President's Letter	31
Other	23

*The score is based on five points for listing the item first, four points for listing the item second, three points for listing the item third, two points for listing the item fourth, and one point for listing the item fifth.

Eight demographic questions were asked at the end of the questionnaire. The first was regarding the type of investments the subject had. Ninety one percent of the subjects have money invested in individual stocks, 86% of the subjects have an IRA or 401k plan, 85% have money invested in mutual funds, 52% have real estate holdings, 22% have investments in municipal bonds, 21% have investments in corporate bonds, 18% have investments in collectibles, and 16% have other types of investments. Complete results are shown in Table 22. Subjects were then asked what type of broker they use. Fifty four percent use a discount broker, 23% a full-service broker, 11% trade online, and 11% invest using other means. Full results can be found in Table 23.

Table 22
Experimental Group Response – "What type of investments do you have?"

Individual Stocks	91.3%
IRA or 401k	86.4%
Mutual Funds	85.4%
Real Estate	52.4%
Municipal Bonds	22.3%
Corporate Bonds	21.4%
Collectibles	17.5%
Other	15.5%

Table 23
Experimental Group Response – "What type of broker do you use?"

Discount Broker	54%
Full-Service Broker	23%
Electronic Trading	11%
Other	11%

On average, each subject makes 1.96 trades a month. The advice the subjects use most when determining the kind of investments to make is the Wall Street Journal or other financial newspaper (62.1%). The second most is an investment newsletter (48.5%), third is analyst's reports (45.6%), and fourth is ValueLine Investment Reports (41.7%). Full results can be found in Table 24. Subjects were asked on a seven point item "How much money do you have invested in individual stocks (not mutual funds) that you have purchased?" The median response was 4, the category corresponding to $50,001 to $100,000. Results for this question are in Table 25.

Table 24
Experimental Group Response – "What kind of information do you use in determining the kind of investments to make?"

Wall Street Journal/Other Financial Newspaper	62.1%
Investment Newsletter	48.5%
Analyst Reports	45.6%
ValueLine Investment Report	41.7%
Newsstand/Subscription Magazines	36.9%
Broker's Advice	33.0%
Other	25.2%
Friends	10.7%

Table 25
Experimental Group Response – "How much money do you have invested in individual stocks (not mutual funds) that you have purchased?"

	Category	N	Percent
1.	$0	7	7.1%
2.	$1 to $10,000	16	16.3%
3.	$10,001 to $50,000	16	16.3%
4.	$50,001 to $100,000	16	16.3%
5.	$100,001 to $500,000	30	30.6%
6.	$500,001 to $1,000,000	8	8.2%
7.	$1,000,000 +	5	5.1%

The last three questions had to do with the subjects' opinions on their sophistication and success. The first question asked as an investor, how successful they felt they were. The mean response on a seven point scale with 1 = unsuccessful and 7 = very successful was 4.57, the median was 5.00. The second question asked them how sophisticated they felt they were. The mean response on a seven point scale with 1 = unsophisticated and 7 = very sophisticated was 4.20, the median was 4.00. The third question asked them what percentage of the time they "beat the market." The mean response was 48%, the median was 50%.

VI. Contributions and Conclusions

VI. 1. Contribution to Judgment and Decision Making Research

Prospect theory has been tested empirically in a variety of contexts. A subject search on the PsychInfo database returns 135 articles dealing with prospect theory. The major contribution of this paper over and above previous research is testing prospect theory in a complex investment context where there is uncertainty regarding future amounts. In the traditional prospect theory study, future payoffs and probabilities are known. In this study, the subjects have to make some inferences about future payoffs and how to value them. This is a more complex setting than has been investigated by previous research. Although the results of this study do not conform to the predictions of prospect theory, additional tests are needed to rule out prospect theory as an explanation for the returns-earnings relation.

Kahneman and Tversky (1979) and Tversky and Kahneman (1986, 1992) provide overwhelming evidence that prospect theory accurately models decision making in a variety of contexts, with monetary and non-monetary incentives, and with sophisticated and unsophisticated decision makers. However, critics argue that prospect theory has not been tested in a context where more sophisticated market participants can immediately correct bias or poor performance. Such an environment allows for timely, systematic feedback, giving market participants ample opportunity to learn from their mistakes. Since capital markets provide this opportunity, many would argue that this is the environment where one would least expect to find behavior consistent with prospect theory. Since the subjects in the current study are actual market participants, this exposure to market feedback and discipline should

already have occurred.

The results of this study, however, provide only initial evidence in this regard. Additional work in this area is necessary to further explore what investors are doing on an individual level, and what the affect would be on capital markets. This is especially true in the debate regarding underreaction or overreaction to earnings announcements.

VI. 2. Conclusion and Suggestions for Future Research

The returns-earnings relation has many observed characteristics, including nonlinearity, underreaction to earnings, and an asymmetrical response to earnings surprises. I, and others, have suggested that prospect theory might explain some of these characteristics of the returns-earnings relation. The two major contributions of this paper are: 1) the analysis explicating the relation of prospect theory and characteristics of the returns-earnings relation, and 2) providing a controlled test of whether prospect theory holds in an investment context where valuation includes future earnings and considerable ambiguity and context specific (market) knowledge.

The results, however, are surprising. Although the analysis indicates that the returns-earnings relation may be due to decisions made according to prospect theory, the experimental results show that prospect theory does not predict the prices set by the participants in my investment task. Thus, prospect theory may explain the returns-earnings relation analytically, but does not seem to hold empirically for individuals. This type of research has many unexplored issues. In an attempt to make the persistence equal for unexpected gains and losses, the company chosen for the experiment was not a very successful company. This may have led to a floor effect for

unexpected losses due to the shareholder's liquidation option which may account for the less than satisfactory results for unexpected losses. A logical follow-up study would be to use a stimulus with a healthy company, minimizing the effect of the shareholder's liquidation option.

An alternative way to test the theory presented would be in an experimental market. However, because the phenomena in question have already been observed in the capital markets, it is not the market phenomena that are of the greatest interest. Testing individual judgments in an experiment is preferable since it is individual judgment phenomena that are the main interest.

Issues relating to management's and analysts' forecasts are another avenue for research in this area. For example, varying the type of analysts' forecasts and dispersion of analysts' forecasts, and their relation to management's forecast might all provide useful information about investor behavior. Other possible avenues of research include studies of the effects of the precision and quality of earnings announcements on judgments, and the effect of persistence on investor's judgments. Losses (negative EPS) and the signal contained in first loss versus subsequent losses could also be studied in an experiment.

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Appendix 1 – Demand Effects

The experiment described herein was carefully designed to avoid demand effects bias. The issue of "demand effects" is discussed by Schepanski et al. (1992, 122). "A principle concern is whether subjects will form a hypothesis about the objective of the experiment and respond in manner that introduces bias into the interpretation of the manipulated treatment variable(s)." Using their model of demand effects bias, I can estimate the probability of any demand effects influencing the results of this experiment.

From Schepanski et al. (1992, 122):

$$P(B_i) = P(E_i) \text{ X } P(D_i|E_i) \text{ X } P(A_i|E_i,D_i)$$

Where: $P(B_i)$ = the probability that subject *i* will be demand biased;

$P(E_i)$ = the probability that subject *i* will encode the cues that provide an a priori deductive basis for discerning the hypotheses or a positively correlated hypothesis.

$P(D_i|E_i)$ = the conditional probability that subject *i* will discern the hypothesis or a positively correlated hypothesis, given that the cues that provide a deductive basis for the hypothesis were encoded.

$P(A_i|E_i,D_i)$ = the conditional probability that subject *i* will act on a hypothesis by conforming to a role that leads to biased responses, given that the cues were encoded and the hypothesis was discerned.

In my experiment, the only information to change from the first judgment to the second judgment is EPS. This may make one independent variable (change in EPS) especially salient. Because the subjects only receive one level of the independent variable (change in EPS) they will not know if the change is large or small (relative to other subjects). Thus, they would not know which condition they were in, even if they knew the hypothesis in question. Thus, $P(E_i)$ would have to be judged to be at most moderately high.

After the encoding of the cues, can the subjects discern the hypothesis in question, or a positively correlated hypothesis? In this experiment, it is doubtful. For subjects to guess that the hypothesis involves the characteristics of the returns-earnings relation would be close to impossible. They might focus on EPS and develop an alternative correlated hypothesis, but that probability is unlikely. I would say $P(D_i|E_i)$ is at most low or moderately low.

Due to the focus on EPS, subjects might use actual EPS in valuing the firm more than they used expected EPS. There is no reason to believe their judgments would be nonlinear or that they would underreact as hypothesized. If the subjects assume the "good subject" role (as defined in Schepanski et al. [1992]), the subjects might try to respond fully to the change in EPS, which is the opposite of what is predicted by prospect theory.

Using sophisticated investors as subjects has an advantage in that they are less likely to submit to demand effects bias. Schepanski et al. (1992) point out that professionals, outside the laboratory, have high prior knowledge, stronger opinions, and are less motivated to act on experimental hypotheses. I estimate that $P(A_i|E_i,D_i)$ is low.

Based on the estimates above, the probability that subjects will be demand biased, $P(B_i)$, is very low. In fact, any bias would likely lead to subjects acting in a linear manner and not underreacting due to an over-emphasis on EPS in the second judgment. This would weaken the tests and bias the coefficients toward the null.

Appendix 2 – Stimuli

INSTRUCTIONS, ENVELOPE #1

1. Please read the information on the following 9 pages, and then answer the questions on the yellow sheet that follows.

You are an employee at a large mutual fund company. Your first assignment is as an analyst for a contrarian fund. The fund's objective is to buy undervalued stocks. You accomplish this by comparing the market price of the stock to the fundamental value that you determine. If the value you determine is higher then the current market price, the stock is purchased for the fund. Likewise, if the price is higher than the value you determine, no stock of that company is purchased. Your first assignment is to establish a value for Natirat Spray Equipment Company. On the next 9 pages, you will find company and industry information. Please examine the information carefully before determining the value of Natirat's stock.

Natirat Spray Equipment Company

BACKGROUND

This Chicago, Illinois-based company manufactures spray-finishing and coating-application equipment. Natirat's product lines are divided into 2 categories: standard equipment and industrial equipment. Standard equipment includes more than 20 different models of spray guns, as well as air and fluid nozzles, material handling pumps, pressure tanks, and air compressors. Industrial equipment includes spray booths, electrocoating systems, and spray-painting robots. It sells its products to automakers, industrial finishers, painting contractors, and others. CEO Chris Fett and his family own about 35% of the company.

In 1980, Chris Fett, a maintenance superintendent at Dayton Hudson's in Chicago, invented a paint-spraying machine to help his workers paint walls more quickly. Mr. Fett left Dayton Hudson's to form Natirat. With money borrowed from friends and relatives, his company started manufacturing the spray painting machine for retail sale. During 1984, Natirat began serving the automobile market. The company established a research and development center in Boulder, Colorado, in 1984.

In 1993, rival Greatco won a patent-infringement suit against the company, winning a judgment of $275,000 that included treble damages and attorney's fees. However, in 1995 a federal circuit court ruled that the infringement was not deliberate and lowered the damages award to about $75,000.

In 1996, Natirat's machines were used to paint several buildings for the Democratic National Convention held in Chicago that year. The painting machine drew the attention of representatives of the U.K. import firm Williams Brothers Ltd. They signed a deal to distribute the machine in the U.K. and Europe.

EXCERPTS FROM THE PRESIDENT'S LETTER

To The Stockholders of Natirat Spray Equipment Company,

On behalf of the Board of Directors and the Management of Natirat Spray Equipment Company, we are pleased to report on our operating results for the fiscal year ended December 31, 1996. The Comparative Highlights section of this report and the audited financial statements follow.

SALES AND EARNINGS

The Company's net sales for fiscal 1996 amounted to $26,600,000 as compared with $24,360,000 in 1995, representing an increase of 9.2%. Domestic sales in 1996 were $1,042,000 higher than in the preceding year. As a whole, international sales accounted for 10% of the Company's total sales in 1996 as compared with 6% in the prior fiscal year. The Management of the Company expects that for the balance of 1997, the demand for Natirat products will continue to be strong in both the United States and in international markets. The company currently has a substantial backlog of orders. We are pleased to report that the Company's net earnings increased by approximately $89,000 over 1995 due mainly to higher sales in fiscal 1996. Net earnings in 1996 amounted to $431,000 or $1.39 per share, as compared with $342,000 or $1.11 per share in 1995, an increase of 26%.

The Company is firm in its commitment to improve gross profit margins in 1997 through increased utilization of productive capacity and through the continued implementation of cost reduction measures throughout its facilities in the United States. Natirat will strive to enhance profitability while continuing marketing and research programs essential to future growth.

INTERNATIONAL OPERATIONS

Export sales from the United States to points abroad totaled $2.7 million in 1996, a gain of approximately 82% over the prior year. This was primarily due to a distribution agreement signed in 1996 with Williams Brothers Ltd. to distribute our products in the U.K. and Europe. These sales include shipments to our international distributors and customers in South America and other countries not served by Williams Brothers Ltd.

OUTLOOK

In many respects, fiscal 1996 was a successful year for Natirat Spray Equipment Company. Net sales increased over 1995, due mainly to increased expansion into foreign markets. The 1996 earnings of the Company showed a 26% increase over the prior year.

Throughout most of 1996, Natirat participated in the favorable economic climate prevailing in the United States, where demand for the Company's products remained strong. This trend has carried over into the new year and at this time expectations for sales growth in the domestic market are good. The Natirat international organization also anticipates a good year, with a substantial backlog of orders received from the automotive and other major industrial users.

At present, economic forecasts for the markets served by Natirat domestically and internationally are for moderate growth for the balance of the year. Nevertheless, the Company is committed to retaining its leadership position in finishing technology and customer service. Natirat research facilities are focused on the development and refinement of reliable products that can fill ever-changing customer requirements and that comply with latest regulations aimed at environment protection.

New capital equipment acquisitions for the Company's sheet metal fabricating facilities in Chicago are expected to increase productive capacity while reducing the costs of the Industrial Equipment line, thereby making it more competitive and attractive to the customer.

The Management of Natirat is not underestimating the multiple challenges ahead in 1997 and subsequent years. The Company is well positioned for growth and Natirat's distribution network should enable us to maximize sales opportunities, increase market share and achieve continued profitability. We anticipate earnings next year to be $1.50 per share.

On behalf of the Board of Directors and the Management of Natirat, I wish to take this opportunity to express our sincere appreciation to our shareholders, customers, suppliers and employees for their confidence and support.

For the Board of Directors,
Chris Fett
President and Chief Executive Officer
March 26, 1997

MANAGEMENT DISCUSSION AND ANALYSIS

LIQUIDITY AND CAPITAL RESOURCES

The Company's cash balances decreased $3,700 for the year ended December 31, 1996. The net decrease was the result of $32,000 used in operating activities principally due to increases in receivables and work in process inventory relating to increased large contract activity; $576,000 used in investing activities chiefly for purchases of property, plant, and equipment; $604,000 provided by financing activities from the issuance of long-term debt and an increase in short-term borrowings.

SHEET METAL CENTER

Capital equipment investment continues as a competitive manufacturing imperative, particularly in high volume production areas. The recent addition of a state-of-the-art Amada Flexible Manufacturing System and a Fasti Metal Folding Machine is a major step in realizing greater productivity in spray booth fabrication.

RESULTS OF OPERATIONS, 1996 COMPARED TO 1995

Net sales increased $2,240,000 or 9.2%, in 1996 to $26,600,000. Domestic sales increased $1,042,000 or 4.6%, to $23,940,000 in 1996. International sales increased $1,198,000 or 82%, to $2,660,000 in 1996. These increases were the result of improving market acceptance of

environmentally friendly technologies introduced in recent years. The split between domestic and international sales was 90% domestic and 10% international in 1996. In 1995, domestic sales represented 94% of sales and international sales represented 6% of sales.

Net Earnings increased $89,000 in 1996 largely because of the increase in sales. The percentage of gross profit to sales increased to 1.62% in 1996 from 1.40% in 1995 primarily because of improved margins on large contracts and price increases in 1996. Selling, general, and administrative expenses increased $672,000 or 12%, from 1995 to 1996 to support the increase in sales.

Interest expense increased $126,000 or 45%, due to higher interest rates and increased borrowings to support the higher level of sales activity. Income taxes were 39% of pretax income in both 1996 and 1995. Net earnings increased $89,000 to $431,000 in 1996 when compared to net earnings of $342,000 in 1995. This 26% increase is the result of all of the factors mentioned above.

FIVE YEAR SUMMARY OF ANNUAL REPORTS, 1992 TO 1996

COMPARATIVE INCOME STATEMENTS ($000's)

Year Ending	**12/31/96**	**12/31/95**	**12/31/94**	**12/31/9**	**12/31/92**
Net Sales	26,600	24,360	21,041	22,36	22,217
Cost Of Goods Sold	17,894	16,726	13,895	14,96	14,865
Gross Profit	8,706	7,634	7,145	7,40	7,352
Research & Development Expense	1,141	1,029	998	1,02	1,018
Selling General & Administrative Expenses	6,188	5,516	5,553	5,71	5,765
Income Before Depreciation & Amortization	1,378	1,088	595	66	569
Depreciation & Amortization	278	317	100	9	4
Non-Operating Income	12	65	(30)	10	56
Interest Expense	403	277	262	34	384
Income Before Taxes	708	560	202	32	236
Provision For Income Taxes	278	216	64	15	106
Other Income	0	(2)	(5)	(22	(26)
Income Before Extraordinary Items	431	342	133	14	104
Extraordinary Items & Discontinued Operations	0	0	0	2	18
Net Income	431	342	133	16	121
Outstanding Shares	309	309	309	29	294
Earnings Per Share (EPS)	$1.39	$1.11	$0.44	$0.5	$0.41

COMPARATIVE BALANCE SHEETS ($000's)

Annual Assets					
Year Ending	**12/31/96**	**12/31/95**	**12/31/94**	**12/31/93**	**12/31/92**
Cash	853	856	1,016	765	565
Receivables	9,073	6,821	6,169	6,139	5,929
Inventories	8,621	7,491	7,090	7,017	6,815
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Total Current Assets	19,068	15,600	14,554	14,359	13,678
Property, Plant & Equipment	6,519	5,916	5,479	5,433	5,401
Accumulated Depreciation	(3,456)	(3,178)	(2,861)	(2,761)	(2,664)
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Intangibles	330	336	341	340	333
Deposits & Other Assets	371	353	582	375	489
Total Assets	23,392	19,625	18,493	17,863	17,360

Annual Liabilities					
Year Ending	**12/31/96**	**12/31/95**	**12/31/94**	**12/31/93**	**12/31/92**
Accounts Payable	5,397	3,529	3,821	3,204	3,024
Notes Payable	996	566	162	421	410
Current Portion Of Long Term Debt	109	77	76	141	124
Accrued Expenses	1,706	1,381	1,121	1,113	1,102
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Deferred Charges/Income	922	826	776	653	630
Long Term Debt	4,320	3,811	3,414	3,339	3,240
Total Liabilities	13,650	10,314	9,523	9,055	8,713

Shareholder's Equity					
Year Ending	**12/31/96**	**12/31/95**	**12/31/94**	**12/31/93**	**12/31/92**
Common Stock	309	309	309	294	294
Additional Paid In Capital	2,450	2,450	2,450	2,437	2,437
Retained Earnings	6,983	6,552	6,210	6,077	5,917
Shareholder's Equity	9,742	9,311	8,970	8,808	8,647
Total Liabilities & Shareholder's Equity	23,392	19,625	18,493	17,863	17,360

COMPARATIVE CASH FLOW STATEMENTS ($000's)

Cash Flow Provided By Operating Activity				
Year Ending	**12/31/96**	**12/31/95**	**12/31/94**	**12/31/93**
Net Income	431	342	133	161
Depreciation/Amortization	278	317	100	97
Net (Increase) Decrease In Current Assets	(3,472)	(1,206)	56	(480)
Net Increase (Decrease) In Current Liabilities	2,732	343	271	220
Net Cash Provided (Used) By Operations	(32)	(205)	561	(3)

Cash Flow Provided By Investing Activity				
Year Ending	**12/31/96**	**12/31/95**	**12/31/94**	**12/31/93**
(Increase) Decrease In Property, Plant & Equipment	(602)	(438)	(46)	(32)
Other Adjustments, Net	26	34	(490)	114
Net Cash Provided (Used) By Investing Activities	(576)	(403)	(535)	82

Cash Flow Provided By Financing Activity Year Ending	12/31/96	12/31/95	12/31/94	12/31/93
Increase (Decrease) In Long Term Debt	509	398	75	99
Other Cash Inflow (Outflow)	95	50	123	23
Issue (Purchase) Of Equity	0	0	19	0
Net Cash Provided (Used) By Financing Activities	604	448	216	122
Cash Or Equivalent At Year Start	856	1,016	765	565
Net Change In Cash	(4)	(160)	241	200
Cash Or Equivalent At Year End	853	856	1,016	765

SELECTED FINANCIAL RATIOS, 1993 TO 1996

Year	12/31/96	12/31/95	12/31/94	12/31/93
Current Ratio	2.27	2.75	2.73	2.84
Quick Ratio	1.18	1.35	1.35	1.36
Receivable Turnover	3.35	3.75	3.42	3.71
Receivable Turnover in Days	109	97	107	98
Inventory Turnover	2.22	2.29	1.97	2.16
Inventory Turnover in Days	164	159	185	169
Asset Turnover	1.24	1.28	1.16	1.27
Profit Margin on Sales	1.62%	1.40%	0.63%	0.72%
Return On Assets	2.00%	1.79%	0.73%	0.91%
Return On Equity	4.52%	3.74%	1.50%	1.84%
EPS	$1.39	$1.11	$0.44	$0.55
Total Debt to Assets	0.58	0.53	0.51	0.51
Long Term Debt to Equity	0.54	0.50	0.47	0.45
Times Interest Earned	2.76	3.02	1.75	1.91
Book Value per Share	$31.54	$30.14	$29.04	$29.95
Operating Cash Flow per Share	($0.10)	($0.66)	$1.82	($0.01)
Cash Flow per Share	($0.01)	($0.52)	$0.81	$0.68

ANALYST REPORTS AND EARNINGS PER SHARE FORECASTS FOR 1997

Finch Investor's Service

Natirat Spray Equipment Company has good market and geographic diversification. The company has relative stability of earnings during periods of economic downturn. The 1996 agreement with Williams Brothers Ltd. Has expanded Natirat's international markets, providing penetration into Europe and greater growth opportunities. About 10% of the company's revenues are generated in international markets, and that percentage is expected to grow. In 1996, Natirat reported EPS of $1.39 on sales of $26,600,000. Earnings should be slightly higher in 1997; we forecast 1997 EPS of $1.55 on sales of $28,000,000.

Sutton's

Natirat is a diversified manufacturer with a strong position in the spray-finishing and coating-application equipment industry. It is also a supplier to the auto industry. Approximately 90% of Natirat's business is in the U.S. and 10% is in International markets, primarily Europe. While a less buoyant domestic economy is expected over the next year, and continued sluggishness

could continue in Europe through year-end, the industry is in the midst of a long and broad-based global industrial economic cycle that should last for several more years. Developing economies in Latin America and the Pacific Rim should provide additional opportunity for growth. Natirat should see moderate growth in sales for 1997, and EPS of $1.45, compared to $1.39 in 1996.

DB First Chicago

Natirat's 1996 performance was stronger than expected with help from a wide variety of sources. Sales rose 9.2%, primarily due to new markets in Europe. Earnings per share were $1.39, up 26% from the $1.11 a year ago. Continued steady growth in domestic markets, and additional strong growth overseas should allow Natirat to exceed management's forecast of $1.50 per share. We expect Natirat's 1997 EPS to be $1.52.

INDUSTRY OUTLOOK

PAINT AND COATING EQUIPMENT MANUFACTURERS

This industry consists of establishments primarily engaged in manufacturing air and gas compressors for general industrial use, and in manufacturing nonagricultural spraying and dusting equipment. Companies in this industry performed well in 1996 and should continue to do so in the U.S. during 1997. Capital spending should be fueled by low interest rates during the year. Although the industry is improving in the U.K and other countries abroad, investors should be cautious with regard to overseas markets, which may not improve as quickly as expected. Industry concentration is high; four producers account for roughly one-third of total U.S. shipments. A diverse group of highly specialized firms account for the remaining two-thirds of production.

INTERNATIONAL COMPETITIVENESS

Historically, the paint equipment industry was largely concerned with satisfying the domestic market. This has begun to change as liberalization of trade within North America progresses. Transportation costs have become less of an impediment to trade than in the past. Exports have nearly doubled during the 1992-1996 period and continue to show momentum in 1997. Canada and Mexico are now the U.S.'s largest export markets, accounting for more than one-half of total exports in 1996.

Exports continue to grow relative to imports, contributing to a consistently positive net trading position in recent years. Part of this increase can be attributed to somewhat more favorable exchange rates in late 1996. Major suppliers to the U.S. in 1996 were Canada, Germany, Japan, and France.

OUTLOOK FOR 1997

The volume of domestic shipments of paint and coating equipment is projected to grow 2 to 3 percent in 1997. Fast-growing areas are likely to be product finishes and specialty coatings.

LONG-TERM PROSPECTS

Demand for higher performance, and continued use of alternative materials and applications technologies will shape industry prospects in coming years. Consumption of architectural coatings is expected to accelerate well into 1997 as construction activity regains momentum. Use of non-solvent methods currently being developed will conceivably replace many products currently being manufactured. Involvement in many currently underserved world markets will most likely be in some form of joint venture arrangement.

INDUSTRY AVERAGES

FOR 12 MONTHS ENDING:	**12/31/96**
PRICE/EARNINGS RATIO:	15.9
ANNUAL DIVIDEND:	$0.32

INDUSTRY TOTALS

DATE	SALES (000$)	NET INCOME
1996	1,253,734	51,174
1995	1,185,246	56,289
1994	1,147,656	29,101
1993	1,051,127	12,688
1992	1,083,002	30,046

INDUSTRY FINANCIAL RATIOS

KEY ANNUAL FINANCIAL RATIOS

Year Ending	**12/31/96**	**12/31/95**	**12/31/94**
Quick Ratio	1.21	1.04	0.90
Current Ratio	2.45	2.15	1.69
Receivables Turnover	10.71	5.98	5.88
Receivables Days Sales	55.33	66.39	80.93
Inventories Turnover	6.73	7.21	5.99
Inventories Days Sales	59.09	59.90	83.37
Total Liab/Total Assets	0.54	0.66	0.64
Total Liab/Common Equity	1.87	3.02	1.88
Times Interest Earned	13.91	7.73	4.01
Long Term Debt/Equity	0.54	1.46	0.62
Total Debt/Equity	0.58	1.56	0.68
Total Assets/Equity	2.81	4.19	3.23

Please indicate your value for Natirat's stock, based on the information in the previous 9 pages, and how confident you are about that assessment, with 1 being not confident at all, and 7 being completely confident.

		Confidence in Your Forecast 1 2 3 4 5 6 7
Value of 1 Share of Stock	_____	Not at all Completely

Please rank, from 1 to 5, the five items you considered the most when establishing the value of Natirat's stock (with 1 being the item you used the most):

_____ Company History
_____ President's Letter
_____ Management Discussion and Analysis
_____ Income Statement
_____ Balance Sheet
_____ Statement of Cash Flows
_____ Natirat's Financial Ratios
_____ Management's Forecast of EPS
_____ Analyst's Forecasts of EPS
_____ Your Own Forecast of EPS
_____ Written Discussion of the Industry
_____ Industry Earnings Information
_____ Industry Financial Ratios
_____ Other _____

Please forecast the following item's for Natirat for 1997, and indicate on a 7 point scale, how confident you are about your forecast, with 1 being not confident at all, and 7 being completely confident.

Item to Forecast	Forecast	Confidence in Your Forecast 1 2 3 4 5 6 7
Sales	_____	Not at all Completely
Net Income	_____	Not at all Completely
Earnings Per Share (EPS)	_____	Not at all Completely

You are now finished with the Envelope #1. Please detach the yellow pages (your responses) and place them in the return envelope provided. Return all of the remaining materials to Envelope #1, and proceed to Envelope #2.

INSTRUCTIONS, ENVELOPE #2

1. Please read the information on the following 8 pages, and then answer the questions on the yellow sheets that follow.

On the following 8 pages, you will find the same information you received before, but now, along with a Wall Street Journal article regarding the release of 1997 earnings information. Please examine the information carefully, and establish the value for a share of Natirat stock based on the information contained in the following pages.

Natirat Spray Equipment Company

BACKGROUND

This Chicago, Illinois-based company manufactures spray-finishing and coating-application equipment. Natirat's product lines are divided into 2 categories: standard equipment and industrial equipment. Standard equipment includes more than 20 different models of spray guns, as well as air and fluid nozzles, material handling pumps, pressure tanks, and air compressors. Industrial equipment includes spray booths, electrocoating systems, and spray-painting robots. It sells its products to automakers, industrial finishers, painting contractors, and others. CEO Chris Fett and his family own about 35% of the company.

In 1980, Chris Fett, a maintenance superintendent at Dayton Hudson's in Chicago, invented a paint-spraying machine to help his workers paint walls more quickly. Mr. Fett left Dayton Hudson's to form Natirat. With money borrowed from friends and relatives, his company started manufacturing the spray painting machine for retail sale. During 1984, Natirat began serving the automobile market. The company established a research and development center in Boulder, Colorado, in 1984.

In 1993, rival Greatco won a patent-infringement suit against the company, winning a judgment of $275,000 that included treble damages and attorney's fees. However, in 1995 a federal circuit court ruled that the infringement was not deliberate and lowered the damages award to about $75,000.

In 1996, Natirat's machines were used to paint several buildings for the Democratic National Convention held in Chicago that year. The painting machine drew the attention of representatives of the U.K. import firm Williams Brothers Ltd. They signed a deal to distribute the machine in the U.K. and Europe.

EXCERPTS FROM THE PRESIDENT'S LETTER

To The Stockholders of Natirat Spray Equipment Company

On behalf of the Board of Directors and the Management of Natirat Spray Equipment Company, we are pleased to report on our operating results for the fiscal year ended December 31, 1996. The Comparative Highlights section of this report and the audited financial statements follow.

SALES AND EARNINGS

The Company's net sales for fiscal 1996 amounted to $26,600,000 as compared with $24,360,000 in 1995, representing an increase of 9.2%. Domestic sales in 1996 were $1,042,000 higher than in the preceding year. As a whole, international sales accounted for 10% of the Company's total sales in 1996 as compared with 6% in the prior fiscal year. The Management of the Company expects that for the balance of 1997, the demand for Natirat products will continue to be strong in both the United States and in international markets. The company currently has a substantial backlog of orders. We are pleased to report that the Company's net earnings increased by approximately $89,000 over 1995 due mainly to higher sales in fiscal 1996. Net earnings in 1996 amounted to $431,000 or $1.39 per share, as compared with $342,000 or $1.11 per share in 1995, an increase of 26%.

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President and Chief Executive Officer
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Retained Earnings	6,983	6,552	6,210	6,077	5,917
Shareholder's Equity	9,742	9,311	8,970	8,808	8,647
Total Liabilities & Shareholder's Equity	23,392	19,625	18,493	17,863	17,360

COMPARATIVE CASH FLOW STATEMENTS ($000's)

Cash Flow Provided By Operating Activity

Year Ending	12/31/96	12/31/95	12/31/94	12/31/93
Net Income	431	342	133	161
Depreciation/Amortization	278	317	100	97
Net (Increase) Decrease In Current Assets	(3,472)	(1,206)	56	(480)
Net Increase (Decrease) In Current Liabilities	2,732	343	271	220
Net Cash Provided (Used) By Operations	(32)	(205)	561	(3)

Cash Flow Provided By Investing Activity

Year Ending	12/31/96	12/31/95	12/31/94	12/31/93
(Increase) Decrease In Property, Plant & Equipment	(602)	(438)	(46)	(32)
Other Adjustments, Net	26	34	(490)	114
Net Cash Provided (Used) By Investing Activities	(576)	(403)	(535)	82

Cash Flow Provided By Financing Activity

Year Ending	12/31/96	12/31/95	12/31/94	12/31/93
Increase (Decrease) In Long Term Debt	509	398	75	99
Other Cash Inflow (Outflow)	95	50	123	23
Issue (Purchase) Of Equity	0	0	19	0
Net Cash Provided (Used) By Financing Activities	604	448	216	122
Cash Or Equivalent At Year Start	856	1,016	765	565
Net Change In Cash	(4)	(160)	241	200
Cash Or Equivalent At Year End	853	856	1,016	765

SELECTED FINANCIAL RATIOS, 1993 TO 1996

Year	12/31/96	12/31/95	12/31/94	12/31/93
Current Ratio	2.27	2.75	2.73	2.84
Quick Ratio	1.18	1.35	1.35	1.36
Receivable Turnover	3.35	3.75	3.42	3.71
Receivable Turnover in Days	109	97	107	98
Inventory Turnover	2.22	2.29	1.97	2.16
Inventory Turnover in Days	164	159	185	169
Asset Turnover	1.24	1.28	1.16	1.27
Profit Margin on Sales	1.62%	1.40%	0.63%	0.72%
Return On Assets	2.00%	1.79%	0.73%	0.91%
Return On Equity	4.52%	3.74%	1.50%	1.84%
EPS	$1.39	$1.11	$0.44	$0.55
Total Debt to Assets	0.58	0.53	0.51	0.51
Long Term Debt to Equity	0.54	0.50	0.47	0.45
Times Interest Earned	2.76	3.02	1.75	1.91
Book Value per Share	$31.54	$30.14	$29.04	$29.95
Operating Cash Flow per Share	($0.10)	($0.66)	$1.82	($0.01)
Cash Flow per Share	($0.01)	($0.52)	$0.81	$0.68

INDUSTRY OUTLOOK

PAINT AND COATING EQUIPMENT MANUFACTURERS

This industry consists of establishments primarily engaged in manufacturing air and gas compressors for general industrial use, and in manufacturing nonagricultural spraying and dusting equipment. Companies in this industry performed well in 1996 and should continue to do so in the U.S. during 1997. Capital spending should be fueled by low interest rates during the year. Although the industry is improving in the U.K. and other countries abroad, investors should be cautious with regard to overseas markets, which may not improve as quickly as expected. Industry concentration is high; four producers account for roughly one-third of total U.S. shipments. A diverse group of highly specialized firms account for the remaining two-thirds of production.

INTERNATIONAL COMPETITIVENESS

Historically, the paint equipment industry was largely concerned with satisfying the domestic market. This has begun to change as liberalization of trade within North America progresses. Transportation costs have become less of an impediment to trade than in the past. Exports have nearly doubled during the 1992-1996 period and continue to show momentum in 1997. Canada and Mexico are now the U.S.'s largest export markets, accounting for more than one-half of total exports in 1996.

Exports continue to grow relative to imports, contributing to a consistently positive net trading position in recent years. Part of this increase can be attributed to somewhat more favorable exchange rates in late 1996. Major suppliers to the U.S. in 1996 were Canada, Germany, Japan, and France.

OUTLOOK FOR 1997

The volume of domestic shipments of paint and coating equipment is projected to grow 2 to 3 percent in 1997. Fast-growing areas are likely to be product finishes and specialty coatings.

LONG-TERM PROSPECTS

Demand for higher performance, and continued use of alternative materials and applications technologies will shape industry prospects in coming years. Consumption of architectural coatings is expected to accelerate well into 1997 as construction activity regains momentum. Use of non-solvent methods currently being developed will conceivably replace many products currently being manufactured. Involvement in many currently underserved world markets will most likely be in some form of joint venture arrangement.

INDUSTRY AVERAGES

FOR 12 MONTHS ENDING:	**12/31/96**
PRICE/EARNINGS RATIO:	15.9
ANNUAL DIVIDEND:	$0.32

INDUSTRY TOTALS

DATE	SALES (000$)	NET INCOME
1996	1,253,734	51,174
1995	1,185,246	56,289
1994	1,147,656	29,101
1993	1,051,127	12,688
1992	1,083,002	30,046

INDUSTRY FINANCIAL RATIOS

KEY ANNUAL FINANCIAL RATIOS

Year Ending	**12/31/96**	**12/31/95**	**12/31/94**
Quick Ratio	1.21	1.04	0.90
Current Ratio	2.45	2.15	1.69
Receivables Turnover	10.71	5.98	5.88
Receivables Days Sales	55.33	66.39	80.93
Inventories Turnover	6.73	7.21	5.99
Inventories Days Sales	59.09	59.90	83.37
Total Liab/Total Assets	0.54	0.66	0.64
Total Liab/Common Equity	1.87	3.02	1.88
Times Interest Earned	13.91	7.73	4.01
Long Term Debt/Equity	0.54	1.46	0.62
Total Debt/Equity	0.58	1.56	0.68
Total Assets/Equity	2.81	4.19	3.23

Excerpt from the March 20, 1998 Wall Street Journal

Natirat Spray Equipment Company

Painting Equipment Manufacturer Reports Disappointing Earnings

Natirat Spray Equipment Company reported disappointing sales and income Friday for the year ended Dec. 31, 1997. Natirat suffered from weaker than expected sales overseas, and sluggish sales in domestic markets. The Chicago, Illinois company reported net income of $370,800, or $1.20 per share, compared with net income of $431,000, or $1.39 per share a year earlier.

Natirat Spray Equipment Company

Year Dec. 31	1996	1997
Revenues	$26,600,000	$22,885,000
Net Income	$431,000	$370,800
Per Share Earnings:		
Net Income	$1.39	$1.20

Please indicate your value for Natirat's stock, based on the information in the previous 8 pages, and how confident you are about that assessment, with 1 being not confident at all, and 7 being completely confident.

		Confidence in Your Forecast						
		1	2	3	4	5	6	7
Value of 1 Share of Stock	_____	Not at all						Completely

If actual EPS in 1997 were different from your forecast of 1997 EPS, what do you believe was the main cause of the difference (briefly describe in one or two sentences)?

_____

_____

_____

To what extent do you think future earnings will be affected by the situation you described above? Please indicate this with a slash mark on the following scale, with 0 being "this is a one time, non-recurring situation" to 100 being "this situation is permanent and will affect all future year's earnings."

0----10----20----30----40----50----60----70----80----90----100

One Time Event — Permanent Situation

Briefly describe the approach or method you used to value Natirat's stock:

_____

_____

_____

Finally, we would like to ask a few questions about you for statistical purposes.

The following questions are intended to find out a little bit about the investing habits of individual investors. Remember that the researcher will not know your identity; all responses are anonymous.

What type of investments do you have? (Please circle number of all that apply):

1 IRA or 401k
2 Mutual Funds
3 Individual Stocks
4 Corporate Bonds
5 Municipal Bonds
6 Real Estate
7 Collectibles
8 Other (specify) _____

What type of broker do you use? (Circle number)

1 Full-Service Broker
2 Discount Broker
3 Electronic Trading (Internet or Online)
4 Other (specify) _____

How many transactions a month do you typically make for your own portfolio? _____

What kind of information do you use in determining the kind of investments to make? (Circle number)

1 Broker's Advice
2 Analyst Reports
3 Wall Street Journal/Other Financial Newspaper
4 Investment Newsletter
5 Friends
6 Newsstand/Subscription Magazines
7 ValueLine Investment Report
8 Other (specify) _____

How much money do you have invested in individual stocks (not mutual funds) that you have purchased? (Circle number)

1 $0
2 $1 to $10,000
3 $10,001 to $50,000
4 $50,001 to $100,000
5 $100,001 to $500,000
6 $500,001 to $1,000,000
7 $1,000,000 +

As an investor, how successful do you feel you are?	1 2 3 4 5 6 7 Unsuccessful	Very Successful
As an investor, how sophisticated do you feel you are?	1 2 3 4 5 6 7 Unsophisticated	Very Sophisticated

What percentage of the time to you feel that you "beat the market?"

0----10----20----30----40----50----60----70----80----90----100
Never Always

You are now finished. Thank you for your help. Please detach the remaining yellow sheets (your responses) and place them in the return envelop provided, seal it, and put it in the mail at your earliest convenience.

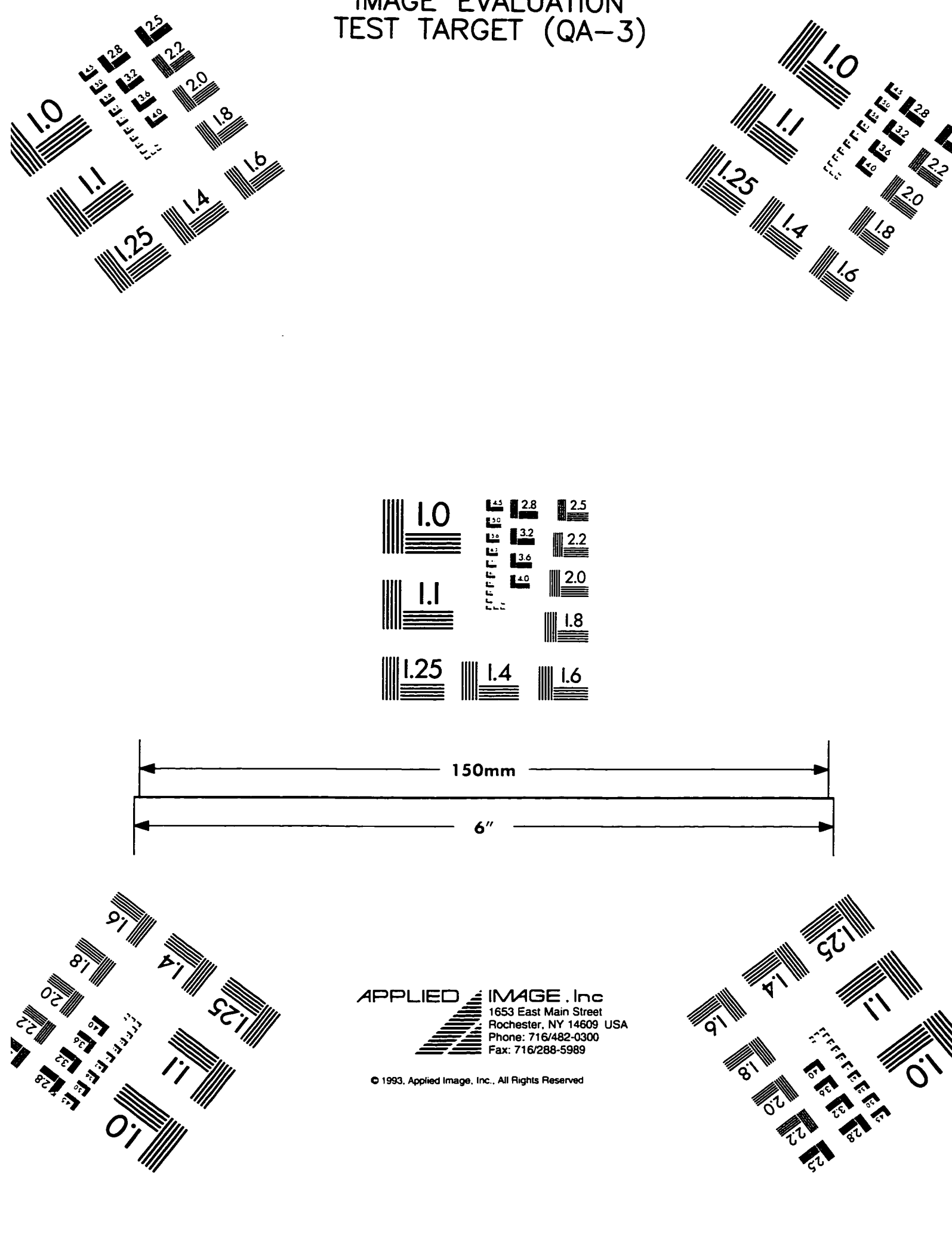
IMAGE EVALUATION
TEST TARGET (QA-3)
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