May 2007

The Effect of Pride and Regret on Investors' Trading Behavior

Samuel Sung
University of Pennsylvania

The Effect of Pride and Regret on Investors' Trading Behavior

Wharton Research Scholars Program, May 2007
Samuel Sung
Faculty Advisor: Alex Muermann

The effect of Pride and Regret on Investors' Trading Behavior

1 Introduction

It is well known that individual investors do not always behave in accordance to rational economic theory. For instance, empirical evidence demonstrates that investors have a tendency to sell winning investments too soon and to hold losing investments too long. This trading phenomenon has been labeled as the disposition effect by Shefrin and Statman (1985). The literature suggests that the disposition effect cannot be explained by traditional trading theories. For example, Odean (1998) shows that portfolio rebalancing and avoiding higher trading costs at lower stock price ranges do not appear to cause the disposition effect. On the other hand, some trading phenomena even seem to contradict one another. Irrational extrapolation, the tendency of investors to invest too much in recent winning stocks and too little into recent losing ones, is the exact opposite from the disposition effect. The irrational extrapolation effect has been documented by Chevalier and Ellison (1997) and Sirri and Tufano (1998) in the context of mutual fund flows.

Shefrin and Statman (1985) discuss several explanations for the disposition effect: prospect theory, mental accounting, avoiding regret and seeking pride, and self control. The most common explanation for the disposition effect is based on prospect theory's S-shaped value function (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992). This value function is a function of gains and losses relative to a reference point rather than a function of wealth levels. The value function is concave in the gain region and convex in the loss region i.e. individuals are risk averse over gains and risk-seeking over losses. In addition, individuals appear to be relatively more averse to losses than happy about gains. Most papers to date, using the purchase price of an investment as the reference point, argue that an investment that has risen in value since purchase puts the investor in the concave region of the value function. Therefore the investor is risk averse in this domain and will want to sell the winning investment. On the other hand, an investment that has fallen in value since purchase brings the investor to the convex region of the value function. The investor, being risk seeking in this domain, will hold on to the losing investment. However, Barberis and Xiong (2006), implementing the value function proposed by Tversky and Kahneman (1992) in a dynamic portfolio choice setting, show that prospect theory often predicts momentum trading: keeping winning investments and selling losing investments, the opposite of the disposition effect.

Furthermore, empirical and experimental evidence show that investors who often sell their winning investments are not the same investors, who hold on to their losing investments until they break even (Weber and Welfens, 2006). The authors suggest the two components of the disposition effect, selling winning investments too soon and holding on to losing investments too long, might not be systematically related. In particular, the authors demonstrate that investors are heterogeneous with respect to their reactions to situations where they face a gain in their investments. On the other hand, it is more common for investors to hold on to losing investments too long. Therefore, it is possible that some investors do not have the tendency to sell their investment regardless of gains or losses e.g. they only exhibit one side of the disposition effect: holding on to losing investments too long. In addition, the same study shows that around one-third of the investors follow the exact opposite of the disposition effect: momentum trading.

Muermann and Volkman (2006), using a dynamic portfolio choice model which incorporates anticipatory regret and pride in the investor's preferences, show that investors might demonstrate a trading behavior consistent with the disposition effect. The basic idea is that an investor who regrets investing in a losing stock would like to keep holding the stock and hope that it goes up in value so that he could avoid regret. On the other hand, the investor's feeling of pride from invested in a winning stock causes him to sell the stock; if the stock had gone down later, the investor would have foregone the feeling of pride. In their model, the authors assume the investors are relatively more concerned about regret than they are happy about pride.

This paper is motivated by the two seemingly competing trading phenomena: the disposition effect and momentum trading. We use a similar dynamic portfolio choice model (Muermann and Volkman, 2006) and study whether different preferences over pride and regret would lead to the opposite of disposition effect – momentum trading. The study by Weber and Welfens (2006) shows that a significant number of investors do not exhibit the disposition effect, meaning that individuals might not weigh the utility/disutility from pride and regret in the same way. In particular, we evaluate the optimal trading behavior of pride seeking and regret-averse investors. An individual with such pride and regret preferences would not necessarily weigh the disutility incurred from regret relatively more than the additional utility derived from pride.

The paper is structured as follows. In the next section, we explain the model and underlying assumptions. In section 3, we evaluate the optimal portfolio strategy and show the necessary conditions for the investor's optimal strategy to be consistent with momentum trading. All proofs are provided in the appendix.

2 Model

In this paper, we will implement a similar dynamic portfolio choice model to the one proposed by Muermann and Volkman (2006). There are two periods, t = 0, 1, and 2, and two assets: a risk-free bond with a zero normalized return and a risky asset (stock). Only one risky asset is considered in order to be consistent with the mental accounting framework proposed by Thaler (1985). We assume that the returns of the risky asset are independent and identically distributed over all trading periods. The returns take two values $x+ > 0 > x-$ with equal probabilities (1/2) in each period.

At t = 0, the investor will decide whether to invest all of his initial wealth w in the bond or the stock. At t = 1, the investor observes his/her wealth level and decides whether to invest in the bond or the stock again. At t = 2, all positions are liquidated. The two-attribute utility function is of the following form

$$\mathbf{v(w) = u(w) – g(u (w^*) - u(w))}$$

The first attribute *u( )* takes into account the investor's risk aversion and we assume *u()* to be an increasing and concave function. We use a log utility function in this paper (In(x)). The second attribute *g( )* measures the disutility or additional utility that the investor experiences from regret or pride. The investor experiences pride when *g( )* is negative and regret when *g( )* is positive. w is the actual wealth level the investor obtains and w^* is the final wealth level the investor obtains from a foregone alternative. *g(x)* is increasing and concave when $x < 0$ and convex when $x > 0$. This implies that the investor is pride seeking and regret-averse.

We assume the investor only incurs the disutility or additional utility from regret or pride in the final period e.g. $t = 2$. Therefore, the investor would follow a trading strategy which maximizes his/her expected utility using function *v( )* at $t = 2$. If the individual's decision turns out to be ex-post suboptimal, w^* will be the wealth level under the foregone best alternative where the investor obtains the highest level of wealth contingent on the realized returns of the stock. If the individual's decision turns out to be ex-post optimal, w^* will be the wealth level under the foregone worst alternative.
In addition, we assume that

$$\text{In } (1 + x^{+})(1 + x^{-}) > 0.$$

As a result, the optimal strategy for the individual investor who does not consider pride and regret is to invest in the risky asset in all trading periods as the risk premium is high enough.

Furthermore, we assume that investors do not observe stock returns if they do not hold the risky asset (the stock). This assumption is supported by Bell (1982) who shows that regret-averse individuals could prefer not to have a foregone alternative lottery resolved.

3 Dynamic Portfolio Choice and Momentum Trading

In this section, we examine how an individual investor who has pride and regret preferences makes decisions in a dynamic portfolio choice problem. In the first subsection, we show that the momentum trading strategy could be optimal under the assumption that the investor invested in the stock at $t = 0$. In the second subsection, we evaluate the investor's decision in a dynamic portfolio choice problem including the initial decision at $t = 0$ and show that the momentum trading strategy could be optimal. That is, it could be optimal for the investor to purchase the stock at $t = 0$, hold it if it went up over the first period and sell if it went down over the first period.

Portfolio Choice at t = 1

In this section, we assume that the investor had invested in the stock at t = 0. At t = 1, the investor's wealth level would be $w(1 + x^{+})$ if the stock went up over the first period or $w(1 + x^{-})$ if the stock went down. We examine the optimal strategy under this assumption and show that momentum trading could be optimal under certain conditions.

Proposition 1

Suppose that the investor purchased the stock at t = 0. It is optimal for the investor at t = 1 to keep the stock if it went up and to sell the stock if it went down over the first period (following the momentum strategy) if stock returns satisfy the following conditions

$$\begin{gathered} \mathbf{g(-2\ln(1+x^{-})) - g(-\ln(1+x^{-})) >} \\ \mathbf{\ln((1+x^{+})(1+x^{-})) >} \\ \mathbf{g(-2\ln(1+x^{+})) - 2g(-\ln(1+x^{+})) + g(-\ln(1+x^{-})).} \end{gathered} \tag{1}$$

Proof. See Appendix.

The lower constraint in (1) implies that the additional pride and risk premium when keeping the stock (after it went up over the first period) outweighs the benefit from securing pride at t = 1 and the potential regret if the stock goes down next period. If instead the stock has gone down, the investor would incur regret about his or her decision at t = 0. The upper constraint in (1) implies that the risk premium is not high enough to compensate for the additional spread in regret should the investor keep the stock.

Dynamic Portfolio Choice

In this section, we endogenize the decision of the investor at t = 0 as opposed to assuming that he or she has invested in the stock at t = 0 in the section above. Thus, we have to examine the dynamically optimal behavior of the investor. In the following propositions, we are able to show that the optimal behavior of an investor is consistent with the momentum trading behavior which is buying the stock at $t = 0$ and keeping (selling) the stock if it went up (down) over the first period.

The conditions under which the investor would follow the momentum trading strategy differ under different specifications of the concavity of function $g(x)$ when $x < 0$. We break them down into the following two conditions:

$$\mathbf{3\, g(-\ln(1 + x^{+})) > g(-2\ln(1 + x^{+}))} \tag{A}$$

or $$\mathbf{g(-2\ln(1 + x^{+})) > 3\, g(-\ln(1 + x^{+}))}. \tag{B}$$

The investor is more pride-seeking under (A) than under (B).

Proposition 2

Under condition (A), it is optimal for the investor to invest in the stock at $t = 0$ and at $t = 1$, to keep the stock if it went up and to sell the stock if it went down over the first period if stock returns satisfy the following condition

$$\begin{gathered}\mathbf{g(-2\ln(1 + x^{-})) - g(-\ln(1 + x^{-})) >} \\ \mathbf{\ln((1 + x^{+})(1 + x^{-})) >} \\ \mathbf{g(-\ln(1 + x^{-})) + (1/3)\,[g(-2\ln(1 + x^{+}))].}\end{gathered} \tag{2}$$

Proof. See Appendix.

The investor's behavior is time consistent as his optimal strategy at $t = 0$ is the momentum trading strategy and at $t = 1$, he follows the same strategy as condition (2) implies condition (1).

Proposition 3

Under condition (B), it is optimal for the investor to invest in the stock at $t = 0$ and at $t = 1$, to keep the stock if it went up and to sell the stock if it went down over the first period if stock returns satisfy the condition (1).

Proof. See Appendix.

The investor's behavior is time consistent as his optimal strategy at t = 0 is the momentum trading strategy and at t = 1, he follows the same strategy as condition (1) is satisfied.

4 Conclusion

Prior studies have shown that trading phenomena such as the disposition effect and momentum trading seem to be contradictory to each other. In this paper, under the same dynamic portfolio choice setting (Muermann and Volkman, 2006), by assuming a different pride and regret preference, we show that it could be optimal for investors to follow the momentum trading strategy – the opposite of the disposition effect. It is possible that groups of investors have rather distinct pride and regret preferences and therefore exhibit two polar opposite trading patterns in financial markets: the disposition effect and momentum trading.

Learning about the effect of pride and regret on the trading behaviors of individual investors will be helpful in understanding the potential costs to individual investors. This could also help individual investors design improved trading devices and strategies to maximize their investment returns.

References

Barberis, N. and W. Xiong. 2006. What drives the disposition effect? An analysis of a long-standing preference-based explanation. Working paper.

Bell, D.E. 1982. Regret in decision making under uncertainty. *Operations Research* 30 (5), 961-981.

Bell, D.E. 1983. Risk premiums for decision regret. *Management Science* 29 (10), 1156-1166.

Braun, M. and A. Muermann. 2004. The impact of regret on the demand for insurance. *Journal of Risk and Insurance* 71 (4), 737-767.

Chevalier, J. and G Ellison. 1997. "Risk taking by mutual funds as a response to incentives. *Journal of Political Economy* 105 (6), 1167-1200.

Hens. T. and M. Vlcek. 2005. Does prospect theory explain the disposition effect? Working paper.

Kahneman, D. and A. Tversky. 1979. Prospect Theory: an analysis of decision under risk. *Econometrica* 47, 263-291.

Kahneman, D. and A. Tversky. 1982. The psychology of preferences. *Scientific American* 246, 167-173.

Muermann, A., and J. Volkman. 2006. Regret, Pride, and the Disposition Effect. Working paper.

Odean, T. 1998. Are investors reluctant to realize their losses? *Journal of Finance* 53 (5), 1775-1798.

Shefrin, H. and M. Statman. 1985. The disposition to sell winners too early and ride losers too long: Theory and evidence. *Journal of Finance* 40 (3), 777-790.

Sirri, E.R. and P. Tufano. 1998. Costly search and mutual fund flows. *Journal of Finance* 53 (5), 1589-1622

Thaler, R. 1985. Mental accounting and consumer choice. *Marketing Science* 4 (3), 199-214.

Tversky, A. and D. Kahneman. 1992. Advances in Prospect Theory: Cumulative Representation of Uncertainty. *Journal of Risk and Uncertainty* 5 (4), 297-323.

Weber M. and F. Welfens. 2006. The repurchase behavior of individual investors: an experimental investigation. Working paper.

Weber M. and F. Welfens. 2006. An Individual Analysis of the Disposition Effect: Empirical and Experimental Evidence. Working paper.

Appendix: Proofs

Assumptions

(1) In $(1 + x^{+})(1 + x^{-}) > 0$
(2) $p = ½$
(3) $g'(x) > 0$
(4) $g''(x) > 0$, when $x >= 0$
(5) $g''(x) < 0$, when $x < 0$
(6) $g(0) = 0$

In addition, we assume that investors do not observe returns when they do not hold stock.

Portfolio Choice at t =1

Proof of Proposition 1

Suppose the investor invested in stock at $t = 0$:

Stock has gone up over the first period

Expected utility from keeping stock

$$(1/2)\,[\ln (w (1 + x^{+})^{2}) - g(-\ln (1 + x^{+})^{2})] +$$
$$(1/2)\,[\ln (w (1 + x^{+})(1 + x^{-})) - g(-\ln (1 + x^{-}))]$$

Expected utility from selling stock

$$\ln (w (1 + x^{+})) - g(-\ln (1 + x^{+}))$$

If

$$\mathbf{\ln ((1 + x^{+})(1 + x^{-})) > g(-2 \ln (1 + x^{+})) - 2\, g(-\ln (1 + x^{+})) + g(-\ln (1 + x^{-})),} \tag{a}$$

then keeping the stock at $t = 1$ is preferred.

Stock has gone down over the first period

Expected utility from keeping stock

$$(1/2)\,[\ln (w (1 + x^{-})^{2}) - g(-\ln (1 + x^{-})^{2})] +$$
$$(1/2)\,[\ln (w (1 + x^{+})(1 + x^{-})) - g(-\ln (1 + x^{-}))]$$

Expected utility from selling stock

$$\ln (w (1 + x^-)) - g (- \ln (1 + x^-))$$

If

$$\mathbf{\ln ((1 + x^+)(1 + x^-)) < g (-2 \ln (1 + x^-)) - g (- \ln (1 + x^-)),} \tag{b}$$

then selling stock is preferred.

At t = 1, it is optimal to follow the momentum trading strategy if conditions (a) and (b) are satisfied.

Dynamic Portfolio Choice

Expected utilities at t = 0 from following the respective strategies

Not invest at all

$$\ln (w)$$

Invest once

$$(1/2) [\ln (w (1 + x^+)) - g (- \ln (1 + x^+))] +$$
$$(1/2) [\ln (w (1 + x^-)) - g (- \ln (1 + x^-))]$$

Invest twice

$$(1/4) [\ln (w (1 + x^+)^2) - g (- \ln (1 + x^+)^2)] +$$
$$(1/4) [\ln (w (1 + x^-)^2) - g (- \ln (1 + x^-)^2)] +$$
$$(1/2) [\ln (w (1 + x^+)(1 + x^-)) - g (- \ln (1 + x^-))]$$

Momentum Strategy

$$(1/4) [\ln (w (1 + x^+)^2) - g (- \ln (1 + x^+)^2)] +$$
$$(1/4) [\ln (w (1 + x^+)(1 + x^-)) - g (- \ln (1 + x^-))] +$$
$$(1/2) [\ln (w (1 + x^-)) - g (- \ln (1 + x^-))]$$

Disposition Effect

$$(1/2)\ [\ln (w (1 + x^{+})) - g (- \ln (1 + x^{+}))] +$$
$$(1/4)\ [\ln (w (1 + x^{+})(1 + x^{-})) - g (- \ln (1 + x^{-}))] +$$
$$(1/4)\ [\ln (w (1 + x^{-})^{2}) - g (- \ln (1 + x^{-})^{2})]$$

If

$$\mathbf{g (-2 \ln (1 + x^{-})) - 2 g (- \ln (1 + x^{-})) > g (-2 \ln (1 + x^{+})) - 2 g (- \ln (1 + x^{+})),} \tag{c}$$

then at $t = 0$, momentum trading strategy is preferred to the disposition strategy.

Condition (c) is satisfied as the right hand side of the inequality is positive due to the convexity of function g when $x > 0$ and the left hand side of the inequality is negative due to the concavity of function g when $x < 0$.

Proof of Proposition 2

Conditions on function g

(A) $3 g (- \ln (1 + x^{+})) > g (-2 \ln (1 + x^{+}))$

(B) $g (-2 \ln (1 + x^{+})) > 3 g (- \ln (1 + x^{+}))$

Under (A), the following inequalities hold:

$$\mathbf{g (-2 \ln (1 + x^{-})) - g (- \ln (1 + x^{-})) >}$$
$$\mathbf{g (- \ln (1 + x^{-})) + g(- \ln (1 + x^{+})) >}$$
$$\mathbf{g (- \ln (1 + x^{-})) + (1/3)\ [g (-2 \ln (1 + x^{+}))] >}$$
$$\mathbf{g (-2 \ln (1 + x^{+})) - 2 g (- \ln (1 + x^{+})) + g (- \ln (1 + x^{-}))}$$

A (1)

If

$$\mathbf{\ln ((1 + x^{+})(1 + x^{-})) > g (-2 \ln (1 + x^{-})) - g (- \ln (1 + x^{-})),}$$

then investing twice is preferred to the momentum strategy. The momentum strategy is preferred to investing once as

$\ln((1 + x^{+})(1 + x^{-})) > g(-2 \ln(1 + x^{+})) - 2 g(-\ln(1 + x^{+}))$.

Investing once is preferred to not investing at all as

$\ln((1 + x^{+})(1 + x^{-})) > g(-\ln(1 + x^{-})) + g(-\ln(1 + x^{+}))$.

Therefore, at t = 0 the investor would invest in the stock and at t =1, the investor would keep the stock regardless of whether the stock went up or gone down over the first period.

A (2)

If

$$\mathbf{g(-2\ln(1 + x^{-})) - g(-\ln(1 + x^{-})) > \ln((1 + x^{+})(1 + x^{-})) > g(-\ln(1 + x^{-})) + g(-\ln(1 + x^{+})),}$$

then momentum strategy is preferred to investing twice. The momentum strategy is preferred to investing once as

$\ln((1 + x^{+})(1 + x^{-})) > g(-2 \ln(1 + x^{+})) - 2 g(-\ln(1 + x^{+})) + g(-\ln(1 + x^{-}))$.

The momentum strategy is preferred to not investing at all as

$\ln((1 + x^{+})(1 + x^{-})) > (-\ln(1 + x^{-})) + (1/3)[g(-2 \ln(1 + x^{+}))]$.

Therefore, at t = 0, the investor would invest in the stock and at t = 1, keep the stock if it went up or sell the stock if it went down.

A (3)

If

$$\mathbf{g(-\ln(1 + x^{-})) + g(-\ln(1 + x^{+})) > \ln((1 + x^{+})(1 + x^{-})) > g(-\ln(1 + x^{-})) + (1/3)[g(-2\ln(1 + x^{+}))],}$$

then momentum strategy is preferred to not investing at all. The momentum strategy is preferred to investing once as

$\ln((1+x^+)(1+x^-)) > g(-2\ln(1+x^+)) - 2g(-\ln(1+x^+)) + g(-\ln(1+x^-))$.

The momentum strategy is preferred to investing twice as

$g(-2\ln(1+x^-)) - g(-\ln(1+x^-)) > \ln((1+x^+)(1+x^-))$.

Therefore, at t = 0, the investor would invest in the stock and at t = 1, keep the stock if it went up or sell the stock if it went down.

A (4)

If

$$\mathbf{g(-\ln(1+x^-)) + (1/3)\,[g(-2\ln(1+x^+))] >}$$
$$\mathbf{\ln((1+x^+)(1+x^-)) >}$$
$$\mathbf{g(-2\ln(1+x^+)) - 2g(-\ln(1+x^+)) + g(-\ln(1+x^-)),}$$

then not investing at all is preferred to the momentum strategy. The momentum strategy is preferred to investing once. The momentum strategy is preferred to investing twice as

$g(-2\ln(1+x^-)) - g(-\ln(1+x^-)) > \ln((1+x^+)(1+x^-))$.

Therefore, the investor would not invest in the stock at all.

A (5)

If

$$\mathbf{g(-2\ln(1+x^+)) - 2g(-\ln(1+x^+)) + g(-\ln(1+x^-)) >}$$
$$\mathbf{\ln((1+x^+)(1+x^-)),}$$

then investing once is preferred to the momentum strategy. The momentum strategy is preferred to investing twice as

$g(-2\ln(1+x^-)) - g(-\ln(1+x^-)) > \ln((1+x^+)(1+x^-))$.

Not investing at all is preferred to investing once as

$g(-\ln(1+x^-)) + g(-\ln(1+x^+)) > \ln((1+x^+)(1+x^-))$.

Therefore, the investor would not invest in the stock at all.

Proof of Proposition 3

Under (B), the following inequalities hold:

$\mathbf{g(-2 \ln(1 + x^-)) - g(-\ln(1 + x^-)) >}$

$\mathbf{g(-2 \ln(1 + x^+)) - 2 g(-\ln(1 + x^+)) + g(-\ln(1 + x^-)) >}$

$\mathbf{g(-\ln(1 + x^-)) + (1/3) [g(-2 \ln(1 + x^+))] >}$

$\mathbf{g(-\ln(1 + x^-)) + g(-\ln(1 + x^+))}$

B (1)

If

$$\mathbf{\ln((1 + x^+)(1 + x^-)) >}$$
$$\mathbf{g(-2 \ln(1 + x^-)) - g(-\ln(1 + x^-)),}$$

then investing twice is preferred to the momentum strategy. The momentum strategy is preferred to investing once as

$\ln((1 + x^+)(1 + x^-)) > g(-2 \ln(1 + x^+)) - 2 g(-\ln(1 + x^+))$.

Investing once is preferred to not investing at all as

$\ln((1 + x^+)(1 + x^-)) > g(-\ln(1 + x^-)) + g(-\ln(1 + x^+))$.

Therefore, at $t = 0$ the investor would invest in the stock and at $t = 1$, the investor would keep the stock regardless of whether the stock went up or gone down over the first period.

B (2)

If

$$\mathbf{g(-2 \ln(1 + x^-)) - g(-\ln(1 + x^-)) >}$$
$$\mathbf{\ln((1 + x^+)(1 + x^-)) >}$$
$$\mathbf{g(-2 \ln(1 + x^+)) - 2 g(-\ln(1 + x^+)) + g(-\ln(1 + x^-)),}$$

then momentum strategy is preferred to investing twice and investing once. The momentum strategy is preferred to not investing at all as
$\ln((1 + x^{+})(1 + x^{-})) > g(-\ln(1 + x^{-})) + (1/3)\,[g(-2\ln(1 + x^{+}))]$.

Therefore, at t = 0, the investor would invest in the stock and at t = 1, keep the stock if it went up or sell the stock if it went down.

B (3)

If

$$\begin{gathered} \mathbf{g(-2\ln(1 + x^{+})) - 2g(-\ln(1 + x^{+})) + g(-\ln(1 + x^{-})) >} \\ \mathbf{\ln((1 + x^{+})(1 + x^{-})) >} \\ \mathbf{g(-\ln(1 + x^{-})) + (1/3)\,[g(-2\ln(1 + x^{+}))],} \end{gathered}$$

then investing once is preferred to the momentum strategy which is preferred to not investing at all. Momentum strategy is preferred to investing twice as
$g(-2\ln(1 + x^{-})) - g(-\ln(1 + x^{-})) > \ln((1 + x^{+})(1 + x^{-}))$.

Therefore, at t = 0, the investor would invest in the stock and at t =1 would sell stock regardless of whether the stock went up or went down over the first period.

B (4)

If

$$\begin{gathered} \mathbf{g(-\ln(1 + x^{-})) + (1/3)\,[g(-2\ln(1 + x^{+}))] >} \\ \mathbf{\ln((1 + x^{+})(1 + x^{-})) >} \\ \mathbf{g(-\ln(1 + x^{-})) + g(-\ln(1 + x^{+})),} \end{gathered}$$

then not investing at all is preferred to the momentum strategy and investing once is preferred to not investing at all. Momentum strategy is preferred to investing twice as
$g(-2\ln(1 + x^{-})) - g(-\ln(1 + x^{-})) > \ln((1 + x^{+})(1 + x^{-}))$.

Therefore, at t = 0, the investor would invest in the stock and at t =1 would sell stock regardless of whether the stock went up or went down over the first period.

B (5)

If

$$\mathbf{g\,(-\ln(1 + x^-)) + g(-\ln(1 + x^+)) > \ln((1 + x^+)(1 + x^-)),}$$

then not investing at all is preferred to investing once. Investing once is preferred to the momentum strategy as

$g(-2\ln(1 + x^+)) - 2g(-\ln(1 + x^+)) + g(-\ln(1 + x^-)) > \ln((1 + x^+)(1 + x^-))$.

Momentum strategy is preferred to investing twice as

$g(-2\ln(1 + x^-)) - g(-\ln(1 + x^-)) > \ln((1 + x^+)(1 + x^-))$.

Therefore, at $t = 0$, the investor would not invest in the stock at all.