Preregistration:
The Determinants of the Disposition Effect

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Abstract

This preregistration describes a laboratory experiment to be conducted at the University of Zurich. The experiment investigates the disposition effect. We describe the experimental design, the variables of interest, the hypotheses, and sample size.

1 Design

We use a stock trading laboratory experiment (Weber and Camerer, 1998; Frydman and Rangel, 2014) in order to study the disposition effect. In each round, each participant is endowed with an initial amount of 34 CHF and is required to buy one share of a single stock at an initial price p_0 of 34 CHF. Subsequently participants observe the evolution of the stock price for 9 periods. The stock price evolves according to a two-state Markov chain with a good state and a bad state. The initial state is determined randomly to be good or bad with equal probability. After each period, the state is updated. With a probability of 80% the stock remains in the same state, and with a probability of 20% it switches to the other state. For a given period, if the stock is in the good state the price goes up with 70% probability and it goes down with 30% probability. Conversely, in the bad state the price goes up with 30% probability and it goes down with 70% probability.

After 9 periods participants decide whether to sell the stock immediately or whether to keep the stock for one more period. If they decide to sell the stock, they get the amount of money corresponding to the current price (p_9). If they decide to keep the stock, then it is automatically sold at the price at the end of the 10th and final period (p_{10}).

Participants receive detailed instructions that explain the structure of the price process. The experiment consists of 120 rounds with randomly pregenerated price paths that are identical for all participants. These price paths are generated using a two-state Markov process with the

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	$\bar{p} > p_9$	$\bar{p} < p_9$
$p_9 > p_0$	I (Sell / Keep)	II (Sell / Sell)
$p_9 < p_0$	III (Keep / Keep)	IV (Keep / Sell)

Table 1: Categorization of rounds and prediction of loss aversion and mean reversion (LA/MR).

parameters described above. The order of the price paths is counterbalanced across participants. Participants are paid for one randomly selected round.

2 Hypotheses and Analysis

The main goal of the study is to establish the presence of the disposition effect and to identify whether it is driven by irrational belief in mean reversion (Barberis et al., 1998; Rabin and Vayanos, 2010; Jiao, 2017) or loss aversion (Kahneman and Tversky, 1979). Following Odean (1998) we calculate the disposition effect as follows. First, every decision can be classified into four mutually exclusive categories. A stock that is not sold after period 9 is a *paper gain* if $p_9 > p_0$ and a *paper loss* if $p_9 < p_0$ (we have deliberately chosen an odd number of periods to avoid situations with $p_9 = p_0$). Similarly, a stock that is sold after period 9 is a *realized gain* if $p_9 > p_0$ and a *realized loss* if $p_9 < p_0$. We then calculate for each trader the proportion of gains realized (PGR) and the proportion of losses realized (PLR):

$$\frac{\text{Realized Gains}}{\text{Realized Gains} + \text{Paper Gains}} = PGR$$

$$\frac{\text{Realized Losses}}{\text{Realized Losses} + \text{Paper Losses}} = PLR$$

The disposition effect amounts to the difference between those two ratios, $PGR - PLR$. For the 120 price paths used in our experiment, we can compute that the disposition effect for a risk-neutral Bayesian trader $PGR - PLR$ is given by $DE^{\text{Bayes}} = -0.32$. We expect that traders show a larger disposition effect than the Bayesian benchmark.

Hypothesis 1. *On average, traders exhibit a disposition effect exceeding the Bayesian benchmark, that is,* $PLR - PGR > -0.32$.

We seek to disentangle two prominent explanations for the disposition effect, loss aversion and irrational belief in mean reversion, which we operationalize as follows. A trader who is driven by loss aversion is more likely (relative to a Bayesian) to sell a stock if its price is above its starting value ($p_9 > p_0$) and is more likely (relative to a Bayesian) to keep a stock if its price is below its starting point ($p_9 < p_0$). A trader who is driven by irrational belief in mean reversion is more likely (relative to a Bayesian) to sell a stock if its price is above its mean price ($p_9 > \bar{p}$) and is more likely to keep a stock if its price is below its mean price ($p_9 < \bar{p}$).

Based on the predicted behavior by loss aversion and mean reversion we can classify each round based on the price path into one of four mutually exclusive categories (see Table 1). In rounds of type II and III the predictions of loss aversion and mean reversion are aligned, whereas in rounds of type I and IV the predictions are opposed. Importantly, irrational belief in mean reversion predicts that the proportion of gains realized is larger in II than in I and that the proportion of losses realized is larger in IV than in III (relative to the Bayesian benchmark), whereas loss aversion predicts no difference. Similarly, loss aversion predicts that the disposition effect calculated only for rounds of type I and III or type II and IV is larger than the Bayesian benchmark, whereas mean reversion predicts no difference.

Hypothesis 2. *A trader is driven by belief in mean reversion if*

(a) $PGR_{II} - PGR_{I} > PGR_{II,Bayes} - PGR_{I,Bayes} = -0.40$

(b) $PLR_{IV} - PLR_{III} > PLR_{IV,Bayes} - PLR_{III,Bayes} = -0.55$

Hypothesis 3. *A trader is driven by loss aversion if*

(a) $PGR_{I} - PLR_{III} > PGR_{I,Bayes} - PLR_{III,Bayes} = -0.19$

(b) $PGR_{II} - PLR_{IV} > PGR_{II,Bayes} - PLR_{IV,Bayes} = -0.04$

3 Exclusions

We have comprehension questions before the actual decision part of the experiment. We will not exclude participants due to incorrect answers to any of those questions. We will, however, carry out our analysis once with the whole data set and once only with the subset of participants who answered the comprehension questions correctly.

4 Sample Size

We will run sessions with 36 invited subjects each until we have 200 or more (non-excluded) subjects. This sample size ensures at least enough power (0.8) to find a medium to small effect size (0.25) for all our hypotheses even after adjusting the significance level according to Bonferroni for a conservative five multiple-test correction. In particular, we test hypotheses 1 to 3 using a non-parametric, within-subject signed-rank test. The sample size is calculated using G*Power (Faul et al., 2009).

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