# Individual investment behavior and disposition effect: An experimental analysis*

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## Abstract

The disposition effect means the tendency to sell stocks too early that have gained value and to keep stocks too long that have lost value relative to some reference point (for example, purchase price). The effect of this tendency depends on risk and reference point. The purpose of this article is to analyze the trading records of subjects in a virtual stock market game. We find that subjects tended to sell winner stocks quickly and to keep loser stocks. However, the disposition effects were greatly reduced when the stocks were automatically sold after a five percent fall in price.

## 1. Introduction

Though traditional finance assumes that investors behave rationally, behavioral finance[1] assumes that the behavior of investors is sometimes far from rational.

In this paper, we analyze the disposition effect. The disposition effect means the tendency to sell stocks too early that have gained value ('winner') and to keep stocks too long that have lost value ('loser'). The disposition effect depends on reference points and risk. If a stock price exceeds a certain reference point (for example, purchase price), individuals tend to be risk averters. They tend to be risk seekers if the stock price falls below the reference point.

As an example, suppose an investor buys a stock at 1,000 yen. After

purchasing it, the stock goes up to 1,100 yen. This investor gains 100 yen relative to initial purchase price. The stock price goes up 1,200 or goes down 1,000 with 0.5 probabilities. When the stock continues to rise, the investor gains an extra 100 yen. When the stock price declines, she loses 100 yen. Having initially been placed in a winning position, she feels more regret for the loss than joy for any additional gain, so she chooses to sell the stock at 1,100 yen. She is a risk averter at the gain domain. She prefers to lock-in 100 yen to gain extra yen.

Next, suppose the stock price opens on the down side after a purchase. An investor buys stock at 1,000 yen. Soon after, the stock quotes at 900 yen. She loses 100 yen. The stock bounces back 1,000 yen or drops 800 yen with 0.5 probabilities. When the downward trend continues, she incurs a loss of 200 yen. When the stock bounces back, she loses nothing. Having initially been placed in a losing position, she feels more joy for having no losses than regret for additional loss, so she chooses to keep a loser stock. She is a risk seeker at the loss domain. The purchase price reference point might move to the last period's highest price. When the stock declines relative to highest level, the investor might feel losses even if the stock hits the high of the original purchase price.

Our purpose is to analyze subjects' trading records in a virtual stock market game in order to test disposition effects. Subjects are students at Yamaguchi University, a businessperson, housewives, individual investors, stock brokers, and fund managers. Our tests have two advantages. First, we have easy access to trade data regardless of institutional factors (for example, tax). Secondly, our tests save time.

Two tests are performed. For Test 1, subjects buy and sell three stocks which have three months' worth of trading records behind them. They buy and sell these stocks based on past and current stock data and newspaper

information. For Test 2, subjects buy and sell five of seventy stocks which have one year's worth of stock price data. They buy and sell stocks based on past and present stock information.

We proceed as follows: Section 2 explains previous articles on the disposition effect. Section 3 describes experimental design. Results and summary are presented in Section 4 and Section 5.

## 2. Previous studies

Shefrin and Statman (1985) observed the disposition effect first by using the prospect theory, showing that loss averse investors had a disposition to sell winner stocks too early and to keep loser stocks too long. They were, however, able to realize an early loss when tax existed[2]. Shefrin and Statman analyzed investors' data from 1964 to 1970 and found insignificant and/or offsetting tax effects, as well as the disposition effect. Moreover, Shefrin and Statman analyzed data from 60 mutual funds dating from 1961 to 1973. They found a disposition to sell early upon gaining and a disposition to keep a loss for a long time. However, their findings were statistically insignificant.

Odean (1998) deepened the disposition effect by analyzing trading records from 1987 to 1993 for 10,000 accounts at a large discount brokerage house[3]. Results showed a strong preference for realizing winner stocks than for loser ones of all years. Odean finds, however, a disposition to sell the loss early in December. This might show the tax-loss selling in December.

Dhar and Zhu (2002) analyzed the trading records from 1991 to 1996 for 14,872 accounts at a large discount brokerage house in the USA to investigate the disposition effect. Their main purpose was to identify individual investment behavior in the disposition bias. Dhar and Zhu classified the investors by profession, income, age and investment experience[4]. Their findings confirm those of Odean (1998), that individual investors on average exhibit the

disposition effect. One fifth of the investors in their samples exhibit, however, opposite behaviors to the disposition effect. Investor characteristics that correspond to greater sophistication, such as income or profession, might reduce the disposition effect.

Shapira and Venezia (2001) analyzed the trade records of a major Israeli bank in 1994. Their subjects also exhibited the disposition effect[5]. Grinblatt and Keloharju (2001) analyzed the disposition effect by using daily trade records in Finland between 1994 and 1997. Their results showed that individual investors in Finland were reluctant to realize losses, excluding losses from taxes, selling in December. Ranguelova (2001) analyzed the daily trade records of 78,000 clients of a discount brokerage house between 1991 and 1996, studying the relationship between the disposition effect and firm size. Results showed that the disposition effect was concentrated in large-cap stocks. On the other hand, small-cap stocks exhibited a reverse disposition effect. Namely, individual investors keep their winner stocks and recognize loser stocks. Weber and Camerer (1998) observed the disposition effect in the experiment. The subjects were able to buy and sell six stocks over the 14 periods of time. Their result showed a tendency to sell the winner stocks too early and to keep loser stocks longer. The disposition effect was reduced, however, when they introduced automatic selling after some periods. This might have been a tendency of subjects to hesitate in selling loser stocks at will.


## 3. Experimental design

Our purpose is to test the disposition effect by analyzing subjects' trading records. For Test 1, subjects buy and sell three stocks freely. We analyze the subjects' trading records in order to observe the disposition effect. In Test 2, subjects buy and sell five stocks freely. We analyze their trading records in order to find the disposition effect. We test ① to ⑤, as follows.

① "Purchase Price Reference Point" subjects sell more stocks earlier when stock prices rise above the reference point than when stock prices fall below the reference point.

② "Last Period Highest Price Reference Point" subjects sell more stocks earlier when stock prices rise above the reference point than when stock prices fall below the reference point.

③ The disposition effect is smaller when selling is classified as an automatic stop-loss order than when stocks are deliberately sold.

④ "Purchase price reference point" subjects sell more stocks when stock prices rise above the reference point than when the stock prices fall below the reference point.

⑤ The loss aversion investor's performance is just bad.


### 3.1. Methodology for Tests 1 and 2

(1) For Test 1, we used the daily closing prices of three stocks (Kirin Brewery, Itochu, and Sony) from 3/4/03 to 27/8/03. We denoted Kirin Brewery as Stock 1, Itochu as Stock 2, and Sony as Stock 3 using computer software. This way prevented subjects from making guesses as to each company's name. Forty pieces of stock price data dated from 3/4/2003 to 2/6/2003 out of 100 (in total dating from 3/4/2003 to 27/8/2003) was displayed in line graph form on computers for subjects to use before the test as reference data. For Test 2, we used 240 daily closing prices from the years 2000 to 2003 as stock price data[6]. Samples are 70 firms which belong to either the first section or the second section on the Tokyo Stock Exchange or JASDAQ. There were five firms randomly selected and used in this experiment. Thus the firms for buying and for selling are different for each subject. We displayed the past 40 daily closing prices of five firms in line chart form for both Test 1 and Test 2.

(2) For Test 1, three stocks were set to change simultaneously at the rate of

60 times every 20 seconds. For Test 2, five stocks were set to change simultaneously 240 times every 5 seconds. For Test 1, subjects buy and sell stocks within 20 seconds. For Test 2, subjects buy and sell within 5 seconds. They can check the present price, initial price, points from the last price[7], high price, low price using the computer. They can freely buy and sell at current prices. They do not have, however, information on what influences these stock price changes.

(3) For Test 1, subjects trade a fictitious 3,000,000 yen. They cannot buy or sell above 3,000,000 yen plus their realized gain. For Test 2, subjects trade a fictitious 5,000,000 yen. They cannot buy or sell above 5,000,000 yen plus their realized profit. For neither test can subjects buy or sell on margin. It excludes tax. The transaction cost per person is 700 yen regardless of the actual amount.

(4) For Test 1, subjects buy and sell one of the following four courses. For Test 2, they buy and sell ① and ②. They cannot freely select a course: the four courses are to be set for random assignment by the computer.

① Subjects buy and sell stocks based on stock price information.

② Subjects buy and sell stocks based on stock price information and when purchased stocks drop in price by 5%, we automatically set it so that it can be sold off via the computer. We made a button labelled 「OK」 to confirm whether subjects immediately after sale buy the stock back at the same stock price. Subjects push the 「OK」 button if they may sell it off. The stop-loss sale holds if nothing is done. If subjects want to immediately return stock before the automatic sale, they should push the 「buyback」 button. During Test 2, stock which drops in price by 5% is compulsorily sold off.

③ Subjects buy and sell stocks based on stock price information and news reports. We used news headlines published in the newspaper Nikkei from 3/6/2003 to 27/8/2003. The news of the day was presented on the computer at

the same time as the current stock price.

④ 　Subjects buy and sell based on stock price information and news reports. They should, however, push the 「 buyback」 button if they do not want to sell off stock which drops in price by 5%.

(5) The stock price graphs are updated as the experiment advances. Subjects can see the process on the computer as it happens.

(6) When buying a stock, subjects click the 「purchase」 button. When selling it off, they click the 「selling」 button. When they buy or sell stock, the computer displays the number of stocks able to be bought and sold through cash in hand.

(7) Subjects can always see their personal trading records, consisting of purchase (selling) price, number of purchase (selling) stocks and, displayed on the computer, tradable cash in hand.

(8) Subjects can always see their effective retained amount over the period of the test.

(9) They can execute a market order. They cannot, however, execute a limit order.

(10) For Test 1, we calculated profit or loss by the First-In First-Out method. That is, if it was the same stock, the settings were: The first stock purchased would be the first sold.

(11) All trades are liquidated after the experiment ends. Unrealized gains and losses at the final term are calculated as realized ones.

## 3.2. Experimental procedure

We performed tests on the Yamaguchi University campus, subjects' offices, their own homes, etc. Subjects consist of university students, housewives, a businessperson, et al, ranging in age from twenty-something to the sixties. Their investment experiences are varied. All of them do not necessarily have

knowledge of stock investment. We explained the experiment to subjects using the following procedure.

(1) From this point on, we would be performing a test on stock investment. We explained to subjects that they would be expected to earn a lot of fictitious money. To do so, they should buy stocks as cheaply as possible, and sell as expensively as possible.

(2) We explained this experiment during a practice investment test, which was practically the same as the real experiment itself. The difference between them was that the subjects used less time practicing than they did performing the actual experiment.

(3) After the practice had ended, subjects answered a questionnaire and began experimenting. The content of the questionnaire included sex, age and investment experience.

(4) After the experiment ended, the results of the subjects' questionnaire, as well as their trade data, were recorded on the computer.

### 3.3. Stock price data

The stocks selected are Stock 1 (Kirin Brewery), Stock 2 (Itochu), and Stock 3 (Sony).Subjects are not informed of the company's name. The data is from 3/4/03 to 27/8/03. Table 1(a) shows the rates of return when subjects hold Stocks 1, 2, or 3 from 4/6/2003 to 27/8/2003. The trend from a past stock price was shown in line chart form about the previous period. The time series data of Stock 1 are downward trends. Those of Stock 2 are upward trends. Stock 3 has a trend showing that the level of the first and last stock prices are almost equal, although Stock 3 drops in price first and recovers afterwards.

For Test 2, the sample stocks are from 70 firms that listed on the first section and the second section on the Tokyo Stock Exchange and on JASDAQ from 2001 to 2003. We explained to the subjects about how to buy or sell the five

stocks selected at random from 70 firms. The selected stocks are Stocks 1, Stock 2, Stock 3, Stock 4, and Stock 5. Subjects are not informed of the company's name. Table 1 (b) shows the rates of return when subjects held all stocks 1 through 5 from beginning to end. The average rates of return are — 3.16%, the standard deviation is 32.40%.

## 4. Result

### 4.1 Subject

Table 2 shows the subjects' profile. Participants of Test 1 and Test 2 are 188 and 195 respectively. The average age of Test 2 subjects is higher than that of Test 1 subjects. There are more Test 2 subjects who have investment experience than Test 1 subjects. There are subjects who participated in both tests. With Test 2, there are subjects who are performing functions two times or more because the stock price data is different each time. In each case, it is calculated as one person.

### 4.2. Do subjects sell winner stocks too early and hold loser stocks too long relative to reference points?

As is evident from table 3, the rates of return are positive in Test 1 from the total and from the classification of the courses. On the other hand, the rates of return are negative in Test 2 from the total and from the classification of the courses. In Test 1, however, the rates of return for courses ① and ③, which subjects can buy and sell at will, are higher than those for courses ② and ④ which they can select as stop-loss.

For Test 2, the minus rates of return for course ②, which sells stop-loss automatically when the stock drops in price by 5%, are higher than those for course ① which subjects can buy and sell at will. As is evident from tables 3 (a) and 3 (b), the frequency of transactions allowed is higher for the course

with permission to do stop-loss orders than that of the course without stop-loss order permission. Table 3 shows the proportion of gains realized (PGR) and the proportion of losses realized (PLR). We observed, using two ratios, whether subjects sell stock too early above the reference point or if they keep stock too long below the reference point. A reference point is the purchase price. Two ratios are calculated following Odean (1998):

Proportion of gains realized (PGR) =

　　　　　　　　realized gains/(realized gains + paper gains)

Proportion of losses realized (PLR) =

　　　　　　　　realized losses/(realized losses + paper losses)

It becomes realized gains if subjects sell off the stock above the reference point, and it becomes realized losses if subjects sell it off below the reference point. When the test ends (60 times for Test 1, 240 times for Test 2), if each subject does not sell off the stock above (below) the reference point, it becomes unrealized gains (losses). If all trades are achieved for the trade period, the value of one is taken. If all trades are unachieved for the trade period, the value of zero is taken. As for Tests 1 and 2, the PGR is always higher than the PLR. This means that subjects might realize gains too early and keep losses too long. If stop-loss trade is added, however, PLR exceeds PGR. As for Test 2, all courses showed statistical significance. As for Test 1, it was not statistically significant when course 1 was excluded.

Next, tables 4 and 5 show how many days on average it takes to realize gains and losses.The stocks which are not sold off during test periods are assumed to liquidate at the 61$^{st}$ day in Test 1, and for Test 2, at the 241$^{st}$ day. Tables 4 and 5 show that the reference points are purchase price and the last high price respectively.

As is evident from tables 4 and 5, the realization gain possession period is shorter than the realization loss possession period for Tests 1 and 2. This might mean that gains realize too early and that losses do not. In addition, the realization gains and losses periods of Test 2 are longer than those of Test 1. This depends on the length of the test period. Moreover, as is evident from table 4, in course 1, uninfluenced by stop-loss selling, the number of realization loss days are twice the number of realization gain days. Table 5 shows that the difference expands further. Realization loss days are six times more than realization gain days.

## 4.3. The disposition effect is smaller when a stop-loss order executes automatic sales

For Test 1, we compared course 1, which is based on stock price information, with course 2, which is based on stock price information but sells automatically if the stock drops in price by 5%. Stock which is automatically sold off can be bought back at the same price. If the disposition effect is high, that is, if the subjects hesitate to realize the losses, they are sure to buy back stocks which are automatically sold off. However, as is evident from the PLR in table 3, subjects tend to realize the losses. In Test 2, this tendency is evident from the comparison between the PLR of course 1 and that of course 2. Nevertheless, a computer compulsorily sells off the stock which drops in price by 5% in Test 2. And as is evident from tables 4 and 5, realization loss days are greatly reduced even though a stop-loss sale is compulsory or voluntary. The disposition effect might be able to be reduced, although not by willpower but by other means (for example, the computer).

When we compare course 1, which is based on the stock price information, and course 3, which is based on the stock price information and newspaper information in Test 1, we find from tables 4 and 5 that realization loss days

reduce and realization gain days increase in course 3. This might show the tendency for the subjects to receive extra information and to pursue the trend. That is, subjects might tend to hold too long because the stock price rises further, and sell early because it falls further. It will be necessary, however, to examine the PLR because course 3 is smaller than course 1 upon studying table 3.

### 4.4. When do subjects sell more stocks?

In total, subjects sell more stocks when the price is above the reference point than when the price is below the reference point (see table 6). In the case of stop-loss selling, subjects sell more stocks that realize losses, excluding course 2 in Test 1. In Tests 1 and 2, there are no statistically significant differences between the number of stocks that realize gains and the number of stocks that realize losses.

### 4.5. Is a loss averse investor's performance bad?

One hundred and eighty-eight (188) subjects' performances in Test 1, 195 for Test 2, were classified from bad order into 4 groups respectively. The performance of group 1 is worst and that of group 4 is best. Tables 7(a) and (b) show whether it is related to the PGR, the PLR, and/or the holding period. According to test results, what divides the performances of group 1 and group 4 is the difference between possession days (gain) and possession days (loss). In Test 1, the PGR of group 1 is higher than that of group 4, and the PLR of group 1 is smaller than that of group 4. This might show that group 4 realizes the loss too early and keeps the gain too long. When comparing it by possession days(gain), group 1's possession days are about half as those of group 4.

Test 2 displays similar tendencies to Test 1. The PGR of group 4 is higher than that of group 1, and the PLR of group 4 is higher than that of group 1. When comparing it by possession days in common with Test 1, the high performance group holds stocks for a longer period of time until the gain is realized, and for a shorter period of time until the loss is realized. The badly performing group might mean that the disposition effect is high.


## 5. Concluding Remarks

Subjects buy and sell using the computer. This paper verified whether bias in action, that is, a disposition effect, has been observed by them. In Test 1, subjects trade over one of four courses which have been selected at random. For Test 2, they trade over one of two courses which have been selected at random. Results show this disposition effect when a stop-loss transaction is not ordered. That is, we find that subjects tend to realize the gain too early and keep the loss too long. However, the disposition effect was greatly reduced when we finally introduced a stop-loss transaction order. For Test 1, subjects realized a loss too early, although a stop-loss order was not compulsory. Moreover, the high disposition effect group's performance was not so good. On the other hand, the performance of the group which tended to realize the loss too early and keep the gain too long was good. Nevertheless, our results are limited due to the fact that 167 Test 1 subjects and 159 Test 2 subjects are stock investment inexperienced persons. The number of the subjects might also be too few. Therefore, this investment experiment might not have reflected reality.

However, according to the results of Odean (1998) and other researchers, the subjects' behaviors in these tests have the possibility with some relations because the disposition effect is observed by real market participants.

(1)　See Kato (2002), Shiroshita (2002), Toshino (2004)

(2)　Statman (1995) explains this point as an arbitrage opportunity using tax swaps.

(3)　Odean (1998) distinguishes between the disposition effect and the mean reversal effect.

(4)　They divide investors into high income, medium income and low income. They also divide investors into professional, non-professional and non－employed.

(5)　In Israel, the distinction between the disposition effect and tax effect is not needed because capital gain is tax free.

(6)　The stock data for Test 1and Test 2 is available from the home page of Panrolling: http://www.panrolling.com/

(7)　For Test 2, it is the point from the last price.

## Table 1　Descriptive statistics on sample stocks

### (a) Test 1

| | |
|---|---|
| Sample firms | 3 |
| Average rates of return | 16.12% |
| Standard deviation | 26.89% |
| Rates of return (Median) | 14.24% |
| Rates of return (Maximum value) | 43.90% |
| Rates of return (Minimum value) | －9.77% |

### (b) Test 2

| | |
|---|---|
| Sample firms | 70 |
| Average rates of return | －3.16% |
| Standard deviation | 32.40% |
| Rates of return (Median) | －5.94% |
| Rates of return (Maximum value) | 118.60% |
| Rates of return (Minimum value) | －79.40% |

## Table 2　Subjects

| | | Sex | | Age | | | Investment experience | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Male | Female | 10～20 | 30～40 | 50～60 | None | 1～3year | More than 4year |
| Test 1 | 188 | 106 | 82 | 133 | 51 | 4 | 167 | 9 | 12 |
| Test 2 | 195 | 111 | 84 | 126 | 57 | 12 | 159 | 18 | 18 |

## Table 3　Disposition effect

(a)　Test　1

| | Total | Course 1 | Course 2 | Course 3 | Course 4 |
|---|---|---|---|---|---|
| ①Sample | 188 | 41 | 55 | 45 | 47 |
| ②Rates of return | 1.25% | 1.34% | 0.51% | 1.78% | 1.51% |
| ③P G R | 0.858 | 0.919 | 0.852 | 0.792 | 0.864 |
| ④P L R | 0.826 | 0.645 | 0.920 | 0.735 | 0.956 |
| ⑤Difference between ③and④ | 0.03 | 0.273* | −0.067 | 0.056 | −0.092 |
| ⑥Average trade frequency | 25.9 | 20.9 | 29.1 | 21.3 | 31.0 |

(b)　Test　2

| | Total | Course 1 | Course 2 |
|---|---|---|---|
| ①Sample | 195 | 95 | 100 |
| ②Rates of return | −3.44% | −4.27% | −2.65% |
| ③P G R | 0.91 | 0.97 | 0.87 |
| ④P L R | 0.81 | 0.62 | 0.99 |
| ⑤Difference between ③and④ | 0.1* | 0.34* | -0.13* |
| ⑥Average trade frequency | 50.29 | 36.27 | 63.61 |

(Note)　Average trade frequency is counted as once at purchase and once at sale
　　　　＊Significant at the 1% level

## Table 4　Trade days（Purchase price）

(a) Test　1

|  | Total | Course 1 | Course 2 | Course 3 | Course 4 |
|---|---|---|---|---|---|
| ①Possession days (Gain) | 11.05 | 10.97 | 10.38 | 13.30 | 9.70 |
| ②Possession days (Loss) | 15.37 | 24.60 | 9.54 | 20.86 | 8.89 |
| ③Difference between ①and② | −4.33* | −13.63* | 0.83 | −7.56* | 0.81 |

(b) Test　2

|  | Total | Course 1 | Course 2 |
|---|---|---|---|
| ①Possession days (Gain) | 28.17 | 31.43 | 25.11 |
| ②Possession days (Loss) | 40.82 | 72.04 | 11.48 |
| ③Difference between ①and② | −12.65* | −40.61* | 13.63* |

(Note)　＊Significant at the　1% level

## Table 5　Trade days（last high price）

(a) Test　1

|  | Total | Course 1 | Course 2 | Course 3 | Course 4 |
|---|---|---|---|---|---|
| ①Possession days (Gain) | 3.74 | 3.72 | 3.50 | 4.72 | 3.10 |
| ②Possession days (Loss) | 12.67 | 21.65 | 6.78 | 18.16 | 6.49 |
| ③Difference between ①and② | −8.93* | −17.92* | −3.28* | −13.44* | −3.39* |

(b) Test　2

|  | Total | Course 1 | Course 2 |
|---|---|---|---|
| ①Possession days (Gain) | 9.80 | 9.47 | 10.11 |
| ②Possession days (Loss) | 34.90 | 63.39 | 8.13 |
| ③Difference between ①and② | −25.1* | 53.92* | 1.98 |

(Note)　＊Significant at the 1 % level

## Table 6　Number of trade stocks（Purchase price）

(a) Test　1

|  | Total | Course 1 | Course 2 | Course 3 | Course 4 |
|---|---|---|---|---|---|
| ①Number of trade stocks（Gain） | 1792.6 | 1874.5 | 1996.2 | 1616.6 | 1651.6 |
| ②Number of trade stocks（Loss） | 1671.7 | 1627.9 | 1837.9 | 1477.6 | 1701.3 |
| ③Difference between ①and② | 121.0 | 246.6 | 158.4 | 139.0 | —49.7 |

(b) Test　2

|  | Total | Course 1 | Course 2 |
|---|---|---|---|
| ①Number of trade stocks（Gain） | 3,544 | 3,214 | 3,855 |
| ②Number of trade stocks（Loss） | 3,471 | 3,007 | 3,906 |
| ③Difference between ①and② | 73.87 | 206.77 | —51.05 |

## Table 7　Performance and disposition effect

(a) Test　1

|  | Group 1 | Group 2 | Group 3 | Group 4 |
|---|---|---|---|---|
| ①Sample | 47 | 47 | 47 | 47 |
| ②Rates of return | —5.44% | —1.17% | 2.47% | 9.13% |
| ③P G R | 0.909 | 0.855 | 0.877 | 0.790 |
| ④P L R | 0.791 | 0.860 | 0.825 | 0.826 |
| ⑤Difference between③and④ | 0.118** | —0.004 | 0.052 | —0.035 |
| ⑥Possession days（Gain） | 7.75 | 9.05 | 11.09 | 16.26 |
| ⑦Possession days（Loss） | 17.82 | 16.03 | 15.35 | 12.29 |
| ⑧Difference between⑥and⑦ | —10.07* | —6.98＊ | —4.26** | 3.97 |

## (b) Test 2

|  | Group 1 | Group 2 | Group 3 | Group 4 |
|---|---|---|---|---|
| ①Sample | 48 | 49 | 49 | 49 |
| ②Rates of return | －26.66% | －8.48% | －0.37% | 21.28% |
| ③P G R | 0.89 | 0.93 | 0.93 | 0.92 |
| ④P L R | 0.73 | 0.76 | 0.89 | 0.87 |
| ⑤Difference between③and④ | 0.15** | 0.17* | 0.04 | 0.04 |
| ⑥Possession days (Gain) | 21.64 | 28.28 | 32.05 | 30.46 |
| ⑦Possession days (Loss) | 54.13 | 47.60 | 34.97 | 26.59 |
| ⑧Difference between⑥and⑦ | －32.49* | －19.32** | －2.92 | 3.88 |

注)　＊Significant at the 1% level
　　＊＊Significant at the 5% level

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