

The Escalation of Commitment and Disposition Effect in Securities Trading: An Experimental Study

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To cite this article:

Gao Kai, Jia Chen, Nie Lei. The Escalation of Commitment and Disposition Effect in Securities Trading: An Experimental Study. *International Journal of Business and Economics Research*. Vol. 7, No. 1, 2018, pp. 1-6. doi: 10.11648/j.ijber.20180701.11

Received: December 25, 2017; **Accepted:** January 11, 2018; **Published:** January 23, 2018

Abstract: This paper investigates the relationship between disposition effect and escalation of commitment in securities trading. First, we developed an investment simulation system, that manipulated five stocks' price during thirty-six periods to test investors' behavioral patterns in securities trading. Then, we investigate whether the gain ratio or loss ratio impacts on disposition effect and escalation of commitment after controlling other variables. The results summarized as follow: First, investors are exhibited disposition effect and escalation of commitment in securities trading. Second, sex, education, duration of securities trading, and investment amount did not affect the disposition effect and escalation of commitment. Third, disposition effect and escalation of commitment has negative impact on performance. Finally, we find individual investors with stronger disposition effect are more likely to be escalated in securities trading.

Keywords: Escalation of Commitment, Disposition Effect, Prospect Theory

1. Introduction

In the traditional financial theory, rational investors makes investment decisions based on the characteristics of investment portfolio risk; however, prior studies show that the disposition effect do exist in investment. Investors are likely to sell profitable stocks, while holding the losses in their portfolio. But some investors not only holding losses, they tend to go further, that is, purchases more, and then fall into the trap of escalation of commitment.

Researches focused on the causes of escalation of commitment [1-2], influencing factors [3-7], control mechanisms [8-9], the existence of disposition effect [10-11], influencing factors [12-14], investment performance and market impact [15-17]. However, there are two insufficient places in these studies. Firstly, most of these studies were based on indirect data, such as fund transaction data and questionnaire, which makes difficult to investigate individual investors' behavior. Secondly, although these studies have explained the causes of escalation of commitment and disposition effect, these studies ignored the intrinsic linkages between the two kinds of behavior.

This paper developed an investment simulation system to examine disposition effect and escalation of commitment in securities trading. We tested the impact of these variables, such as sex, education, duration of securities trading, and investment amount to disposition effect and escalation of commitment. Then we divided the investors into five groups to test the relationship between two kinds of behavior with investment performance. Finally, we find the relationship between disposition effect and escalation of commitment in securities trading.

2. Literature Review and Hypotheses

Literature reviews consist of three categories, first, the review of escalation of commitment; second, the review of the disposition effect; third, the review of the relationship between two kinds of behavior.

2.1. Escalation of Commitment

A typical escalation of commitment has three characteristics: a lot of resources have been invested (such as money, time or effort); the initial action has not achieved the

desired effect or is actually on the verge of failure, that is, a negative feedback has been received; investors can decide either to continue investing in an attempt to recover the costs already paid or to withdraw completely from the operation. Escalation of commitment means that investors continued to devote resources to purchasing more while they suffered a serious setback in their previous investments in order to share the loss of their previous investments. Prospect theory and self-defense theory explain the causes of escalation of commitment from the perspective of cognitive process and motivation. Both theories declared that escalation of commitment is a distortion of investors' cognition and is mainly emotional and irrational. However, the decision dilemmas theory argued that escalation of commitment is not totally irrational. Bowen pointed that negative feedback and social value norms are not the main reasons for the escalation of commitment. The ambiguity of feedback and the lack of objective criteria for evaluating feedback are the major contributors to escalation of commitment [18]. The experimental methods can not only overcome the deficiencies of indirect data, but also investigate the process of personal information processing through a programmed experimental platform [19]. In order to test the escalation of the individual's commitment in securities trading, according to the connotation of escalation of commitment, we derive hypotheses as follow:

H1a: Taking the purchase price as a reference point, subjects buy more shares for the lost stock than for the profitable stock.

H1b: Subjects' gender, education, duration of securities trading, and investment amount influence the level of escalation of commitment.

H1c: The escalation of commitment has a negative impact on investment performance.

2.2. Disposition Effect

According to Prospect theory, due to the existence of framework effect, investors' utility of holding profitable shares is less than the utility of selling them. On the other hand, investors' utility of holding losses is more than the utility of selling them [10]. Elzbieta built a model from both the value function and the probability weight function, and found that the traders with reverse strategy has a stronger tendency of disposition effect [12]. Based on the Estonian stock market data, Tonn measured the effects of disposition effect with Cox's method and found that foreign investors tended to exhibit more negative effects of disposition than domestic ones, with more inertia traded. Experienced investors showed lower Disposition Effect [15]. To test disposition effect in individual investment, we derive hypotheses as follow:

H2a: Taking the purchase price as a reference point, subjects sell more shares for the profitable stock than for the lost stock.

H2b: Subjects' gender, education, duration of securities trading, and investment amount influence the level of disposition effect.

H2c: The disposition effect has a negative impact on

investment performance.

2.3. The Relationship Between Disposition Effect and Escalation of Commitment

There are some differences between disposition effect and escalation of commitment, but there are also some links of them. Firstly, they are different in the manifestations and measurement. The escalation of commitment mainly reflects in the buying side of the securities, while the disposition effect reflects in the selling side. Secondly, in the perspective of the prospect theory, both of the causes of the two kinds of behavior is the frame effect and the deterministic effect. Investors tend to go further when they hold the shares that the sale price is below the purchase price, that makes disposition effect and escalation of commitment occur at the same time. To test the relationship between the two, we derive hypotheses as follow:

H3: Subjects with higher degree of disposition effect will be with higher degree of escalation of commitment.

3. Method

3.1. Subjects

A total of 123 subjects were randomly selected from the two groups. Group I consist of 72 undergraduates from Nanjing Normal University. These students had studied investment-related knowledge. Group II consist of 51 investors with investment experience from the Bank of Nanjing and Tianfeng Securities Ltd.

3.2. Experimental Design

The experiment was complemented by the investment simulation software. Each participant abided by the presumed 100,000 Yuan budget constraint before the experiment started, and formed a portfolio investment by buying and selling stocks. All of the subjects was informed that at the end of the experiment, the corresponding reward of 1% would be given according to the sum of the cash on the account and the market value of the stock portfolio. In addition, the subjects were informed that their stock trading activities did not affect the market price. For the participants, they faced a perfectly competitive market, which was also consistent with the real market.

We selected five stocks actually issued in the stock market of Shanghai Stock Exchange as the research objects. The five stocks came from banks, high-tech, real estate, home appliances and clothing segments, and intercepted from January 2013 to the end of December 2015 every month on the 30th Closing price as the experimental data point. In the experiment, we give the trend of the first four periods of each stock, after the completion of the participants to buy and sell operation we show the price of the next period. The reason for choosing the price in three years is as follows: (1) In the short term (3-12 months), the stock market is underreacted and investors can get excess returns by using inertial strategies. At the same time, there is overreaction in the securities market in

the medium to long term (3-5 years) and the excess returns can be obtained by using the reversal strategy [20]. Choosing a three-year period of price will reduce the difference in returns due to the difference in initial investment strategy. (2) From

January 2013 to December 2015, the Shanghai Composite Index represented a bull market and bear market from 1849 points to 5178 points and 2,600 points. The data of this period is more representative.

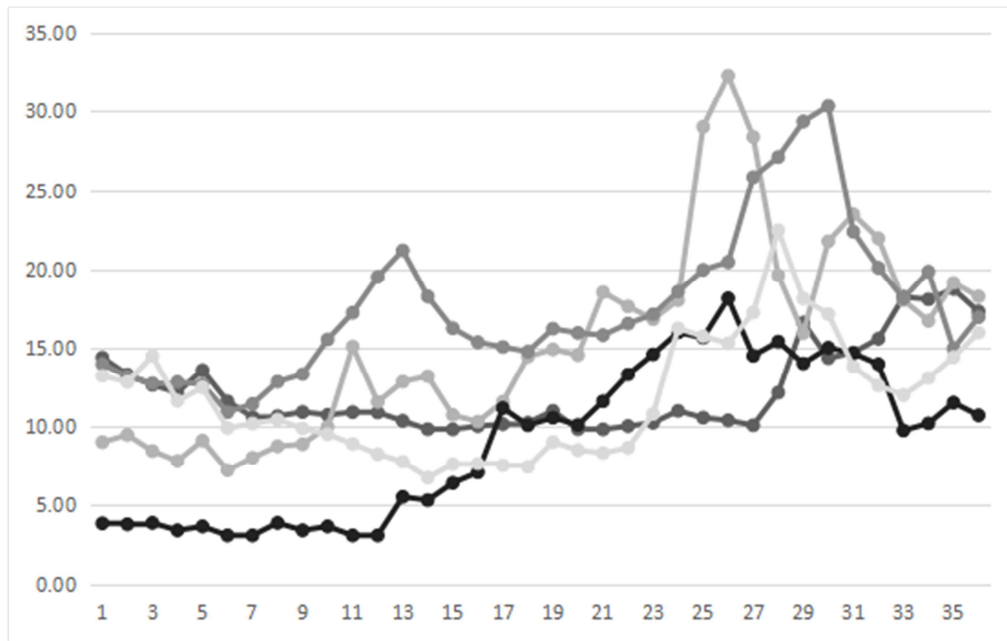


Figure 1. Time series of stock prices used in the experiment.

3.3. Experimental Procedure

For group I, the test procedure was as follows: (1) The subjects were concentrated in a laboratory and distributed to each person a stock "learning material" with 10 major knowledge points quoted from the stock books and large stock trading website to help them understand the stocks trading. (2) Laboratory staff read the instructions, including guidelines and operation introductions. (3) Subjects logged the investment simulation system through LAN to complete 32 investment experiments. (4) Each subject left the laboratory at the end of the experiment, led by an experimenter to the next room to receive the reward corresponding to the investment performance. For group II, test procedures were as follows: (1) subjects log in the experimental system to read the "learning material" and experimental notes. (2) The subjects completed the experiment in investment simulation system. (3) According to the social accounts subjects left, we gave the rewards to them.

3.4. Measurement

There are three ways to measure disposition effect: the first one is developed by Shefrin and Statman [21]. The second one is the method of survival model used in actuarial science by Feng and Seasholes; the third one is the method of "sell ratio" statistic by Odean [22]. On the basis of Odean, Weber constructed the degree of disposition effect index, which was widely used in experimental research [23]. We measured disposition Effect with Weber's method. Taking the bidding price as a reference point, the number of shares an investor sold the profitable stocks is S_{i+} , the number of shares an

investor sold the losing stocks is S_{i-} . Then the degree of disposition effect is:

$$\alpha_i = (S_{i+} - S_{i-}) / (S_{i+} + S_{i-})$$

Obviously, $\alpha_i \in [-1, 1]$

For the measure of escalation of commitment, Lin proposed a calculation indicator of "P/L ratio". However, this method adds investors' influence on the buying of profitable stocks so it is not accurate. According to the connotation of escalation of commitment, we developed an indicator to measure the degree of escalation of commitment. Taking the bidding price as a reference point, the number of shares an investor bought the profitable stocks is B_{i+} , the number of shares an investor bought the losing stocks is B_{i-} . Then the degree of escalation of commitment is:

$$\beta_i = B_{i-} / (B_{i-} + B_{i+})$$

Obviously, $\beta_i \in (0, 1)$.

4. Result

4.1. Test of the Escalation of Commitment

Table 1 shows the buy-in decision of group I and group II. 58.08% of the shares were bought when the price is below the purchase price, and the other 34.41% of the buy-in occurred in profit. For a single stock, investors buy the stock B, C, D, E under a loss more than the stock under a profit, while buy the

stock A slightly more than the loss under the stock A Buy in profitability. Therefore, investors have a higher probability of buying shares for losing stocks, and the escalation of commitment occurs. Comparing group I and group II, we found that investors with experience were more likely to buy stocks at a loss price, that is, they had high degree of

escalation of commitment. There are two reasons. Firstly, investors with experience are more likely to be affected by "avoidance of regret." Secondly, the stock market has just undergone dramatic fluctuations before the experiment, investors may have a stronger willingness to evade losses, that made them more escalated.

Table 1. Number of shares bought by subjects depending on the purchase price.

Stock	A	B	C	D	E	Total						
Group I												
Gain	11376	44.44	17607	41.68	17774	38.54	14355	38.98	25966	39.89	87078	40.34
Loss	14224	55.56	22379	52.98	20552	44.56	20862	56.65	33431	51.36	111448	51.63
Even	0	0	2257	5.34	7795	16.90	1612	4.38	5690	8.74	17353	8.04
Group II												
Gain	3945	55.98	1255	8.10	6962	26.47	2831	9.68	17560	32.71	32553	24.71
Loss	1176	16.69	13151	84.91	16245	61.76	26016	88.99	33875	63.11	90463	68.66
Even	1926	27.33	1083	6.99	3094	11.76	387	1.32	2243	4.18	8734	6.63
Total												
Gain	15321	46.93	18862	32.67	24736	34.16	17186	26.01	43526	36.65	119631	34.41
Loss	15400	47.17	35530	61.54	36797	50.81	46878	70.96	67306	56.67	201911	58.08
Even	1926	5.90	3340	5.79	10889	15.04	1999	3.03	7933	6.68	26087	7.50

4.2. Test of the Disposition Effect

Table 2. Number of shares sold by subjects depending on the purchase price.

Stock	A	B	C	D	E	Total						
Group I												
Gain	19564	55.68	26998	83.88	35181	53.71	27310	60.90	56905	65.03	165958	62.58
Loss	15050	42.84	2234	6.94	20122	30.72	14680	32.73	22847	26.11	74933	28.26
Even	520	1.48	2954	9.18	10204	15.58	2857	6.37	7752	8.86	24288	9.16
Group II												
Gain	1702	18.72	16647	87.64	20458	55.53	32361	83.55	42138	64.42	113305	67.02
Loss	4995	54.93	866	4.56	12378	33.60	5890	15.21	21930	33.53	46059	27.24
Even	2396	26.35	1482	7.80	4003	10.87	481	1.24	1340	2.05	9702	5.74
Total												
Gain	21266	48.08	43645	85.27	55638	54.36	59671	71.39	99042	64.77	279263	64.31
Loss	20045	45.32	3100	6.06	32500	31.76	20570	24.61	44777	29.28	120992	27.86
Even	2916	6.59	4436	8.67	14207	13.88	3338	3.99	9092	5.95	33990	7.83

Table 2 shows the sales of group I and group II at profit, loss and flat time. Investors tend to sell previously profitable shares more than loss-making stocks, which is evident in the four stocks of B, C, D and E. For stock B, the number of shares investors sold at loss is 14 times of that at gain. The results shows that the disposition effect exist in the experiment, which is consistent with previous researches. In addition, we also find that group I shows a stronger disposition effect in stock A and stock E, while group II shows a stronger disposition effect on stock B and stock D.

4.3. The Factors Influence Disposition Effect and Escalation of Commitment

The mean value of the index of disposition effect is 0.36 and the standard deviation is 0.36. The mean value of the index of escalation of commitment is 0.47 and the standard deviation is

0.34. We take the index of disposition effect and the index of escalation of commitment as dependent variables respectively, take sex, education, duration of securities trading, and investment amount as independent variable to make regression analysis. The results shows that the selected variables have no significant effect on the index of disposition effect and the index of escalation of commitment, which is inconsistent with the previous findings. First, in this trial, the average age of the investors group was 29.5 years and the average years of securities trading was 5.4 years. However, investors' behavior was the result of years of accumulation. Second, the factors that influence disposition effect and escalation of commitment may not only be external characterization variables but should be characterized by psychological and behavioral characteristics.

Table 3. Regression model test results.

Variables	Escalation of commitment		Disposition effect	
	β (std. dev.)	t (p)	β (Std. dev.)	T (p)
constant	0.065(0.138)	0.472(0.638)	0.2(0.144)	1.394(0.166)
sex	0.063(0.065)	0.391(0.696)	0.069(0.068)	0.116(0.908)
education	-0.21(0.032)	-0.671(0.503)	-0.16(0.33)	-0.045(0.487)
investment amount	0.13(0.033)	0.970(0.334)	0.04(0.035)	1.011(0.314)
duration of securities trading	0.002(0.034)	0.05(0.961)	0.30(0.036)	0.839(0.403)
.	0.003		0.02	
	1.075		0.528	
	1.881		2.304	

4.4. A Test of Disposition Effect, Escalation of Commitment and Returns

The subjects were divided into five groups according to the degree of escalation of commitment, and compared the average return for each group. The results are shown in Table 4. The third group with the highest returns and the fifth with the lowest returns. As the degree of escalation of commitment increases, the rate of return generally decreased. Then we divided the subjects into five different groups according to the degree of disposition effect, and compared the average return for each group. The second group has the highest return rate and the fifth group has the lowest return rate. As the degree of disposition effect increases, the return on investment generally decreases. From the table, it is also found that the rate of return of the first group with the weakest disposition effect is 4 higher than the rate of return of the fifth group with the strongest disposition effect. The rate of return of the first group with the weakest escalation of commitment is 6.7 lower than the rate of return of the fifth group with the strongest escalation of commitment. The escalation of commitment is more harmful to returns than the disposition effect in securities trading.

Table 4. Disposition effect, escalation of commitment and returns.

Escalation of commitment			Disposition effect		
Group	Mean	Rate of return	Group	Mean	Rate of return
1	0.34	15.1	1	-0.18	13.2
2	0.42	15.9	2	0.19	13.8
3	0.56	12.5	3	0.41	12.4
4	0.64	9.6	4	0.64	10.3
5	0.76	8.4	5	0.79	9.2
1-5	-0.42	6.7	1-5	-0.97	4

4.5. Test of the Relationship Between the Disposition Effect and Escalation of Commitment

Correlation analysis and regression analysis of the indicators of escalation of commitment and disposition effect showed that Pearson's correlation coefficient was 0.828 and the significance reached 0.05. There is a strong correlation between the two kinds of behavior. Taking the the index of escalation of commitment as the dependent variable and the index of disposition effect as the independent variable, the regression results showed that the adjusted R square was 0.683, the D-W value was 2.359, and the t value was 16.191, which

was significant at 0.05 level. Results show that investors with higher degree of disposition effect on the selling side tend to be with higher degree of escalation of commitment on the buying side.

5. Conclusion

Our analysis show the disposition effect and the escalation of commitment in securities trading. Investors not only hold more shares that are below purchase price, but also they may continue to buy more of them. However, both the disposition effect and the escalation of commitment are harmful to investment performance. The escalation of commitment has a greater negative impact on returns. The escalation of commitment has a positive correlation with the disposition effect. The results support the validity of prospect theory in explaining the causes of disposition effect and escalation of commitment.

Investors should recognize the negative effects of irrational investment, especially the escalation of commitment. Firstly, they can diversify the investment portfolio to reduce the risk of investment and return fluctuations. Secondly, taking self-control mechanisms to reduce impulse to the hold and buy loss. For example, investors can set stop-loss points to get rid of the wrong investment decisions.

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