AN EXPERIMENTAL ECONOMIC STUDY OF LOSS AVERSION IN STOCK TRADING DECISIONS

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THANCHANOK ARAMRUENG

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BY

THANCHANOK ARAMRUENG

HAS BEEN APPROVED BY THE GRADUATE SCHOOL IN PARTIAL FULFILLMENT
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The disposition effect is a form of behavioral bias that tends to result in investors holding on to their losing stocks for too long and selling winning stocks too soon. It can be explained by the Behavioral Economics theory of Loss Aversion. Even though this kind of behavioral bias has been studied in a variety of countries, none of them have investigated the disposition effect in the case of Thailand. Therefore, the main objective of this study is to test the disposition effect among Thais by applying the experimental economic approaches of Weber and Camerer (1998) and Odean (1998), while also including the findings of questionnaires and interviews. A simulation stock trading market was set up to test the disposition effect of participants regardless of whether or not they had stock trading experienced. The subjects were required to trade among six stocks in 14 trading periods. There were also three more periods added to test how different types of news impacted the trading decisions of the subjects. In addition, the socio-economic factors that affect the disposition effect behavior were analyzed using an Econometric Binary Choices model. Regarding the results, it was found that this experiment can exhibit the disposition effect of subjects in terms of overall and individual measurement. In normal stock trading situations, it was found that over 70% of subjects showed clear signs of the disposition effect, while the disposition effect behavior seemed to decrease after they received the fictional news.

Keyword : Behavioral economics, Loss aversion, Disposition effect

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Introduction

Background and Significance of the Study

Nowadays, investing in stocks is very popular with people who have savings since it provides returns that can compete with continuous inflation, and gives higher returns than investing in other types of assets. By looking at the major global stock market indexes such as the S&P500, Dow Jones, Nikkei and DAX, the average stock market return for the last ten years has been around 10% (Macrotrends LLC, 2021). The data from The Stock Exchange of Thailand (2021a) states that in the past ten years, the Thai stock market has had an average yearly return of 9.39%. This leads to investment in the stock market having more appeal compared to other types of assets.

Furthermore, The Stock Exchange of Thailand (2021b) stating that at the end of December 2020, there were 3.51 million trading accounts opened in the Thai stock market. An increase of 747,063 accounts compared to the end of last year was the highest increase in history (usually an annual increase of about 230,000 to 330,000 accounts). A large number of opened accounts reinforces the growing popularity of investing as shown in Figure 1.

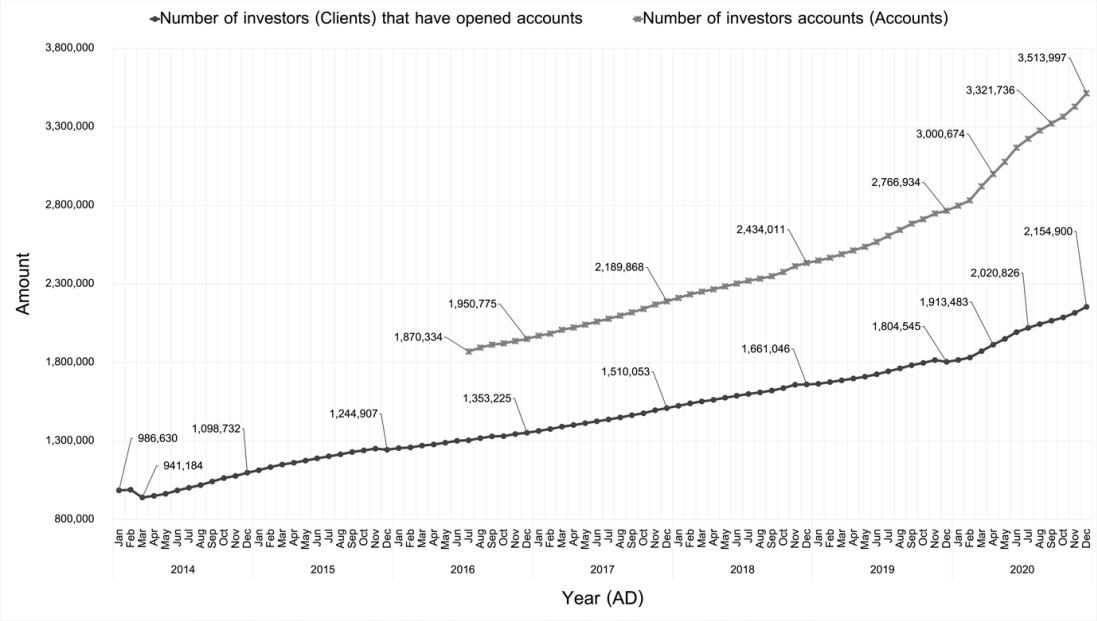

Figure 1 Number of investors that have opened accounts and Number of investors accounts

Source: The Stock Exchange of Thailand (2021b)

If considering the total return of the Stock Exchange of Thailand (SET Total Return: SET TR or SET TRI) since established in 1975 - 2020 (46 years), as shown in Figure 2, we found that the total return is high fluctuation. An interesting point is the total return often has a positive value in the long term. Over the past 46 years, there are only 18 years that the stock market has a negative total return (39.13% chance) and a negative of more than 15% is only 7 years (15.22% chance).

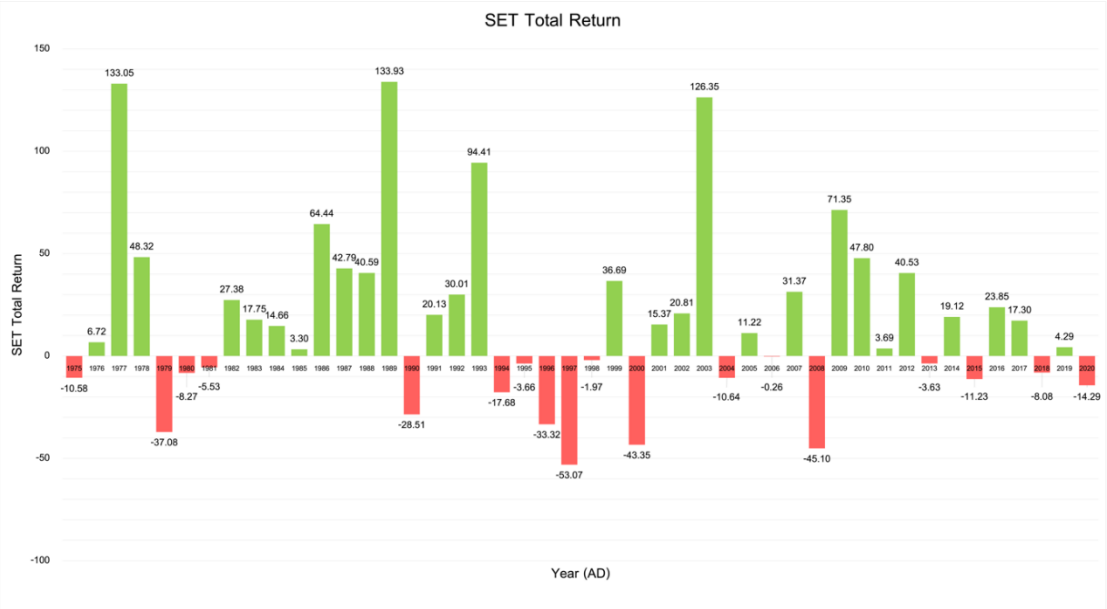

Figure 2 SET Total Return (1975 – 2020)

Source: Bear Investor (2018), The Stock Exchange of Thailand (2021c)

However, an investment in high return assets also involves a level high of risk. Apart from uncontrollable economic and financial risks, another danger of investing in the stock market can be caused by an investor's behavioral bias. To elaborate, some people may occasionally make decisions without really considering the rationale which in turn causes a result deviating from an optimal outcome. This behavioral bias also relates to the disposition effect in the Behavioral Economics theory of Loss Aversion (Kahneman & Tversky, 1979).

The disposition effect, one principle of extending Kahneman and Tversky's prospect theory to investments, was first formally presented by Shefrin and Statman (1985). It is a form of bias that causes the investors to hold on to their losing stocks for too long and sell winning stocks prematurely. Most investors keep their losing stocks in their portfolios to avoid the pain of loss. They will wait, hoping it will eventually become profitable often because they cannot accept the reality of the situation and negative outlook.

There are a number of international papers that attempt to apply this behavioral economic principle to study individual trading decisions and disposition effect, such as Weber and Camerer (1998), A. L. Brown and Kagel (2009) and Hermann, Muÿhoff, and Rau (2017). Nevertheless, in terms of our literatures review, the research that uses experimental methods to explain investment decision behavior, especially disposition effect, is rarely found in Thailand.

This research, therefore, aims to apply the concept of Behavioral Economic Disposition Effect together with an experimental economic approach to study the case of Thailand under the belief that this behavioral bias can be found in the Thai population as well. Following Weber and Camerer (1998), Odean (1998), and Hermann et al. (2017) 14 periods game, we constructed a simulation stock trading market (14 periods) to test the disposition effect of participants, and also added a further three periods (period 15 -17) to test the effect of news on behavioral change. The participants in this study are divided into two groups which are those who have stock investment experience and those who do not have stock investment experience in Bangkok covering both student and working groups. Our hope is that the study on the topic disposition effect in the stock exchange market for the case of Thailand will better our understanding about investment behavior in another dimensions.

Research Objectives

1. To test the behavioral economic theory of the disposition effect on the decision-making of participants with or without stock investment experience in Bangkok

2. To test the effect of obtaining fictional news on the decision-making of participants with or without stock investment experience in Bangkok

3. To analyze the socio-economic factors that affect the disposition effect behavior

Research Scope

This research collected primary data through experimental economic approaches, questionnaires and interviews. The sample group for this study is people who have stock investment experience and those who do not have stock investment experience in Bangkok which has approximately 90 people by using the Convenience Sampling method.

We analyze investment decision behavior based on basic statistics and behavioral economic theory. In addition, the Binary Choices model was used to analyze the third objective.

Definition of Terms

Behavioral Economics is a study of psychology as it relates to the economic decision-making processes of individuals and institutions. It draws on psychology and economics to explore why people sometimes make irrational decisions, and why and how their behavior does not follow the predictions of economic models (Investopedia, 2020).

Loss Aversion is an important concept associated with prospect theory and is encapsulated in the expression “losses loom larger than gains” (Kahneman & Tversky, 1979). It is thought that the pain of losing is psychologically about twice as powerful as the pleasure of gaining.

Disposition effect refers to investors’ reluctance to sell assets that have lost value and greater likelihood of selling assets that have made gains (Shefrin & Statman, 1985).

Conceptual Framework

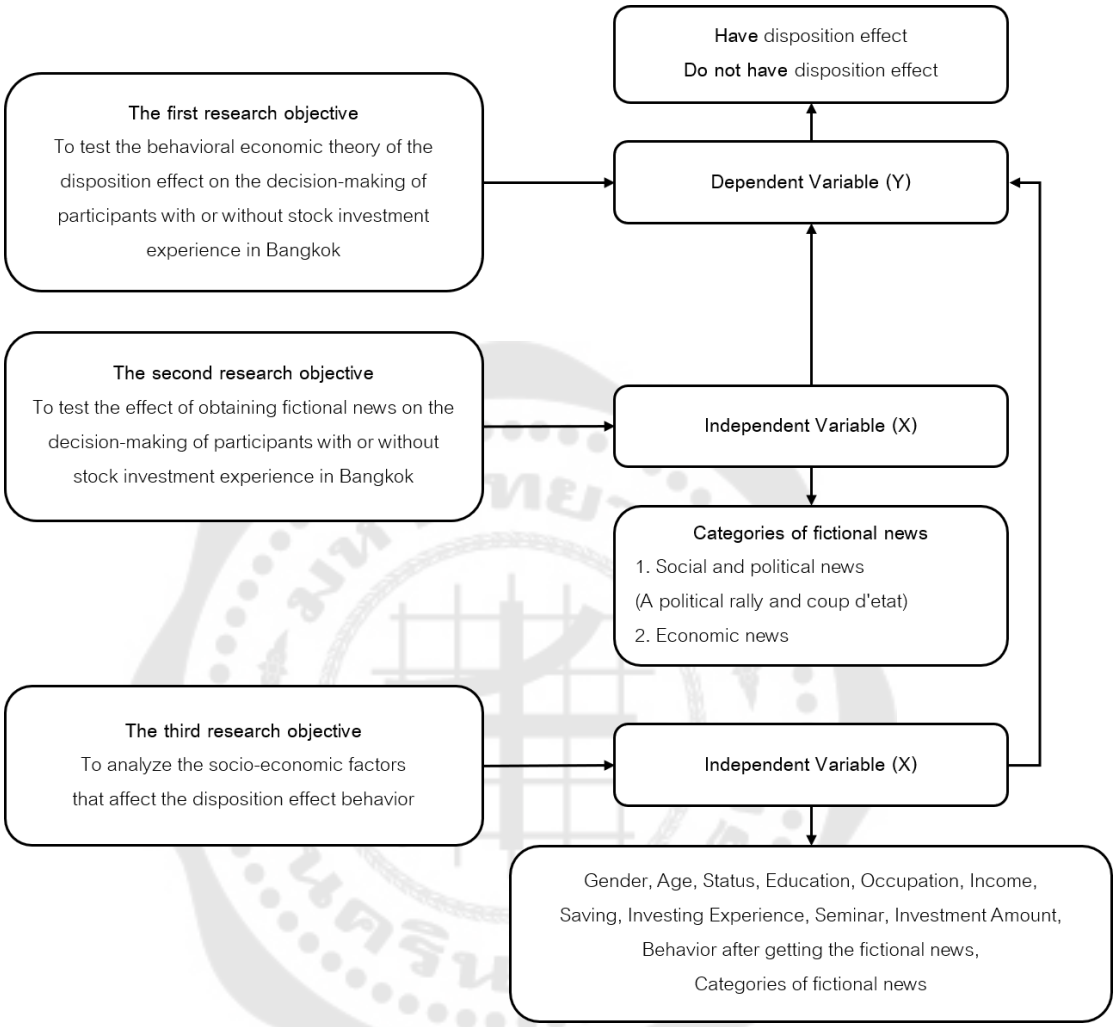

Figure 3 Conceptual Framework

Chapter 2
Literature Reviews

Related Theories

The Prospect Theory was developed by Kahneman and Tversky (1979), which awarded the 2002 Nobel Memorial Prize in Economics. This Theory presented the idea that humans are not rational in making decisions like the mainstream economics assumptions. The feeling of people when they lose and the feeling of gain are different. Kahneman and Tversky (1979) described the cause of human's irrationality that humans are prone to lose. In a situation where they know that they will lose, they will make the riskier choice in order to avoid any regret of loss. This is because losing has a greater effect on mood than earning the same amount which represents the behavior of Loss Aversion.

The behavioral economic of disposition effect is one kind of Loss Aversion behavioral bias that represents a situation in which an individual switches or changes a reference point in order to improve the way they feel about the situation. This bias can be neatly explained by a value function in the 'S'-shape that focuses on gains and losses rather than overall levels of wealth in standard utility models. The function is concave in the region of gains and convex in the region of losses. The asymmetry in curvature of the valuation function implies that people are much more sensitive to a drop in their investments when compared to equal-sized gains.

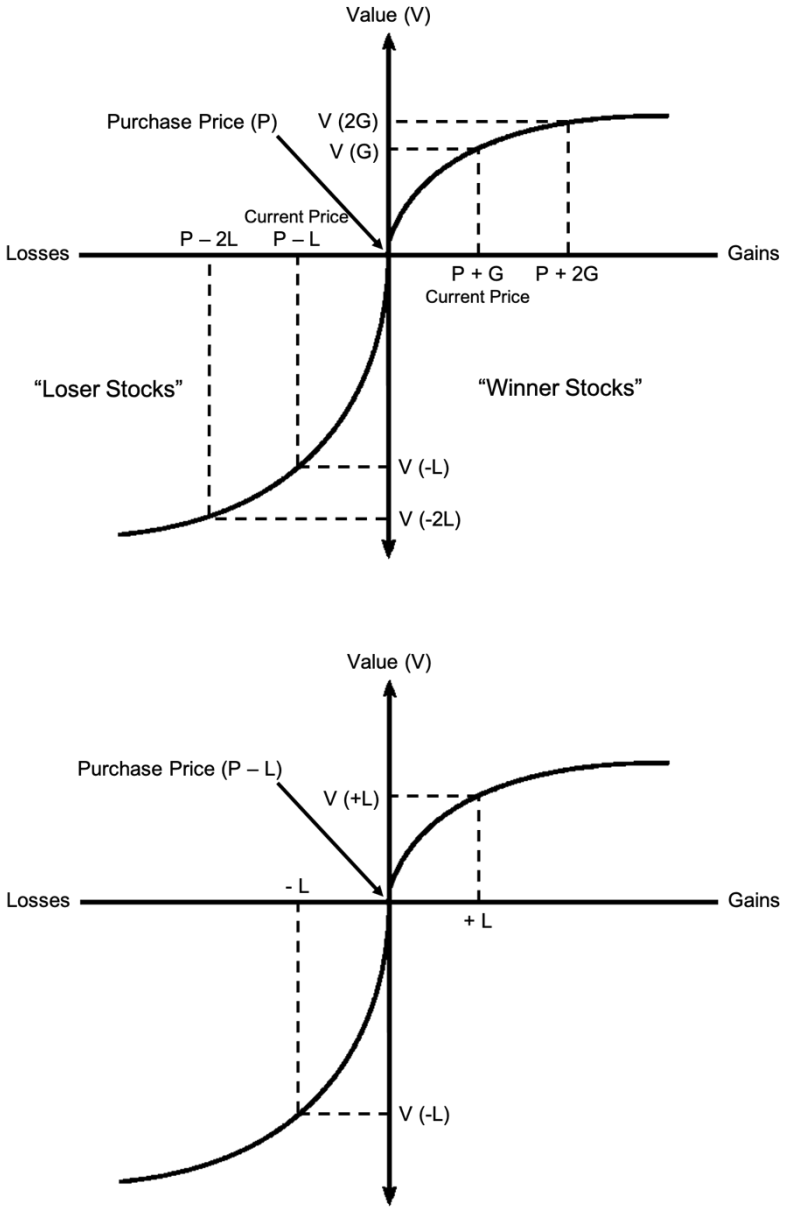

Figure 4 How reference point creates disposition effects

Source: Weber and Camerer (1998)

Referring to Figure 4, if an investor buys stock at purchase price 'P', suddenly the value of this stock falls by the amount of 'L', causing the stock's price to drop to P – L, which is called the current price, resulting in the investor then having to decide whether to hold this stock or sell it. If they decide to hold the stock, it is equally likely that its price

will return to ‘P’, which is its purchase price, or fall by the amount of ‘L’ again to a price of P - 2L or P – L – L. As a result, the value of this losing stock could be either P or P – 2L if it is held, and P – 2L if it is sold. If we set the purchase price ‘P’ as a reference point, the decision of the investor will formulate into two choices between accepting a certain loss with negative value of v(-L), or opting to gamble with value of v(0) or v(-2L). If the investor tends to be more risk-seeking in the region of losses and the chance of returning to the purchase price ‘P’ (which means he breaks even) or losing another amount of ‘L’ are equal, he will decide to hold the stock because the pain of losing a further ‘L’ is less than the satisfaction of recovering the purchase price ‘P’. In other words, they switch their reference point from an original ‘P’ to the new one ‘P-L’to avoid any negative feelings regarding the drop in value of their stock.

On the other hand, in the situation of a winning stock, its value rises by the amount of ‘G’, causing the stock's price to increase to P + G (Current Price). If the investor decides to hold the stock, it is just as likely that the stock's price will fall back to ‘P’or rise by the amount of ‘G’ again to a price of ‘P + 2G’ or P + G + G. Thus, the value of this winning stock could be either P or P + 2G if it is held, and P + G if it is sold. If the investor tends to be much more risk-averse in the realm of gains and the chances of returning to the purchase price ‘P’ (meaning they break even) or gains of ‘G’ are equal, they will decide to sell the stock to create a gain with value of v(G) rather than gambling on earning v(2G) or v(0).

If we consider the current price as being a reference point instead of the purchase price where the gains and losses are valued, the losing stock with a current price of ‘P – L’ will either gain +L (if it returns to the purchase price ‘P’) or lose an additional -L (if it falls to P – 2L). If a gamble over v(L) and v(-L) is better than v(0), the investor will hold this stock. Otherwise, they will sell it. On the other hand, the winning stock will either lose -G (if it returns to the purchase price ‘P’) or gain an additional G. The investor will decide to hold it if a gamble over v(G) and v(-G) is better than v(0).

Literature Reviews

From research studies related to human decision-making behavior, we found that the disposition effect has a different relationship with decision making.

According to a study conducted by Shefrin and Statman (1985), which officially presented the disposition effect for the first time, fear of loss and searching for pride causes investors to hold losers too long and sell winners too early. This result is consistent with the research by Weber and Camerer (1998) which found that disposition effect is a bias that affects the behavior of people in the stock market. Therefore, they are more likely to sell fewer lost assets than profitable assets. They also sell less when the price is below the purchase price than when it is above. It is also in line with a study of Odean (1998) who analyzed the trading records of 10,000 individual investors. His study shows that investors exhibit the disposition effect, that is, they are more likely to sell shares when the price rise than when the price fall. The proportion that investors realize their gains was about 50 percent higher than realized losses.

Garvey and Murphy (2004) found evidence of the disposition effect whilst observing the behavior of 15 professional traders. The traders tended to hold on to their shrinking stocks for too long and sell their winning stocks too soon and this tendency to do so lowered their profitability. The research by Da Costa Jr, Goulart, Cupertino, Macedo Jr, and Da Silva (2013) showed that regardless of whether the sample was experienced or not in the stock market, they still indicated the same disposition effect. However, experienced investors were typically less affected by disposition effect than the inexperienced ones. In addition, Ploner (2017) found that disposition effects exist in a general risk task in which choices are taken sequentially; however, the disposition effect can often be reversed when choices are planned ahead. Also, research by Andersson, Holm, Tyran, and Wengström (2016) found that on average, the participants who make decisions on behalf of others will choose the same level of risk as their own decisions when excluding losses. On the other hand, if a loss occurs, making decisions on behalf of others increases the risk. This result is in line with Hermann et al. (2017) that provided experimental evidence under a circumstance where the investor decides on behalf of

another person. They found that trading on behalf of others increases the disposition effects of traders.

Conversely, the research by A. L. Brown and Kagel (2009), which examine three specific behavioral biases, found that the disposition effect is a bias that is inconsistent with the behavior of people in the stock market. Most subjects rarely ignore profit-maximizing strategies and continue to hold the stock regardless of its performance.

Gender, the research by Cheng, Lee, and Lin (2013) revealed that women exhibited a stronger disposition effect which due to the fact that women are more loss averse than men. This finding is also in line with the report by Rau (2014) that female investors have significantly higher disposition effects, realize less capital losses, and are more loss averse than men. As well as the research by Frino, Lepone, and Wright (2015) emphasizes that the disposition effect is more prevalent in female investors. While, a study by Breitmayer, Hasso, and Pelster (2019) states that men suffer from the disposition effect to a lesser extent. Thus, contrary to the findings reported by Talpsepp (2010) that he did not find any differences between female and male investors in respect to the disposition effect. The research by Da Costa Jr, Mineto, and Da Silva (2008) showed that when using the purchase price as a reference point, both males and females exhibited the disposition effect but there is no significant difference. However, when the reference point was the previous price, the disposition effect still occurred for males but vanished for females.

Age, a study of Cheng et al. (2013) states that more mature traders show a stronger disposition effect, and hence more loss averse. This result is in line with the research by Frino et al. (2015) which state that the disposition effect is more prevalent in older investors. Same as Breitmayer et al. (2019) whose investigated the differences in the degree of disposition effect of traders from 83 countries across the world and found that the disposition effect appears to increase with age.

Education, a study by Tehrani and Gharehkoolchian (2012) found that the level of education has a negative relationship with the disposition effect. Investors with a higher level of education will have lower disposition effect. This finding is consistent with Goo, Chen, Chang, and Yeh (2010) whose show that level of education is significantly

associated with the disposition effect. Investors with a higher level of education and a higher academic degree have a lower disposition effect. Even so, Vaarmets, Liivamägi, and Talpsepp (2019) show that investors with a master's or doctoral degree tend to be less affected by the disposition effect.

Occupation, Dhar and Zhu (2002) divided investors into three categories, 'professional', 'non-professional' and 'non-employed' occupations. The result showed that individual investors in professional occupations exhibit lower disposition effect than non-professional investors. While non-employed investors have a much lower disposition effect than employed investors.

Wealth, Dhar and Zhu (2002) found the empirical evidence that the disposition effect will decrease when investors become wealthier.

Income, according to Dhar and Zhu (2002), they found that investors with low-income have the highest disposition effect among all subjects. This result is consistent with the research by Weber and Welfens (2007) which found that individual investors with high-income resulting in lower disposition effect.

Experience, a study by Dhar and Zhu (2002) confirms that trading experience tends to help reduce the disposition effect, which supports the research by Feng and Seasholes (2005), Weber and Welfens (2007), Da Costa Jr et al. (2013) and Richards, Rutterford, Kodwani, and Fenton-O'Creevy (2017). These studies show that investors who have more experience are less prone to the disposition effect. Trading experience makes investors sell their winner stocks less and their loser stocks more often. Seru, Shumway, and Stoffman (2010) also found that as investors become more experienced, the performance improves and the disposition effect declines.

Investment amount, P. Brown, Chappel, da Silva Rosa, and Walter (2006) found that larger investments tend to be affected less by the disposition bias.

News, the belief adjustment model developed by Hogarth and Einhorn (1992) provides evidence that people tend to weigh more importance in the recent information than the previous information, or in other words, there is a recentness effect that causes a person to make biased decisions. According to a study by Astania and Almilia (2017),

the results show that there is no significant difference in the judgment between the participants who obtain good news followed by bad news and those who obtain bad news followed by good news. Besides, there is no order effect occurring in investment decision-making.

From the relevant study in Thailand, we found the related fundamental factors which can affect the stock trading decisions as follows:

Social and political factors, according to the research by Napaphat Payulert and Vissnu Poommipanit (2015), the political factors including political rally, censure debate and government stability correlated with the investment decisions such as investment objectives, trading frequency, trading decision time, etc.

Economic factors, a study by Napaphat Payulert and Vissnu Poommipanit (2015) state that the economic factors, the interest rates and Monetary Policy, also correlated with the decision-making in investment.

Table 1 The relationship of factors affecting the disposition effect

Variable	Result	Reference
Gender	No significant difference between males and females	Da Costa Jr et al. (2008) Talpsepp (2010)
	Females exhibited higher disposition effect than males	Cheng et al. (2013) Rau (2014) Frino et al. (2015) Breitmayer et al. (2019)
	Males exhibited higher disposition effect than females	Da Costa Jr et al. (2008)

Table 1 (continued)

Variable	Result	Reference
Age	Positive relationship	Cheng et al. (2013) Frino et al. (2015) Breitmayer et al. (2019)
Education	Negative relationship	Tehrani and Gharehkoolchian (2012) Goo et al. (2010) Vaarmets et al. (2019)
Occupation	Investors with professional occupations exhibited lower disposition effect than non-professional investors	Dhar and Zhu (2002)
Wealth	Negative relationship	Dhar and Zhu (2002)
Income	Negative relationship	Dhar and Zhu (2002) Weber and Welfens (2007)
Experience	Negative relationship	Dhar and Zhu (2002) Feng and Seasholes (2005) Weber and Welfens (2007) Seru et al. (2010) Da Costa Jr et al. (2013) Richards et al. (2017)

Table 1 (continued)

Variable	Result	Reference
Investment Amount	Negative relationship	P. Brown et al. (2006)
News		Hogarth and Einhorn (1992) Astania and Almilia (2017)

Chapter 3

Research Methodology

Research Methodology

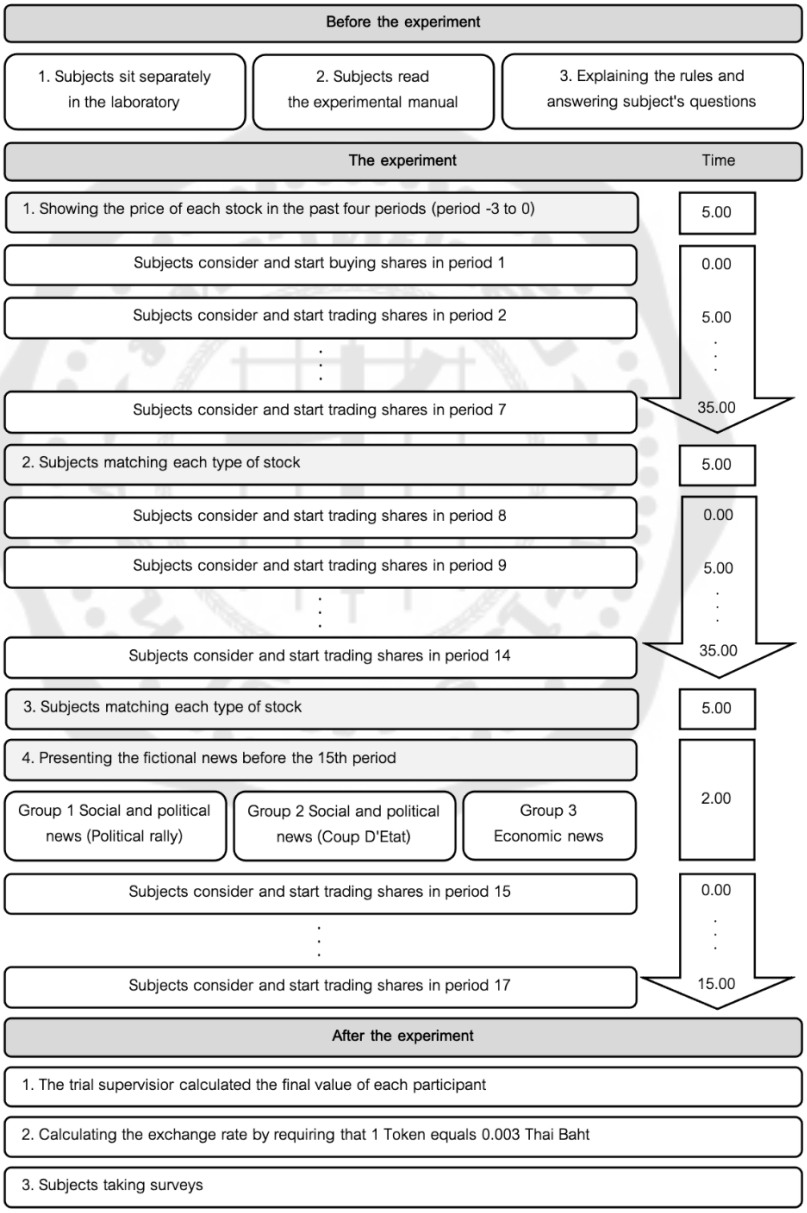

Figure 5 The experiment process

The experimental method is done by creating a stock market model by applying the experimental methods of Weber and Camerer (1998), Odean (1998), and Hermann et al. (2017). There are six stocks in the market, labeled A, B, C, D, E, and F, and there are 17 trading sessions for one experiment, which takes approximately an hour and a half. The experiment was divided into three parts. The first part is period 1 to 7, the second part is period 8 to 14, and the third part is period 15 to 17, where subjects can buy and sell all six shares in all 17 periods.

At the beginning of the experiment, each subject was endowed with 10,000 tokens (a unit of experimental funds) for trading in all 17 periods. Funds that were not invested in stocks during the experiment were counted as cash so did not earn interest. In each period, subjects could buy and sell shares at announced prices with a decision time of around five minutes. The price of shares in all 17 periods was predetermined by a random process, as shown in Table 2 and Figure 6, to ensure the amount of trading shares did not affect the price of the stock. The prices of each stock in the past four periods (period -3 to 0) were given before the experiment started, so the subjects had an idea of the essential characteristics of the stock.

Table 2 The price of shares in each period

Unit : tokens

Period	Price					
	A	B	C	D	E	F
-3	76	64	130	88	150	92
-2	73	59	127	87	149	93
-1	74	56	128	90	148	98
0	79	53	125	95	145	97
1	80	50	120	100	150	100

Table 2 (continued)

Period	Price					
	A	B	C	D	E	F
2	81	53	119	95	153	105
3	86	48	124	90	152	100
4	91	43	125	93	155	105
5	92	46	128	96	150	108
6	91	51	125	91	151	113
7	90	46	124	88	156	118
8	85	47	119	85	157	123
9	86	48	118	86	156	122
10	83	47	115	85	153	127
11	86	42	114	86	150	128
12	91	37	115	91	145	129
13	86	36	114	92	146	128
14	81	39	109	91	143	129

Source: Hermann et al. (2017)

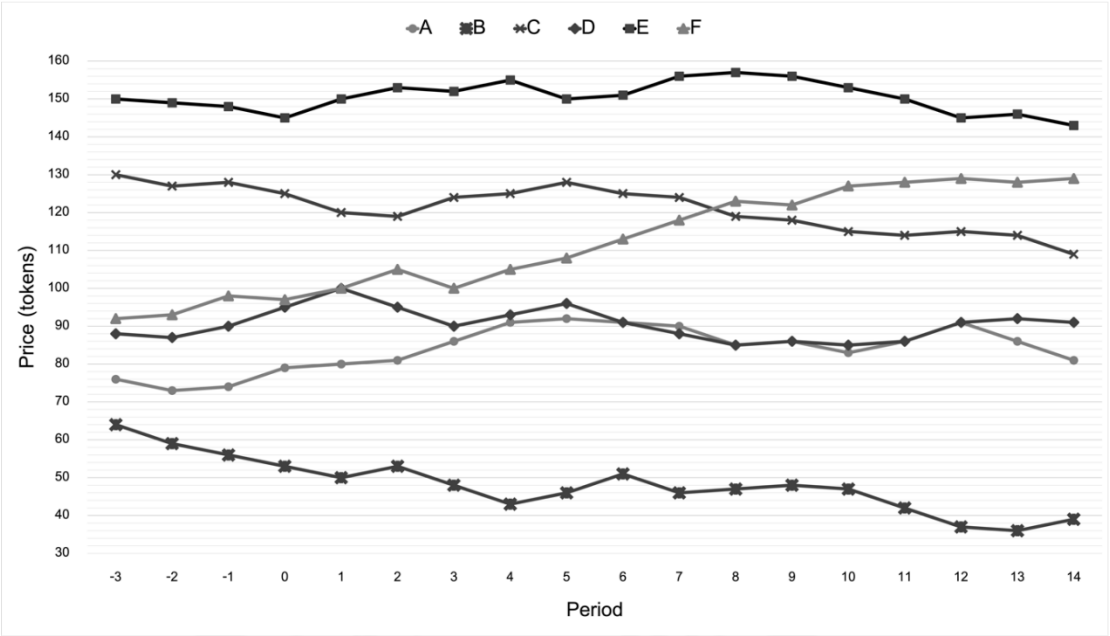

Figure 6 The movement of stock prices over time

Source: Hermann et al. (2017)

For each period, the price randomization was separated into two issues: (1) Determination of price movement direction (2) Determination of price change. Determining the direction of price action, all shares were categorized in advance based on quality levels and allocated the probability of increases and decreases in the share price as shown in Table 3.

Table 3 Stock Characteristics

Stock		Probability of price change	
Name	Type	Price increases	Price decreases
A	+	55%	45%
B	−	45%	55%
C	− −	35%	65%
D,E	0	50%	50%
F	+ +	65%	35%

Source: Hermann et al. (2017)

Although subjects knew that the price of all six stocks could change, they did not know the probability of each stock rising or falling. After periods 7 and 14, subjects were asked to guess which of the six shares represented which of the six possible types (++, +, 0, 0, -, - -).

The size of the price change rose or fell by 1, 3, or 5 tokens which were randomly assigned and the possibilities of all changes were equal. The decisions of the subjects were according to themselves in the first part of the experiment (periods 1 through 7) and the second part (periods 8 through 14). However, before the third part (period 15) began, the fictional news had already been presented. The news was divided into two main categories, which were economic news and social and political news, and consisted of a political rally and coup d'etat. These two situations are important events which occurred in Thailand in the past two decades.

The first experimental group will receive political rally news with the following content: Due to the political conflict situation, the division has led to a political protest against the government. The main goal is to pressure the government to resign and oust

the current prime minister. The protesters believe that the current government is doing tremendous corruption and destroying the country's democracy. The rally moves from the Government House to the Parliament to block parliamentary meetings. Some demonstrators gradually move to besieged the Metropolitan Police Bureau and the Ministry of Finance. While the others move into the airport area, the passengers are unable to enter the airport. The surrounding traffic system is paralyzed. Thousands of passengers and crew miss the flight. In the end, the airport has to close both inbound and outbound services indefinitely.

While the second experimental group will receive the fictional news about coup d'etat with the following content: After the ongoing political crises, there are rumors of a tendency to take power through a coup to overthrow the government. If this event happened, the curfew announcement could have an impact on businesses such as the entertainment industry, especially TV and cinema, retail and travel, that would be affected by the warning letter to citizens of the country's departure travelling to Thailand. Several aviation groups will affect by a contraction of tourists including hospital groups that focus on drawing foreign patients, etc.

The last experimental group will receive the economic news with the following content: Due to the Thai Baht appreciation, the Bank of Thailand (BOT), therefore, announces measures to prevent Thai Baht speculation with a 30 percent of the foreign reserve for one year without giving bank interest to protect short-term funds from short-term investors who come to speculate on Thai Baht. The BOT will keep the inflow of funds at a rate of 30 percent. If foreign investors withdraw their investment before one year, they will have to forfeit 10 percent of their deposited reserves (only 20 percent back).

Table 4 The price of shares after receiving the fictional news

Unit : tokens

Period	Price					
	A	B	C	D	E	F
15	78	36	106	88	140	126
16	73	31	101	83	135	121
17	74	32	102	84	136	122

At the end of the experiment, the money of each subject was calculated as the final value, which came from the sum of cash held in hand, and the final value of the return. We set the one token exchange rate to be 0.003 Thai Baht.

In addition, interviews were conducted and the questionnaires were collected. The questionnaire was divided into two parts: In the first part, we collected general information about the subjects which consisted of gender, age, marital status, level of education, occupation, monthly income and amount of savings per month. In the second part, we collected investment information which included stock investment experience, the amount of investment in shares, stock trading strategies and informational awareness.

Hypothesis

We had three hypotheses with the first one (H1) stating that the number of shares sold would be smaller for losing stocks (stocks making a loss) than for winning stocks (stocks making a gains). Therefore, we determined the gain or loss by comparing the purchase price with the reference price which had two possible reference prices: (1) Using the purchase price as a reference price, and (2) Using the previous period's price as a reference price. Regarding the method of using the purchase price as a reference price, we decided to calculate by applying two different accounting principles which were

First-In-First-Out (FIFO) and average price. The FIFO principle assumes that subjects will sell their shares by the order — shares purchased first are sold first. Whereas, the average price approach identifies the purchase price as the weighted average of all purchase prices.

Furthermore, we identified the individual-level disposition effect by determining the proportion of gains realized (PGR) and the proportion of losses realized (PLR) of each subjects since their decisions are independent from each other. We also evaluated the disposition effect with the 'Alpha' measure.

According to Odean (1998), we can calculate the PGR and PLR by the following ratio:

$$\text{Proportion of Gains Realized (PGR)} = \frac{\text{Realized Gains}}{\text{Realized Gains} + \text{Paper Gains}}$$

$$\text{Proportion of Losses Realized (PLR)} = \frac{\text{Realized Losses}}{\text{Realized Losses} + \text{Paper Losses}}$$

Whenever subjects sell their shares, we count the number of stocks according to the situations as follow:

Realized Gain (Loss) is defined as the number of stocks that subject sold for a gain (a loss).

Paper Gain (Loss) is defined as the number of stocks that are in the subject's portfolio which not sold and showing a gain (a loss).

We considered gains and losses by comparing the stock's price with the stock's purchase price.

The level of disposition effect (DE) of each subject is based on the difference between PGR and PLR and will be demonstrated when PGR is higher than PLR.

$$\text{DE} = \text{PGR} - \text{PLR}$$

A positive DE value is considered evidence that this particular subject is more likely to realize gains than losses in her portfolio. The bigger disposition effect, the more likely one investor realize winners than losers.

The Alpha measurement, based on research by Weber and Camerer (1998), can determine the willing to sell of subjects after the price rises. The alpha is defined as:

$$\alpha = \frac{(S_+ - S_-)}{(S_+ + S_-)}$$

Thus, S_+ refers to the sum of Realized Sales after the price has risen.

S_- refers to the sum of Realized Sales after the price has fallen.

Because the alpha corresponds to the difference in the number of sales after the price increases and decreases, therefore, the alpha value of 1 means that subject will sell their shares only after the price has increased (show the disposition effect behavior). Conversely, the alpha value of -1 means that subject will sell their shares only after the price has decreased. The alpha value equal to 0 indicates the number of equal sales after the price increases and decreases.

While our second hypothesis (H2) stated that trading volume is positively correlated with the size of price changes which rise or fall by 1, 3, or 5 tokens, we assumed that the trading volume was designated as the total number of shares bought and sold. A number of studies such as Ying (1966) and Cornell (1981) found that the trading volume has a positive relationship with the price change. A large trading volume should be related to a rise in price while a small trading volume should be related to a fall in price.

Last but not Least, to test the third hypothesis (H3), we used the Binary Choices model to analyze socio-economic factors affecting the disposition effect behavior. The dependent variable is binary, equal to one for all observations in the data for which the event of the disposition effect exhibited, and zero for the remaining observations which are shown in the following equation:

$$\mathrm{Y} = b_0 + b_1\mathrm{Gender} + b_2\mathrm{Age} + \sum_i b_{3i}\,\mathrm{Status}_i + \sum_i b_{4i}\,\mathrm{Education}_i + \sum_i b_{5i}\,\mathrm{Occupation}_i + \mathrm{b}_6\mathrm{Income} + \mathrm{b}_7\mathrm{Saving} + \mathrm{b}_8\mathrm{Experience} + \mathrm{b}_9\mathrm{Seminar} + \mathrm{b}_{10}\mathrm{Amount} + \mathrm{b}_{11}\mathrm{Behavior} + \sum_i b_{12i}\,\mathrm{News}_i + \mathrm{e}$$

The independent variables are as follow: Gender (male are coded as 0, and female are coded as 1), Age, Status (single (base), married, divorced, and widowed), Education (lower than Bachelor's Degree (base), Bachelor's Degree, and higher than Bachelor's Degree), Occupation (university student (base), private employee, government official, self-employed, and others), Income (average income per month), Saving (average saving per month), Investing Experience (experienced are coded as 0, and inexperienced are coded as 1), Seminar — stock market investing training experience (experienced are coded as 0, and inexperienced are coded as 1), Amount (investment amount), Bahavior — behavior after getting the fictional news (changed are coded as 0, and unchanged are coded as 1), News — the categories of fictional news giving to subjects (political rally (base), coup d'etat, and economic news).

Table 5 Variables affecting the disposition effect on the decision-making of subjects

Variable	Meaning	Code
Y	Effect of disposition effect on the decision-making of subjects	do not have disposition effect = 0 have disposition effect = 1
Gender		male = 0 female = 1

Table 5 (continued)

Variable	Meaning	Code
Age		
Status	Marital status	single (base group) = 0,0,0
	(3 dummies)	maried = 1,0,0
		divorced = 0,1,0
		widowed = 0,0,1
Education	Level of education	lower than Bachelor's Degree (base
	(2 dummies)	group) = 0,0
		Bachelor's Degree = 1,0
		higher than Bachelor's Degree = 0,1
Occupation	(4 dummies)	university student (base group) =
		0,0,0,0
		private employee = 1,0,0,0
		government official = 0,1,0,0
		self-employed = 0,0,1,0
		others = 0,0,0,1
Income	Average income per month	
Saving	Average saving per month	
Experience	Investing Experience	experienced = 0
		inexperienced = 1
Seminar	Stock market investing training	experienced = 0
	experience	inexperienced = 1

Table 5 (continued)

Variable	Meaning	Code
Amount	Investment amount	
Behavior	Behavior after getting the fictional news	changed = 0 unchanged = 1
News	The categories of fictional news giving to subjects (2 dummies)	political rally (base group) = 0,0 coup d'etat = 1,0 economic news = 0,1

Chapter 4
Data Analysis

Characteristics of subjects

Fifty-one females and thirty-nine males attended the experiment. Most (72.22%) subjects had no experience in stock investing, although about half of them (52.31%) were interested in stock investing at the highest level. Focusing on training experience, it turned out that 62.22% of subjects had never been in stock market investing training or seminars.

Experienced participants spent 1-90% of their savings (on average 30.36% of their savings) to invest in stocks. The stocks that most experienced participants were interested in was the Technology industry (28%), followed by the Financial sector (24%). While the number one industry that most experienced participants were investing in was the Financial sector (24%), Services industry (24%), and Property & Construction industry (24%). The person who had the most influence on stock trading decisions was themself (44%). Investment analysis reviews were the most influential sources of information on trading decisions (52%). The most common channel for placing the stock order was internet (72%) and the residence was the place to invest in stocks the most (76%). While inexperienced participants expected to use around 3-70% of savings (on average 19.97% of their savings) to invest in stocks. The Financial industry was the number one sector of stocks that inexperienced participants were mainly interested in (23.08%), followed by the Technology industry (21.54%).

Most investing objectives prioritized by participants were capital gains, then long-term growth and then dividends. (see Appendix C for full statistics)

Hypothesis testing for disposition effect

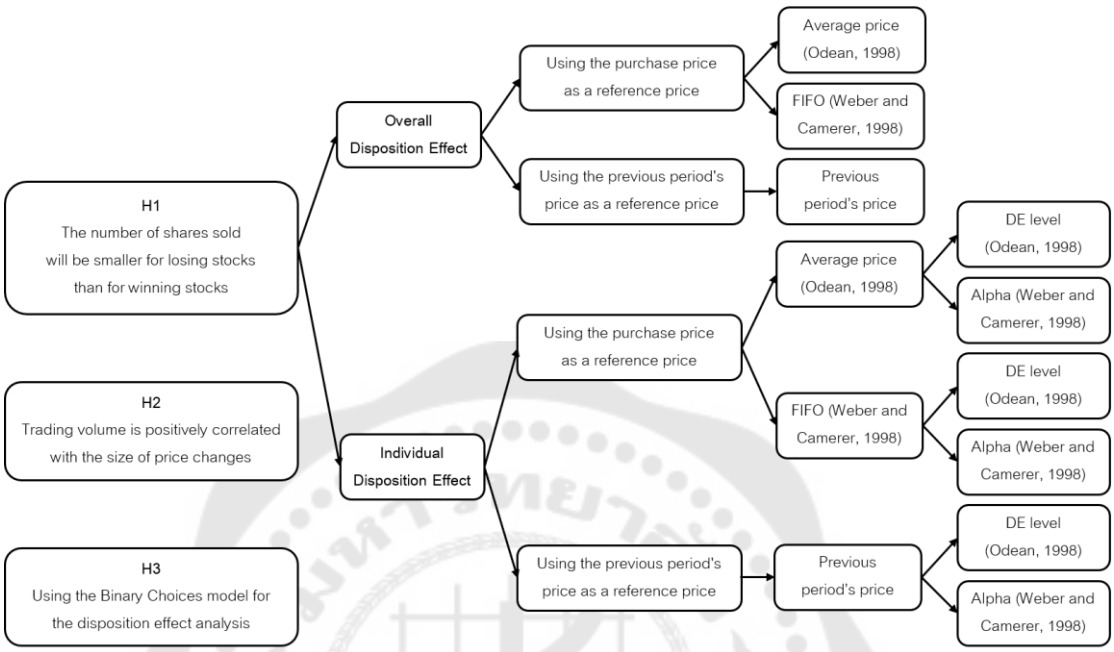

Figure 7 The Process of Hypothesis Testing

This experiment consisted of three hypotheses (H1, H2, and H3) as shown in Figure 7. We decided to measure the H1 in two ways which were overall and individual. When a share is sold, there are two different accounting principles to find the sale price: using the purchase price as a reference price, and using the previous period's price as a reference price. Therefore, to be able to identify the individual disposition effect needed to rely on two measurements, we calculated the individual-level disposition effect as the difference between the PGR and PLR and using the 'Alpha' measure. The second hypothesis (H2) states that trading volume is positively correlated with the size of price changes. Lastly, we analyzed factors affecting the disposition effect (H3) by using the Binary Choices model.

Table 6 Overall Disposition Effect (Summary)

Measurement	Trading result	A	B	C	D	E	F	Overall
Average price	Gain	1,565	1,315	676	957	1,000	2,189	7,702
	Even	0	3	0	5	40	20	68
	Loss	941	1,170	672	1,476	700	735	5,694
FIFO	Gain	1,451	1,352	635	990	965	2,394	7,787
	Even	180	46	68	92	114	167	667
	Loss	895	1,090	655	1,388	649	431	5,108
Previous period's price	Gain	1,551	1,772	815	1,481	1,142	2,257	9,018
	Even	0	0	0	0	0	0	0
	Loss	970	711	528	984	583	730	4,506

Table 6 shows the number of shares that were sold during the experiment which gave the subject profit, break-even, or loss. When considering each stock in the market, it was found that subjects decided to sell winning stocks more than losing stocks. This supported the H1 and related to the disposition effect — subjects tend to sell their winning stocks too early and hold onto their losing stocks too long.

Regardless of what method is used, the results are the same. In fact, when interviewing subjects about the strategies that they use during the experiment, we found that most subjects tend to use the strategy which was similar to the previous period's price method and they think it is the easiest way to calculate the profit.

There is an exception for the D shares which were calculated by the average price method and First-In-First-Out (FIFO) method. This might be caused by the past four periods prices (period -3 to 0) that were presented to subjects before the experiment began which showed an upward trend of D shares price. This lead most subjects to

decide to buy a lot of D shares since period 1. After that, the price of D shares continued to drop especially after period 8. Thus, if the subjects sell D shares during the second part (periods 8 through 14) or the third part (periods 15 through 17) of the experiment, almost all sales are losses because the price of D shares in period 14 and period 17 was lower than period 1 (the price that most of subjects bought).

Table 7 Overall Disposition Effect (Classified by the investment experience)

Measurement	Investment experience	Trading result	A	B	C	D	E	F	Overall
Average price	Experienced	Gain	478	526	166	395	183	616	2,364
		Even	0	0	0	0	30	0	30
		Loss	219	367	130	534	130	192	1,572
	Inexperienced	Gain	1,087	789	510	562	817	1,573	5,338
		Even	0	3	0	5	10	20	38
		Loss	722	803	542	942	570	543	4,122
FIFO	Experienced	Gain	413	556	166	416	183	639	2,373
		Even	105	0	0	35	50	60	250
		Loss	199	337	140	488	110	109	1,383
	Inexperienced	Gain	1,038	796	469	574	782	1,755	5,414
		Even	75	46	68	57	64	107	417
		Loss	696	753	515	900	539	322	3,725

Table 7 (continued)

Measurement	Investment experience	Trading result	A	B	C	D	E	F	Overall
Previous period's price	Experienced	Gain	408	642	161	519	176	544	2,450
		Even	0	0	0	0	0	0	0
		Loss	309	251	135	430	167	284	1,576
	Inexperienced	Gain	1,143	1,130	654	962	966	1,713	6,568
		Even	0	0	0	0	0	0	0
		Loss	661	460	393	554	416	446	2,930

From the table above, if we considering subjects based on their investment experience, we found that the results are similar to the overall measurements of all subjects previously shown in Table 6. This is even more clear evidence to indicate that both subjects those with or without investment experience are all expressive of the disposition effect behavior.

Table 8 Individual Disposition Effect (Summary)

Measurement	The individual-level DE measure				Alpha measure			
	Before		After		Before		After	
	Total	%	Total	%	Total	%	Total	%
Average price	69	76.67	63	70.00	68	75.56	56	62.22
FIFO	73	81.11	67	74.44	75	83.33	61	67.78
Previous period's price	64	71.11	72	80.00	66	73.33	68	75.56

An individual disposition effect measurement is shown in Table 8. This table compares the number of subjects that had disposition effect before and after getting the fictional news by using the individual-level disposition effect and alpha measurements. It was found that more than 70% of subjects showed a disposition effect before getting the fictional news. While after getting the fictional news, more than 60% of subjects experienced the disposition effect. When calculated by the average price and First-In-First-Out (FIFO) methods, we found a decrease in the number of subjects who exhibited the disposition effect. On the other hand, when calculated by the previous period's price measure, the number of subjects showing that the disposition effect has increased.

Table 9 Individual Disposition Effect (Classified by the investment experience)

Measurement	Investment experience	The individual-level DE measure				Alpha measure			
		Before		After		Before		After	
		Total	%	Total	%	Total	%	Total	%
Average price	Experienced	19	76.00	19	76.00	19	76.00	17	68.00
	Inexperienced	50	76.92	44	67.69	49	75.38	39	60.00
FIFO	Experienced	20	80.00	20	80.00	21	84.00	18	72.00
	Inexperienced	53	81.54	47	72.31	54	83.08	43	66.15
Previous period's price	Experienced	18	72.00	19	76.00	18	72.00	17	68.00
	Inexperienced	46	70.77	53	81.54	48	73.85	51	78.46

When considering the disposition effect individually by the investment experience, we found that about 75% of experienced subjects exhibit the disposition effect. Meanwhile, an average of 73.97% of inexperienced subjects reveals the disposition effect behavior.

Table 10 Individual Disposition Effect (Classified by the experimental group)

Measurement	Group	The individual-level DE measure				Alpha measure			
		Before		After		Before		After	
		Total	%	Total	%	Total	%	Total	%
Average price	1	24	80.00	22	73.33	22	73.33	18	60.00
	2	23	76.67	21	70.00	25	83.33	20	66.67
	3	22	73.33	20	66.67	21	70.00	18	60.00
FIFO	1	27	90.00	24	80.00	26	86.67	19	63.33
	2	24	80.00	23	76.67	27	90.00	21	70.00
	3	22	73.33	20	66.67	22	73.33	21	70.00
Previous period's price	1	24	80.00	26	86.67	23	76.67	23	76.67
	2	21	70.00	25	83.33	22	73.33	24	80.00
	3	19	63.33	21	70.00	21	70.00	21	70.00

Then, we found that group 2, who received the political rally news, had the highest percent change in the number of subjects who had disposition effect when measuring by an Average price method and Previous period's price method. While using the First-In-First-Out (FIFO) measure, the political rally news had the greatest effect on the percent change.

Next, we tested H2, which hypothesizes that the trading volume is positively correlated with the size of price changes. We counted the volume of shares traded when the price changed (1, 3, or 5 Tokens) and tested the statistical significance using the *t*-test. There were twelve pairs of the size of price changes that significant at the 0.05 level which means H2 cannot be rejected. We can analyze that (1) the trading volume when

the price rises significantly (falls) is greater than the trading volume when the price rises (falls) by a lesser degree (2) The trading volume when the price rises was greater than the trading volume when the price falls and this indicates that the change in the size of the price affects the trading decisions of the subjects.

Table 11 Marginal Effect Logistic Regression

Estimation Methods	Average price		FIFO		Previous period's price	
	DE Method	Alpha Method	DE Method	Alpha Method	DE Method	Alpha Method
Gender	0.0360	0.0540	0.0530	-0.1094	0.0203	-0.1201
Age	0.0094	-0.0107	0.0054	-0.0009	0.0112	0.0120
Status (Married)	-0.1163	0.0765	-0.1783	0.0404	-0.1217	-0.0501
Education (Bachelor's Degree)	-0.0385	-0.1140	-0.0208	-0.0354	-0.0709	-0.0888
Education (Higher than Bachelor's Degree)	-0.0407	-0.0218		0.1667	0.1126	0.1655
Occupation (Private employee)	-0.0871	0.1214	-0.2418**	-0.0977	-0.1640	-0.1511
Occupation (Government official)						
Occupation (Self-employed)	-0.2017	0.2107	-0.2477	-0.3198	-0.5567**	-0.4327*
Occupation (Others)						
Income (1:1000 THB)	0.0023	0.0011	-0.0088**	-0.0039	0.0037	0.0033

Table 11 (continued)

Estimation Methods	Average price		FIFO		Previous period's price	
	DE Method	Alpha Method	DE Method	Alpha Method	DE Method	Alpha Method
Saving (1:1000 THB)	-0.0125	-0.0060	0.0475***	0.0152	-0.0134	0.0255***
Experience	-0.0889	-0.0166	0.1576	0.1603	0.1259	0.2486*
Seminar	-0.0530	-0.3304***	0.0581	-0.1281	-0.0693	-0.2661**
Amount	-0.0006	-0.0033	0.0030	-0.0027	0.0023	0.0017
Behavior	0.3092*	0.2667	0.0000	0.5231***	0.1614	0.2118
News (coup d'etat)	-0.1198	0.1063	-0.1539**	0.0333	-0.1454	-0.1267
News (economic news)	-0.2040*	-0.0421	-0.2982***	0.0316	-0.2629***	-0.1525

Notes: *, ** and *** indicate significance at 90%, 95% and 99% confidence level, respectively.

According to the estimation in the logit model, the disposition effect is significantly affected by nine variables. The first variable is an occupation which shows that both private employees and the self-employed are less likely to show behavior associated with the disposition effect. For example, if the subjects are private employees or self-employed, the probability of them holding on to losing stocks for too long and selling ones that are doing well will decrease compared to those who are students. This result is consistent with the research of Dhar and Zhu (2002) which found that the investors in 'professional' occupations who have technical, managerial, or administrative careers will exhibit a smaller disposition effect than the investors whose occupations are non-professional. In this case, we might say that private employees and self-employed who mostly deal with a systematic work process were prone to have more appropriate decision

outcomes in the stock trading market compared to students. However, the difference in the occupational background of each person could affect people's perceptions and risk preferences in different ways.

The average monthly income also has a negative correlation to the disposition effect at 95% confidence level. As the average monthly income increases, the subjects will experience less disposition effect. If the subjects have an increase in average monthly income by 1,000 Thai Baht, the probability of disposition effect will decrease by 0.0088, or roughly 0.9%. This result is in line with the research by Dhar and Zhu (2002) finding that the high-income investors exhibited lower disposition effect than low-income investors. From this it can be inferred that subjects with a higher level of income are those who have more available funds for investing. Hence, they are more risk-seeking and can accept bad decisions more easily than the lower-income subjects. In addition, high-income subjects may have more ability to access financial information than low-income subjects. For instance, the higher earners are more likely to have contacts who are financial experts. Conversely, our experiments are opposed to the research of Dhar and Zhu (2002) which stated that wealthier people exhibit less disposition effect. Our results show that average monthly savings have a positive correlation to the disposition effect. The probability of having a disposition effect will increase by 0.0255 and 0.0475, or approximately at a range of 3 to 5 percent, if the subjects have an increase in average monthly savings by 1,000 Thai Baht.

When considering investment information, there are two significant variables. The first variable is when the stock investment experience, which uses the Average price method, has a negative correlation to the disposition effect. This result is consistent with the research by Dhar and Zhu (2002), Feng and Seasholes (2005), Weber and Welfens (2007), Da Costa Jr et al. (2013) and Richards et al. (2017) which suggests that more experience will help lower the disposition effect of most investors. However, this method is not statistically significant. The other methods show that the stock investment experience has a positive correlation to the disposition effect, especially the previous period's price method which is statistically significant with a confidence level of 90%. If

the subjects have more experience in stock investing, they are likely to have a 25% increase in the disposition effect. On the other hand, subjects who have more experience in stock market investing training are likely to have a negative correlation to the disposition effect.

The fictional news on the issue of a coup d'etat along with economic issues are the variables that have statistical significance. The subjects who received the coup d'etat news will have a reduction in the chance of the disposition effect by 0.1539, or approximately at a probability of 15 percent compared to those who received the fictional news on the issue of a political rally. Meanwhile, the subjects who received news relating to the economy will have a drop in the chance of the disposition effect by 0.2040, 0.2982, and 0.2629, or approximately at a probability in the range of 20 to 30 percent compared to those who received news about political rallies. The behavior of subjects after getting the fictional news had a positive correlation to the disposition effect in that the subjects who did not change their behavior after getting the fictional news are more likely to experience the disposition effect.

Responding to returns when gains or losses

We use an independent samples *t*-test to see if the number of shares sold when gains (losses) of subjects who have investment experience and who do not have investment experience are different. The hypotheses are specified as follows:

H0: There is no (statistically) significant difference between experienced and inexperienced subjects concerning the number of shares sold when gains (or losses).

H1: There is a (statistically) significant difference between experienced and inexperienced subjects concerning the number of shares sold when gains (or losses).

Table 12 Independent Samples Test Table

Measurement	Trading result	Period 1-14		Period 1-17	
		t-value	*p*-value	*t*-value	*p*-value
Average price	Gain	-1.0845	0.2811	-1.0032	0.3185
	Loss	-0.7140	0.4771	0.0454	0.9639
FIFO	Gain	-0.9542	0.3426	-0.9415	0.3490
	Loss	-0.6826	0.4967	0.1334	0.8942
Previous period's price	Gain	-1.0213	0.3099	0.2072	0.8364
	Loss	-0.7078	0.4809	-1.4237	0.1581

Table 12 provides the statistical results that we cannot conclude that there is a statistically significant difference between averages because the *p*-value from all measurements is greater than 0.05. Therefore, there is no difference in the region of gains (losses) between those with or without investment experience both before and after receiving the fictional news.

As we did not find any significant differences between experienced and inexperienced subjects, the government sector or related departments can provide similar policy recommendations.

Next, we conducted a paired *t*-test to determine whether, on average, there was a difference in the number of shares sold between the region of gains and losses. The hypotheses can be expressed as:

H0: The average difference in the number of shares sold is 0 between the region of gains and losses

H1: The average difference in the number of shares sold is NOT 0 between the region of gains and losses

Table 13 Paired Sample *t*-test Table

Measurement	Period 1-14			Period 1-17		
	t-value	*p*-value	diff	*t*-value	*p*-value	diff
Average price	6.8317	0.0000	40.29	3.3411	0.0012	22.31
FIFO	8.9763	0.0000	51.18	4.3307	0.0000	30.10
Previous period's price	6.0906	0.0000	49.76	5.7495	0.0000	50.13

Since *p*-value is less than our chosen significance level $\alpha = 0.05$, it is safe to reject the null hypothesis and state that there is a difference in the number of shares sold between the region of gains and losses. On average, the number of shares sold in the region of gains was higher than the number of shares sold in the region of losses. Thus, we may be able to indicate that the region of gains and the region of losses are asymmetrical. Subjects should pay more attention to their trading decisions when their stocks have a positive return rather than a negative one.

Subject's portfolio allocation

In this section, we will consider the subjects' portfolio allocation because some subjects decided to hold a lot of cash while some subjects bought a lot of shares and keep less cash. In general, subjects held an average of 4,710.48 tokens throughout the experiment and increased to 5,007.19 tokens after received the fictional news.

When considering the number of shares bought in the first trading period, we found a significant difference between subjects with or without stock investment experience. On average, the inexperienced subjects bought 18.06 units lower than the experienced subjects in the first period.

By looking at the proportion between the cash held and the number of shares traded, we establish the problem by using a *t*-test with the following hypotheses:

H0: There is no (statistically) significant difference in the portfolio allocation between experienced and inexperienced people.

H1: There is a (statistically) significant difference in the portfolio allocation between experienced and inexperienced people.

The result shows that the *p*-value is larger than 0.05, so we cannot conclude that a significant difference exists.

Then, we conduct the *t*-test by assuming the null hypothesis that the mean is no difference between subjects who exhibit disposition effect and do not exhibit disposition effect. The result indicates that we cannot reject the null hypothesis since the *p*-value is higher than 0.05, that is, there is no statistically significant difference in the mean for subjects who exhibit disposition effect and do not exhibit disposition effect. These provide the support that the disposition effect does not depend on the subject's portfolio allocation between the cash held in hand and the number of shares traded.

Matching the stocks characteristics

In terms of guessing the characteristics of all six stocks, it was found that only 2.22% of subjects were able to rank all stocks correctly after period 7 with the percentage increasing to 5.56% after period 14.

Table 14 The number of subjects who correctly ranked the stocks

Group	The first round of guessing						The second round of guessing					
	A	B	C	D	E	F	A	B	C	D	E	F
1	14	4	1	13	16	21	8	4	3	18	20	28
2	8	8	2	9	15	15	15	5	8	15	19	21
3	11	5	4	14	15	19	11	8	6	20	18	26
Total	33	17	7	36	46	55	34	17	17	53	57	75

About half of the subjects (61.11%) ranked F shares as the best quality stocks since the first round of guessing (after period 7). In the second round of guessing (after period 14), there were 83.33% of subjects who were able to correctly rank F shares. Where 55.56% of subjects correctly guessed that F is the best stock in both rounds.

One interesting observation from this experiment is that there were only 49.09% of subjects who correctly guessed the F shares as being the best quality stocks (or 30% of all subjects) and consequently decided to buy more of them in period 8. Nevertheless, even though they perceived that F shares tend to go up in price, they did not buy as many as they should have. This could be linked to the Loss Aversion bias in which subjects have the tendency to prefer avoiding losses especially when the price of F shares is dramatically higher. From the interviews, some subjects said that the steadily rising price of F shares made them reluctant to buy more. They were afraid of huge losses if the price of F shares started to fall in the future. Therefore, they decided to buy other shares instead, even though they realized that the other shares were not as good as the F shares. In other words, it is safe to say that these subjects presented risk-averse characteristics.

Only 7.78% of subjects could tell that C was the worst quality stock since the first round of guessing (after period 7). While after period 14, there were 18.89% of subjects could rank C as the worst stock.

Most of the subjects (70%) guessed that the worst quality stock is B. But after the second round of guessing, the number of subjects who incorrectly ranked was decreased to 64.44%. The reason why many of the subjects ranked B as the worst stock is because they realized that the price of B shares was the cheapest compared to other stock and led them to feel that low-prices stocks probably be the worst quality stocks. But in fact, the quality of our stocks is measured by the probability of a price change (not the real price).

News Effects

After receiving the fictional news, subjects of the group that got news about a political rally were the group with the highest tendency to sell their shares, followed by the

group that got a coup d'etat news, then economic news relating to the topic of measures to prevent Thai Baht speculation. About 33.33% of subjects sold some of their shares in period 15, meanwhile, 5.56% of subjects decided to sell all their shares and leave their portfolio empty during the last two periods. After period 16, the number of subjects who sold all the shares increased to 7.78%.

Table 15 The number of subjects who done something with their portfolio

News topic	After period 15				After period 16			
	Sold shares	Sold all shares	Bought shares	Done nothing	Sold shares	Sold all shares	Bought shares	Done nothing
Political rally	11	2	6	11	3	1	2	24
Coup d'etat	10	2	7	11	11	3	3	13
Economics	9	1	4	16	10	3	4	13
Total	30	5	17	38	24	7	9	50

According to Table 15, we found that political rally news and coup d'etat news caused the subjects to decide to do something with their shares whether it be bought more or sold their shares.

This behavior directly contradicts the disposition effect that subjects should hold onto losing stocks. We can summarize from the subjects interviewed that the fictional news made them feel panicked. Therefore, they hurried to sell their shares despite the fact these shares gave negative returns to them — worrying that they may face enormous pain or lose everything if they continued to hold these shares.

Chapter 5
Conclusion, Interpretation and Discussion

Summary of Research

This paper examines the investment behavior on the disposition effect in the stock exchange market for the case of Thailand. We explored the subject's behavior through an experimental economic method and collected data from questionnaires and interviews.

The major conclusion of the study is that the simulation of trading stocks within this simple market can reflect the existence of the disposition effect — subjects tend to sell the winning stocks more than the losing stocks. Moreover, when considering individual subjects, it was found that more than 70% of subjects in this experiment were influenced by the disposition effect in normal trading situations. Our findings are aligned with the results of Weber and Camerer (1998). Although the number of samples is small, the findings strongly suggest that this type of bias behavior can be found in the Thai population as well.

We also found that the perception of the probability price change rarely influences the subject's decision to buy more shares. For example, most subjects perceived that F shares have a positive trend; however, they still avoided buying more F shares or did buy not as much as they should have. From the interviews, some of them mentioned that they did not dare to buy because the price of F shares was already too high. Some people do not dare to take risks in case the price of F shares fall in the future, despite the fact that the probability of the price decreasing in F shares is the lowest compared to other stocks.

The size of price changes also effected the trading volume of this experiment. We found that the trading volume of shares was greater when there is a large change in price size as opposed to when there is only a small change.

Discussion and Interpretation of Findings

Our paper shows that whether it be the First-In-First-Out (FIFO), the average price, or the previous period's price method, the results regarding the disposition effect were similar. We noticed that the First-In-First-Out (FIFO) method looked to be the most realistic one when it came to reflecting profit. Most of the subjects who used a strategy similar to this method were those who had experience in investment, and this was a relatively small number. The previous period's price was the easiest method to compare the profit. Most subjects also used this method to quickly calculate their profit before deciding to hold or sell their shares. This method is most likely to be able to identify the decision-making behavior of the subjects in this experiment. The most difficult method to calculate the gain or loss is the average price measure.

As we present the probability that the price will rise or fall, there may be a part that we need to be aware of, that is, this experiment may not be free from Bayesian probability, which causes the possibility for the subjects to have a prediction based on what we have set (or in other words, we anchor probability to them). For example, assuming the price of one share has dropped over and over for several periods, then the subject might be able to predict that the price of this stock might go up over the next period. This remark depends on whether the subject can accurately guess the quality of that stock or not. If that subject cannot predict what quality the stock is, it might be an exception to this kind of argument. The results from our experiment indicate that only 2.22% and 5.56% of subjects were able to correctly match all stocks after periods 7 and 14, respectively.

Some Thai personality traits may have contributed towards increasing the behavioral bias. For example, some Thai people believe in fate, making them more likely to accept their current state and be satisfied with what they have without struggling. Meanwhile, many people want to come into the stock market because they think it is an activity that seems to be an easy way to make money without much effort. They only focus on how to get profit or get rich quickly without planning. However, this characteristic seems to an obstacle in terms of investing. When they face a loss, it looks to be difficult to accept. So, many people decide to keep their losing stock because they are scared

that they will lose or make a mistake and hope that fate will be kinder to them in the future. On the other hand, when their shares are profitable, they often decide to sell in order to feel they have achieved success. This behavior was evident in our research and clearly shows the disposition effect in the decision making of these Thai subjects.

Also, we found that the shock from outside the market which is a negative external factor appears to have an impact on the subject's disposition effect behavior. After receiving the fictional news, most of the participants showed that they were quite worried about it. From the interviews, they felt that the political news was closer to their lives and easier to understand compared to the measures to prevent Thai Baht speculation news. Throughout their lifetimes, the military coup d'etat and several political rallies had occurred at least once. They could immediately imagine that a terrible incident would surely happen again after this. Whenever these situations happened or even just a rumor circulated, it often shook their confidence and affected the sensitivity of their decisions. Therefore, most of them decided to sell their shares regardless of their past playing habits because they expected that the stock market indexes tend to be negative and difficult to recover. While the subjects who received economic news took some time to consider the implications that might occur, those with a knowledge of economics were better equipped to predict how the situation would progress. Some of them decided to sell their shares immediately but many more waited to see the results of the next round first.

According to the surveys, we found that most of the participants lack of investing training experience whether they are already in the stock market or not. We suggest that the Bank of Thailand and the government sector should promote more financial literacy to Thai investors, possibly considering using social media that meets today's digital lifestyles, to help them gain knowledge and understanding with enough information to become an investor.

In addition to increasing the number of individual investors, related departments should encourage individual investors to choose the investment that is suitable for them. Moreover, they should focus on increasing the incentive for individual investors to be long-term speculation rather than short-term speculation in order to avoid the occurrence of

behavioral bias, especially the disposition effect. This may be done by increasing tax incentives and increasing investment channels to allow individual investors to access more securities than before, for example, it may be in the form of increasing the distribution of newly issued securities to individual investors, along with continuous publicity to provide investors with a proper understanding of investment and realizing the importance of long-term savings. This will be an important factor in strengthening the stability of the capital market in the future. Meanwhile, the listed companies should increase public relations or distribute benefit information so that investors will have enough information to make investment decisions.

Due to the fact that most participants exhibited the disposition effect behavior, the household should pay more attention to their investment in both knowledge and behavior bias, even if they are already in the stock market or wish to step into the stock market. They should regularly observe and be aware of their trading behavior to reduce the behavioral bias, especially during an uptrend of the stock market.

Recommendations for Further Research

For future research, it would be interesting to increase the number of subjects and to apply the idea of simulation trading in other types of markets that have price fluctuations, such as the cryptocurrency market in order to present the Loss Aversion and other bias.

Hopefully, this research can help individual investors, or those who wish to invest to understand the behavioral biases that can lead them to making mistakes. By being more aware of the psychology behind their decisions, they will be able to minimize risk on their trading activities and gain investment return.

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Appendix

Appendix A

Experimental Instructions

Welcome to the experiment. Please read and understand all of the following instructions:

There are six stocks in this market, labeled A, B, C, D, E, and F, and there are 17 trading sessions for one experiment, which takes approximately an hour and a half.

At the beginning of the experiment, you are endowed with 10,000 tokens (a unit of experimental funds) for trading in all 17 periods. Funds that are not invested in stocks during the experiment will count as cash so do not earn interest.

In each period, you can buy and sell shares at announced prices with a decision time of around five minutes.

Note:

1. The stock price in each period will not be the same as the price of the previous period.
2. The stock price of all 17 periods is predetermined. Therefore, player's trading will not affect the share price.

The prices of each stock in the past four periods (period -3 to 0) are given before the experiment started, so you will have an idea of the essential characteristics of the stock.

All stocks are categorized according to their quality levels. This indicates the probability that the stock price will rise or fall, as shown in the table.

Table 1 Stock Characteristics

Stock		Probability of price change	
Type	Amount	Price increases	Price decreases
+ +	1	65%	35%
+	1	55%	45%
0	2	50%	50%
ー	1	45%	55%
ー ー	1	35%	65%

After periods 7 and 14, you have to guess which of the six shares represented which of the six possible types (++, +, 0, 0, -, - -).

At the beginning of period 15, the fictional event data will be presented. After that, you will have five minutes for trading decisions in each remaining period.

Finally, your money will be calculated as the final value. We set the one token exchange rate to be 0.003 Thai Baht.

Appendix B

Research questionnaire

This questionnaire is prepared to study socio-economic factors that affect the disposition effect behavior of persons with or without investing experience in Bangkok. This research, therefore, asks for cooperation from all participants by specifying numerical data or selecting in the box that best matches the answer for further academic analysis.

The questionnaire consists of two parts:

Part 1 General information

Part 2 Investment information

Note: Your answers will be anonymous, and we will use the responses to study factors affecting the disposition effect behavior only. Thank you for taking the time to complete this survey.

Part 1 : General information

1. Gender O Male O Female
2. Age _____
3. Status O Single O Married O Devorced O Widowed
4. Level of Education
   - O Lower than Bachelor's Degree
   - O Bachelor's Degree
   - O Higher than Bachelor's Degree
5. Occupation
   - O University student O Private employee O Government official
   - O Self-employed O Others _____
6. Average income per month _____ THB
7. Average saving per month _____ THB or _____ % of income per month

Part 2 : Investment information

8. Stock market investing training experience

O Experienced such as _____

O Inexperienced

9. Stock investing experience

O Experienced _____ years (** Go to question 17)

O Inexperienced (** Go to question 18)

Experienced in stock investment (Answer Question 10 – 17)

10. Investment Amount _____ % of total saving

11. Industry group that you are interested in investing

(** Please rate each of the following choices on a scale of 1-3, where 1 is 'the most interested')

_____ Agro & Food Industry (Agribusiness, Food & Beverage)

_____ Consumer Products (Fashion, Home & Office Products, Personal Products & Pharmaceuticals)

_____ Financials (Banking, Finance & Securities, Insurance)

_____ Industrials (Automotive, Industrial Materials & Machinery, Paper & Printing Materials, Petrochemicals & Chemicals, Packaging, Steel)

_____ Property & Construction (Construction Materials, Construction Services, Property Fund & REITs, Property Development)

_____ Resources (Energy & Utilities, Mining)

_____ Services (Commerce, Health Care Services, Media & Publishing, Professional Services, Tourism & Leisure, Transportation & Logistics)

_____ Technology (Electronic Components, Information & Communication Technology)

12. Industry group that you are investing

(** Please rate each of the following choices on a scale of 1-3, where 1 is 'the most investing')

_____ Agro & Food Industry (Agribusiness, Food & Beverage)

_____ Consumer Products (Fashion, Home & Office Products, Personal Products & Pharmaceuticals)

_____ Financials (Banking, Finance & Securities, Insurance)

_____ Industrials (Automotive, Industrial Materials & Machinery, Paper & Printing Materials, Petrochemicals & Chemicals, Packaging, Steel)

_____ Property & Construction (Construction Materials, Construction Services, Property Fund & REITs, Property Development)

_____ Resources (Energy & Utilities, Mining)

_____ Services (Commerce, Health Care Services, Media & Publishing, Professional Services, Tourism & Leisure, Transportation & Logistics)

_____ Technology (Electronic Components, Information & Communication Technology)

13. People who have the most influence on your stock trading decisions

(** Please rate each of the following choices on a scale of 1-3, where 1 is 'the most often')

_____ Yourself

_____ Family

_____ Friends

_____ Brokers

_____ Analyst

_____ Media such as internet / newspaper / television / radio

_____ Rumor

_____ Others _____

14. Sources of information that influence your stock trading decisions

(** Please rate each of the following choices on a scale of 1-3, where 1 is 'the most often')

_____ Internet

_____ Newspaper

_____ Television

_____ Radio

_____ Investment Reviews

_____ Investment Journal

15. The most popular trading channel

O Manual orders at the investment center

O Sending orders via mobile / cell phone

O Sending orders via internet

16. The place where you invest the most

(** Please rate each of the following choices on a scale of 1-3, where 1 is 'the most often')

_____ Investment center

_____ Residence

_____ Workplaces

_____ Others _____

17. The first objective of the stock investment

O Capital Gains

O Dividends

O Long-term increase in stock value

O Others _____

Inexperienced in stock investment (Answer Question 18 – 21)

18. The level of interest to invest in stocks

O Very interested

O Interested

O Neutral

O little interested

O Not interested

19. Expected investment Amount _____ % of total saving

20. Industry group that you are interested in investing

(** Please rate each of the following choices on a scale of 1-3, where 1 is 'the most interested')

_____ Agro & Food Industry (Agribusiness, Food & Beverage)

_____ Consumer Products (Fashion, Home & Office Products, Personal Products & Pharmaceuticals)

_____ Financials (Banking, Finance & Securities, Insurance)

_____ Industrials (Automotive, Industrial Materials & Machinery, Paper & Printing Materials, Petrochemicals & Chemicals, Packaging, Steel)

_____ Property & Construction (Construction Materials, Construction Services, Property Fund & REITs, Property Development)

_____ Resources (Energy & Utilities, Mining)

_____ Services (Commerce, Health Care Services, Media & Publishing, Professional Services, Tourism & Leisure, Transportation & Logistics)

_____ Technology (Electronic Components, Information & Communication Technology)

21. The first objective of the stock investment

O Capital Gains

O Dividends

O Long-term increase in stock value

O Others _____

Appendix C

The characteristics of subjects

General information of the participants

This study analyzed the data of 90 participants, divided into three groups based on the type of fictional news they received.

Group 1 received social and political news on the issue of a political rally.

Group 2 received social and political news on the issue of a coup d'etat.

Group 3 received economic news on the issue of measures to prevent Thai Baht speculation.

We can classify the information of the participants as follows:

Table 1 Classified by Gender

Group	Male		Female	
	Total	%	Total	%
1	11	36.67	19	63.33
2	14	46.67	16	53.33
3	14	46.67	16	53.33
Total	39	43.33	51	56.67

Table 2 Classified by Age

Group	Max	Min	Average
1	66	20	33.9
2	53	20	32.6
3	54	20	35.0
Total	66	20	34.1

Table 3 Classified by Status

Group	Single		Married		Divorced	
	Total	%	Total	%	Total	%
1	20	66.67	10	33.33	0	0.00
2	19	63.33	11	36.67	0	0.00
3	18	60.00	10	33.33	2	6.67
Total	57	63.33	31	34.44	2	2.22

Table 4 Classified by Education

Group	lower than Bachelor's Degree		Bachelor's Degree		higher than Bachelor's Degree	
	Total	%	Total	%	Total	%
1	5	16.67	20	66.67	5	16.67
2	9	30.00	18	60.00	3	10.00
3	12	40.00	15	50.00	3	10.00
Total	26	28.89	53	58.89	11	12.22

Table 5 Classified by Occupation

Group	University students		Private employees		Government officials		Self-employed		Others	
	Total	%	Total	%	Total	%	Total	%	Total	%
1	8	26.67	17	56.67	1	3.33	3	10.00	1	3.33
2	9	30.00	19	63.33	0	0.00	1	3.33	1	3.33
3	8	26.67	16	53.33	1	3.33	5	16.67	0	0.00
Total	25	27.78	52	57.78	2	2.22	9	10.00	2	2.22

Table 6 Classified by Income

Group	Max	Min	Average
1	90,000	4,000	29,183.33
2	100,000	6,000	31,033.33
3	300,000	4,000	47,800.00
Total	300,000	4,000	36,465.80

Table 7 Classified by Saving

Group	Max	Min	Average
1	60,000	400	7,046.67
2	20,000	0	5,623.33
3	60,000	0	8,860.00
Total	60,000	0	7,697.60

Table 8 Classified by Stock Investing Experience

Group	Experienced people		Years of experience	Inexperienced people		
	Total	%	Max	Total	%	Max
1	8	26.67	15	0.5	22	73.33
2	9	30.00	8	0.5	21	70.00
3	8	26.67	5	0.5	22	73.33
Total	25	27.78	15	0.5	65	72.22

Table 9 Classified by Stock Training Experience

Group	Experienced people		Inexperienced people	
	Total	%	Total	%
1	12	40.00	18	60.00
2	11	36.67	19	63.33
3	11	36.67	19	63.33
Total	34	37.78	56	62.22

VITA

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