Chapter 3

Data and Methodology

3.1 Data

The Taiwan Stock Exchange (TSEC) provided our data set for this research. The data set includes all intraday transactions for the investments of all investors from January 1995 to December 1999. For each transaction, we can identify the stock code, the trade date and the trade time (to a hundredth of a second), the trade price, the number of shares transacted, and the identity of every buyer and seller who were involved in the transaction.

To protect traders’ privacy, the TSEC replaced the true names of the traders with distinct codes, which allowed us to distinguish traders by investor type. The Security Exchange Act of Taiwan requires all orders for stocks to be listed on the TSEC and to match those on the TSEC. And there is no third or fourth market, our data set is complete in the sense that all transactions on stocks listed on the TSEC are included in our data set. The database is, to our knowledge, the first comprehensive data source on trading records of a stock market in the world.

In this research, we focus on the common stock investments of individual investors. We exclude from the current analysis investments in mutual funds (both open-end and closed-end), warrants, options, and preferred stocks. Moreover, we eliminate traders who have ever used credit trading. It is known that credit traders
are more risk seeking and may possess different investment characteristics from common investors. Those who are more risk seeking may have stronger house money effect. To get more general risk taking behavior on stock trading, our sample excludes traders who have ever used credit trading.

By going through trading records of all the investors’ accounts in chronological order, I construct for each date a portfolio of stocks for which the purchase and sale date, purchase and sale price are known. Clearly, this portfolio represents only part of each investor’s total portfolio because there will be stocks that were purchased before January 1995 for which the purchase shares and price are not available. To test the reference point effect, we need to know each investor’s total portfolio. To get a more precise portfolio, to be included in our sample, an investor must have had no trades in the previous year. For example, an investor who had no trades in 1996 but traded in 1997 is included in the sample of the year 1997, yet he is excluded from the sample of 1996. After running the above filter, our sample has two types of traders. Some are new opened account traders; the others are traders who have had no trades in the previous year. We compare the number of new opened account investors with traders in our sample.\textsuperscript{1} During our sample period, 98.4, 88.1, 96.6, and 85.5 percent of traders in the sample are new opened account investors in the year of 1996, 1997, 1998, and 1999 respectively.\textsuperscript{2}

\textsuperscript{1} There were 181,127, 886,518, 980,604, 624,464 new opened account investors in the year of 1996 to 1999 which was reported in the \textit{TSEC monthly review}, Volume 453.

\textsuperscript{2} Some people might open account but not trade immediately. Given the trading motivation, we can expect a very small sample proportion of no trades but new opened account investors.
Therefore, we focus our study on the risk taking behavior of novices in stock markets. Moreover, after running the above filter, our sample have different group of investors in each year. This means that an investor must not occur in the sample on adjacent years. Therefore, by testing the house money effect on different people in different years, we can get more pervasive conclusion.

In Table 1, we present descriptive information on the trading activity for our sample. Panel A shows the number of individual traders and its proportion of all TSEC individuals. Panel B presents the trading activities per individual traders per year include the number of stocks, the number of trades, annual trading lots, and annual trading volume. Panel C reports the trading activities per individual traders per month. During our sample period, there are 184,005, 1,006,260, 1,014,991 and 730,575 trades in the year of 1996, 1997, 1998, and 1999, respectively. The annual (monthly) average number of stocks traded by each investor is 4 to 7 (0.47 to 0.95). The average investor trades 16 to 28 (2.67 to 3.79) stocks during a year (month). The annual (monthly) trading lots per individual is from 42 to 83 (10 to 19) and the annual trading volume in NT$ thousand is from 1,878 to 4,841 (435 to 902) during our sample period.

Insert Table 1 here

There are three data sets similar to this one described in the literature. A large retail brokerage house provided Schlarbaum, Lewellen, and Lease (1978) trading records for 2,500 accounts for the period January 1964 to December 1970. They
analyzed the performance of individual investors’ stock investments. Badrinath and Lewellen (1991) analyzed a second data set provided by the same retail broker for 3,000 accounts for the period January 1971 to September 1979. Odean (1998) and others examined the disposition effect for 10,000 accounts provided by a nationwide discount brokerage house from January 1987 through December 1993. There were three files in their data set: a trades file, a security number to CUSIP, and a positions file. The data set studied here differs from these primarily in that it is more recent and directly comes from the stock exchange. Unlike data of Odean (1998) represented only part of each investor’s total transactions, investors might have other accounts in other brokerage houses that are not part of their data set. Our data have trading records of all accounts for a trader,\(^3\) which represented the complete transactions of each investor in the market.

3.2 Methodology

This study tests whether investors increase their risk taking when they have just received an investment gain. It also investigates the issue related to familiarity bias and reference point effect. To determine whether investors have a prior gain, we use several methods to calculate trading profits. On the other hand, we use price change of the stock as a proxy for investors’ risk taking.

\(^3\) There is no third or fourth market, our data set is complete in the sense that all transactions on stocks listed on the TSEC are included in our data set.
3.2.1 Trading Profits

As we do not have either the position records or the entire trading history of a trader, we cannot link with certainty the sell trades during the sample period to their previous buys (initiated either during or before our sample period). Therefore we run several filters over the data before we begin to compute profits. We describe the steps in the following.

First, we run several filters over the data, prior to computing the profits of every individual. In an investor’s portfolio, every security must have had a positive inventory during the period to be included in our analysis. We exclude investors that any of their stocks’ inventories is negative, stock that was purchased before January 1995 for which purchase price is not available. We then able to calculate the profit on every sale trade by subtracting the price of the corresponding purchase trades from the sale price, and then multiply the number of shares. For each day, we sum profits from sales made by a trader and the rate of return is calculated as the ratio of these profits to one’s portfolio value.

Any test of the house money effect is a joint test of hypothesis that people take more risk after a prior gain and of the specification of the reference point from which gains and losses are determined. Some possible choices of a reference point for stocks are the first purchase price, the most recent purchase price, the average purchase price, or the highest market price. To test the reference point issue, we use several methods to compute the profit in each sale trade for individual investors.
According to the inventory-costing method, we calculate the profit by following ways: (1) first-in, first-out (FIFO), (2) last-in, first-out (LIFO), and (3) average cost. In addition, suggested by previous studies in stock option trading on the issue of disposition effect (Heach, Huddart, and Lang (1999) and Huddart and Lang (2003)), we also consider the prior maximum stock price as the cost price (reference price).

The first (FIFO) method assumes that the first share that makes its way into the inventory is the first sold which means that the choice of a reference point for stock is the first purchase price. For example, for a given stock, an investor buys 1000 shares on Monday at a purchase price of $20, and 1000 more on Tuesday at $21. FIFO states that if the investor sells 1000 shares at $22 on Wednesday, the corresponding purchase price is $20 because that is the price of the first shares that went into the inventory, and the profit of this sale is $2000.

The second (LIFO) method assumes that the last share making its way into the inventory is sold first which means that the choice of a reference point for stock is the most recent purchase price. For example, for a given stock, an investor buys 1000 share on Monday at a purchase price of $20, and 1000 more on Tuesday at $21. LIFO states that if the investor sells 1000 shares at $22 on Wednesday, the corresponding purchase price is $21 because that is the price of the last shares into inventory and the profit of this sale is $1000. The older inventory is therefore left over from selling. For the 1000 shares sold on Wednesday, the same investor would assign $21 to the corresponding purchase price while the remaining $20 shares would be used to calculate the profit of the next sale. The profit of this sale is
$1000.

The third method is quite straightforward; it takes the weighted average of all shares available for sale and then uses that average purchase price to determine the gains or losses. In our above example, the average purchase price for 1000 shares would be $20.5 and the profit is $1500 which in the middle between FIFO and LIFO.

In addition, we calculate trading profits adjusted for the cash and stock dividend. In Taiwan it is much more common for firms to pay stock dividends than cash dividends. Very few firms pay only cash dividends. Either stock dividends are paid along with cash dividends or only stock dividends are paid. As stock dividends increase the number of shares outstanding, the ex-dividend stock price would be lower than the pre-dividend stock price. Note that some round trip trades are initiated before stock dividends are paid and terminated afterwards. Other round trip trades do not cross over the dividend paying date. We thus need to calculate the dividend adjusted trading profits.

Similar to Heach, Huddart, and Lang (1999) and Huddart and Lang (2003), we define the prior high to be the highest closing stock price in the 20-days-long period ending 5 trading days before the day that stock is sold. This definition excludes closing prices in the week immediately prior to the sample day. We do this to avoid the problem that there would be very few observations above a prior maximum if the comparison included days immediately prior to the current day. The notion is
that investors’ reference points adapt over time; the currently-salient reference point is the highest stock price attained some time ago.

We use FIFO as the benchmark method in the calculation of trading profit because it is more likely to confirm with the general thoughts that the physical flow of stocks’ inventory is FIFO. In addition, investors can save memory or records keeping cost by using FIFO. However, people may rely on heuristic principles to make decisions in complex environments. The availability heuristic (Tversky and Kahneman (1973), Tversky and Kahneman (1974), and Slovic (1972)) suggests that people often recall their memories for more recent events. Therefore, the LIFO may be a more likely way to compute profits because last-in shares are more easily to access from human’s memory.

In another respect of psychological and reference point effect literature, previous studies suggest that investors may set reference points according to two characteristics of the stock price: central tendency and extreme. People are more likely to remember the general meaning of information than particular details (Anderson (1974), Anderson (1990), and Mandler and Ritchey (1977)). Many researches on stock options also use average stock price as reference point. Thus we repeat our analysis in the house money effect by using the third calculation method—average cost.

Finally, more recent evidence on reference points issue in financial markets (Gneezy (1998), Heach, Huddart, and Lang (1999), Huddart and Lang (2003), Core
and Guay (2001), and Poteshman and Serbin (2003)) reveal that the maximum stock price was a more effective reference point than the average purchase price. We conjecture that the results by using the maximum stock price as reference point may have the most prominent effect.

3.2.2 Risk Taking

When buying a stock, investors are faced with a difficult search problem that hundreds or thousands of stocks could be potentially bought. Due to the limited memory and ability of human beings to process so much information, we are generally not able to evaluate and rank hundreds of alternatives. According to attention effect, when there are many alternatives, choices that attract attention are more likely to be chosen. In studies of individual investors’ buying decision, Odean (1999) and Barber and Odean (2005) argued that individual investors are more likely to buy those stocks that catch their attention because attention affects buying, where investors are unable to evaluate and search across hundreds of stocks. They also presented that individual investors typically buy stocks that have experienced greater absolute price changes, abnormally good or bad performance. Stocks that have performed unusually well or poorly are more likely to be reported in the media, more likely to be considered by individual investors and, finally, more likely to be purchased. Investors do not buy all stocks that catch their eyes, but depend on their personal preferences. Momentum investors believe in trend will buy previous winners to which their attention has been caught, while contrarian investors believe
in reversion will buy previous losers to which their attention has been caught.

We argue that a proxy for risk is related to the absolute price change of a stock. According to attention theory, the absolute price change, whether abnormally positive or negative, catch investors’ attention when they make buying decision on stock investments. The presence of risk means that more than one outcome is possible. Risk refers to the possibility of suffering losses or gains under an uncertainty environment. A stock that has a recently big absolute price change will be considered higher risk because it can quite easily lose or gain any potential returns due to the volatile nature of the stock.

Therefore, our primary risk measure is based on the magnitude of the historical price change of stock. Specifically, we define the price change of stock \( j \) in period \([t-k, t-1]\) (denoted \( PC(j, k) \)) as:

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PC(j,k) = \frac{P(j,t-1) - P(j,t-1-k)}{P(j,t-1-k)},
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where \( P(j,t-1) \) is the closing price of stock \( j \) in one trading day before the purchase day \( t \) and likewise \( P(j,t-1-k) \) is the price of stock \( j \) in \( k+1 \) trading days before the purchase day. This measure also indicates the past performance of a specific stock. For example, \( PC(j,1) \), \( PC(j,5) \), \( PC(j,20) \), and \( PC(j,60) \) denote

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4 We use alternative risk taking measures to test the house money effect. The results are presented in Appendix A and show no evidence of the house money effect.
the stock $j$’s return in the previous day, previous week, previous month, and previous quarter, respectively. For some degrees, the risk taking measure we use is basically close to the idea of beta. A stock with a beta higher than 1 would be more volatile than the market, and would therefore offer greater upside and downside potential. Our measure seeks to measure the relative probability associated with upside and downside risk.

3.2.3 House Money Effect Measure

House money effect refers to a greater tendency to take more risk once a gain has been experienced. For our baseline test, our measure of the house money effect for a given investor in a given period, $HME$, is defined as the coefficient from the regression of the change of risk taking in the period $[t, t-1]$ on the investment gain from the previous period $(t-1)$:

$$\Delta RT_{i,t} = \beta G_{i,t-1} + \epsilon_{i,t},$$  \hspace{1cm} (2)

where, for each $ith$ observation, $\Delta RT_{i,t}$ is the change of risk taking in the period $[t, t-1]$, $G_{i,t-1}$ is the investment gain from the previous period $t-1$. The coefficient $\beta$ from the regression is the house money effect measure $HME$.

There is some reason to believe that an investor’s selling or buying behavior may last a couple of days, and does not occur with a one-shot trade. This may be
because they fear the price pressure or that they may lose the opportunity to obtain a higher profit in the ensuing days. The price pressure hypothesis, originally proposed by Scholes (1972), and Kraus and Stoll (1972), suggests that security prices are affected by temporary changes in demand, even in the absence of any new information on the stock. Under this hypothesis, a large purchase (sale) order for a security will trigger an increase (decrease) in the price of the security. Therefore, before the calculation of our measure of the house money effect, we proceeded with the following steps.

First, the specifications of the buy and sell behavior for each trading day are ascertained. On each day, we sum the value of buys and the value of sells' made by an individual. The buy ratio is calculated as the ratio of the value of buys to the sum of the value of buys and sells. Likewise, the sell ratio is then calculated as the ratio of sells' value to the sum of the value of buys and sells. Then we are able to identify a buy (sell) day when the buy (sell) ratio is higher or equal to 0.99. For each investor, a buy (sell) day denotes a very strong tendency to make a buy (sell) decision, and almost all the trades are purchase trades.

The second step is the recognition of the purchase and sale period. Under the assumption that an investor might take few days to finish his purchase or sale decision, we explore cases for the purchase period of $m$ days following the sale.

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5 The value of a buy is determined by multiplying the purchase price by the purchase shares. Similarly, the value of a sell is determined by multiplying the sale price by the sale shares.
period of $k$, successive days which are denoted by $kSmB$. For example, $3S3B$ indicates the purchase period of 3 days following the sale period of 3 successive days.

To investigate whether the timing is an important factor in decision making, we examine the house money effect over various samples for different days of purchase and sale periods ($3S3B$, $4S4B$, $3S4B$, $3S5B$, and $3S10B$). Table 2 to 6 report descriptive information on the trading activity for our sample. Panels A and B show there are sales about two times more than purchase during our sample period, though the average value of stock purchased is slightly higher than the value of stocks sold. As a result, in Panel C, the aggregate value of sales is still higher than aggregate value of purchases. The value of trades is positively skewed; the medians for both purchases and sales are substantially less than the mean values.

In addition, we calculate the daily turnover for each trader each case of our sample. For each case in each day during our sample period, we identify the stocks held by each trader at the beginning of day $t$ from their position records. The daily sales turnover is calculated as the value of stocks sold during the day divided by the total beginning-of-day market value of the investor’s portfolio. The daily purchases turnover is calculated as the value of stocks purchased during the day divided by the total beginning-of-day market value of the investor’s portfolio. In Panels A and B we report that, on average, investors sell about 30 percent and purchase over 100
percent of their stock portfolio each day for each case. In Panel C, we calculate aggregate sales (purchases) turnover by summing all sales (purchases) during sale (purchase) period in each case and dividing by the total beginning-of-case market value of the investor’s portfolio. The aggregate sale turnover is about 60 percent and aggregate purchase turnover is about 40 percent. As a result, the purchase-sale ratio which is calculated as the aggregate purchases divided by the aggregate sales of each case is about two-third (40/60).

Insert Table 2 to Table 6 here

The third step is the calculation of gains and the change of risk taking. For each investor in each case, we sum the profit of all sales during the sale period as the profit in stock investment. If this profit had a positive value, then we regard it as a prior gain. In regard to change of risk taking, we calculate the historical price change of stocks.

In Table 7 to Table 11, we report descriptive information on the investment performance for our samples (3S3B, 4S4B, 3S4B, 3S5B, and 3S10B). To calculate trading profits for each trade, we use FIFO, LIFO, average-cost, and prior high methods and report summary in Panels A to D, respectively. In terms of gain and loss, we count each sale for a gain and sale for a loss as separate independent observations. Except for prior high method, Panels A to C show in general there are sales for gains more than sales for losses and the average gain of stock sold is lower
than the average loss of stock sold. Consistent with previous studies of the disposition effect (Shefrin and Statman (1985), Odean (1998), and Barber and Odean (2000)), our findings imply that investors frequently realize small gains and less frequently take large losses. They may reluctant to realize losses and more willing to realize gains, such a behavior may not good for their wealth because their gains (return of gains) is lower than their losses (return of losses).

Insert Table 7 to Table 11 here

Finally, we estimate the coefficient from the regression of price change of stocks on prior gains. The house money effect would require that the coefficient significantly differs from zero, whether positive or negative. Further, investors may sell stocks in an effort to meet their liquidity demands or to increase their profits. Our sampling process examines only sales and purchases where a purchase is made within couple of days of a sale; such transactions are unlikely to be liquidity motivated since investors who needs cash for several days or less can borrow cheaply (e.g., using credit cards) than the cost of selling and later buying securities. So our methods potentially eliminate trades that motivated by a desire for consumption.