The Disposition Effect and Investment Performance in the Futures Market*

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Abstract

This paper examines whether the disposition effect, the tendency of investors to ride losses and realize gains, exists in the Korean index futures market. Using a unique database, we find strong evidence for the disposition effect and explain this in terms of investor characteristics. We also investigate the effect the disposition bias that has on investment performance. There are four main findings. First, individual investors are much more susceptible to the disposition effect than institutional and foreign investors. Second, sophistication and trading experience tend to reduce the disposition effect. Third, the disposition effect is stronger in the long positions than in the short positions. Finally, there is a negative relationship between the disposition effect and investment performance. This result is consistent with Odean (1998), but contrasts with Locke and Mann (2005) who find no evidence of any contemporaneous measurable costs associated with the disposition effect.

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1. Introduction

One of the most well-documented regularities in the behavior of investors is the tendency to hold losers too long and sell winners too soon. Such behavior, which has been termed the "disposition effect" by Shefrin and Statman (1985), has been found in a variety of data sets and time periods. The disposition effect is one implication of "prospect theory" (Kahneman and Tversky (1979)) and "mental accounting" (Thaler (1985)).[1] While an investor keeps a separate mental account for each stock, he maximizes an "S"-shaped value function within this account. This reflects risk aversion in the domain of gains and risk seeking in the domain of losses. If an asset appreciates in price, the investor's wealth will be in a risk-averse domain, making a sale more likely. In contrast, if the asset is trading below its reference price, the investor becomes risk loving and will hold on to the asset for a chance to break even.

With the availability of account-level transaction data recent studies provide direct evidence of the disposition effect from actual trading records of individual investors. Subsequent to the well-known paper by Odean (1998), a number of studies find empirical regularity.[2] In contrast to a lot of evidence about the disposition effect in stock market, there is little evidence in the futures market.[3] Coval and Shumway (2005) report evidence of behavioral biases among market makers in the Treasury Bond futures contract at the Chicago Board of Trade (CBOT) and investigate the impact of such biases on prices. They find strong evidence that proprietary traders are loss averse, regularly assuming above-average risk to recover from

[1] A number of papers have proposed behavioral theories. See, for example, the model of loss aversion (Benartzi and Thaler (1995), Barberis, Huang, and Santos (2001), Baberis and Huang (2001)), the house-money effect (Thaler and Johnson(1990)), and the liquidation decisions of economic agents under prospect theory (Kyle, Ou-Yang, and Xiong (2006)). Grinblatt and Han (2005) suggest that the disposition effect creates a spread between a stock's fundamental value and its equilibrium price, as well as price underreaction to information.

[2] See, for example, Grinblatt and Keloharju (2001), Ranguelova (2001), Shapira and Venezia (2001), Goetzmann and Massa (2003), Wermer (2003), Feng and Seasholes (2005), Jin and Scherbina (2005), Shumway and Wu (2005), Dhar and Zhu (2006), Frazzini (2006), Kumar (2006).

[3] Heath, Huddart, and Lang (1999) investigate the option exercising behavior and Poteshman and Serbin (2003) analyze the rationality of early exercises of Chicago Board Option Exchange (CBOE). Genesove and Mayer (2001) shed further light on investor irrationality by analyzing loss aversion and seller behavior in the housing market and O'Connell and Teo (2003) analyze trading decisions of institutional investors in currency market.

morning losses. However, any price impact resulting from traders' behavioral biases dissipates extremely quickly. Consistent with this, they find that mornings with widespread losses lead to increases in short-run afternoon volatility but no increase in volatility measured over longer periods. Locke and Mann (2005) analyze the trading behavior of professional futures traders on the Chicago Mercantile Exchange (CME) and find that all traders hold onto losses significantly longer than gains. While the least successful traders hold losers the longest, the most successful traders hold losers for the shortest time. However, there is no evidence of any contemporaneous measurable costs associated with this behavior.

In this paper, we focus on the disposition effect in the futures market. The reason for investigating the futures market is as follows. First, even though a lot of studies find evidence of the disposition effect, there is little evidence in the futures market. Locke and Mann (2005) find the disposition effect of professional futures traders, but find no evidence of costs associated with this behavior. However, their analysis is limited to professional traders and has limitations to interpret these results. Second, when the stock market is in an upward-moving stage, investors tend to sell winners than losers even though they have no disposition bias because their portfolios appreciate. In contrast, in the futures market, a long position holder's gain equals to a short position holder's loss. Consequently, there is no need to control for market conditions such as an upward-moving market or a downward-moving market to identify the disposition effect. Finally, since an expiration date exists in the futures contracts, it is possible to calculate profits correctly. We don't need to assume that there is no beginning inventory. This enables us to calculate the exact profits which are critical for figuring out the disposition effect.

In particular, we focus on the disposition effect in the Korean stock index futures market. The Korean stock index futures market offers a number of unique advantages in assessing behavioral biases. First, since individual investors trade actively, the Korean stock index futures

market is a good laboratory to study individual investors' behavioral biases. In 2004, individual investors took part in 48.6% of total trades. Second, the Korean futures and options market is the world's number one active market and the Korean futures market is ranked 4th. Therefore, the Korean futures market is one of the key futures markets in the world. Third, the Korean futures market is open to foreign investors. There are no restrictions on foreign investors regarding their participation in the futures market. This environment enables us to analyze foreign investors' behavior.

We examine the disposition effect based on a transactions dataset on the Korean stock index futures market. Because we begin with every transaction made by all market participants over a 2-year period, the results have significant power to detect behavioral biases in trading behavior. Since previous papers use a particular investor database on a brokerage house, they have limitations on finding behavioral biases and interpreting the results. We estimate the magnitude of the disposition effect for all market participants at the account-level as well as at the market-level. We examine the disposition effect across investor types and the relationship between the disposition effect and investor trading characteristics. We also analyze the disposition effect in the short positions as well as in the long positions, and test whether the disposition effect is a costly behavioral bias.

Using a data set of all trades on the Korean stock index futures market from January 2, 2003, to March 31, 2005, we find evidence that investors have the disposition effect. While the tendency to hold onto losers exists for all investor types, individuals are more prone to the disposition effect than institutional and foreign investors. We also find that sophisticated and experienced investors show less disposition effect. By contrast, the less sophisticated and experienced investors are more predisposed to sell winners and hold onto losers. This finding indicates that professional training and experience may reduce judgmental biases, even though

experience cannot eliminate them. There is also an asymmetric disposition effect between the long positions and the short positions. The disposition effect is stronger in the long positions than in the short positions. Testing the hypothesis that the disposition effect is a costly behavioral bias, we find some results that the disposition bias has a negative effect on investment performance. Additionally, we find that foreign investors outperform domestic investors in the Korean stock index futures market.

The rest of the paper is organized as follows. Section 2 defines the hypotheses about the characteristics of the disposition effect Section 3 describes the futures trading data and general methodology. Section 4 presents empirical evidence of the disposition effect. Finally, Section 5 concludes.

2. Hypotheses

Even though Coval and Shumway (2005) and Locke and Mann (2005) show the existence of the disposition effect in the futures market, their analysis is restricted to market makers or professional traders. Therefore, their studies have limitation to interpret these results as a market whole phenomenon. In contrast, this paper shows empirical evidence of the disposition effect, and investigates the cross sectional characteristics of the disposition effect using all market participants' transaction data. To test the property of the disposition effect, we set the following four hypotheses.

Hypothesis 1: *The disposition effect exists in the Korean stock index futures market.*

Many countries show the evidence of the disposition effect. For example, Odean (1998)

demonstrates the existence of the disposition effect in the US stock market. Grinblatt and Keloharju (2001) find the disposition effect in the Finnish stock market and Shumway and Wu (2005) show the disposition effect using data from a large Shanghai brokerage firm. Using the Odean (1998) methodology, we test the above hypothesis in the Korean stock index futures market.

Hypothesis 2: *Individual investors are more prone to the disposition effect than institutional and foreign investors.*

Shumway and Wu (2005) show that accounts associated with corporations or brokerage firms exhibit significantly less disposition than individual accounts. To test which investor groups may or may not be acting in a manner with behavioral biases, we partition the sample by individuals, institutions, and foreigners. Having identified the disposition effect in the Korean stock index futures market, we test whether there is any different pattern in the disposition effect among investor types.

Hypothesis 3: *Sophisticated and experienced investors show less disposition effect.*

Hypothesis 3 is in line with Hypothesis 2 in that institutional investors and foreign investors are believed to be more sophisticated and experienced than individual investors. Yet Dhar and Zhu (2006) find that the disposition effect differs among individual investors depending upon personal characteristics such as investors' income, professional occupations, trading experience, age, and portfolio size. In experimental analysis, Haigh and List (2005) find that professional traders are more prone to show symptoms of myopic loss aversion than

undergraduate students. Therefore, we want to test whether there is a negative relationship between the disposition effect and sophistication and trading experience after controlling for investor types.

Hypothesis 4: *The disposition effect is a costly behavioral bias.*

Odean (1998) shows that for winners which are sold, the average excess return over the following year is more than it is for losers which are not sold. Wermers (2003) and Frazzini (2006) show that managers of underperforming funds appear reluctant to sell their losing stocks. In contrast, Locke and Mann (2005) find that there is no evidence of any contemporaneous measurable costs associated with this behavior. If the disposition effect has an impact on investment performance, investors who show the higher disposition effect earn less money than those who display the lower disposition bias. To test the above hypothesis, we investigate the impact of the disposition effect on the performance.

3. Data and Methodology

3.1 Korean Futures Market

The Korea Exchange (KRX) launched stock index futures on the Korea Stock Price Index (KOSPI) 200 on May 3, 1996. Despite its short history, the derivatives market in Korea has grown dramatically since its introduction and is the largest market by trading volume in the world. According to the Futures Industry Association (FIA) in Table Ⅰ, the futures and options trading volume of the KRX was 2.9 billion contracts in 2003 and 2.6 billion contracts in 2004, and it was ranked 1st in the world. The stock index futures volume of the KRX was 62 million contracts in 2003 and 56 million contracts in 2004, and it was ranked 4th in the world, following

the E-Mini S&P 500 of CME, DJ Euro STOXX 50 of EUREX, and E-Mini NASDAQ 100 of CME.

The underlying asset of stock index futures in the KRX is KOSPI 200. It is a market capitalization weighted index composed of 200 major stocks listed in the KRX. Contract months of index futures are March, June, September, and December. The last trading day for each contract month is the second Thursday of the contract month. The normal trading hours are from Monday through Friday, 09:00 to 15:15. There are no trades during the last ten minutes, when orders are collected for the closing call auction at 15:15. Trading prices during the rest of the trading hours are determined by continuous auction. On the last trading day of futures, the trading of matured futures contracts ends at 14:50. The settlement price is set to the closing price of the cash market, which is determined by call auction at 15:00. The KRX does not have designated market makers. Buyers and sellers meet via the Automated Trading System (ATS). The stock index futures price is the same as KOSPI 200 times KRW 500,000. The trading unit is one contract and the minimum tick size is 0.05 index point, representing a value of KRW 25,000. The daily price limit is 10 percent of the previous closing price.

3.2 Data

In this paper, we use a unique data set to shed new light on the issue of whether investors exhibit the disposition effect. For better understanding the disposition effect, it is useful to analyze a data set on how all market participants behave. By looking at all the market participants in the Korean stock index futures market, we are able to generate a more complete picture of the stylized facts of trading.

Our primary data consist of the entire history of transactions of the Korean index futures

from January 2003 to March 2005. The data include a trader's account information, identifiers for the buying trader and the selling trader, the price, and the time for each transaction. They provide information on the country of residence of investors as well as on whether they are individuals or institutions. There are 69,391 different traders and records of over 22 million transactions in the data. The number of individuals, institutions, and foreign investors are 59,081, 9,742, and 568, respectively. The percentage of individual investors is approximately 85%, which is strikingly higher than that of institutions (14%) and foreign investors (1%). However, the percentage of individual investors on the basis of trading volume is not so high. In 2004, 48.6% of the gross volume of trade was by individual investors. In contrast, 29.1% of the gross volume of trade was by institutional investors and 22.3% was by foreign investors.[4]

3.3 Summary Statistics for Data

In Table Ⅱ, we report the minimum, 25th percentile, median, mean, 75th percentile, maximum, and standard deviation of the number of trading days, daily average number of trades, daily average trading volume, daily average trading value, total profits, and total profits over daily average trading value. The top and middle thirds of Panel A present statistics for the trading activities of all investors. Investors in our sample trade, on average, 45 days (median is 19) among 556 trading days. They execute 7 trades (median is 4) and 34 contracts (median is 7) on a typical day. The value of daily trading is KRW 1.6 billion (median is KRW 348 million) on a given day. The bottom third of Panel A reports statistics for total profits and relative profits, which mean total profits over daily average trading value, for each account during the sample period. The distribution of total profits is skewed to the right.[5] The median of total profits is

[4] In 2005, individuals, institutions, and foreign investors were 44%, 31.7%, and 23.7% in the gross volume of trade, respectively.
[5] The skewness measure is 15.52.

KRW -1.2 million indicating that the number of traders who lose money during the sample period is greater than that of traders who gain money. Since all traders' profits in the futures market are zero sum, the mean of total profits equals zero. Furthermore, the mean of relative profits is -1.1% (median is -0.3%).

Panel B of Table Ⅱ reports statistics for individuals, institutions, and foreign investors, respectively. The results indicate that there is considerable heterogeneity in trading activities and profits across investor types. The number of individuals, institutions, and foreign investors are 59,081, 9,742, and 568, respectively. The portion of individual investors is approximately 85%, which is strikingly higher than that of institutions (14%) and foreign investors (1%). The most active group is foreign investors who trade 91 days among 556 days and execute 30 trades on a given day. While individuals trade 47 days and 7 times a day, institutions trade 29 days and 6 times on a special day. Even though institutions trade less often than individuals, the trading volume of institutions is larger than that of individuals. The daily average trading volume of individuals, institutions, and foreign investors is 25, 74, and 327 contracts, respectively. The mean of total profits (relative profits) of foreigners is KRW 839.3 million (1.3%), which is greater than KRW -2.6 million (-0.9%) of individuals and KRW -33.5 million (-2.0%) of institutions.

Several points emerge from Table Ⅱ that are worth noting. First, most of market participants in the Korean stock index futures market are individual investors. They trade more actively than institutional investors. Therefore, the Korean stock index futures market is a good laboratory for testing individual investors' behavioral biases. Second, foreign investors are the most active traders in the Korean stock index futures market. Third, the distribution of total profits is positively skewed, which means that more than half of the investors lose money. In other words, the winners in the futures market are less than a half. Fourth, foreign investors are

on average winners and others are losers in the Korean stock index futures market. However, the performance of institutions is inferior to individual investors. We can say that foreign investors have an information advantage over domestic institutions. This result is consistent with Grinblatt and Keloharju (2000).

3.4 Measuring the Disposition Effect

We slightly modify the Odean (1998) methodology and measure the disposition effect (DE) as the difference between investors' propensity to realize gains and their propensity to realize losses. The current futures price is compared to the contract-weighted average open-buy (or open-sell) price to determine whether the futures contract is trading at a gain or a loss. If the current price is above (below) the reference price, then the futures contract is counted as trading at a gain (loss). There are two types of gains and losses. If the investor trades at a gain (loss), it is counted as a "realized gain (loss)". If the investor does not close-buy (or close-sell) futures contracts and holds the positions, it is counted as a "paper gain (loss)" which the current price is above (below) the reference price.

The Account-Level Disposition Effect

Proportion of gain realized (PGR) and proportion of loss realized (PLR) in account *i* are defined as:

$$PGR_i = \frac{N_{RG}^i}{N_{RG}^i + N_{PG}^i}, \qquad PLR_i = \frac{N_{RL}^i}{N_{RL}^i + N_{PL}^i} \tag{1}$$

N_{RG}^i = number of trading days in account *i* where a gain is realized

N_{RL}^i = number of trading days in account *i* where a loss is realized

N_{PG}^i = number of potential trading days in account *i* where there is a gain

N_{PL}^{i} = number of potential trading days in account *i* where there is a loss

The disposition effect (DE) for account *i* is defined as the difference of each investor's PGR and PLR:

$$DE_i = PGR_i - PLR_i \tag{2}$$

A positive disposition indicates that this particular investor is more likely to realize gains than losses. The bigger the disposition effect, the more likely one investor is to realize winners than losers. The t-statistics test the null hypothesis that the disposition effect is equal to zero.

The Market-Level Disposition Effect

We can also calculate the disposition effect at the aggregate level by assuming investors' trade or accounts are independent. Proportion of gain realized (PGR) and proportion of loss realized (PLR) at date *t* are defined as:

$$PGR^t = \frac{N_{RG}^t}{N_{RG}^t + N_{PG}^t}, \quad PLR^t = \frac{N_{RL}^t}{N_{RL}^t + N_{PL}^t} \tag{3}$$

N_{RG}^{t} = number of accounts at date *t* where a gain is realized

N_{RL}^{t} = number of accounts at date *t* where a loss is realized

N_{PG}^{t} = number of accounts at date *t* where there is a paper gain

N_{PL}^{t} = number of accounts at date *t* where there is a paper loss

The disposition effect (DE) at date *t* is defined as the difference of PGR and PLR:

$$DE^t = PGR^t - PLR^t \tag{4}$$

The t-statistics test the null hypotheses that the disposition effect is equal to zero assuming that all realized gains, paper gains, realized losses, and paper losses result from independent decisions. To calculate the t-statistics, the standard error for the difference of PGR and PLR is:

$$\sqrt{\frac{PGR^t(1-PGR^t)}{N_{RG}^t+N_{PG}^t}+\frac{PLR^t(1-PLR^t)}{N_{RL}^t+N_{PL}^t}} \tag{5}$$

Realized (Paper) Capital Gains and Losses

Realized capital gains and losses (RC) and paper capital gains and losses (PC) in account *i* at date *t* are defined as:

$$RC_i^t = RG_i^t + RL_i^t\ , \quad PC_i^t = PG_i^t + PL_i^t \tag{6}$$

RG_i^t = realized gains in account *i* at date *t*

RL_i^t = realized losses in account *i* at date *t*

PG_i^t = paper gains in account *i* at date *t*

PL_i^t = paper losses in account *i* at date *t*

A negative RC indicates that this particular investor has a tendency to sell winners too soon. A negative PC indicates that this particular investor has a tendency to hold losers too long. The t-statistics test the null hypothesis that RC (PC) is equal to zero.

4. Evidence of the Disposition Effect

This section details the evidence that investors on the Korean stock index futures market exhibit the disposition effect. We investigate the existence of the disposition effect at the aggregate

market level as well as the individual account level. In particular, we examine the relationship between each trader's disposition effect and account characteristics, such as investor types, trading days, daily number of trades, daily trading volume, daily trading value, and total profits. In addition, we also show the difference of the disposition effect between the long positions and the short positions. Finally, we test the hypothesis that the disposition effect is a costly behavioral bias.

4.1 Distribution of the Disposition Effect

Table Ⅲ reports the distribution of the disposition effect measure for all investors in Panel A, and for each investor type in Panel B. In panel A, we see that PGR and PLR are widely distributed with a minimum of 0 and a maximum of 1 and the mean of PGR is slightly larger than that of PLR. The mean of DE, which is the difference betwen PGR and PLR in a specific account, is 0.078 (median is 0.014). It implies that investors are likely to sell winners and hold onto losers. Next, turning to the magnitude of realized and paper capital gains and losses, the mean of realized gains (RG) is KRW 2.4 million which is lower than KRW 3.0 million of realized losses (RL). The maximum of RL is roughly 3 times larger than that of RG. The mean of paper gains (PG) and paper losses (PL) is KRW 7.6 million and 7.5 million, respectively. Both realized capital gains and losses (RC) and paper capital gains and losses (PC) have a negative value which shows that losses are larger than gains. Although these values have no t-statistics, they are consistent with the tendency for realizing gains too soon and holding onto losses. We can find similar results among individuals, institutions, and foreigners in Panel B.

Since we don't calculate DE when each account has only PGR or PLR value, the observation of DE is less than that of PGR and PLR. For example, if a particular account has a

good performance during the sample period, PLR has no value. DE measure has an upward bias if we assume PLR is zero. In contrast, if a particular account has a bad performance, PGR has no value. In this case, DE measure has a downward bias if we regard PGR as zero. For this reason, we calculate DE measure only if an investor has a potential opportunity to realize gains as well as losses. This method is also applied to RC and PC calculation.

Figure 1 shows the distribution of DE of which the right tail is much thicker. This result shows that the proportion of investors who are more likely to realize their gains than losses is large in our sample. This is supporting evidence for the existence of the disposition effect in the Korean stock index futures market. Plotting the distribution of realized capital gains and losses (RC) and paper capital gains and losses (PC) is also insightful. Figure 2 shows the distribution of the relative realized capital gains and losses and Figure 3 shows the distribution of the relative paper capital gains and losses. While the left tail of the realized capital gains and losses is much thinner than the right tail in Figure 2, the left tail of the paper capital gains and losses is much thicker than the right tail in Figure 3. It is consistent with the tendency for gains to be realized and losses to be hold onto. This is most strikingly evident in individual investors. In Figure 2, the frequency to realize capital losses near zero drops sharply. It is consistent with the tendency that investors are reluctant to realize small losses.

4.2 The Account-Level Disposition Effect

An account-level disposition effect measure allows us not only to identify variations in investors, but also to examine the role of investor trading characteristics in explaining the disposition effect. We expect investors who are sophisticated and have more trading experience to have a lower disposition effect because they have a better understanding of the market, are more aware

of such a tendency, and hence likely to correct it.

Table Ⅳ reports the mean and t-statistics for the disposition effect (DE), realized capital gains and losses (RC), and paper capital gains and losses (PC). As stated previously, there is a statistically strong (t-statistic is 76.79) tendency for investors to sell a higher proportion of their winners than their losers. Panel A shows the mean of DE for all investors is 0.078, which is larger than the average 0.05 reported by Odean (1998) for retail investors, but still of the same order of magnitude. The mean of realized capital gains and losses (RC) is KRW - 0.62 million (t-statistic is -14.62) which implies that realized gains are less than realized losses. The mean of paper capital gains and losses (PC) is KRW -0.23 million (t-statistic is -3.34) which represents that paper gains are less than paper losses. On average, investors realize small gains and hold large losses.

To test which investor groups may or may not be acting in a manner with behavioral biases, we partition the sample by investor types in Panel B. While we find that the disposition effect holds in sub-samples, the magnitude of the disposition effect is different across investor types. An interesting finding is that professional traders who are believed to be more sophisticated and experienced than individual investors are less prone to the disposition effect. The mean of DE for individual investors is 0.085 (t-statistic is 77.13), which is larger than institutions 0.040 (t-statistic is 14.66) and foreigners 0.031 (t-statistic is 3.79). This result is consistent with the previous findings (Shapira and Venezia (2001), Grinblatt and Keloharju (2001), Jin and Scherbina (2005), Shumway and Wu (2005), Frazzini (2006)), but contrasts with Haigh and List (2005). Perhaps most striking finding is that foreign investors have larger paper gains than paper losses. Paper capital gains and losses (PC) for foreigners is KRW 7.50 million (t-statistic is 2.32) and positive. In other words, foreign investors hold onto winners instead of realizing gains too soon.

To study how the number of trading days, daily average number of trades, daily average trading volume, daily average trading value, and total profits of an account contribute to variations in the disposition effect, we assign all accounts from the sample the given variable quintiles. The top 20% accounts are 5 (high) and the bottom 20% are 1 (low).

Panel C of Table Ⅳ compares the disposition effect measures by the number of trading days quintiles. DE is monotonically increasing with the number of trading days as one moves from the bottom to the top quintile. It is a counter-intuitive result that traders who trade more days are disposition-prone investors. However, we need to interpret this result carefully. In Panel C, we cannot differentiate an investor who trades many times a day from a trader who trades a few times a day. So, we introduce another measure of trading experience which represents how many times he trades a day.

As people repeat the same activity, they become more familiar with the objectives and can do better than individuals who do the same thing less frequently. Therefore, we expect the number of trades that each investor executed to decrease the disposition effect. We can find DE is decreasing with the number of trades increasing in Panel D. DE in the bottom 20% is 0.074 (t-statistic is 24.03), which is higher than 0.047 (t-statistic is 27.17) in the top 20%. The results support that trading experience also tends to reduce the disposition effect.

We report the disposition effect of investors by daily average trading volume quintiles in Panel E and by daily average trading value quintiles in Panel F. It is widely accepted that professional investors have larger trading volume and value than amateurs. Trading volume and value may be proxies for professionals. As predicted, DE is monotonically decreasing with trading volume and value increasing. For example, DE in the bottom 20% in Panel E is 0.100 (t-statistic is 32.54), which is 2 times larger than 0.053 (t-statistic is 26.16) in the top 20 %. The results show that professional investors are less susceptive to the disposition effect.

What is striking is the amount of variations that is observed across the performance-based quintiles in Panel G. From the finding that DE in winners, 0.065 (t-statistic is 33.04), is smaller than DE in losers, 0.088 (t-statistic is 48.30), we can say that unsuccessful investors tend to be disposition prone. This result is consistent with the evidence in Wermers (2003) and Frazzini (2006) that managers of underperforming funds appear reluctant to sell their losing stocks. We will further analyze a contemporaneous relation between trader success and tendency to hold losers longer in Section 4.4.

We perform a cross-sectional regression analysis to elaborate on the impact of investor characteristics on the disposition effect. The regression takes the following form;

$$DE_i = \alpha + \beta_1 INS + \beta_2 FOR + \beta_3 TRDDAYS_i + \beta_4 NTRD_i + \beta_5 VALUE_i + \beta_6 PROFIT_i + e_i \quad (7)$$

DE_i = the disposition effect measure which is the difference between PGR and PLR in account i

INS = dummy variable for institutional investors

FOR = dummy variable for foreign investors

$TRDDAYS_i$ = ln(the number of trading days) in account i

$NTRD_i$ = ln(daily average number of trades) in account i

$VALUE_i$ = ln(daily average trading value) in account i

$PROFIT_i$ = total profits in account i

total profits/daily average trading value in account i

Table Ⅴ reports coefficients from regression of the disposition effect on investor dummy, the number of trading days, daily average number of trades, daily average trading value, and profits variables along with t-statistics. The result confirms that institutional investors and

foreign investors exhibit lower disposition than individual investors. Controlling for investor types, we also find that there is a significantly negative relationship between the disposition effect and proxies for professional or sophistication or trading experience. Among institutions and foreign investors, trading experience has a critical role for reducing the disposition effect. Profits variables have also a negative relationship with the disposition effect. This result confirms evidence in Table Ⅳ that traders who are more sophisticated, professional, experienced, and successful are less prone to the disposition effect and is consistent with Feng and Seasholes (2005) and Dhar and Zhu (2006). It also supports experimental findings in List (2003, 2004) that experience can eliminate some market anomalies.

4.3 The Market-Level Disposition Effect

The disposition effect at the aggregate level is equivalent to treating all investors as one representative agent. This method enables us to analyze the impact on market induced by the disposition effect. PGR and PLR are reported for both the full sample and the short/long positions sample by investor categories in Table Ⅵ. The t-statistics test the null hypothesis that DE is equal to zero.

Panel A of Table Ⅵ reports the disposition effect at the aggregate level by investor types. The result is similar to the account-level disposition effect. DE of individual investors is 0.098 (t-statistic is 203.7), higher than 0.022 (t-statistic is 20.7) of institutional investors and 0.038(t-statistic is 15.0) of foreign investors. This presents additional evidence that individual investors show more disposition-prone symptoms.

Panel B of Table Ⅵ reports the disposition effect at the aggregate level by investor types and the long (short) positions. Since we calculate RG, RL, PG, and PL on a daily basis, we

exclude the trade which buy trade and sell trade execute on a same day. What is striking is that the disposition effect in the long positions is 0.078 (t-statistic is 79.9) and higher than 0.054 (t-statistic is 53.8) in the short positions. It is not easy to explain this phenomenon by prospect theory. We may suggest some clues in investors' habits and beliefs or in index arbitrage trade. Investors are accustomed to selling behavior. While close-sell is similar to selling stocks, close-buy doesn't exist in the stock market. On the other hand, index arbitragers who take profits from the gap between futures and stock usually take more the short positions than the long positions in futures contracts. There is no room for human behavior to involve in program trade in which trades execute automatically. The fact that observations of the short position for institutional investors are 98,800, which are a lot more than 78,503 in the long positions, is indirect evidence of such an interpretation.

The disposition effect varies among investors across months. Odean (1998) finds that investors have exhibited negative disposition effect during December because of tax-loss selling. After we conduct a similar analysis to see whether such a pattern also exists in our sample, we cannot find the same results. Figure 4 shows that the ratio of PGR to PLR to each month over the sample period from January 2003 to December 2004. The ratio is stable during the sample period in Panel A. While the ratio of institutional investors declines from 1.32 in January to 1.04 in December in Panel B, it doesn't have a value below one. This contrasts with the results in Odean (1998). There may be several reasons why the negative disposition effect in December doesn't exist in the Korean stock index futures market. The most important reason is that capital gains in the Korean stock index futures market are tax-free. Therefore, investors pay no attention to tax-motivated selling. In addition, since investors in the futures market have the risk of margin calls, they don't carry their positions longer. It is also impossible to hold onto losing futures until December because of maturity.

4.4 Impact of the Disposition Effect on the Investment Performance

Having identified the relationship between profits and the disposition effect, we then ask whether the disposition effect has an impact on investment performance. We perform a cross-sectional regression analysis to elaborate on the impact of the disposition effect on the performance. The regression takes the following form;

$$PROFIT_i = \alpha + \beta_1 INS + \beta_2 FOR + \beta_3 DE_i + \beta_4 TRDDAYS_i + \beta_5 NTRD_i + \beta_6 VALUE_i + e_i \quad (8)$$

$PROFIT_i$ = total profits in account *i*

total profits/daily average trading value in account *i*

INS = dummy variable for institutional investors

FOR = dummy variable for foreign investors

DE_i = the disposition effect measure which is the difference between PGR and PLR in account *i*

$TRDDAYS_i$ = *ln*(the number of trading days) in account *i*

$NTRD_i$ = *ln*(daily average number of trades) in account *i*

$VALUE_i$ = *ln*(daily average trading value) in account *i*

Table Ⅶ reports coefficients from regression of profits on investor dummy, DE, the number of trading days, daily average number of trades, and daily average trading value variables along with t-statistics. The coefficient pattern in Table Ⅶ suggests the negative relationship between DE and profits after controlling for other variables. This supports the hypothesis that the disposition effect is a costly behavioral bias, and is consistent with the

results in Odean (1998) that for winners which are sold, the average excess return over the following year is more than it is for losers which are not sold.

The finding that daily average number of trades has a negative effect for the performance is interesting. Trading frequently has also been shown to be hazardous to investor's wealth in Barber and Odean (2000). We find the reason for the different result in the marketplace. The futures market is more competitive than the stock market and has no limited liability. For this reason, investors close out the positions very often instead of holding the futures contracts for too long periods. This may be one reason that trading frequently is not hazardous to investor's wealth in the futures market.

The result of Table Ⅶ could arise from the potential endogeneity bias. To reinforce our empirical evidence about the impact of the disposition effect on the performance, we investigate the alternative model. The model tests whether the prior behavioral bias has an impact on the investment performance of the next period. Regression takes the following form;

$$PROFIT_i^{2004} = \alpha + \beta_1 INS + \beta_2 FOR + \beta_3 DE_i^{2003} + \beta_4 TRDDAYS_i^{2004} + \beta_5 NTRD_i^{2004} + \beta_6 VALUE_i^{2004} + e_i \quad (9)$$

$PROFIT_i^{2004}$ = total profits in account *i* in 2004

total profits/daily average trading value in account *i* in 2004

DE_i^{2003} = the disposition effect measure which is the difference between PGR and PLR in account *i* in 2003

$TRDDAYS_i^{2004}$ = *ln*(the number of trading days) in account *i* in 2004

$NTRD_i^{2004}$ = *ln*(daily average number of trades) in account *i* in 2004

$VALUE_i^{2004}$ = *ln*(daily average trading value) in account *i* in 2004

Table Ⅷ reports the results of cross-sectional regression of the prior disposition effect on the current performance controlling for investor characteristics, which is the extension of the equation (8). As we expected, the sign of the coefficients in Table Ⅷ does not change compared to Table Ⅶ. This table suggests that the disposition prone investor predicts subsequent inferior investment performance. This result implies that the disposition effect is a costly behavioral bias.

5. Conclusion

This paper presents evidence on the existence of the disposition effect in the Korean stock index futures market. We analyze trading records of all market participants from January 2, 2003, through March 31, 2005. We find that investors display the disposition effect. Individuals are more prone to the disposition effect than institutional and foreign investors. We also find that sophisticated and experienced investors show less disposition effect. This finding indicates that professional training and experience may reduce judgmental biases, even though experience cannot eliminate them. This result is consistent with the previous findings (Shapira and Venezia (2001), Grinblatt and Keloharju (2001), Jin and Scherbina (2005), Shumway and Wu (2005), Frazzini (2006)), but contrasts with Haigh and List (2005). The disposition effect is stronger in the long positions than in the short positions. Testing the hypothesis that the disposition effect is a costly behavioral bias, we find some results supporting that the disposition bias has a negative effect on investment performance. This result is consistent with Odean (1998), but contrasts with Locke and Mann (2005) who find no evidence of any contemporaneous measurable costs associated with the disposition effect. Besides, foreign investors outperform domestic investors in the Korean stock index futures market. This result is consistent with Grinblatt and Keloharju

(2000), but contrasts with Kang and Stulz (1997).

Our investigations so far confirm that the disposition effect exists in the futures market, and the disposition effect has an impact on market prices. The findings of this paper have several important implications. First, better understanding behavioral biases is an important challenge. For instance, traders who are more sophisticated, professional, experienced, and successful are less prone to the disposition effect. This result suggests that brokerage firms should remind market participants of behavioral biases and educate traders. In a similar vein, policymakers need to keep in mind the importance of the behavioral bias because it has an impact on market prices. From the result of this paper, our paper can also suggest further theoretical development and empirical research on behavioral biases.

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Table Ⅰ

Global Exchange Trading Volume (2003-2004)

This table reports global exchange trading volume ranking, exchange, country, underlying index, and trading volume during the period from 2003 to 2004. Future and options volume is in Panel A, and stock index futures volume is in Panel B. Data source is from the Futures Industry Association (FIA). Trading volume unit is 10,000 contracts.

Panel A: Global Futures and Options Volume

2004 Rank	2003 Rank	Exchange	Country	2004 Trading Volume	2003 Trading Volume
1	**1**	**KRX**	**Korea**	**258,682**	**291,289**
2	2	EUREX, Frankfurt	Germany	106,564	101,493
3	3	CME	US	80,534	64,021
4	4	CBOT	US	59,999	45,419
5	5	EURONEXT, Liffe	UK	38,696	33,583
6	6	CBOE	US	36,109	28,395
7	8	ISE	US	36,085	24,497
8	7	EURONEXT, Paris	France	31,851	27,788
9	10	BOVESPA	Brazil	23,535	17,722
10	11	MEXDER	Mexico	21,040	17,382

Panel B: Global Stock Index Futures Volume

2004 Rank	2003 Rank	Exchange	Country	Underlying Index	2004 Trading Volume	2003 Trading Volume
1	1	CME	US	E-Mini S&P 500	16,720	16,118
2	2	EUREX, Frankfurt	Germany	DJ Euro STOXX 50	12,166	11,604
3	3	CME	US	E-Mini NASDAQ100	7,717	6,789
4	**4**	**KRX**	**Korea**	**KOSPI 200**	**5,561**	**6,220**
5	6	EUREX, Frankfurt	Germany	DAX	2,923	2,718
6	5	EURONEXT, Paris	France	CAC 40 10 Euro	2,406	2,932
7	12	National Stock Exchange	India	S&P CNX NIfty	2,335	2,056
8	7	EURONEXT, Liffe	UK	FT-SE 100	2,077	2,025
9	11	CBOT	US	Mini(5$) DJ Industrial	2,069	1,086
10	28	CME	US	E-Mini Russell 2000	1,712	388

Table Ⅱ

Summary Statistics for Data (Jan 2003 – Mar 2005)

This table reports the minimum, 25th percentile, median, mean, 75th percentile, maximum, and standard deviation of the number of trading days, daily average number of trades, daily average trading volume, daily average trading value, total profits, and total profits over daily average trading value. The sample consists of the trading experiences of 69,391 traders in the Korean stock index futures market over 556 trading days from Jan 2003 to Mar 2005. Daily average trading value and total profits are KRW one million.

Panel A: All Accounts (N = 69,391)							
	Mean	St. Dev.	Min	Q1	Median	Q3	Max
No. of trading days	45	67	1	6	19	53	553
Daily avg. number of	7	16	1	2	4	8	1,657
Daily avg. trading volume	34	340	1	4	7	18	53,454
Daily avg. trading value	1,645.5	16,718.3	32.7	166.2	347.8	859.8	2,734,095.4
Total profits	0.0	1,042.4	-65,541.0	-8.0	-1.2	0.8	67,371.7
Total profits/ Daily avg. trading value	-1.1%	14.9%	-766.9%	-2.0%	-0.3%	0.2%	446.0%
Panel B: Accounts Partitioned by Investor Types							
	Mean	St. Dev.	Min	Q1	Median	Q3	Max
Individuals (N = 59,081)							
No. of trading days	47	68	1	6	21	57	553
Daily avg. number of	7	9	1	3	4	8	326
Daily avg. trading volume	25	225	1	3	6	14	17,428
Daily avg. trading value	1,190.4	10,959.9	32.7	155.4	306.0	676.1	939,703.4
Total profits	-2.6	349.8	-13,415.6	-6.7	-1.2	0.4	28,730.0
Total profits/ Daily avg. trading value	-0.9%	7.7%	-277.1%	-1.8%	-0.3%	0.1%	179.4%
Institutions (N = 9,742)							
No. of trading days	29	53	1	4	11	30	553
Daily avg. number of	6	23	1	2	3	5	1,657
Daily avg. trading volume	74	627	1	8	22	58	53,454
Daily avg. trading value	3,539.7	30,856.8	35.1	382.7	1,078.1	2,807.8	2,734,095.4
Total profits	-33.5	1,169.8	-35,248.9	-47.5	-1.5	23.6	57,720.0
Total profits/ Daily avg. trading value	-2.0%	32.9%	-766.9%	-4.4%	-0.2%	2.7%	446.0%
Foreigners (N = 568)							
No. of trading days	91	130	1	9	33	109	552
Daily avg. number of	30	112	1	2	4	12	1,421
Daily avg. trading volume	327	1,413	1	8	27	123	16,423
Daily avg. trading value	16,489.3	70,906.8	43.3	368.7	1,366.5	5,913.4	820,555.2
Total profits	839.3	9,797.3	-65,541.0	-95.4	-1.6	109.4	67,371.7
Total profits/ Daily avg. trading value	1.3%	48.4%	-438.7%	-7.4%	-0.4%	5.5%	250.8%

Table Ⅲ

Summary Statistics for the Disposition Effect Measure

This table reports the minimum, 25th percentile, median, mean, 75th percentile, maximum, and standard deviation of the disposition effect measure. PGR is the number of trading days on realized gains divided by the number of trading days on realized gains plus the number of trading days on paper gains, and PLR is the number of trading days on realized losses divided by the number of trading days on realized losses plus the number of trading days on paper losses. DE is the difference of each investor's PGR and PLR. RG, RL, PG, and PL represent realized gains, realized losses, paper gains, and paper losses on daily basis. RC is the sum of RG and RL, and PC is the sum of PG and PL. The sample consists of the trading experiences of 69,391 traders in the Korean stock index futures market over 556 trading days from Jan 2003 to Mar 2005.

Panel A: All Accounts (N = 69,391)

	N	Mean	St. Dev.	Min	Q1	Median	Q3	Max
PGR	65,470	0.652	0.339	0.000	0.397	0.733	1.000	1.000
PLR	66,182	0.580	0.355	0.000	0.262	0.604	0.983	1.000
DE	62,570	0.078	0.254	-1.000	-0.018	0.014	0.200	1.000
RG	61,592	2.4	11.8	0.0	0.2	0.4	1.0	589.5
RL	61,327	-3.0	15.9	-1462.7	-1.3	-0.6	-0.3	0.0
PG	46,546	7.6	47.2	0.0	0.4	0.8	2.5	3599.6
PL	49,891	-7.5	43.1	-3154.2	-2.5	-0.9	-0.5	0.0
RC	55,491	-0.6	9.9	-536.7	-0.4	-0.1	0.0	589.3
PC	43,388	-0.2	14.5	-535.9	-0.5	-0.1	0.2	1160.4

Table Ⅲ (continued)

Panel B: Accounts Partitioned by Investor Types

	N	Mean	St.	Min	Q1	Median	Q3	Max
Individuals (N = 59,081)								
PGR	55,579	0.699	0.312	0.000	0.500	0.785	1.000	1.000
PLR	56,419	0.621	0.338	0.000	0.333	0.667	1.000	1.000
DE	53,203	0.085	0.253	-1.000	-0.013	0.023	0.212	1.000
RG	53,523	1.2	8.3	0.0	0.2	0.4	0.7	589.5
RL	53,753	-1.6	9.5	-637.0	-1.0	-0.5	-0.3	0.0
PG	38,308	2.4	15.5	0.0	0.4	0.7	1.4	1161.7
PL	41,508	-2.6	15.5	-1046.6	-1.5	-0.8	-0.5	0.0
RC	49,110	-0.4	6.2	-536.7	-0.4	-0.1	0.0	589.3
PC	35,569	-0.3	9.7	-535.9	-0.4	-0.1	0.1	1160.4
Institutions (N = 9,742)								
PGR	9,335	0.392	0.370	0.000	0.040	0.284	0.692	1.000
PLR	9,206	0.346	0.362	0.000	0.018	0.214	0.597	1.000
DE	8,820	0.040	0.258	-1.000	-0.036	0.000	0.107	1.000
RG	7,640	9.5	21.7	0.0	1.0	3.3	10.0	560.5
RL	7,118	-11.9	29.7	-858.0	-10.9	-3.6	-1.1	0.0
PG	7,734	24.5	57.1	0.0	2.5	8.4	23.7	1321.3
PL	7,870	-25.0	55.7	-1263.4	-25.0	-9.0	-2.6	0.0
RC	5,988	-2.5	23.2	-514.3	-2.6	-0.2	0.9	407.8
PC	7,327	-0.5	20.9	-503.5	-2.6	-0.1	1.6	531.1
Foreigners (N = 568)								
PGR	556	0.343	0.340	0.000	0.008	0.286	0.549	1.000
PLR	557	0.315	0.322	0.000	0.026	0.222	0.500	1.000
DE	547	0.031	0.189	-1.000	-0.023	0.000	0.074	1.000
RG	429	19.1	40.2	0.0	0.6	2.8	17.5	324.6
RL	456	-27.0	85.8	-1462.7	-21.2	-3.6	-0.8	0.0
PG	504	140.8	337.5	0.1	3.0	15.8	92.5	3599.6
PL	513	-131.2	303.1	-3154.2	-84.2	-15.2	-2.6	0.0
RC	393	-0.6	31.0	-329.8	-2.0	-0.1	0.8	237.7
PC	492	7.5	71.7	-518.6	-2.6	-0.1	2.9	786.0

Table Ⅳ

The Account-Level Disposition Effect Measure According to Investor Characteristics

This table reports the mean and t-statistics for DE, RC, and PC according to investor characteristics. DE is the difference of each investor's PGR and PLR. PGR is the number of trading days on realized gains divided by the number of trading days on realized gains plus the number of trading days on paper gains, and PLR is the number of trading days on realized losses divided by the number of trading days on realized losses plus the number of trading days on paper losses. RC is the sum of RG and RL, and PC is the sum of PG and PL. RG, RL, PG, and PL represent realized gains, realized losses, paper gains, and paper losses on daily basis. The sample consists of the trading experiences of 69,391 traders in the Korean stock index futures market over 556 trading days from Jan 2003 to Mar 2005. The t-statistics test the null hypothesis that the disposition effect measure is equal to zero and 5% statistical significance is indicated in bold.

Panel A: All Accounts

	N	DE	t-statistic	N	RC	t-statistic	N	PC	t-statistic
All	62,570	**0.078**	(76.79)	55,491	**-0.62**	(-14.62)	43,388	**-0.23**	(-3.34)

Panel B: Accounts Partitioned by Investor Types

Investor Types	N	DE	t-statistic	N	RC	t-statistic	N	PC	t-statistic
Individuals	53,203	**0.085**	(77.13)	49,110	**-0.39**	(-14.03)	35,569	**-0.29**	(-5.66)
Institutions	8,820	**0.040**	(14.66)	5,988	**-2.47**	(-8.25)	7,327	-0.47	(-1.91)
Foreigners	547	**0.031**	(3.79)	393	-0.59	(-0.38)	492	**7.50**	(2.32)

Table Ⅳ (continued)

Panel C: Accounts Partitioned by Trading Days									
Trading Days	N	DE	t-statistic	N	RC	t-statistic	N	PC	t-statistic
1(low)	8,023	**0.068**	(14.90)	3,961	**-1.38**	(-5.94)	3,874	0.18	(0.54)
2	13,400	**0.071**	(29.36)	11,141	**-0.65**	(-5.62)	7,367	**-0.58**	(-2.44)
3	13,620	**0.077**	(41.45)	13,050	**-0.53**	(-7.39)	9,380	**-0.49**	(-4.29)
4	13,690	**0.081**	(49.56)	13,537	**-0.51**	(-6.66)	10,667	-0.08	(-0.75)
5(high)	13,837	**0.088**	(55.44)	13,802	**-0.56**	(-7.61)	12,100	-0.09	(-0.78)
Panel D: Accounts Partitioned by Number of Trades									
No. of trades	N	DE	t-statistic	N	RC	t-statistic	N	PC	t-statistic
1(low)	11,560	**0.074**	(24.03)	6,880	**-0.65**	(-5.45)	9,552	**-0.35**	(-4.53)
2	12,039	**0.090**	(38.25)	10,895	**-0.61**	(-7.95)	8,554	**-0.31**	(-3.66)
3	12,722	**0.094**	(43.13)	12,097	**-0.46**	(-7.18)	8,333	**-0.29**	(-2.44)
4	13,062	**0.086**	(44.01)	12,705	**-0.50**	(-7.14)	8,717	**-0.30**	(-2.28)
5(high)	13,187	**0.047**	(27.17)	12,914	**-0.87**	(-6.78)	8,232	0.10	(0.34)
Panel E: Accounts Partitioned by Trading Volume									
Trading Volume	N	DE	t-statistic	N	RC	t-statistic	N	PC	t-statistic
1(low)	11,027	**0.100**	(32.54)	8,074	**-0.09**	(-15.04)	8,332	**-0.08**	(-16.55)
2	12,720	**0.093**	(41.02)	11,486	**-0.11**	(-19.91)	8,420	**-0.12**	(-16.03)
3	12,788	**0.084**	(40.14)	12,036	**-0.16**	(-17.67)	8,408	**-0.15**	(-11.41)
4	13,103	**0.064**	(33.13)	12,248	**-0.28**	(-11.21)	8,967	**-0.27**	(-9.63)
5(high)	12,932	**0.053**	(26.16)	11,647	**-2.31**	(-11.63)	9,261	-0.51	(-1.57)

Table Ⅳ (continued)

Panel F: Accounts Partitioned by Trading Value

Trading Value	N	DE	t-statistic	N	RC	t-statistic	N	PC	t-statistic
1(low)	11,166	**0.101**	(32.93)	8,179	**-0.09**	(-15.13)	8,279	**-0.08**	(-15.27)
2	12,505	**0.094**	(41.62)	11,333	**-0.12**	(-20.20)	8,403	**-0.12**	(-15.80)
3	12,917	**0.083**	(39.90)	12,193	**-0.17**	(-17.21)	8,617	**-0.17**	(-12.40)
4	13,051	**0.064**	(32.81)	12,140	**-0.28**	(-10.94)	8,888	**-0.27**	(-9.52)
5(high)	12,931	**0.052**	(25.76)	11,646	**-2.29**	(-11.53)	9,201	-0.50	(-1.54)

Panel G: Accounts Partitioned by Total Profits

Total Profits	N	DE	t-statistic	N	RC	t-statistic	N	PC	t-statistic
1(low)	13,694	**0.088**	(48.30)	12,035	**-2.52**	(-16.73)	12,364	**-2.81**	(-18.12)
2	13,535	**0.077**	(38.22)	12,616	**-0.33**	(-34.27)	9,933	**-0.27**	(-21.59)
3	12,166	**0.063**	(24.88)	11,267	**-0.21**	(-34.15)	5,199	**-0.13**	(-5.81)
4	9,755	**0.101**	(31.12)	8,558	**-0.04**	(-4.22)	4,224	0.02	(0.99)
5(high)	13,420	**0.065**	(33.04)	11,015	**0.27**	(2.06)	11,668	**2.38**	(12.11)

Table Ⅴ

The Impact of Investor Characteristics on the Disposition Effect

This table reports the results of cross-sectional regression of investor characteristics on the disposition effect. The regression takes the following form;

$$DE_i = \alpha + \beta_1 INS + \beta_2 FOR + \beta_3 TRDDAYS_i + \beta_4 NTRD_i + \beta_5 VALUE_i + \beta_6 PROFIT_i + e_i$$

where DE_i is the disposition effect measure which is the difference between PGR and PLR in account *i*, INS is dummy variable for institutional investors, FOR is dummy variable for foreign investors, $TRDDAYS_i$ is *ln*(the number of trading days) in account *i*, $NTRD_i$ is *ln*(daily average number of trades) in account *i*, $VALUE_i$ is *ln*(daily average trading value) in account *i*, and $PROFIT_i$ is total profits (KRW one thousand) in account *i* or total profits/daily average trading value in account *i*. PGR is the number of trading days on realized gains divided by the number of trading days on realized gains plus the number of trading days on paper gains, and PLR is the number of trading days on realized losses divided by the number of trading days on realized losses plus the number of trading days on paper losses. RG, RL, PG, and PL represent realized gains, realized losses, paper gains, and paper losses on daily basis. The sample consists of the trading experiences of 69,391 traders in the Korean stock index futures market over 556 trading days from Jan 2003 to Mar 2005. The t-statistics are in parenthesis and 5% statistical significance is indicated in bold. Standard errors are adjusted for heteroscedasticity according to White (1980).

Dependent variable	DE						
Model No.	1	2	3	4	5	6	7
Intercept	**0.072**	**0.110**	**0.146**	**0.085**	**0.084**	**0.113**	**0.113**
	(20.29)	(43.25)	(26.31)	(77.13)	(76.81)	(17.55)	(17.57)
INS	**-0.042**	**-0.052**	**-0.034**	**-0.045**	**-0.045**	**-0.040**	**-0.041**
	(-14.13)	(-17.09)	(-11.37)	(-15.07)	(-15.15)	(-11.62)	(-11.71)
FOR	**-0.056**	**-0.052**	**-0.038**	**-0.053**	**-0.053**	**-0.045**	**-0.045**
	(-6.84)	(-6.30)	(-4.62)	(-6.47)	(-6.58)	(-5.32)	(-5.40)
$TRDDAYS_i$	**0.004**					**0.009**	**0.009**
	(4.36)					(9.41)	(9.23)
$NTRD_i$		**-0.015**				**-0.014**	**-0.014**
		(-12.64)				(-7.85)	(-7.80)
$VALUE_i$			**-0.010**			**-0.006**	**-0.006**
			(-11.80)			(-4.47)	(-4.46)
$PROFIT_i$ (total)				**-0.002**		**-0.001**	
				(-3.83)		(-2.47)	
$PROFIT_i$ (relative)					**-0.032**		**-0.027**
					(-9.02)		(-7.67)
Adj. R^2	0.004	0.007	0.006	0.004	0.004	0.009	0.009
N	62,570	62,570	62,570	62,570	62,570	62,570	62,570

Table Ⅵ

The Market-Level Disposition Effect

This table compares the market-level DE. DE is the difference of PGR and PLR. PGR is the number of trading days on realized gains divided by the number of trading days on realized gains plus the number of trading days on paper gains, and PLR is the number of trading days on realized losses divided by the number of trading days on realized losses plus the number of trading days on paper losses. RG, RL, PG, and PL represent realized gains, realized losses, paper gains, and paper losses on daily basis. RG, RL, PG, and PL are aggregated over time (Jan 2003-Mar 2005) and across all accounts in the data set. The t-statistics test the null hypotheses that the difference in proportions are equal to zero assuming that all realized gains, paper gains, realized losses, and paper losses result from independent decisions. To calculate the t-statistics, the standard error for the difference of PGR and PLR is

$$\sqrt{\frac{PGR(1-PGR)}{n_{RG}+n_{PG}}+\frac{PLR(1-PLR)}{n_{RL}+n_{PL}}}$$

where n_{RG}, n_{PG}, n_{RL}, and n_{PL} are the number of realized gains, paper gains, realized losses, and paper losses. Panel A reports the disposition effect at the aggregate level by investor types. Panel B reports the disposition effect at the aggregate level by investor types and the long (short) positions. Since we calculate RG, RL, PG, and PL on a daily basis, we exclude the trade which buy trade and sell trade execute on a same day.

Panel A: All Accounts

	N	RG	RL	PG	PL	PGR	PLR	DE	t-statistic
All	4,440,402	1,477,817	1,144,222	1,165,144	1,289,418	0.559	0.470	**0.089**	201.2
Individuals	3,715,129	1,360,518	1,038,841	872,695	991,727	0.609	0.512	**0.098**	203.7
Institutions	623,220	97,217	88,508	247,673	252,387	0.282	0.260	**0.022**	20.7
Foreigners	102,053	20,082	16,873	44,776	45,304	0.310	0.271	**0.038**	15.0

Table Ⅵ (continued)

Panel B: All Accounts which Exclude Daily Closing Trade

	N	RG	RL	PG	PL	PGR	PLR	DE	t-statistic
All	1,371,769	102,336	77,908	418,236	520,274	0.197	0.130	**0.066**	94.5
Short	670,485	46,177	41,951	196,136	265,953	0.191	0.136	**0.054**	53.8
Long	701,284	56,159	35,957	222,100	254,321	0.202	0.124	**0.078**	79.9
Individuals	1,148,208	91,509	67,710	326,343	425,560	0.219	0.137	**0.082**	101.4
Short	548,604	39,024	34,504	149,003	215,035	0.208	0.138	**0.069**	59.6
Long	599,604	52,485	33,206	177,340	210,525	0.228	0.136	**0.092**	82.4
Institutions	177,303	10,093	9,420	70,612	72,860	0.125	0.114	**0.011**	6.6
Short	98,800	6,804	7,001	36,715	39,825	0.156	0.150	**0.007**	2.9
Long	78,503	3,289	2,419	33,897	33,035	0.088	0.068	**0.020**	10.2
Foreigners	46,258	734	778	21,281	21,854	0.033	0.034	-0.001	-0.6
Short	23,081	349	446	10,418	11,093	0.032	0.039	**-0.006**	-2.5
Long	23,177	385	332	10,863	10,761	0.034	0.030	0.004	1.8

Table Ⅶ

The Impact of Investor Characteristics on the Performance

This table reports the results of cross-sectional regression of investor characteristics on the performance. The regression takes the following form;

$$PROFIT_i = \alpha + \beta_1 INS + \beta_2 FOR + \beta_3 DE_i + \beta_4 TRDDAYS_i + \beta_5 NTRD_i + \beta_6 VALUE_i + e_i$$

where $PROFIT_i$ is total profits in account *i* or total profits/daily average trading value in account *i*, INS is dummy variable for institution investors, FOR is dummy variable for foreign investors, DE_i is the disposition effect measure which is the difference between PGR and PLR in account *i*, $TRDDAYS_i$ is *ln*(the number of trading days) in account *i*, $NTRD_i$ is *ln*(daily average number of trades) in account *i*, $VALUE_i$ is *ln*(daily average trading value) in account *i*. PGR is the number of trading days on realized gains divided by the number of trading days on realized gains plus the number of trading days on paper gains, and PLR is the number of trading days on realized losses divided by the number of trading days on realized losses plus the number of trading days on paper losses. RG, RL, PG, and PL represent realized gains, realized losses, paper gains, and paper losses on daily basis. The sample consists of the trading experiences of 69,391 traders in the Korean stock index futures market over 556 trading days from Jan 2003 to Mar 2005. The t-statistics are in parenthesis and 5% statistical significance is indicated in bold. Standard errors are adjusted for heteroscedasticity according to White (1980).

Dependent variable	Total profits				Total profits/ Daily avg. trading value			
Model No.	1	2	3	4	1	2	3	4
Intercept	-20.92	-54.95	**-162.88**	-141.85	**0.007**	**-0.012**	**-0.016**	-0.003
	(-1.06)	(-1.91)	(-2.17)	(-1.93)	(3.31)	(-9.14)	(-5.05)	(-0.78)
INS	**-31.77**	-19.47	**-62.42**	**-52.69**	**-0.015**	**-0.011**	**-0.013**	**-0.015**
	(-2.10)	(-1.08)	(-4.21)	(-2.49)	(-3.84)	(-3.16)	(-3.52)	(-3.73)
FOR	**870.61**	**868.15**	**829.71**	**837.57**	0.024	0.023	0.021	0.022
	(2.05)	(2.05)	(2.02)	(2.02)	(1.17)	(1.07)	(0.99)	(1.07)
DE_i	**-31.51**	**-24.82**	**-24.39**	**-23.33**	**-0.012**	**-0.012**	**-0.012**	**-0.010**
	(-4.17)	(-2.76)	(-2.79)	(-2.62)	(-11.96)	(-11.68)	(-11.83)	(-10.22)
$TRDDAYS_i$	6.54			-2.35	**-0.005**			**-0.006**
	(1.03)			(-0.87)	(-7.61)			(-7.79)
$NTRD_i$		33.74		11.88		**0.002**		**0.004**
		(1.89)		(0.66)		(2.68)		(3.00)
$VALUE_i$			**27.35**	21.83			**0.001**	0.001
			(2.15)	(1.73)			(2.31)	(1.52)
Adj. R^2	0.006	0.006	0.007	0.007	0.003	0.001	0.001	0.004
N	62,570	62,570	62,570	62,570	62,570	62,570	62,570	62,570

Table Ⅷ

Prior Disposition Effect and Current Performance

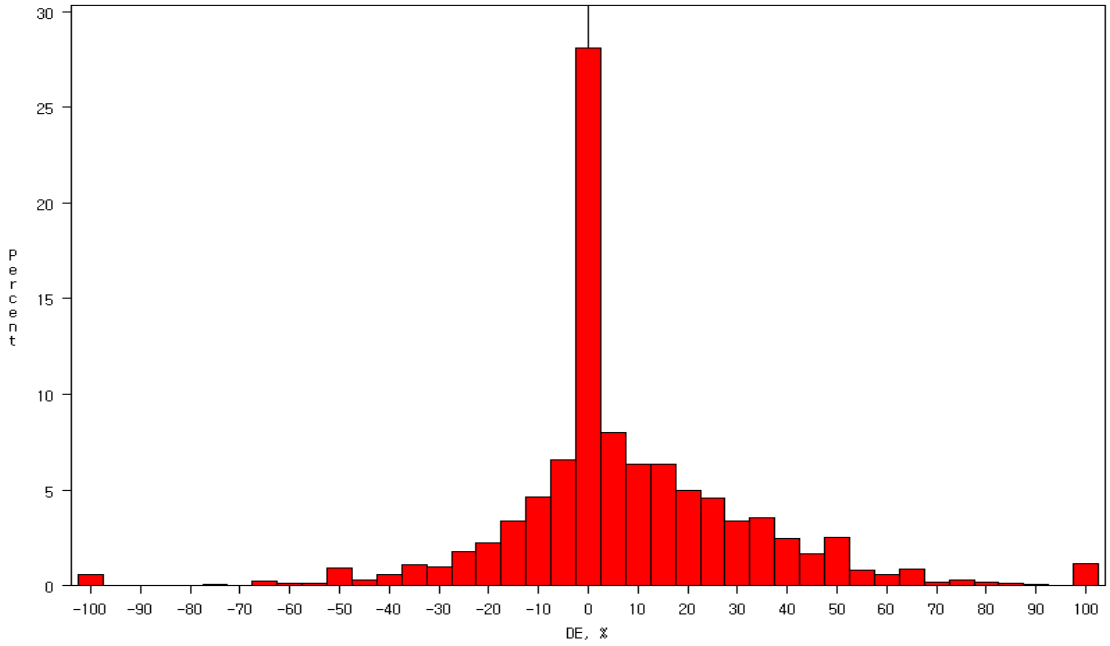
This table reports the results of cross-sectional regression of investor characteristics on the performance. Regressions take the following form;

$$PROFIT_i^{2004} = \alpha + \beta_1 INS + \beta_2 FOR + \beta_3 DE_i^{2003} + \beta_4 TRDDAYS_i^{2004} + \beta_5 NTRD_i^{2004} + \beta_6 VALUE_i^{2004} + e_i$$

where $PROFIT_i^{2004}$ is total profits in account *i* in 2004 or total profits/daily average trading value in account *i* in 2004, INS is dummy variable for institution investors, FOR is dummy variable for foreign investors, DE_i^{2003} is the disposition effect measure which is the difference between PGR and PLR in account *i* in 2003, $TRDDAYS_i^{2004}$ is *ln*(the number of trading days) in account *i* in 2004, $NTRD_i^{2004}$ is *ln*(daily average number of trades) in account *i* in 2004, $VALUE_i^{2004}$ is *ln*(daily average trading value) in account *i* in 2004. PGR is the number of trading days on realized gains divided by the number of trading days on realized gains plus the number of trading days on paper gains, and PLR is the number of trading days on realized losses divided by the number of trading days on realized losses plus the number of trading days on paper losses. RG, RL, PG, and PL represent realized gains, realized losses, paper gains, and paper losses on daily basis. The sample consists of 12,641 traders in the Korean stock index futures market over 556 trading days from Jan 2003 to Dec 2004, who trade at least 10 days for each year. The t-statistics are in parenthesis and 5% statistical significance is indicated in bold. Standard errors are adjusted for heteroscedasticity according to White (1980).

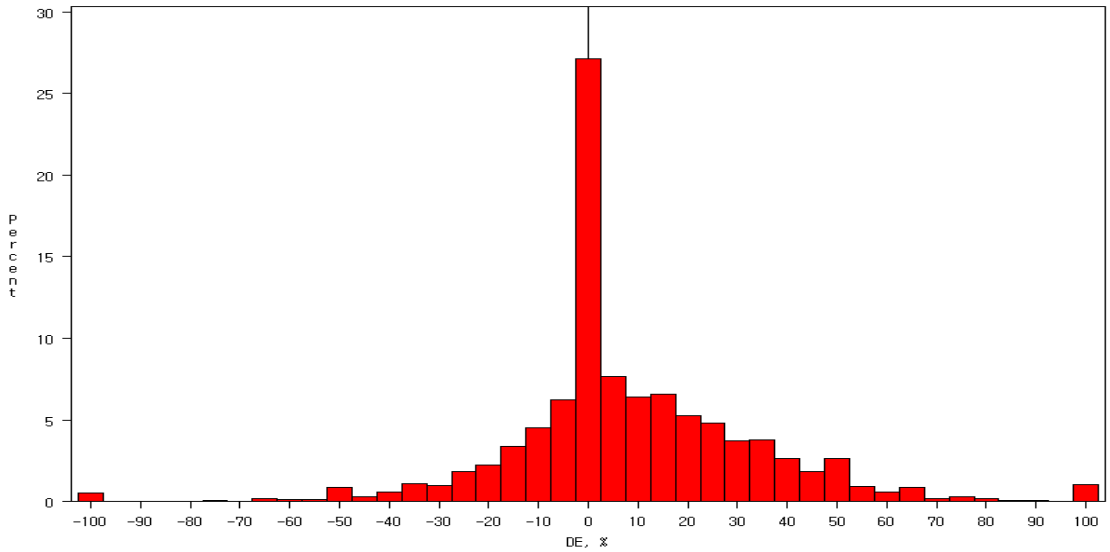
Dependent	Total profits				Total profits/			
Model No.	1	2	3	4	1	2	3	4
Intercept	-27.58	**-92.32**	**-342.50**	**-327.51**	**-0.016**	**-0.032**	**-0.059**	**-0.048**
	(-0.91)	(-3.81)	(-5.93)	(-4.74)	(-5.22)	(-12.65)	(-9.94)	(-6.67)
INS	45.63	61.91	-20.23	-31.74	**0.013**	**0.016**	0.006	0.006
	(1.22)	(1.66)	(-0.53)	(-0.74)	(3.24)	(4.14)	(1.44)	(1.38)
FOR	**824.25**	**806.51**	**706.16**	**701.79**	**0.033**	**0.030**	0.019	**0.021**
	(8.62)	(8.43)	(7.24)	(7.10)	(3.37)	(3.04)	(1.85)	(2.02)
DE_i	-35.08	-26.93	-17.96	-16.07	**-0.028**	**-0.027**	**-0.026**	**-0.025**
	(-0.61)	(-0.47)	(-0.31)	(-0.28)	(-4.68)	(-4.49)	(-4.34)	(-4.26)
$TRDDAYS_i$	7.50			-13.88	-0.001			**-0.004**
	(0.91)			(-1.50)	(-0.97)			(-4.40)
$NTRD_i$		**59.81**		3.42		0.009		**0.005**
		(4.45)		(0.16)		(6.14)		(2.40)
$VALUE_i$			**57.19**	**61.41**			**0.007**	**0.006**
			(6.05)	(4.21)			(6.95)	(3.84)
Adj. R^2	0.006	0.007	0.009	0.009	0.004	0.006	0.007	0.009
N	12,641	12,641	12,641	12,641	12,641	12,641	12,641	12,641

Panel A. All Accounts

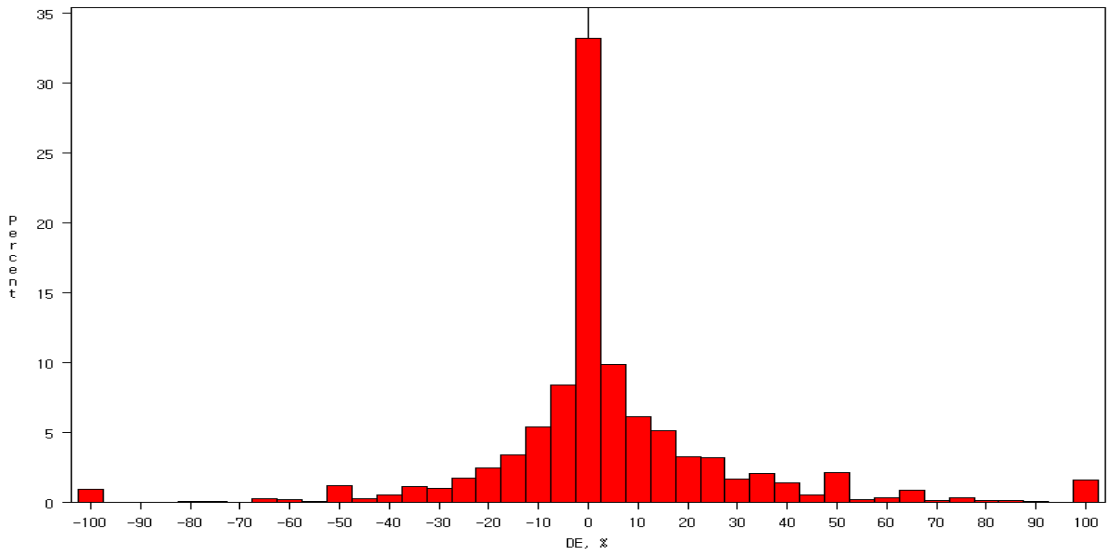


Panel B. Accounts Partitioned by Investor Types

Individuals



Institutions



Foreigners

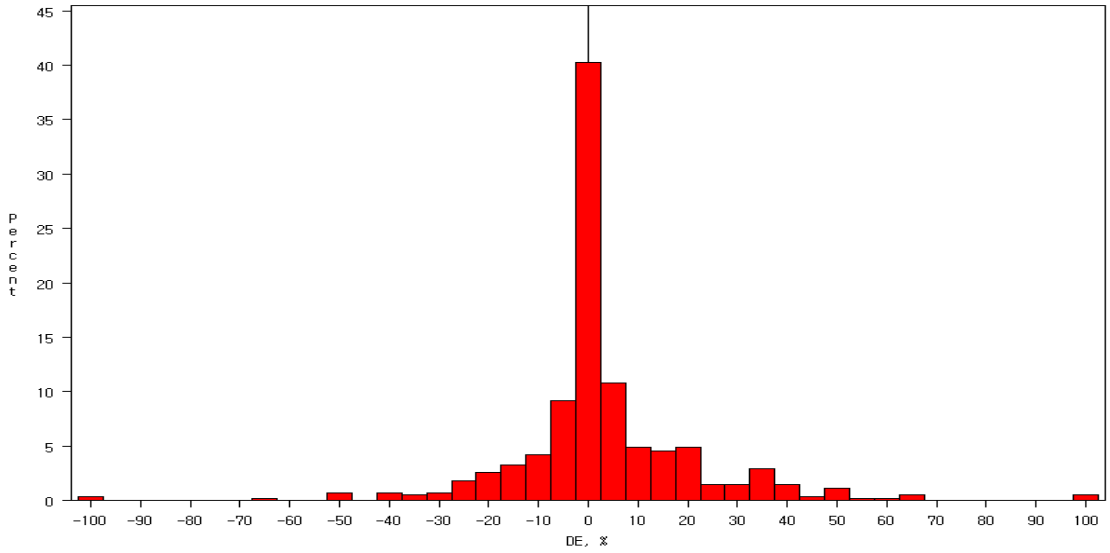
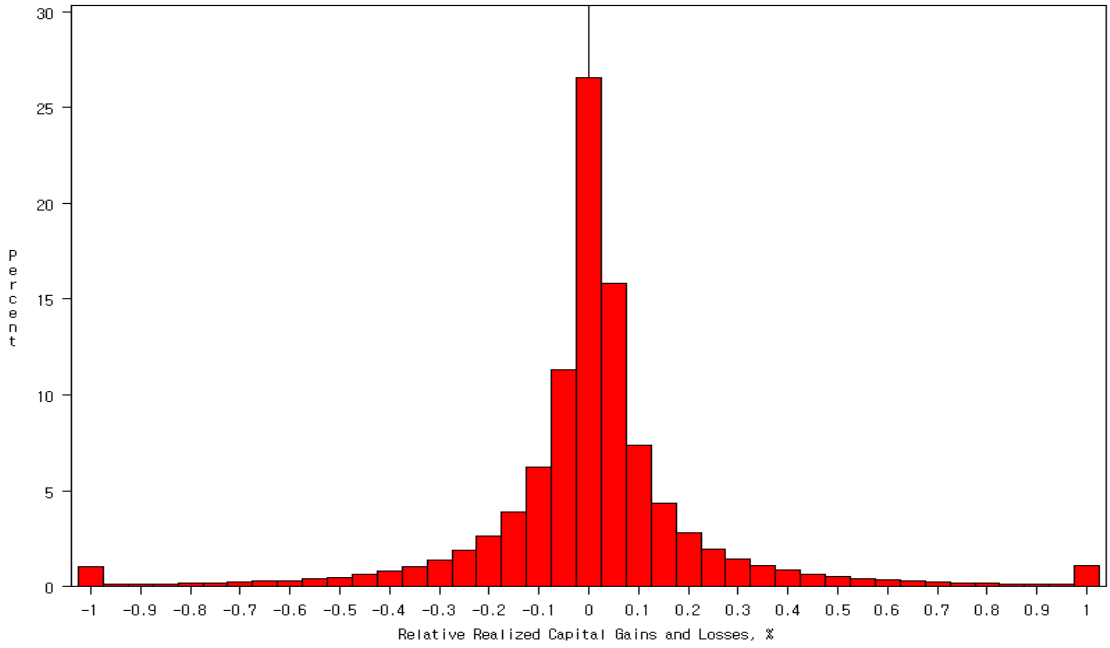


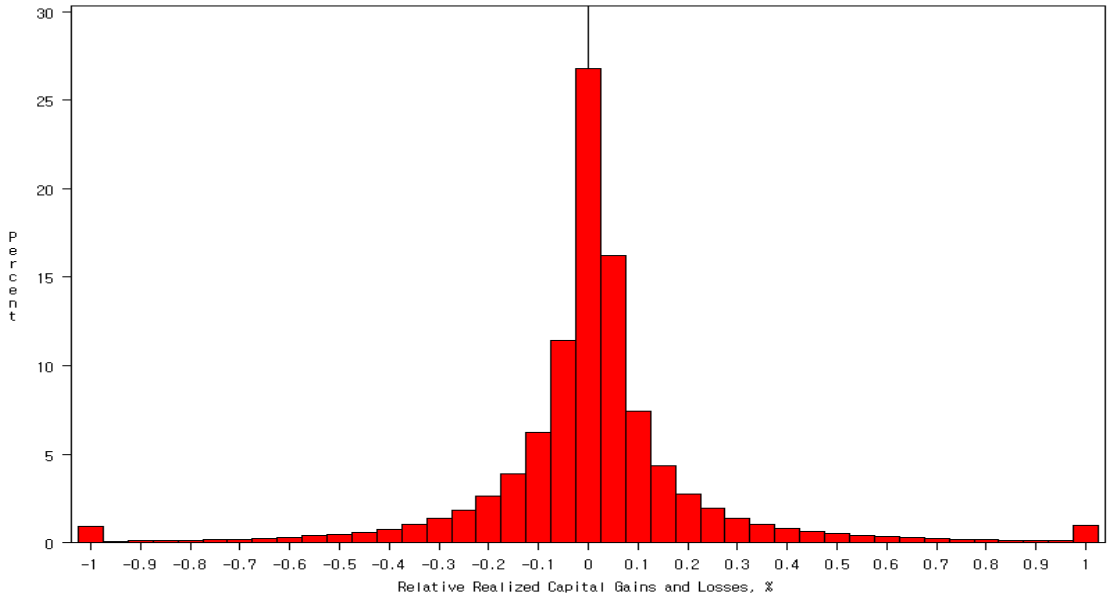
Figure 1. Distribution of the Account-Level Disposition Effect. DE is the difference of each investor's PGR and PLR. PGR is the number of trading days on realized gains divided by the number of trading days on realized gains plus the number of trading days on paper gains, and PLR is the number of trading days on realized losses divided by the number of trading days on realized losses plus the number of trading days on paper losses. RC is the sum of RG and RL, and PC is the sum of PG and PL. RG, RL, PG, and PL represent realized gains, realized losses, paper gains, and paper losses on daily basis. The sample consists of the trading experiences of 69,391 traders in the Korean stock index futures market over 556 trading days from Jan 2003 to Mar 2005.

Panel A. All Accounts

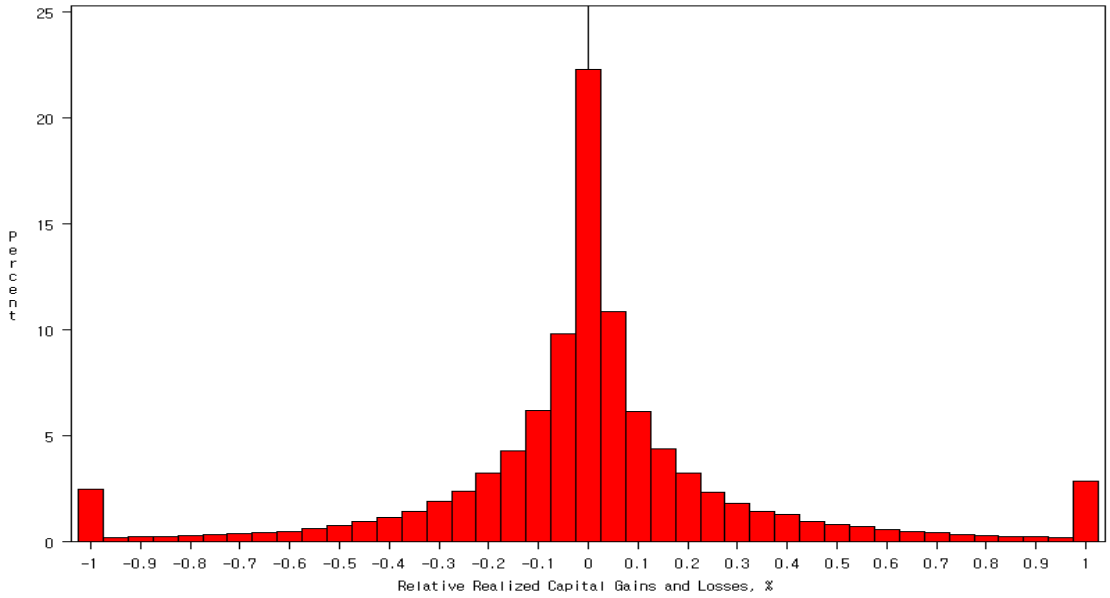


Panel B. Accounts Partitioned by Investor Types

Individuals



Institutions



Foreigners

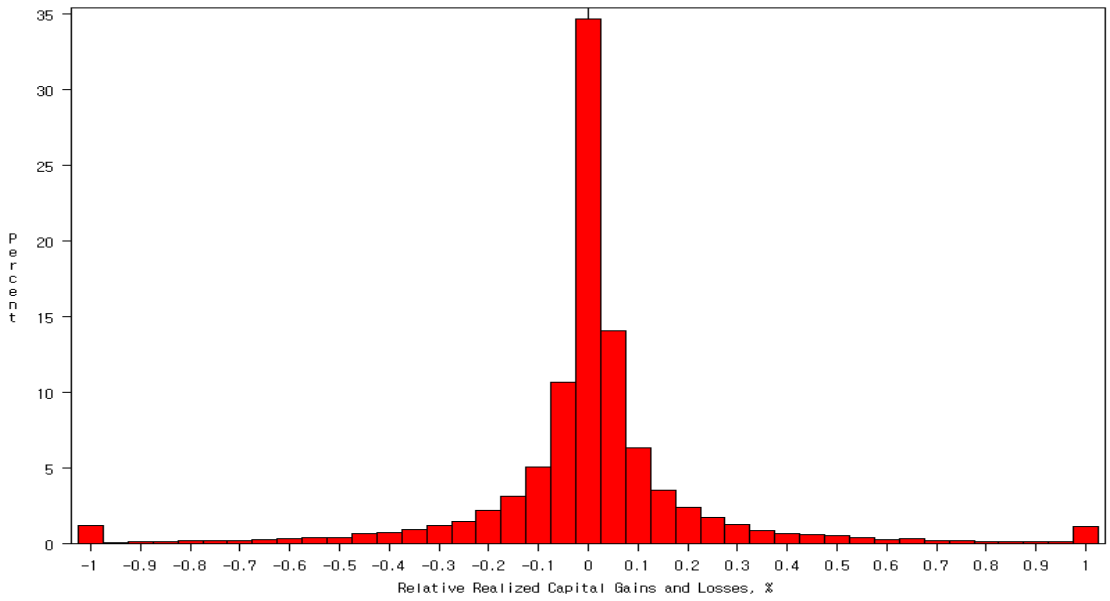
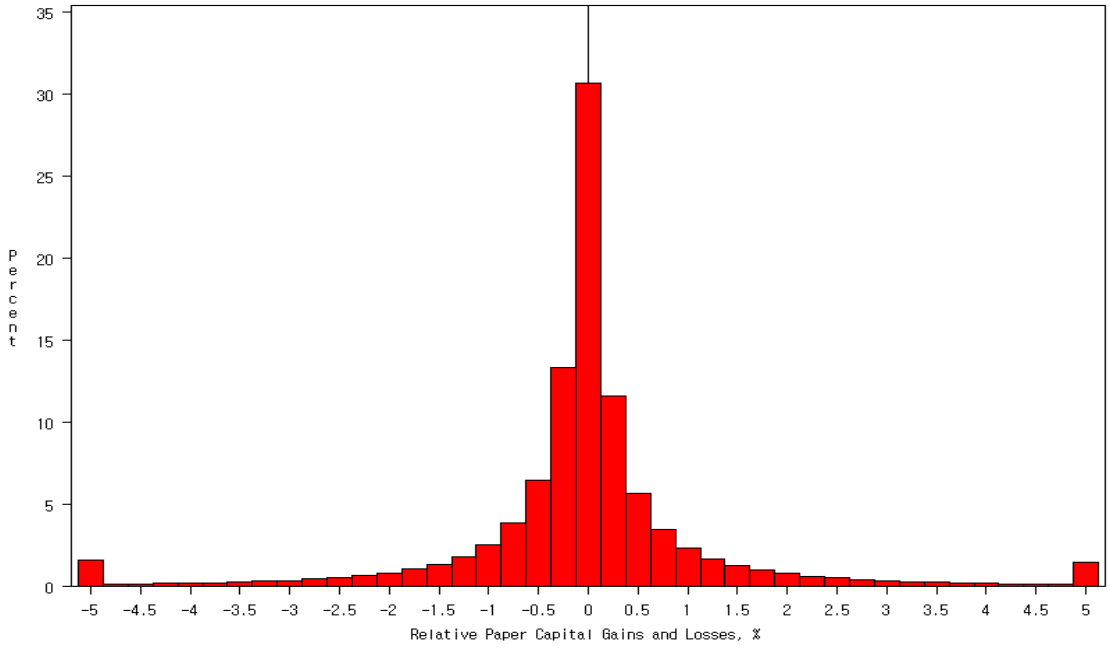


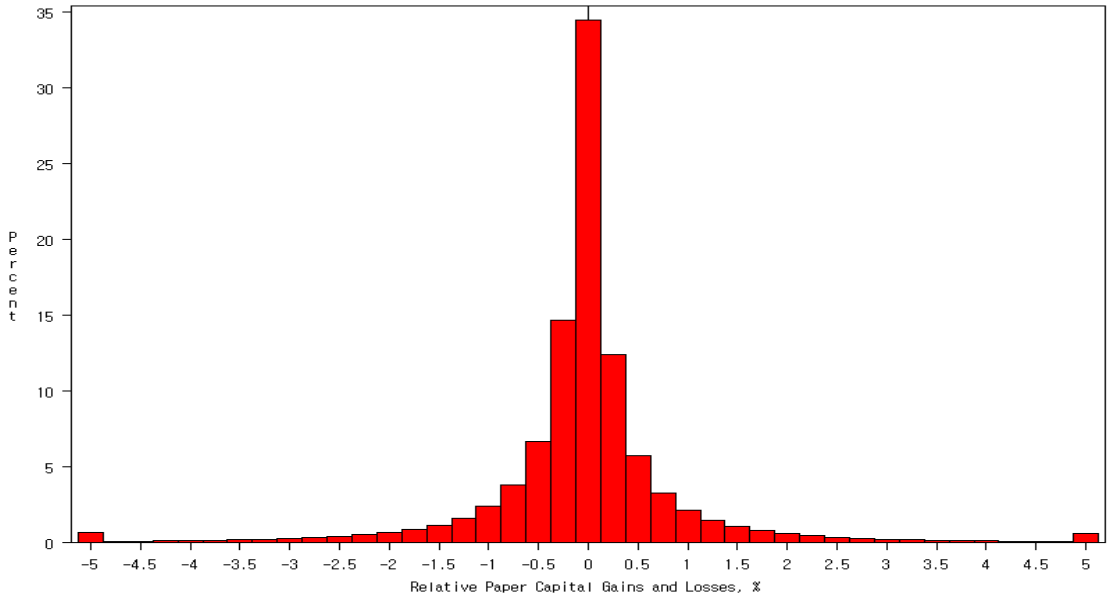
Figure 2. Distribution of Relative Realized Capital Gains and Losses. Relative realized capital gains and losses are the sum of RG and RL over daily average trading value . RG and RL represent realized gains and realized losses on daily basis. The sample consists of the trading experiences of 69,391 traders in the Korean stock index futures market over 556 trading days from Jan 2003 to Mar 2005.

Panel A. All Accounts

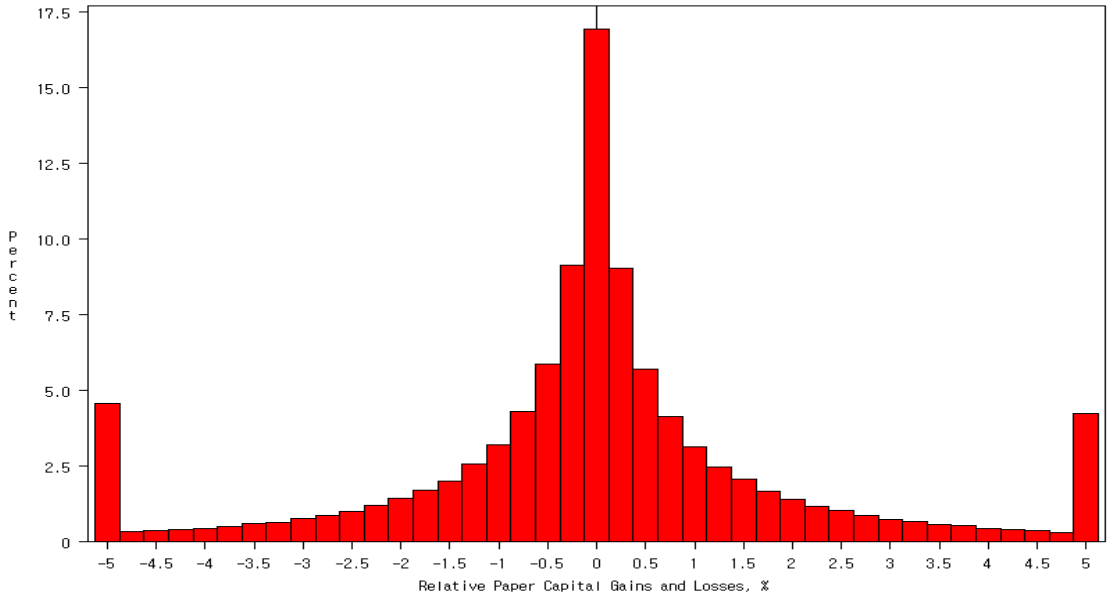


Panel B. Accounts Partitioned by Investor Types

Individuals



Institutions



Foreigners

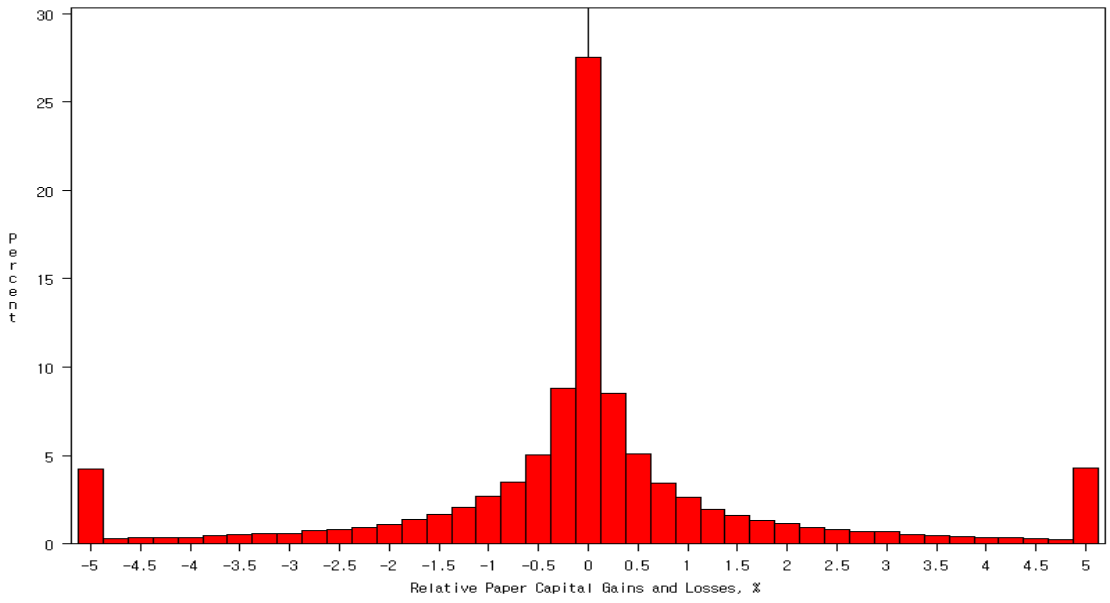
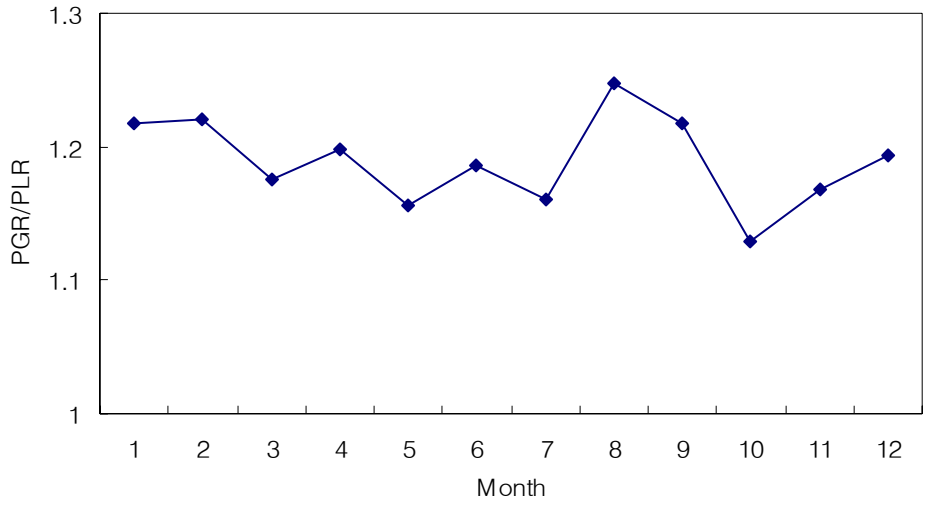


Figure 3. Distribution of Relative Paper Capital Gains and Losses. Relative paper capital gains and losses are the sum of PG and PL over daily average trading value. PG and PL represent paper gains and paper losses on daily basis. The sample consists of the trading experiences of 69,391 traders in the Korean stock index futures market over 556 trading days from Jan 2003 to Mar 2005.

Panel A. All Accounts



Panel B. Accounts Partitioned by Investor Types

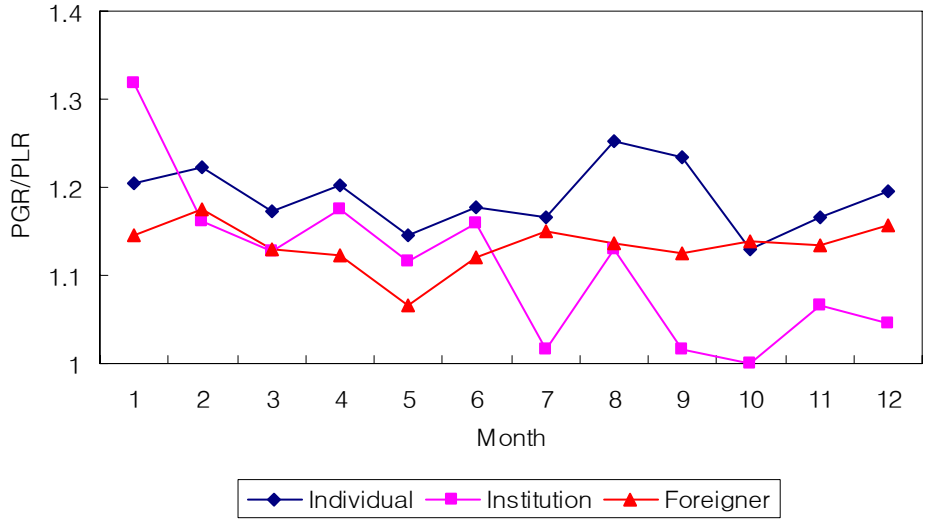


Figure 4. Ratio of PGR to PLR for each Month. PGR is the number of trading days on realized gains divided by the number of trading days on realized gains plus the number of trading days on paper gains, and PLR is the number of trading days on realized losses divided by the number of trading days on realized losses plus the number of trading days on paper losses. RG, RL, PG, and PL represent realized gains, realized losses, paper gains, and paper losses on daily basis. RG, RL, PG, and PL are aggregated over time (Jan 2003-Dec 2004) and across all accounts in the data set.