The Disposition Effect in the Futures Market †

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First Draft: May 15, 2006

JEL Classification: G11, G15, G24

Keywords: The disposition effect; Prospect theory; Futures; Experience

† I am especially grateful to Hyuk Choe for his encouragement, many insightful comments, and help with the data. All errors are mine.
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Abstract

This paper tests whether the “disposition effect”, which is the tendency of investors to ride losses and realize gains, exists in the Korean index futures market. Using a unique database, I find strong evidence for the disposition effect and explain this in terms of investor characteristics. I also investigate the effect the disposition bias 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 for long positions than short positions. Finally, there is a negative relationship between the disposition effect and investment performance. Besides, two findings that foreign investors outperform domestic investors and trading frequently may not be hazardous to investor’s wealth in the Korean index futures market are worth noting.

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)). While investors keep a separate mental account for each stock, they maximize 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 a stock appreciates in price, the investor's wealth will be in a risk-averse domain, making a sale more likely. In contrast, if the stock is trading below its reference price, the investor becomes risk loving and will hold on to the stock for a chance to break even.

In this paper, I focus on the disposition effect in the Korean index futures market. The Korean index futures market offers a number of unique advantages in assessing behavioral biases. First, since individual investors trade actively, the Korean index futures market is a good laboratory to study individual investors' behavioral biases. In 2004, individual investors take 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 index futures market is ranked 4th. 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.

I examine the hypothesis with all transactions dataset on the Korean index futures market. Because I 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 to find behavioral biases and to interpret these results. I estimate the magnitude of the disposition effect for all market participants at the account-level as well as at the market-level. I examine the disposition effect across investor types and the relationship between the disposition effect and investor trading characteristics. I also analyze the disposition effect in short positions as well as in long positions, and test whether the disposition effect is a costly behavioral bias.

Using a data set of all trades on the Korean index futures market from January 2, 2003, to May 31, 2005, I 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. I also find that sophisticated and experienced investor classes 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 it cannot eliminate them. There is also an asymmetric disposition effect between long positions and short positions. The disposition effect is stronger for long positions than short positions. Testing the hypothesis that the disposition effect is a costly behavioral bias, I find some results that the disposition bias has a negative effect on investment performance. Besides, two findings are worth noting. First, foreign investors outperform domestic investors in the Korean index futures market. Second, trading frequently may not be hazardous to investor's wealth in the Korean index futures market.

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

2. Literature Review[1]

2.1 Prospect Theory

The disposition effect, introduced into the finance literature by Shefrin and Statman (1985), refers to the tendency to hold losers too long and sell winners too soon. The theoretical framework they employ is an extension of the behavioral model which combines the ideas of prospect theory (Kahneman and Tversky (1979)) and mental accounting (Thaler (1985)).

Kahneman and Tvesky (1979), in the original presentation of prospect theory, suggest an "S"-shaped value function, which is defined on gains and losses relative to a reference point, rather than an absolute wealth. Specifically, they state that the value function is (i) defined on deviations from the reference point; (ii) generally concave for gains and commonly convex for losses; (iii) steeper for losses than gains.

Thaler (1985) has developed the model starts with the mental coding of combinations of gains and losses using the prospect theory value function. Mental accounting provides a foundation for the way in which decision makers set reference points for the accounts that determine gains and losses. The main idea is that decision makers tend to segregate different types of gambles into separate accounts, and then apply prospect theory to each account by ignoring possible interactions.

Thaler and Johnson (1990) find that when faced with sequential gambles, people are more willing to take risk if they made money on prior gambles, than if they lost. The result that risk aversion goes down after prior gains has been labeled the "house money effect". They also suggest from real money experiments supporting "break-even effects" that in the presence of prior losses, outcomes which offer a chance to break even are especially attractive.

Benartzi and Thaler (1995) examine single-period portfolio choice for an investor with

[1] See Hirshleifer (2001) or Barberis and Thaler (2003) for reviews of behavioral finance.

prospect-type utility. They suggest myopic loss aversion, which assume that people are myopic in evaluating outcomes over time, and are more sensitive to losses than to gains, to provide a theoretical foundation for the observed equity premium puzzle. Myopic loss aversion is a combination between loss aversion (Kahneman and Tvesky (1979)) and mental accounting (Thaler (1985)). They find that loss aversion makes investor reluctant to invest in stocks, even in the face of a sizable equity premium.

Barberis, Huang, and Santos (2001) introduce loss aversion over financial wealth fluctuations into a dynamic equilibrium model. They suggest that time varying risk aversion which incorporates the effect of prior outcome is essential to explain the equity premium. They find that their framework can help explain the high mean, excess volatility, and predictability of stock returns, as well as their low correlation with consumption growth. Employing the house money effect, they also suggest that investors become more risk tolerant when their risky asset holdings earn returns that exceed a historical benchmark.

Baberis and Huang (2001) apply Barberis, Huang, and Santos' (2001) ideas to individual stocks. They suggest that when investors hold a number of different stocks, narrow framing may induce them to derive utility from gains and losses in the value of individual stocks.

Grinblatt and Han (2005) develop a theoretical model to explain the equilibrium price implications of the disposition effect. They 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. Intuitively, if disposition-prone investors are holding a stock for which good news is revealed, they will sell their shares as price rise, decreasing any upward pressure on the stock price. Similarly, if disposition-prone investors are holding a stock for which bad news is revealed, they will hold their shares rather than sell on the news, again decreasing any downward pressure on the stock price. This allows them to relate momentum to the amount of

unrealized capital gains/losses and to derive cross-sectional implications they use to test their model. They find that a capital gains variable appears to be the key variable that generates the profitability of a momentum strategy.

Kyle, Ou-Yang, and Xiong (2006) provide a formal framework to analyze the liquidation decisions of economic agents under prospect theory. Their model shows two forces in play. The convexity in the agent's direct value function of losses can induce the agent to delay liquidation. Loss aversion induces the agent to be more risk averse near the reference point, and can induce liquidation near this point. Their model suggests that prospect theory preferences induce the agent to delay liquidation of a relatively inferior project if it is in losses and to accelerate liquidation of a relatively superior project if it is in gains.

2.2 The Disposition Effect in the Stock Market

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.

Odean (1998) demonstrates the existence of the disposition effect with empirical evidence from a large sample of individual investors in U.S. stock market. By analyzing trading records for 10,000 accounts at a major discount brokerage firm, he shows that individual investors have a strong preference for realizing winners rather than losers. He also shows that on average, the trades that these traders place appear irrational. The stocks that individual investors buy tend to underperform the stocks that they sell. Finally, he reports that tax-motivated selling is most evident in December.

Grinblatt and Keloharju (2001) find evidence that investors are reluctant to realize losses except in December, after controlling for trading style and many other factors. They also find significant differences in trading styles between Finnish retail investors and foreign institutions, as does Grinblatt and Keloharju (2000), suggesting that professionals could differ from retail customers. However, little evidence has been offered as to whether the disposition effect influences the decisions of professional traders.

Ranguelova (2001) analyzes the daily trading records of 78,000 clients of a discount brokerage house and finds that the disposition effect is concentrated primarily in large-cap stocks. Trades in stocks at the bottom 40 percent of the market capitalization distribution exhibit a reverse disposition effect. She also finds that the relationship between firm size and the disposition effect appears to be monotonic.

Shapira and Venezia (2001) use data from Tel Aviv Stock Exchange to show that both professional and independent investors exhibit the disposition effect, although the effect is stronger for independent investors. Additionally, there is considerable evidence (Grinblatt and Keloharju (2001), Jin and Scherbina (2005), Shumway and Wu (2005), Frazzini (2006)) that relatively more sophisticated institutional investors exhibit the disposition effect, even though the magnitude of their bias is weaker than individual investors.

Goetzmann and Massa (2003) derive several additional implications of Grinblatt and Han (2005) model about the expected relationship between the preponderance of disposition-prone investors in a market and volume, volatility, and stock returns. They show that in a period of rising prices, there is a significant negative correlation between the prevalence of disposition investor trades and turnover or volatility. Consistent with Grinblatt and Han (2005), they find that a behavioral factor capturing the stochastic change in the percentage of disposition investors is significantly negatively related to returns when the capital gains overhang is

positive. Further, their results suggest that exposure to this disposition factor seems to be priced.

Wermer (2003) shows that mutual fund returns strongly persist over multi-year periods and managers of underperforming funds appear reluctant to sell their losing stocks to finance the purchase of new momentum socks, which is consistent with the disposition effect.

Feng and Seasholes (2005) use account-level data from a national brokerage firm in the People's Republic of China and show that together, sophistication (static differences across investors) and trading experience (evolving behavior of a single investor) eliminate the reluctance to realize losses. However, an asymmetry exists as sophistication and trading experience reduce the propensity to realize gains by 37%, but fail to eliminate this part of investor behavior.

Jin and Scherbina (2005) document that mutual fund managers exhibit the disposition bias. They show that new fund managers, who are emotionally unattached to their predecessors' decisions, sell the momentum losers they have inherited more readily than continuing managers.

Shumway and Wu (2005) use data from a large Shanghai brokerage firm and find that a large majority of Chinese investors exhibit the disposition effect. They show that investors that exhibit the bias most strongly in one period have inferior investment performance in subsequent periods, and trade less frequently and in a smaller sizes. Accounts associated with corporations or brokerage firms exhibit significantly less disposition than individual accounts. They also find evidence supporting Grinblatt and Han (2005) model that disposition drives momentum.

Dhar and Zhu (2006) find that the tendency towards the disposition effect differs among individual investors depending upon personal characteristics. Using demographic and socio-economic data as proxies for investors' sophistication, they show that, within the individual investor category, investors who are more sophisticated exhibit weaker disposition effect. Investors' income, professional occupations, trading experience, age, and portfolio size are

negatively related to the disposition effect.

Frazzini (2006) suggests that the disposition effect can induce underreaction to news, leading to return predictability and post-announcement drift. He finds additional support for Grinblatt and Han (2005) model by showing that the post-announcement drift following earnings surprise and changes in analyst recommendations is most severe when capital gains and the news have the same sign. Moreover, the magnitude of the post-announcement drift is directly related to the amount of unrealized capital gains/losses experienced by the stockholders at the announcement date. He also finds that a holding-based proxy for capital gains is a better predictor of returns than both past returns and turnover-based proxy for capital gains.

Kumar (2006), using Odean's (1998) database, finds that investors are more confident and exhibit stronger disposition effect when stocks are more difficult to value. He also shows that behavioral biases are stronger when there is greater market-wide uncertainty, as reflected by higher mean stock-level volatility and higher unemployment rate.

2.3 The Disposition Effect in the Other Markets

Heath, Huddart, and Lang (1999) use data on the option exercising behavior of over 50,000 employees at seven big companies and report that psychological factors affect exercise behavior. They find that the early exercise of executive stock options is triggered by the underlying stock price reaching a yearly high and by positive returns on the underlying stocks.

Genesove and Mayer (2001) shed further light on investor irrationality by analyzing loss aversion and seller behavior in the housing market using data from downtown Boston. They report that owners who are averse to losses set a higher asking price, spend a longer time on the market, and receive a higher transaction price upon a sale. Housing fits Kyle, Ou-Yang, and

Xiong's (2006) model in that a house is an indivisible asset which cannot easily be partially liquidated.

O'Connell and Teo (2003) using a detailed database of currency trading decisions of institutional investors show that past performance manifestly affects currency risk-taking in this group, but the sign and magnitude of the effect runs counter to much of the existing theory and evidence. There is no evidence of the disposition effect; rather, the dominant characteristic is aggressive risk reduction following losses. They think that a modified version of the loss aversion model of Barberis, Huang, and Santos (2001) accounts for the observed behavior.

Poteshman and Serbin (2003) analyze the rationality of early exercises of Chicago Board Option Exchange (CBOE) calls by discount customers, full-service customers, and firm proprietary traders. They find that customers of discount brokers and customers of full-service brokers both engage in a significant number of irrational exercises while traders at large investment houses exhibit no irrational early exercise behavior. They also find that exercise is triggered by its highest level over the past years and by high returns on the underlying stock.

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 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.

2.4 The Disposition Effect in the Experimental Market

Benartzi and Thaler (1995) advance myopic loss aversion as a potential explanation for the well-known equity premium puzzle. Some experimental evidence in support of myopic loss aversion has become available. Thaler, Tversky, Kahneman and Schwartz (1997) find that subjects who display myopic loss aversion will be more willing to accept risks if they evaluate their investments less often. Gneezy and Potters (1997) show that the more frequently returns are evaluated, the more risk averse investor will be. Gneezy, Kapteyn and Potters (2003) find, in an experimental setting, that more information feedback and more flexibility result in less risk taking. They also report that market prices of risky assets are significantly lower if feedback frequency and decision flexibility are increased. Haigh and List (2005) also find that a small self-selected sample of 54 professional traders are more prone to show symptoms of myopic loss aversion than 64 undergraduate students.

Weber and Camerer (1998) provide evidence supporting for disposition behavior in an experimental setting. Subjects tend to sell fewer shares when the price falls than when it rises. In addition, they sell less when the price is below the purchase price than when it is above.

List (2003) examines trading rates of sports memorabilia in an actual marketplace and observes that an inefficiently low number of trades by naïve traders, consistent with prospect theory. He shows that individual behavior approaches neoclassical expectations as market experience intensifies. List (2004) also reports the similar results that prospect theory adequately organizes behavior among inexperienced consumers, but consumers with intense

market experience behavior largely in accordance with neoclassical predictions.

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, futures and options trading volume of KRX was 2.9 billion contracts in 2003 and 2.6 billion contracts in 2004, and it is ranked 1st in the world. Stock index futures volume of KRX was 62 million contracts in 2003 and 56 billion contracts in 2004, and it is 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 KOSPI200. 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 will be the second Thursday of the contract month. The normal trading hours are from 09:00 to 15:15 and days are from Monday through Friday. 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 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. The stock index futures price is the same as KOSPI200 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, I use a unique data set to shed new light on the issue of whether investors exhibit the disposition effect. To better understand the disposition effect, it is useful to analyze a data set how all market participants behave. By looking at all market participants in the Korean index futures market, I am able to generate a more complete picture of the stylized facts of trading.

My 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 portion of individual investors is approximately 85 % and strikingly higher than that of institutions (14%) and foreign investors (1%). However, the portion of individual investors by 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.[2]

3.3 Summary Statistics for Data

In Table Ⅱ, I report the minimum, 25th percentile, median, mean, 75th percentile,

[2] In 2005, individuals, institutions, and foreign investors are 44%, 31.7%, and 23.7% in the gross volume of trade, respectively.

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 profit over daily average trading value. The top and middle thirds of Panel A present statistics for the trading activities of all investors. Investors in my 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 1,646 million (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.[3] The median of total profits is KRW -1.2 million indicating that the number of traders who lose money during the sample period are 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 % and 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 total profits

[3] The skewness measure is 15.52.

(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 index futures market are individual investors. They trade more actively than institutional investors. Therefore, the Korean index futures market is a good laboratory for testing individual investors' behavioral biases. Second, foreign investors are the most active traders in the Korean index futures market. Third, the distribution of total profits is positively skewed which means that more than half of investors lose money. In other words, the winner in the futures market is less than half. Fourth, foreign investors are on average winners and others are losers in the Korean index futures market. However, the performance of institutions is inferior to individual investors. I can say that foreign investors have an information advantage over domestic instituions. This result is consistent with Grinblatt and Keloharju (2000).

3.4 Measuring the Disposition Effect

I 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 contract 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:

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

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:

$$DE_i = PGR_i - PLR_i$$

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

I 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:

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

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:

$$DE^t = PGR^t - PLR^t$$

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:

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

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:

$$RC_i^t = RG_i^t + RL_i^t, \quad PC_i^t = PG_i^t + PL_i^t$$

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 index futures market exhibit the disposition effect. I investigate the existence of the disposition effect at the aggregate market level as well as the individual account level. In particular, I 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, I also show the difference of the disposition effect between long positions and short positions. Finally, I 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 maximum of 1 and the mean of PGR is slightly larger than that of PLR. The mean of DE, which is the difference between 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 statistics, they are consistent with the tendency for realizing gains too soon and holding onto losses. I can find similar results among individuals, institutions, and foreigners in Panel B.

Since I 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, I 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 2 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 my sample. This is supporting evidence for the existence of the disposition effect in the Korean index futures market. Plotting the distribution of realized capital gains and losses (RC) and paper capital gains and losses (PC) is also insightful. Figure 3 shows the distribution of the realized capital gains and losses and Figure 4 shows the 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 3, the left tail of the paper capital gains and losses is much thicker than the right tail in Figure 4. 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 3, 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. I 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 winner than their loser. 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, I partition the sample by investor types in Panel B. While I 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 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, I 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, I cannot differentiate an investor who trades many times a day from a trader who trades a few times a day. So, I 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, I expect the number of trades that each investor executed to decrease the disposition effect. I 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.

I 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 susceptible to the disposition effect.

What is striking is the amount of variations that can be 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 0.088 (t-statistic is 48.30) of losers, unsuccessful investors tend to be as 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. I will further analyze a contemporaneous relation between trader success and tendency to hold losers longer in Section 4.4.

I perform a cross-sectional regression analysis to elaborate on the impact of investor characteristics on the disposition effect. Regressions take the following form;

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

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, I 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 for market induced by the disposition effect. PGR and PLR are reported both the full sample and 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 long (short) positions. Since I calculate RG, RL, PG, and PL on a daily basis, I exclude the trade which buy trade and sell trade execute on a same day. What is striking is that the disposition effect in long positions is 0.078 (t-statistic is 79.9) and higher than 0.054 (t-statistic is 53.8) in short positions. It is not easy to explain this phenomenon by prospect theory. I 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 short positions than long positions in futures. There is no room for human behavior to involve in program trade which trades execute automatically. The fact that observations in short position for institutional investors are 98,800 and larger than 78,503 in long positions is indirect evidence of that 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 I conduct a similar analysis to see whether such a pattern also exists in my sample, I cannot find same results. Figure 5 shows that the ratio of PGR to PLR to each month over the sample period from January 2003 to December 2004. The ratio is constant 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 index futures market. The most important reason is that capital gains in the Korean 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 long. It is also impossible to hold onto losing futures until December because of maturity.

4.4 Profits and the Disposition Effect

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

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

$PROFIT_i$ = 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 that are sold, the average excess return over the following year is more than it is for losers that are not sold.

The finding that daily average number of trades have 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). I 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 contract for too long a period. This may be one reason that trading frequently is not hazardous to investor's wealth in the futures market.

5. Conclusion

This paper presents evidence on the existence of the disposition effect in the Korean index futures market. I analyze the trading records of all market participants from January 2, 2003, through May 31, 2005. My findings show that investors display the disposition effect. Individuals are more prone to the disposition effect than institutional and foreign investors. I also find that sophisticated and experienced investor classes show less disposition effect. This finding indicates that professional training and experience may reduce judgmental biases, even though it 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 for long positions than short positions. Testing the hypothesis that the disposition effect is a costly behavioral bias, I 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 index futures market. This result is consistent with Grinblatt and Keloharju (2000), but contrasts with Kang and Stulz (1997). Contrary to Barber and Odean (2000), trading frequently may not be hazardous to investor's wealth in the Korean index futures market.

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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 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)

	Min	Q1	Median	Mean	Q3	Max	St. Dev.
No. of trading days	1	6	19	45	53	553	67
Daily avg. number of trades	1	2	4	7	8	1,657	16
Daily avg. trading volume	1	4	7	34	18	53,454	340
Daily avg. trading value	32.7	166.2	347.8	1,645.5	859.8	2,734,095.4	16,718.3
Total profits	-65,541.0	-8.0	-1.2	0.0	0.8	67,371.7	1,042.4
Total profits/ Daily avg. trading value	-766.9%	-2.0%	-0.3%	-1.1%	0.2%	446.0%	14.9%

Table Ⅱ (continued)

Panel B: Accounts Partitioned by Investor Types

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

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 index futures market over 556 trading days from Jan 2003 to Mar 2005.

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

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

Table Ⅲ (continued)

Panel B: Accounts Partitioned by Investor Types

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

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 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. Regressions take 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 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 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 errorr are adjusted for heteroscedasticity according to White (1980).

Dependent	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)				**-0.000**		**-0.000**	
				(-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 long (short) positions. Since I calculate RG, RL, PG, and PL on a daily basis, I 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. Regressions take 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 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

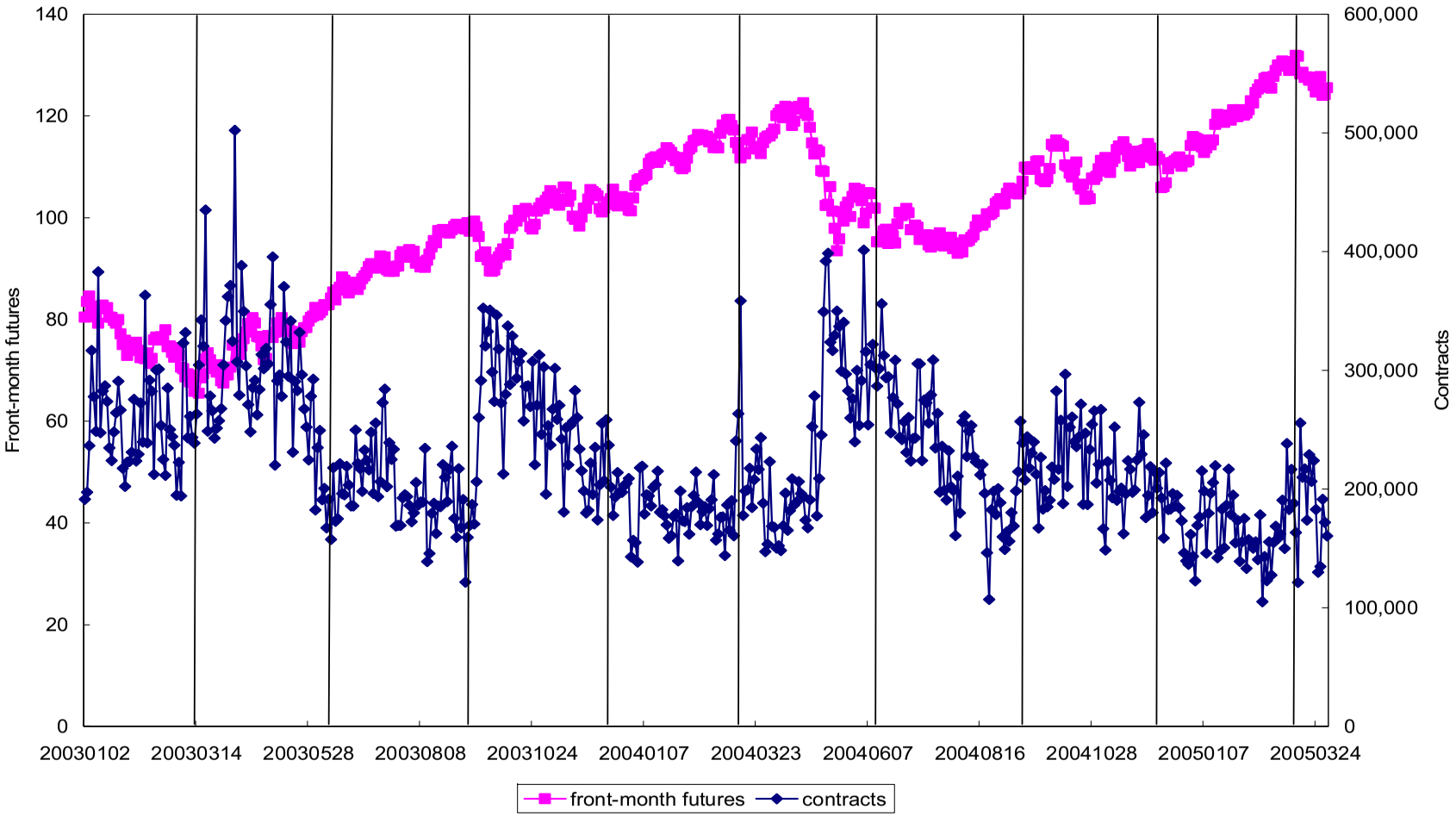
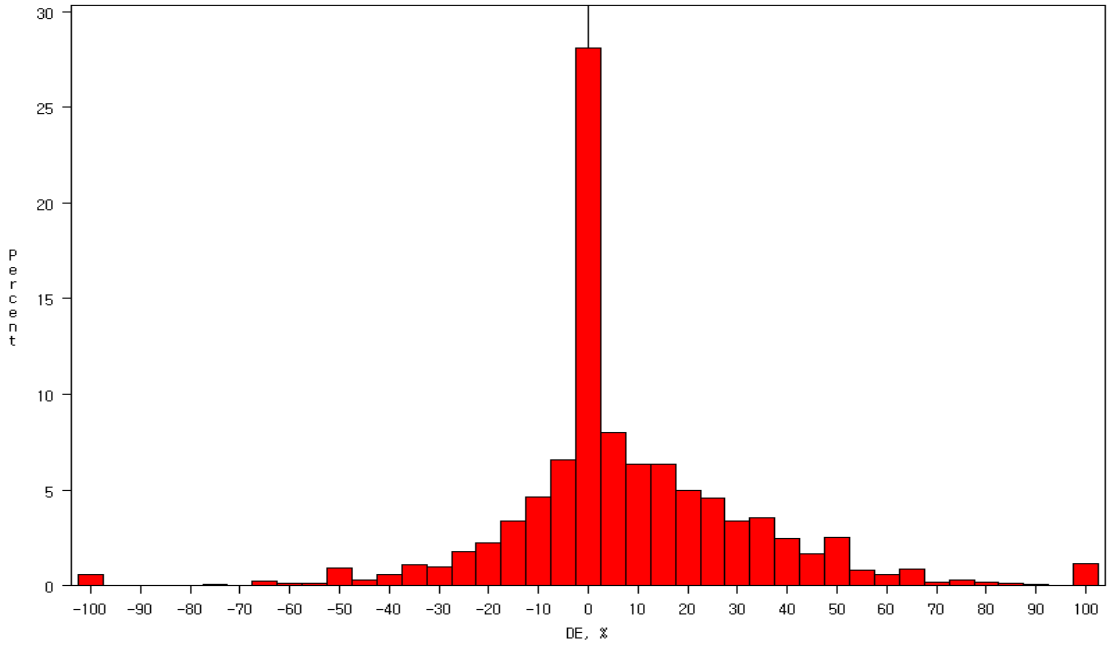


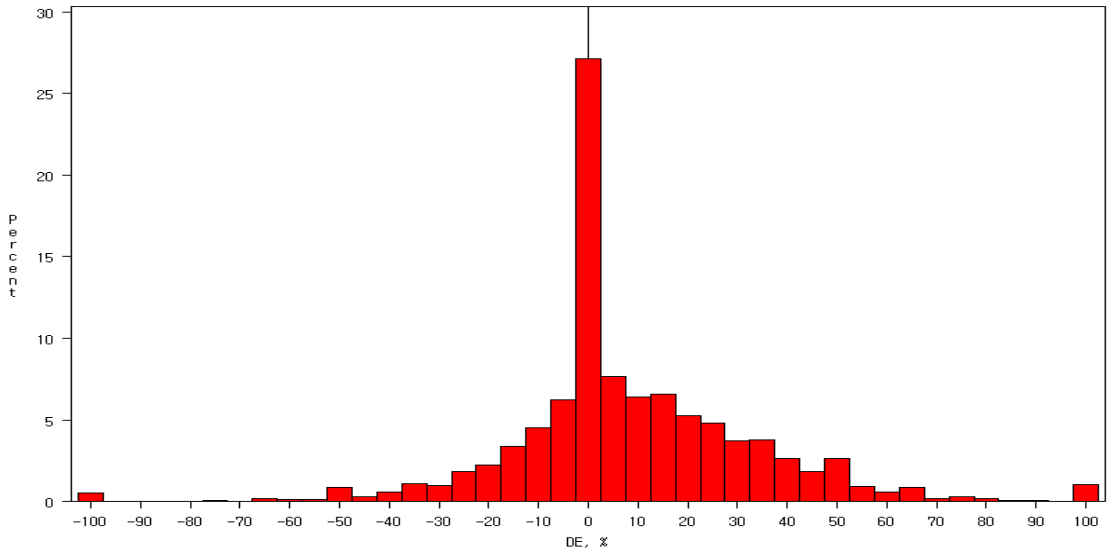
Figure 1. Time Series of Front-month Futures Index and Volume (Jan 2003 – Mar 2005). Front-month futures index (left axis) and trading volume (right axis) are graphed during the sample period from Jan 2003 to Mar 2005. Vertical line represents the last trading day for each front-month contract.

Panel A. All Accounts

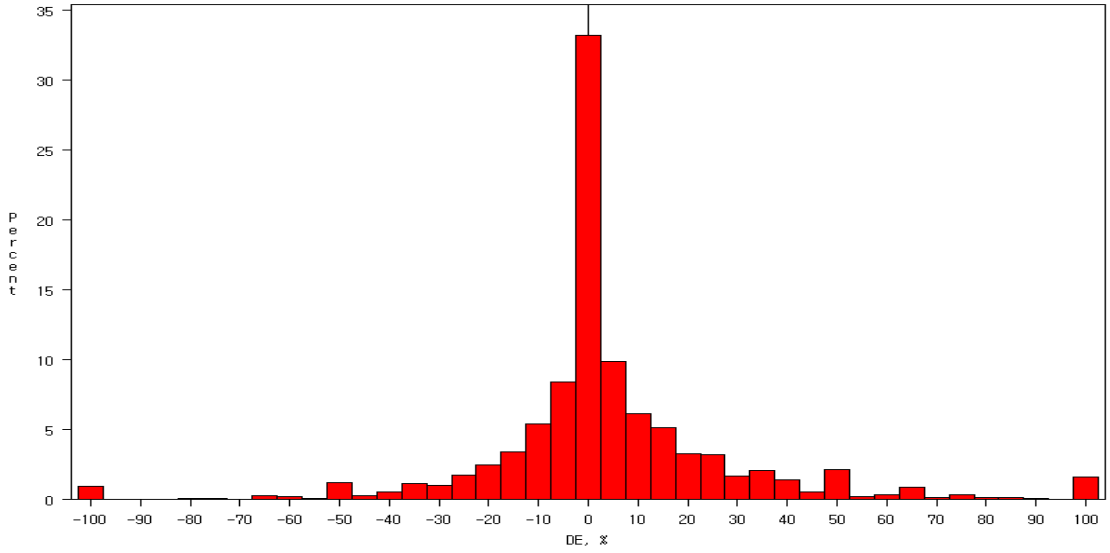


Panel B. Accounts Partitioned by Investor Types

Individuals



Institutions



Foreigners

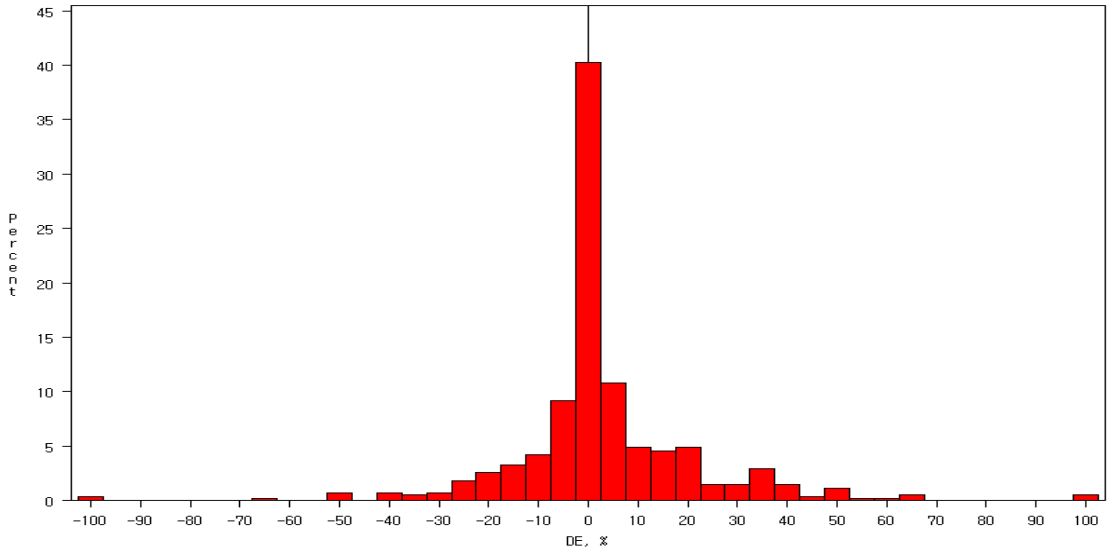
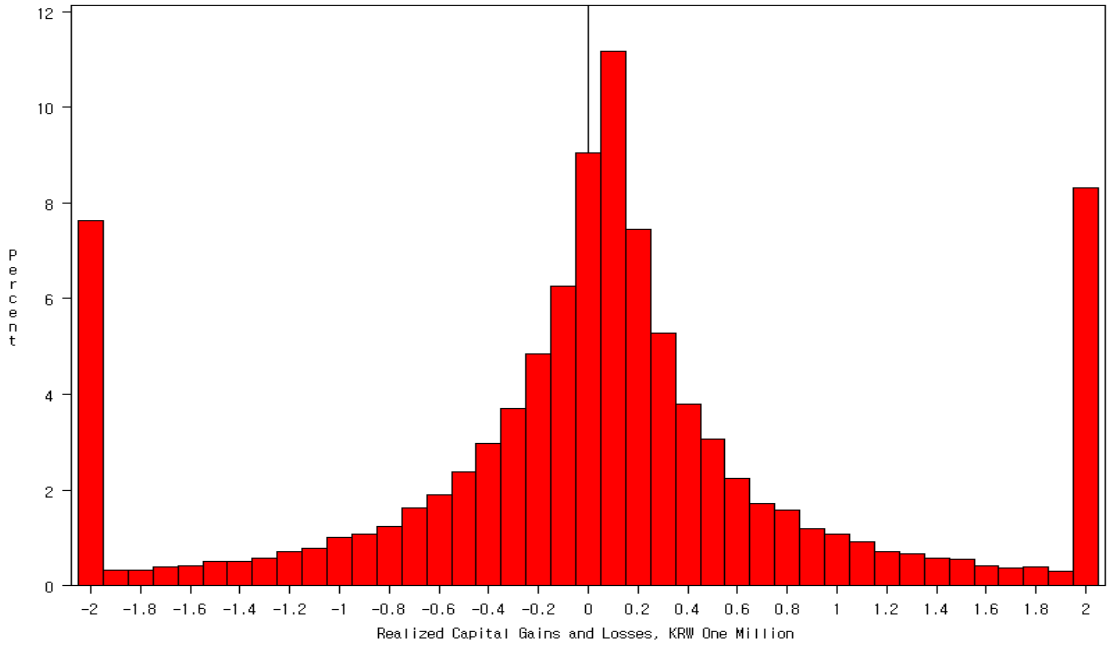


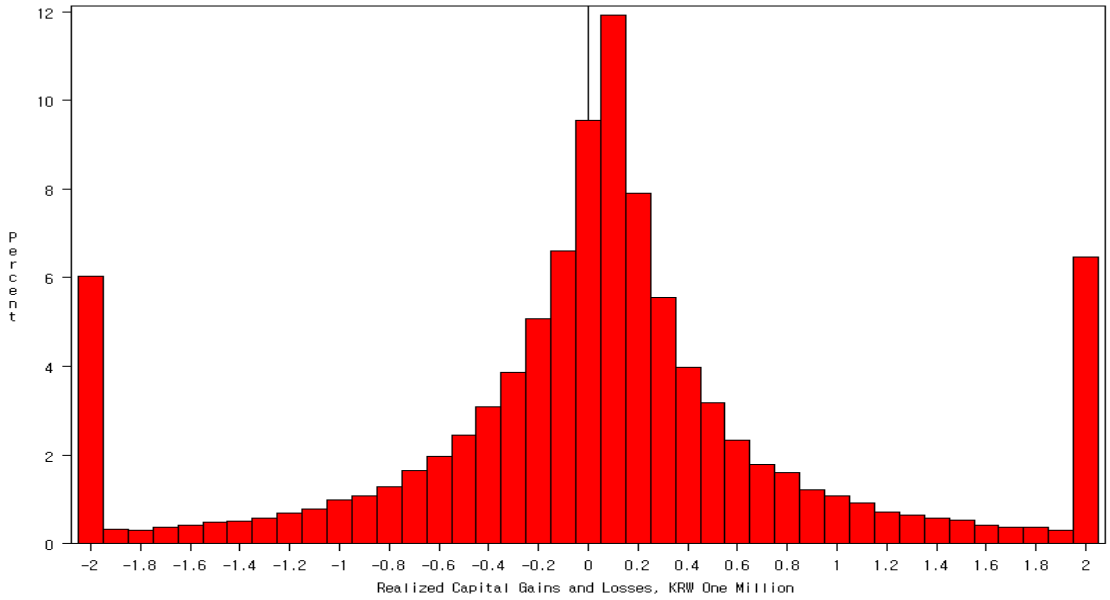
Figure 2. Distribution of the Account-Level Disposition Effect. DE is the difference of each investor's PGR and PLR. PGR is the number of trading days on realized gains divided by the number of trading days on realized gains plus the number of trading days on paper gains, and PLR is the number of trading 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 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



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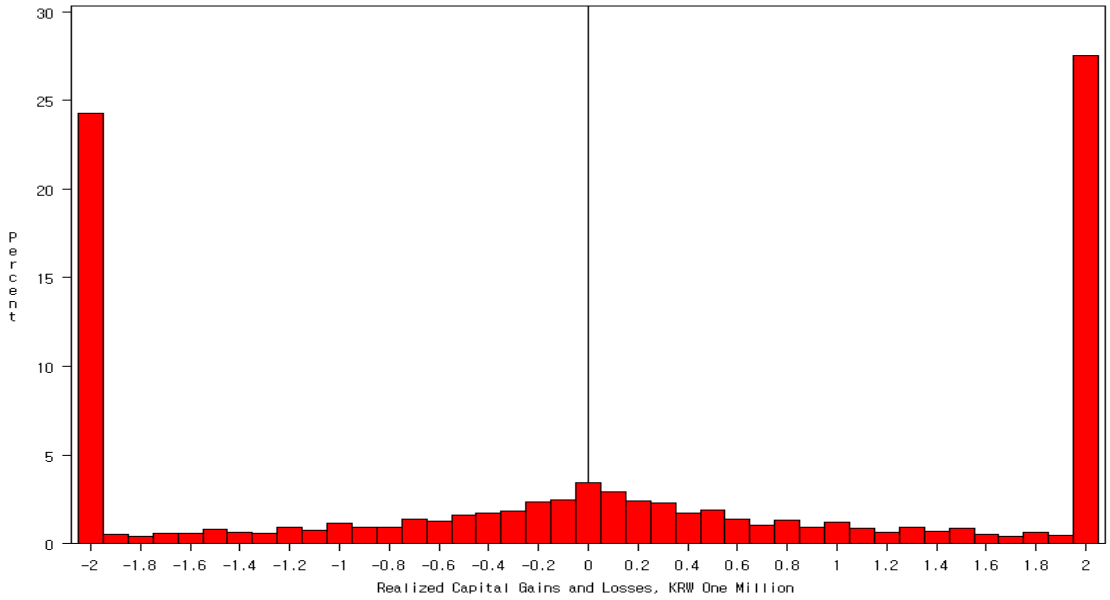


Foreigners

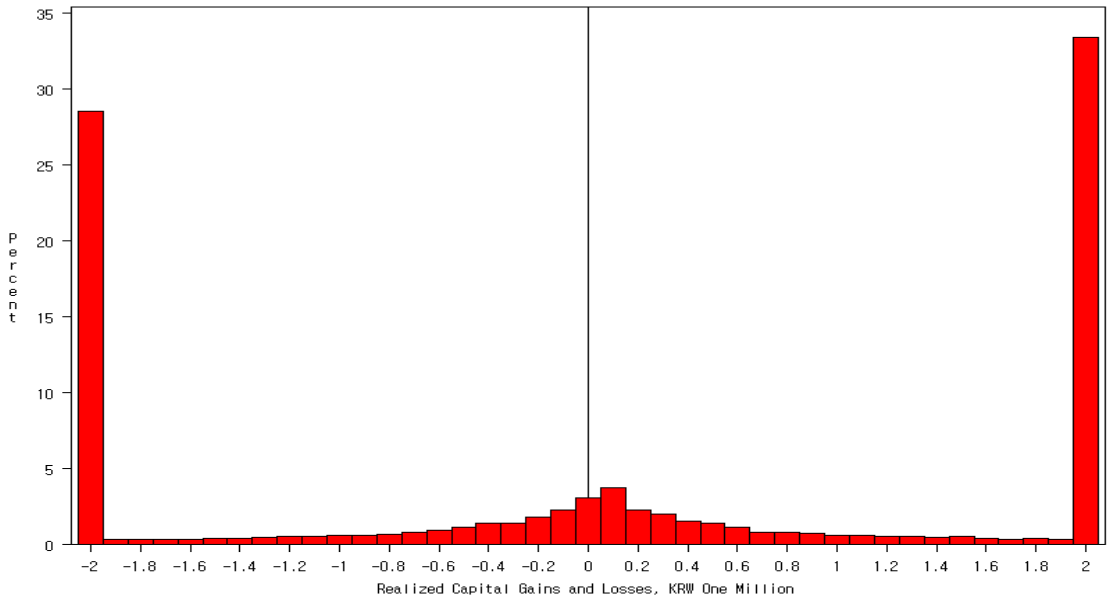
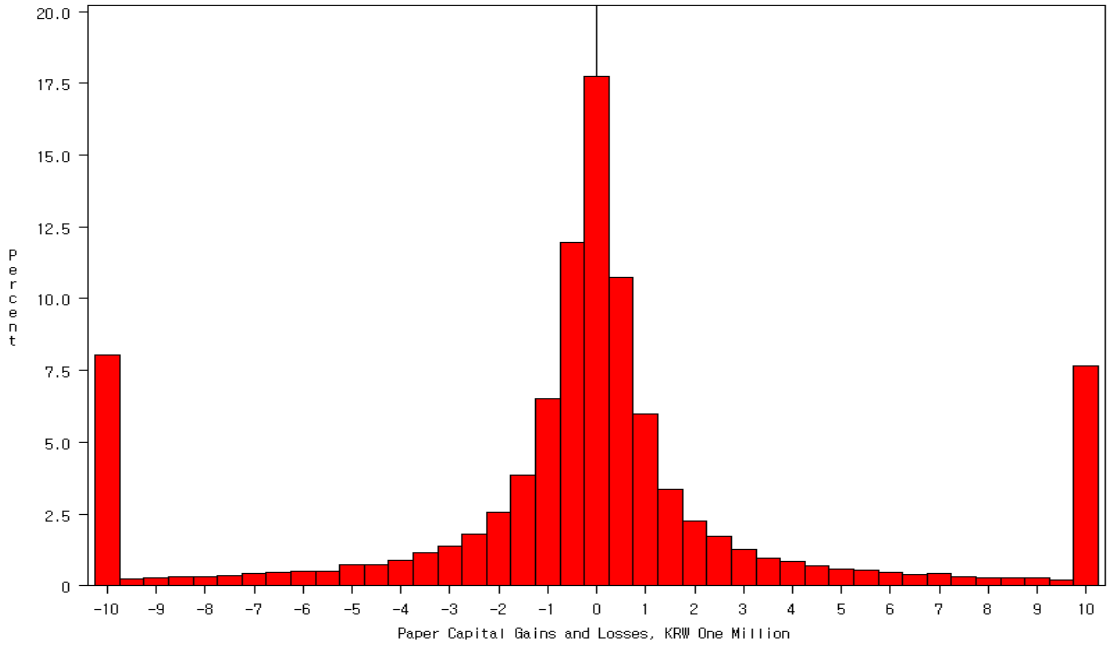


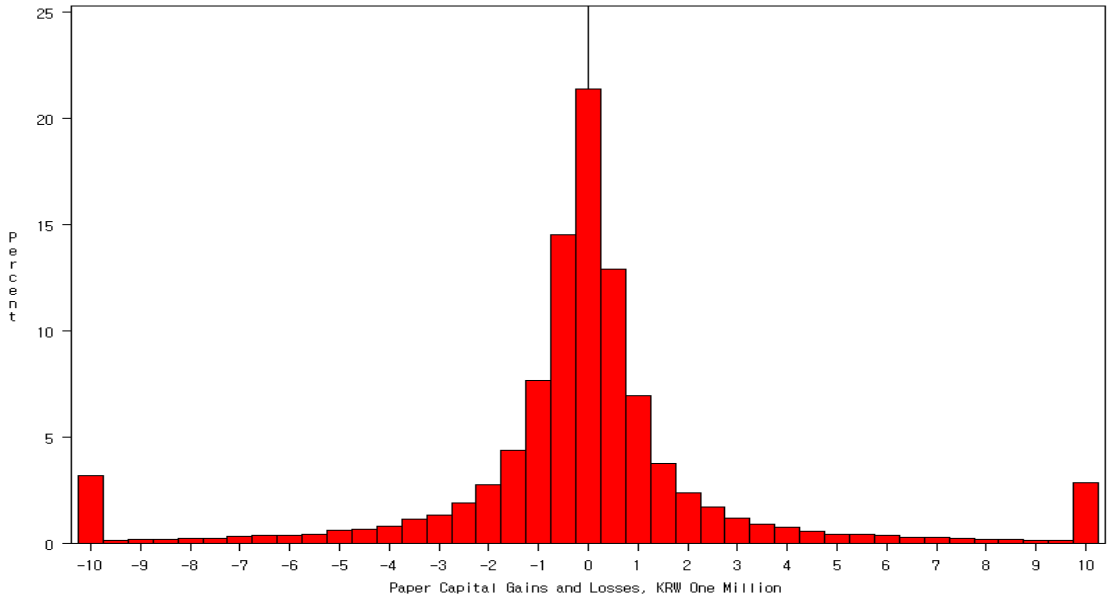
Figure 3. Distribution of Realized Capital Gains and Losses. Realized Capital Gains and Losses are the sum of RG and RL. RG and RL represent realized gains and realized losses on daily basis. The sample consists of the trading experiences of 69,391 traders in the Korean index futures market over 556 trading days from Jan 2003 to Mar 2005.

Panel A. All Accounts



Panel B. Accounts Partitioned by Investor Types

Individuals



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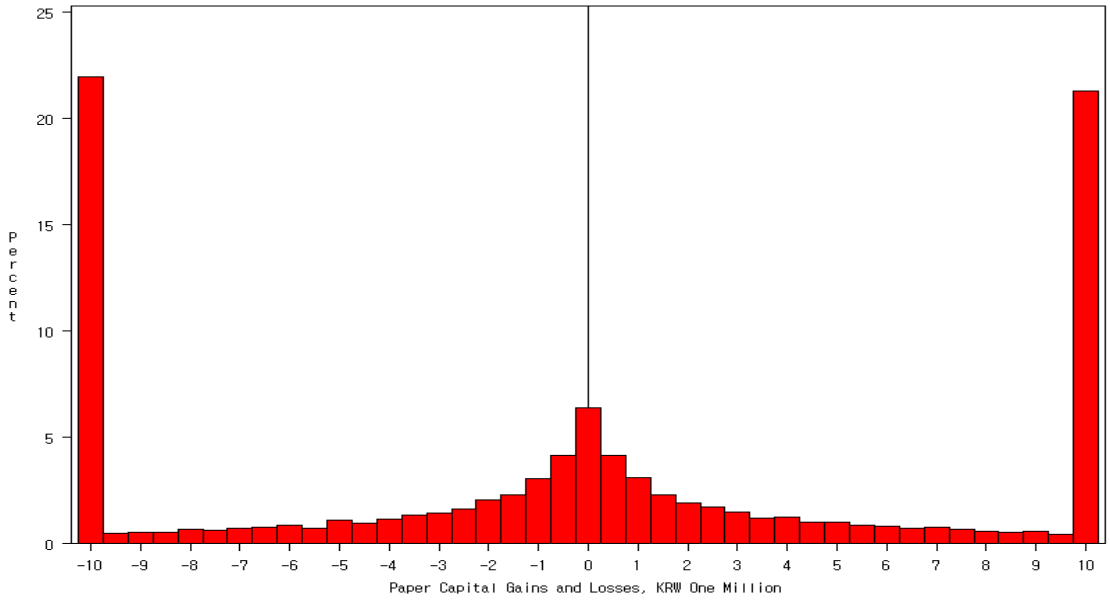


Foreigners

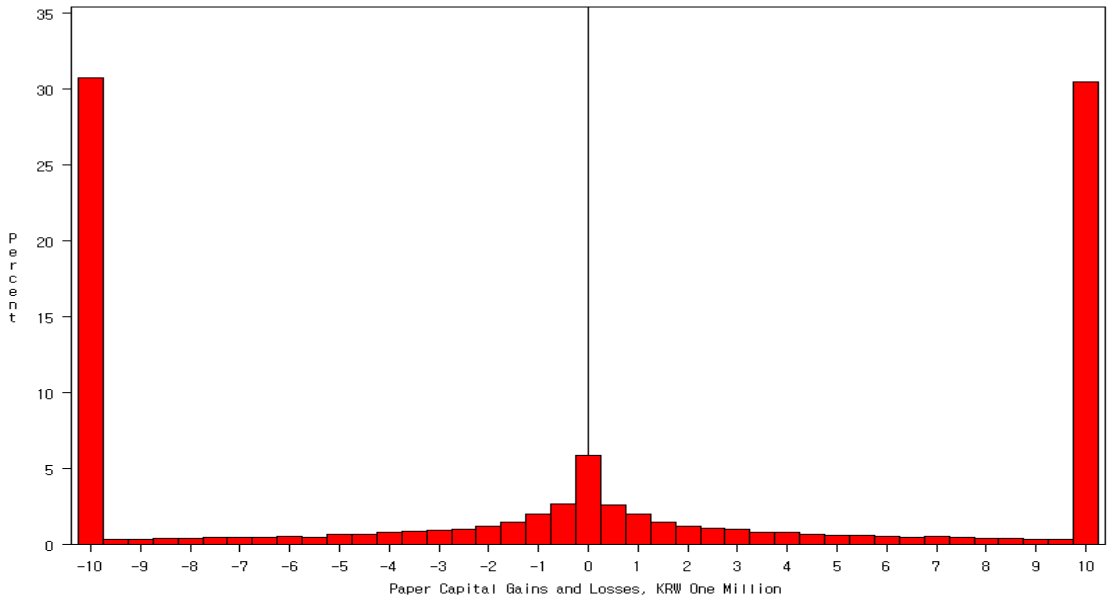
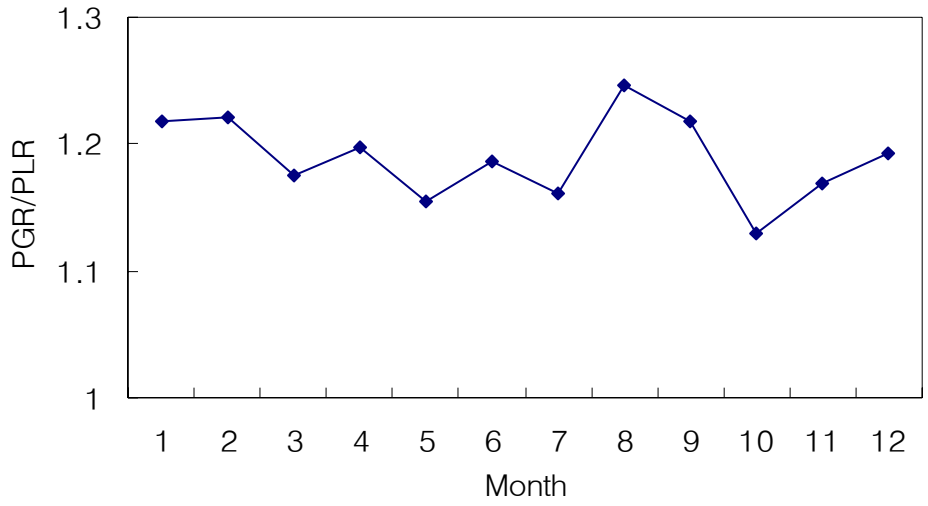


Figure 4. Distribution of Paper Capital Gains and Losses. Paper Capital Gains and Losses are the sum of PG and PL. PG and PL represent paper gains and paper losses on daily basis. The sample consists of the trading experiences of 69,391 traders in the Korean index futures market over 556 trading days from Jan 2003 to Mar 2005.

Panel A. All Accounts



Panel B. Accounts Partitioned by Investor Types

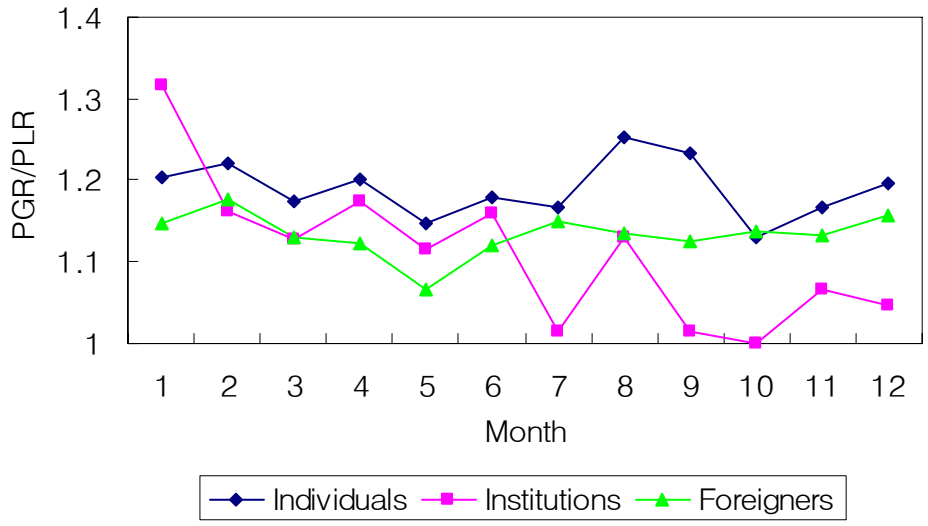


Figure 5. Ratio of PGR to PLR for each Month. PGR is the number of trading days on realized gains divided by the number of trading days on realized gains plus the number of trading days on paper gains, and PLR is the number of trading days on realized losses divided by the number of trading days on realized 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.