

An Examination of Profitability and Risk-Taking Behavior in Futures Market

Teng Yuan Cheng^{*}

Chao Hsien Lin^{}**

Chun I Lee^{*}**

^{*}Corresponding author, National Cheng Kung University, Department of Business Administration, Taiwan tybrian@gmail.com

^{**} National Kaohsiung First University of Science and Technology, Department of Finance, Taiwan

^{***}Loyola Marymount University, Department of Finance/CIS, Los Angeles, CA 90045.

We wish to thank Taiwan Futures Exchange for making the data available.

An Examination of Profitability and Risk-Taking Behavior in Futures Market

Abstract

This paper examines the profitability and risk-taking behavior of individual traders in the Taiwan Futures Exchange (TAIFEX) by tracking their trade-by-trade transaction histories. We first show that although as a group individual traders have a net loss after all transaction costs, there are fairly profitable traders, accounting for about 1/3 of the traders. Further examination reveals that profitability varies systematically with trading frequency and volume. Focusing on the frequent and high-volume traders and following their trades as they steadily accumulate and offset contract positions, we analyze their risk-taking behavior by examining their responses after reaching some threshold levels of losses and gains. We then investigate whether they vary in their responses and link the variations to their profitability. We show that in aggregate they tend to offset their trades after reaching some threshold levels of losses and gains. However, the tendency to offset positions varies among them in a systematic fashion, which in turn affects their profitability differently depending on whether they are profitable or not. Among profitable traders, those who have a greater tendency to offset their trades in the face of threshold losses and gains are less profitable. On the other hand, among unprofitable traders, those who tend to offset their positions when faced with the threshold losses and gains suffer smaller losses. In contrast to the evidence from previous studies that examine the aggregate trader, the results from this study shed new light that challenges the general conclusions on the profitability and overconfidence in the literature. The results also have practical implications for traders in view of the linkage between profitability and risk-taking trading strategies.

I. Introduction

In this study, we conduct a close-up examination of the profitability of individual investors in futures market by tracking the trade-by-trade transaction histories of each investor separately over a period of almost three years long. In doing so, we seek to provide a detailed portrait of trading performance of investors. Until recently, most studies that examine investment performance focus mainly on mutual funds. With the exception of a few (e.g., Schlarbaum et al. [1978b], Harris and Schultz [1998], and Garvey and Murphy [2004]), studies that touch on the profitability of individual investors primarily look at the performance of investors as a group, rather than at the individual level (e.g., Schlarbaum et al. [1978a], Odean [1999], Barber and Odean [2000, 2001], Grinblatt and Keloharju [2000], Goetzmann and Kumar [2005], Linnainmaa [2003a, 2003b]). This lack of attention to individual-level trading profitability is partly because profitability per se is not the main issue in many of these studies and partly because treating each individual separately and calculating and tracking their individual performance can be either infeasible due to lack of detail information or technically challenging because of the tremendous time and effort required in processing the data.

By overcoming the technical challenges, our detailed examination of individual-level profitability allows us to gain insight on the profitability of investors beyond the general conclusion in previous studies that average investors lose money after accounting for transaction costs. From the standpoint of investors, evidence that not all investors lose money offers a glimpse of hope, justifying their very existence. Indeed, consistent with studies that document the existence of some successful investors (e.g., Harris and Schultz [1998], Schlarbaum et al [1978b], Barber and Odean (2000), and Ivkovich and Weisbenner [2005]), we show that there are quite a few profitable futures traders. However, because they are outnumbered by the unprofitable traders, when all investors are examined in aggregate, their profits are dwarfed by the losses of the unprofitable, resulting in an overall loss for all traders as a group, similar to the conclusion reached in previous studies that average investors lose money.

In addition to portraying the profitability and the variations among individual traders, the trade-by-trade tracking of their trading offers us a unique opportunity to take a step further to

explain why profitability varies among traders by linking it to issues in behavioral finance. The first issue is overconfidence, which in previous studies (e.g., Odean [1998] and Barber and Odean [2001]) is generally assumed to lead investors to trade excessively with a negative consequence of reduced profitability. Given that this conclusion is derived from the examination of aggregate investor that ignores the heterogeneity among investors, further examination, especially at the individual level, is needed. We perform such an examination by investigating whether and how trading activities, measured by trading frequency and volume of, are related to profitability, hence shedding new light on whether active trading is necessarily detrimental to profitability.

The second behavioral finance issue we address is risk-taking, specifically, whether and how risk-taking behavior of individual investors affects their profitability. We look at their responses to some threshold level of unrealized gains and losses and examine whether and how the responses affect their profits and losses. While previous studies have touched on this linkage, the primary focus of most of them is the disposition effect, the tendency of investors' reluctance to realize losses but haste to realize gains. For example, in the examination of a group of investors in a discount brokerage, the main focus in Odean [1998] is to demonstrate the existence of the disposition effect exists in investors as a group. To prove such behavioral tendency is irrational, Odean shows that in aggregate, the portfolio of stocks investors realized for a gain tends to underperform the portfolio of stocks they sold for a loss. Based on this evidence, Odean concludes that this behavioral bias is undesirable since it lowers the after-tax returns of investors. The exception to indirect evidence of this sort is Cheng et al. [2009] who show a direct link between profitability and disposition effect. Furthermore, while the disposition effect is about aversion to loss, it deals with only one aspect of risk-taking behavior—how investors sell securities—and ignores the other aspect, the purchase of securities. Additionally, to be an insightful examination of risk-taking behavior of investors, the level of risk must not be trivial in the sense that the stake is low. We do so by examining how investors respond to threshold level of gains and losses, whether they continue adding more stakes or starting cutting their bets. In doing so, we depict a comprehensive picture of investors' risk-taking behavior and its impact on profitability.

In documenting the cross-sectional variations in trading profitability after accounting for all transaction costs, we show that despite a net loss in the aggregate, about 1/3 of traders who trade frequently and in high volume are actually profitable. This result of profitable trading by frequent traders sheds a new light on the behavioral finance literature on the issue of overconfidence that generally conclude, based on the analysis of the aggregate investor, that excess trading due to overconfidence reduces profitability, or, worse, results in losses. Focusing on the frequent and high-volume traders, our examination of their risk-taking tendency in response to losses and gains shows that in aggregate they have a high tendency to offset their trades after reaching some threshold levels of losses and gains. However, the tendency to offset varies with trading frequency and volume among the traders in a systematic fashion. Such variations in tendency in turn affect their profitability differently depending on whether they are profitable or not. Among traders who are profitable, those who tend to offset their trades after reaching the thresholds are less profitable. On the other hand, among unprofitable traders, those who tend to offset their positions when faced with the thresholds suffer smaller losses. In view of the lack of evidence in the literature, these results hence demonstrate a link between profitability and risk-taking behavior of investors that clearly has implications for traders as well as behavior finance.

The rest of the paper is organized as follows: Section II reviews the related literature. Section III explains the data and methodology. Section IV presents and discusses the results. Finally, Section V concludes the paper.

II. Literature Review

Voluminous studies in psychology and experimental economics have examined the issue of risk-taking. However, most of them are devoted to the understanding of how people perceive risk in general. While research in experimental finance extends this line of research by examining investors' perception of, and attitude toward, risk in their financial and investment decision makings¹, little is known about risk-taking in action and the associated consequences on

¹ See Ruccuardi [2008] for a review.

profitability. In recent years, studies² in behavioral finance fill this void by examining the disposition effect, the tendency of loss aversion—holding onto losing securities and selling winning securities too readily. As this tendency is manifested when investors are deciding on whether to hold onto or sell securities, it leaves unanswered the issue of risk-taking and tendency, if any, when investors are contemplating buying and accumulating more investment positions. This is surprising given that investors and, especially, speculators are in the business of taking on the risk of unexpected movements in asset price, as such, the act of buying and accumulating investment is equally as important as, if not more than, selling investment. Therefore, much remains to be explored about risk-taking associated with buying and accumulating securities and its impact on profitability. A study on these issues therefore is warranted. For the rest of the section, we focus on reviewing the evidence on profitability and overconfidence.

2.1 Profitability

Profitability is not a new issue in the literature and has attracted the attention of academics and practitioners. However, most studies aggregate across investors and present the performance for the group as a whole or for distinctive subgroups (e.g., individuals and institutional investors) at the group level. For example, in analyzing the returns earned by a random sample of 2,500 individual investors at a full-service brokerage firm, Schlarbaum et al. [1978a] construct two

² To name just a few: in equity market, Odean [1998], Barber and Odean [2000], and Dhar and Zhu [2006] look at retail investors in a US discount brokerage house, and Barber et al. [2007] analyze four types of investors (individuals, corporations, dealers—but not mutual funds, and foreign investors) in Taiwan; in futures market, Heisler [1994] studies small off-exchange retail speculators, Locke and Mann [2005] investigate professional traders of the currency and agriculture futures in CME, and Frino et al. [2004] examine local traders of four main futures contracts traded on the Sydney Futures Exchange; in other markets, Genesove et al. (2001) examine real estate investors and Heath et al. (1999) look at employees exercising stock options. Recently, however, Annaert et al. [2008] examine the transactions by mutual funds and document a propensity of mutual fund managers cutting losses early, hence the absence of the disposition effect.

monthly “aggregate” portfolios by combining the portfolios of all sample investors. Similarly, Barber et al. [2006] construct two portfolios, one buy and the other sell, for each of the five investor groups—individuals, corporations, dealers, foreigners, and mutual funds. The general conclusion of these studies is that individual investors tend to lose money after accounting all transaction costs. Garvey et al. [2007] show 150 professional stock traders working for a national security dealer barely broke even before trading costs and lost after costs over a one-year period. Likewise, Barber et al. [2006] document that individual investors in Taiwan suffer losses that are equivalent to 2.2 percent of the country’s GDP or 2.8 percent of total personal income.

Despite these bleak findings, there is some evidence of small group of investors with superior stock investment skill from studies that focus on examining investors at the individual level. For example, Harris and Schultz [1998] examine individual day traders who use NASDAQ’s Small Order Execution System (SOES). By establishing a position before most market makers have updated their quotes and lay off the position at favorable prices via Instinet or SelectNet, these traders are profitable despite being less informed than market makers. Analyzing the gross and net returns of round-trip trades made by the same sample of investors over the same period examined in Schlarbaum et al. [1978a], Schlarbaum et al [1978b] conclude that the investors show some skill in security selection, especially on short-term trades. Even among studies that look at the performance at the group level there is evidence suggesting superior performance. For example, Barber and Odean (2000) document that the top-performing quartile of the individuals outperform the market on average by 0.5 percent per month. Ivkovich and Weisbenner [2008] find that stocks of companies geographically close to individual investors generate higher returns than the stocks of distant companies. Finally, Ivkovich et al. [2005] find that individuals with relatively concentrated portfolios outperform those that are more diversified.

The mixed results on performance at the group level and the evidence of superior performance of some investors suggest that to gain further insight on investors’ profitability, it is necessary to go past the group level by examining investors at the individual level and exploring the heterogeneity among them in their characteristics and trading behaviors. For example, with the finding that a small group of day traders in Taiwan are profitable persistently, Barber et al.

[2004a] pursue further by examining the order records of the traders. They find that trading losses of individuals are linked to their aggressive orders and passive orders placed by individuals are profitable at short horizons but suffer modest losses at longer horizons.

2.2 Overconfidence

One investor behavior that has been a major subject in many studies in psychology and experimental economics is overconfidence. Drawing heavily on the findings in these fields, the overconfidence literature in finance argues it is the innate human tendency for investors to be overconfident about their ability and the precision of their knowledge. Odean [1999] analyzes the trading of investors in a discount brokerage house and suggests that due to overconfidence, individual investors trade excessively in the sense that they trade even when the expected gains through trade are not sufficient to cover the trading costs. Examining the trading activity of households accounts in the same discount brokerage, Barber and Odean [2000] show that overconfidence leads to excessive trading and the more active the trading the lower the after-trading-cost returns. Using the same data, Barber and Odean [2001] further show that men trade more excessively than women and, as a result of excessive turnover, both suffer a reduction of returns with men suffering an additional 1.44 percentage points reduction in annual returns than women. Odean [1999] conjectures that the disposition effect he observes may have contributed to the documented pattern of security sales in his sample.

Given that excess trading due to overconfidence reduces returns, it seems logical to expect traders who trade excessively to lose money—as in Barber and Odean’s [2000] words “excess trading is hazardous to your wealth”—and eventually exit the market. Several theoretical studies have examined this issue and come to two opposite conclusions. Figlewski [1978] shows that investors who are poor at forecasting may go bankrupt and leave the market and Sandroni [2005] demonstrates that agents with correct beliefs drive agents with incorrect beliefs out of the market. However, numerous studies conclude that overconfident investors not only survive, they also thrive. Analyzing a duopoly game of informed speculation, Kyle and Wang [1997] show that an overconfident trader may dominate his rational opponent. Acting like a commitment device, overconfidence earns the overconfident trader a reputation for trading aggressively. He tends to

buy more of the asset when he receives good signals and sell more of the asset with bad signals. Recognizing this behavior, his rational opponent trades less aggressively. Consequently, the overconfident trader generates higher expected profit and utility not only than his rational opponent but also than if he were also rational himself. As a result of the higher profit, the overconfident trader persists and survives in the long run. Arguing that high expected returns alone do not guarantee long-run survival, since some losses might be big enough to wipe out the wealth as long as there is a non-zero probability of a big loss, De Long et al. [1990] suggest it's necessary to analyze the long-run distribution of the wealth of noise traders and rational investors. They show that, as a group, noise traders survive and dominate their rational counterparts because they earn higher returns and their wealth tends to grow.

Wang [2001] points out that in both De Long et al. [1990] and Kyle and Wang [1997], the population share of noise traders and rational investors is assumed fixed, hence are inadequate to address the long-run survival issue. He extends these static models into an evolutionary game and examines the resulting population dynamics of irrational traders according to their relative fitness in the evolution process. The results show that irrational traders with negative sentiment (underconfidence or bearishness) or extremely positive sentiment (excess confidence or bullishness) will never survive in the long run. Irrational traders with moderately positive sentiment tend to dominate the market, particularly when the variance of the risky asset's value (called "fundamental" risk) is large. Individual irrational traders may bankrupt sooner than individual rational traders because of the fundamental risk. But, irrational traders, as a group, with a higher expected return can still accumulate wealth at a higher speed than rational traders and, hence, increase in population and ensure the survival of the group. Gervais and Odean [2001] demonstrate that investors become overconfident by incorrectly inferring their ability from trading success. It is the process of becoming successful, and wealthy, that makes traders overconfident. Due to their wealth, overconfident traders stay in business. Although they may eventually lose confidence and wealth and cease to trade, the continuous inflow of inexperienced traders guarantees there will always be overconfident traders in the market who trade excessively. More recently, Garcia et al. [2007] show that as overconfident traders aggressively trade on their private signals, more information is revealed in price. In response, rational investors reduce their

information gathering. The presence of overconfidence hence leads to a decrease in the population of informed traders.

III. Data and Methodology

3.1. Data

We employ tremendous amount of computing resources—hardware that requires the use of many work stations as well as programming that relies heavily on the help from professional programmers—in processing and tracking the trade-by-trade transaction histories of 126,024 individual traders in the Taiwan Futures Exchange (TAIFEX).

Our data consist of all of the trades of the front-month³ Taiwan Stock Exchange Capitalization Weighted Stock Index (TAIEX) Futures contracts (hereafter, TX, the tick symbol) from the Taiwan Futures Exchange (TAIFEX) that mature between January 2003 and December 2004. To obtain each trader's complete trading history for each contract, we trace her trades back to the first day when the contract start trading. This means, for example, for the March 2003 contract, we go back to April 1, 2002. Therefore, our data span the period from April 1, 2002 to the third Wednesday of December 2004, the last trading day of the December 2004 contract. Introduced on July 21, 1998, TX is the first index product traded in Taiwan and the most active futures contract, accounting for close to 70% of the trading volume of the TAIFEX futures contracts. TX is based on the major stock index of the Taiwan Stock Exchange (TWSE), TAIEX, which includes all stocks traded on the TWSE. Each TX tick represents 200 times the TAIEX index value. By examining futures contract, as opposed to stocks, we avoid the complicating issues typically involved with stocks of different sizes, frequency of trading, and risk levels, as well as the composition and rebalancing of portfolios. Furthermore, the daily marking to market that compels futures traders to constantly evaluate their performance makes futures traders' trading a better, instinctive reflection of their profit motive and offers a clearer view of traders' behavior biases.

³ Contracts listed for trading include the front month, the next calendar month, and the next three quarterly months.

In addition to the typical information such as the time—to the second, date, price, volume—number of contracts, and buy-sell indicator of the transaction, each record also includes an account number that allows us to distinctively identify whether the trader is an individual, institution, or proprietary trader.

We exclude trades by institutional and proprietary traders and focus only on trades that are executed by individual traders for three reasons. First, unlike institutional traders, individual traders trade for themselves, therefore their trades are not complicated by agency relationships or hedging motives. Instead, driven purely by the motive to accumulate wealth in order to survive, they are the ideal subjects for the analysis of the profitability and behavior biases. Second, many institutions employ more than one trader who trade in rotating shifts, rendering trades by institutions a reflection of the behaviors of more than a single individual, therefore distorting the analysis of individual behavior biases. Finally, the dominance of individual traders in Taiwan⁴ dictates that their trades be the main subject of the investigation.

3.2. Methodology

We track and calculate the gains and losses of trading by each trader and analyze how profitability is affected by risk-taking behavior in the face of gains and losses. To achieve this, we construct a sequence of trades for each trader for each contract by tracing trades executed by the trader back to his first trade of the contract. This requires us to search for trades that are executed as far as one year before January 2003, therefore, our examination actually extends beyond the two-year sample period. Once the first trade is located we then track each subsequent trade. We mark to market after each trade and calculate all the necessary statistics such as the open interests (OIs), weighted average costs, and realized and unrealized gains/losses. As an example, on April 2, 2002, Trader A shorts five TX contracts that expire in March 2003 (TXC3). Our analysis of his trading history for TXC3 starts with this trade and shows a short position of five contracts. Subsequent trades are tracked individually until the maturity of TXC3 in March 2003. With each trade, we calculate and update the OIs, weighted average costs of the contracts,

⁴ Individual traders account for 80.17% and 75.60% of the total trading volume, in number of contracts, of TAIFEX in 2003 and 2004 respectively.

and unrealized as well as realized gains/losses using the weighted average costs and current price. By constantly updating after each trade, we have a running tally of the OIs and unrealized and realized gains/losses. These calculations are detailed below using Table 1 for illustration.

A. Weighted Average Costs and Open Interests

As shown in Table 1, the first trade executed by Trader A for TXA3 is identified to be a short position of five contracts at a price of 5,951. His record thus shows an open interest of -5 and an average cost of 5,951. After shorting one more contract in his second trade at a price of 5,950, his record is updated to show an average cost of 5,950.833 ($= (5,951 \times 5 + 5,950) \div (5+1)$) and an OI of -6.

Insert Table 1 about here

B. Unrealized Gains/Losses

With the market price now being 5,950, an average cost of 5,950.833, and open interest of -6, the trader now has an unrealized gain of 5 ($= (5,950 - 5,950.833) \times -6$). Same calculations like these are repeated for the following five trades, Trades 3 to Trade 7. Together, these first seven trades constitute the accumulation phase of his trades when he loads up contracts and are labeled as “A” in Column 3 in Table 1 to indicate that the trades are in the accumulation phase.

C. Realized Gains/Losses

Following the accumulation phase of trades, Trader A starts to offset his positions which results in realized gains/losses. Continuing with the same example, Trader A starts the offsetting phase of his trades in Trade 8 by longing two contracts, resulting in a realized gain of 14.267 ($= (5,952.133 - 5,945) \times 2$). To calculate the net profit, we subtract the commission and transaction tax, which is $1/100^{\text{th}}$ of one percent of the transaction value. The commission varies among the brokerage houses and based on our interviews with many of them, the average is about 150 New Taiwan Dollar (NT\$), the currency of Taiwan, for each contract longed and each contract shorted.

Given that a tick for TX is worth NT\$200, this average commission of NT\$150 has a value equivalent to 0.75 tick, we therefore subtract 0.75 as the commission from each contract longed and shorted in our analysis. Although in practice traders must pay the commission and transaction tax after each trade but considering the extremely short-term nature of futures trading as well as the fact that realized gains/losses occur only with the offsetting trades, we choose to add all commissions and transaction taxes incurred for all trades in the accumulation phase to those for the first trade in the offsetting phase. Therefore, after executing the Trade 8, Trader A should have paid a total commission of 24, which is calculated as 0.75 times 32 contracts—30 contracts shorted in the first seven trades plus two contracts longed in the 8th trade. The total transaction tax⁵ incurred is 19.045, calculated as 0.01% of the sum of the total transaction values of 190,450 [= (5,951×5 + 5,950 ×1+...+ 5,959×1) + (5,954×2).] Subtracting these transaction costs from the realized gain, we have a net realized gain of -28.799 (= 14.267 – 24.000 – 19.045). For positions that are held until maturity and closed by the exchange, we calculate the net realized gains/losses based on the final price of the contract. Notice that, unlike Locke and Mann [2005] who imposes an assumption that open interest is zero at the end of each trading day, our calculation of realized gains/losses does not have to make such an assumption, hence providing us with an accurate measure of realized gains/losses.

D. Maximum Possible Losses and Gains

To analyze the risk-taking behavior in the face of gains and losses we examine how gains/losses of earlier trades affect the trader's subsequent trades. To do this, we utilize the two phases in the trade sequence by examining how the unrealized gains/losses during the accumulation phase affect the subsequent trades in the offsetting phase that result in the realization of gains/losses. We group trades together into rounds. Within each round, there are two phases: the accumulation phase and offsetting phase, which is labeled as "O" in Column 3 in Table 1. In the accumulation phase, the trader is building up his position with a continually rising OI in one position direction, either long or short. After this phase, enters the offsetting phase when the trader reverses the position direction and starts to unload his contracts. The offsetting

⁵ There is no capital gain tax in Taiwan; instead, investors are required to pay a transaction tax equal to 1/100th of one percent of the value of each trade.

phase ends when he starts the next round by resuming the accumulation phase. At the end of the offsetting phase of each round the OI is not necessarily reduced to zero. Additionally, not all trades by all traders follow this regular sequence of rounds with alternating phases. In analyzing the risk taking behavior, we exclude the erratic trades that don't follow this trade sequence and only look at trades with regular sequence of rounds, although the gains/losses are calculated and tracked for all trades. By focusing on these trades, we are able to analyze the risk taking behavior of traders by examining their trades, whether they continue loading up or start unloading their positions, when they are faced with losses and gains.

Obviously, experienced traders don't make such accumulation or offsetting decisions when they are faced with tiny, insignificant gains or losses. The losses and gains must be large enough to reach some thresholds before they start considering whether to continue loading up or begin unloading their positions. The issue now, therefore, is what constitutes threshold-level losses or gains. The risk management literature has been working on this issue for a while and the standard today is the Value at Risk (VaR). It has been broadly applied in banking and security industries to measure the market risk of their asset portfolios. Although widely accepted, VaR is not without limitations. From the practical point of view, its successful application hinges on the use of a vast amount of data on an array of assets with a sufficiently long history. Whether individuals have access to such data and will they be sophisticated enough to apply the VaR technique are seriously questionable. Furthermore, for individual traders in the futures market, they are rarely involved with the management of a portfolio of assets, hence, using a sophisticated measure such as VaR seems to be overkill. Due to these practical concerns, we choose not to use VaR, though Locke and Mann [2005] apply it ex post in their analysis of professional futures traders at CME. Instead, we follow the spirit of VaR: the maximum loss concept, by identifying the maximum unrealized loss and gain during the accumulation phase of a round as the threshold level of loss and gain and call them the maximum possible loss (MPL) and maximum possible gain (MPG). For traders, the MPL signifies a threshold level of loss beyond which some may feel intolerable and the MPG represents a threshold level of gain that some traders may be content with. Although we identify these measures ex post by poring over traders' trading histories, given that it's impossible to actually observe traders in action, we believe this method is straightforward and the best alternative. It is more likely to reflect how

individual traders behave, and captures the dynamics of traders in action, given the short-term nature and the immediate cash-flow impact of the daily marking to market that force traders to be fully aware of and keep a running tally of the unrealized gains/losses throughout the accumulation phase of trades and react to them. By examining the trades after the MPLs and MPGs are reached, we are able to answer the question of how traders behave when facing trading losses and gains.

Continuing with the same example, the MPL and MPG in Round 1 are the maximum unrealized loss of -206 and unrealized gain of 29, respectively. Notice that there are some rounds that experience only unrealized losses and no unrealized gains, and, vice versa, there are some rounds that only show unrealized gains and no unrealized losses. For the former, there are no MPGs, and for the latter, there are no MPLs.

E. Reversals of Loss (ROL) and Reversals of Gain (ROG)

Throughout the accumulation phases, the trader is constantly keeping track of the MPLs and MPGs. Taking into account these threshold-level losses and gains, he may decide to load up more contracts or unload the existing ones. Continuing with the example in Table 1, we see that the accumulation phase of Round 2 includes Trades 19 through 41 and the MPL and MPG are, respectively, -193 and 3,066. Notice that while facing an MPL of -193 after Trade 28 is executed, instead of quitting, Trader A takes a chance by continuing to load up more contracts. In doing so, he apparently is hoping for the tide to turn. The tide indeed turns in his favor and reduces the unrealized loss to -28 in Trade 29, turns the unrealized loss to an unrealized gain in Trade 30, and continues to boost the unrealized gain in subsequent trades. By the end of the accumulation phase in Trade 41, Trader A experiences a total reversal of loss (ROL) of 3,259, which is the difference between the unrealized gain of 3,066, at the end of the accumulation phase, and the MPL of -193. By construction, ROL is either zero or a positive value, given that MPL, the maximum value among all unrealized gains/losses in the accumulation phase, is subtracted from the last unrealized gains/losses, which is either less than or equal to the maximum value, the MPL, in the accumulation phase.

For unrealized gains, a similar process takes place. Faced with MPG, a threshold-level of gain, the trader may be content with the gain and starts offsetting. Or, he may continue taking on more bets, only to realize in hindsight that doing so is a mistake because rather than gaining more, some of the gain achieved earlier is taken away. In our example, the MPG of 3,066 for Round 2 appears after Trade 41 is executed. Since this trade is the last one in the accumulation phase, it indicates Trader A decides to start the offsetting trades, presumably being content with the gain. Therefore, in Round 2, the reversal of gain (ROG) is zero, because the ending unrealized gain is also the MPG in this round.

Finally, there are some rounds when traders experience only gains or only losses, possibly when the overall market is steadily moving in one direction. For these rounds there are no MPLs or MPGs, hence no associated ROLs and ROGs. An example of these cases can be seen in Round 3, when Trader A faces only a string of unrealized losses, rendering no MPG and ROG in this round. We indicate cases like this with a NA.

F. Proportions of Zero Reversal of Loss and Zero Reversal of Gain

A zero ROL occurs when the unrealized loss at the end of the accumulation phase equals the MPL, indicating that the trader, in the face of a threshold-level loss, reverses the course and starts the offsetting phase, apparently feeling uncomfortable with the MPL. Similarly, a zero ROG happens when, facing the maximum possible gain, the trader ends the accumulation phase and starts to offset his/her bets, presumably satisfied with the threshold-level gain and preferring not to risk it. On the other hand, a positive ROL suggests that instead of starting the offsetting trades, the trader takes risk, presumably hoping to recover some of the loss, by accumulating more, resulting in recovering some loss before he eventually starts the offsetting trades. Similarly, in the case of a negative ROG, instead of offsetting his bets, which would result in a zero ROG, the trader takes more risk but ends up losing some gain before he finally starts the offsetting trades. By examining the relative frequency of the zero ROLs and positive ROLs and, similarly, the relative frequency of zero ROGs and negative ROGs, we are able to analyze the risk taking behavior of traders and its consequences on profitability of traders in the face of gains/losses.

After all the ROLs and ROGs are calculated for each trader, we calculate the proportion of zero ROLs (PZROL) and proportion of positive ROLs (PPROL). The former is the total number of zero ROLs divided by the total number of ROLs—which is the sum of the number of zero ROLs and the number of positive ROLs, and the latter is the total number of positive ROLs divided by the total number of ROLs:

$$PZROL = \frac{\# \text{zero_ROLs}}{\# \text{zero_ROLs} + \# \text{positive_ROLs}} \quad (1)$$

$$PPROL = \frac{\# \text{positive_ROLs}}{\# \text{zero_ROLs} + \# \text{positive_ROLs}} \quad (2)$$

For ROGs, we similarly calculate the proportion of zero ROGs (PZROGs) and proportion of negative ROGs (PNROGs) for each trader by dividing the total number of zero ROGs by the total number of ROGs for the former and total number of negative ROGs by the total number of ROGs for the latter:

$$PZROG = \frac{\# \text{zero_ROGs}}{\# \text{zero_ROGs} + \# \text{negative_ROGs}} \quad (3)$$

$$PNROG = \frac{\# \text{negative_ROGs}}{\# \text{zero_ROGs} + \# \text{negative_ROGs}} \quad (4)$$

Given that a zero ROL indicates that as the trader reaches a threshold-level of loss he takes an immediate action to reduce his risk, while a positive ROL suggests that rather than reducing his exposure he takes on more risk, a comparison between PZROL and PPROL therefore offers us a way to evaluate the risk-taking behavior of the trader. If $PZROL > PPROL$ we know that the trader is more likely to reduce risk by offsetting his bets as the loss threshold is reached than to take more risk by continuing to load up his bets. Similarly, since a zero ROG indicates that the trader takes an immediate action to reduce his exposure as the threshold gain is achieved, while a

negative ROG suggests more risk is taken, a higher PZROG than PPROG, tells us that instead of taking more risk, the trader tends to avoid risk-taking as the threshold-level gain is reached.

IV. Results

4.1 Profitability and Trading Statistics

Table 2 describes the data used in this study. There are a total of 132,021 accounts. Together, they account for a total of 24,496,774 contracts and 4,045,886 trading days. Accounting for transaction costs of commissions and taxes, they show a total net loss of 68,553,921 ticks and an average net loss of 519 ticks. Since each tick is worth NT\$200, this translates to a total loss of NT\$13,710,784,200 and average loss of NT\$103,800, or about \$415,478,309 and \$3,145 respectively, based on the exchange rate of NT\$33/\$ on 12/31/2003. This result is consistent with the evidence in prior studies that average investors lose money. However, our examination beyond the aggregate reveals tremendous variations among traders. Notably, while the median loss is a mere 159 ticks (\$964), the contrast between the loss suffered by the extremely unsuccessful traders and the profit earned by the most profitable traders is striking, as indicated by the minimum net profit of -3,566,781 ticks (\$20,981,064) and maximum of 4,777,947 (\$28,105,570). With a loss of over \$20 million, it immediately leads one to ask why such a loss is possible and conjectures that such trader must have ceased trading. Investigating further, our analysis show that traders with similar losses not only trade frequently, they continue to trade over the sample period. It turns out, from conversations with traders, that these losers earn enough from trading securities in other market to make up for the losses incurred in the trading of TAIEFX.

The results discussed above clearly demonstrate not all investors are equal in their performances and further in-depth examination of the traders beyond the aggregate level is warranted. We do so by looking at traders' profitability separately according to the number of days they trade. To conserve space and due to a large number of traders trading only a few days over the sample period, we group traders who trade less than 90 days in increments of 10 days and those who trade over 90 days in increments of 30 days. The results show that traders who

trade less than or equal to 10 days account for over 41% of the accounts and have a net loss of 10,277,271, representing 14.99% of total net loss of all traders. The corresponding numbers for traders who trade between 11 and 20 days are 17.08% of the accounts and a net loss of 9,540,413, or 13.92% of total net loss, a bit lower than the amount of loss of the first group. Continue moving down to longer trading-day groups, one can't but see a general trend of declining total loss until the 241-270 group. Beyond that, all remaining groups are profitable but don't appear to exhibit a strong trend. This lack of trend in profits turns out to be due to the ever dwindling number among these more frequent traders. By looking at average and median values, the trends of losses and profits are undeniably clear: the average and median losses (profits) for groups trading under (over) 270 days are clearly rising as traders trade more frequently. Another notable trend appears among the minimum net profit value, i.e., the largest losses. For traders who trade up to 150 days, we notice the largest losses generally rise as trading days get longer and as mentioned above, the trader who lost the most, with a net loss of 3,566,718 ticks is among the 121-150-day group, which is also the group that has the trader with the largest net profit of 4,777,947 ticks. There is no apparent trend beyond this group regarding the minimum values, nor is a trend among the maximum net profit values.

The above results on the average and median net profits among traders in different trading-day groups suggest a relationship between the profitability and trading days. The shape of the relationship, however, is not monotonic. In fact, it can best be described as a dipper, with the downward sloping segment of the curve resembling the tilted-v shaped cup of the dipper and reflecting the worsening loss as trading days increase and the upward sloping segment of the curve showing the handle of the dipper and reflecting the rising profit as trading days, with the juncture of the two parts at 270 days, in terms of mean, and 330 days, in terms of median.

To demonstrate how aggregation conceals the disparity among traders, we group traders who trade up to 90 days in increments of 30 days and report the results at the bottom of Panel A. Notice that traders who trade less than 30 days represent 69.06% of all accounts, who trade between 31 and 60 days, 16.04%, and between 61 and 89 days, 6.80%. Together, these three groups account for 91.91% of all accounts. The rest of the traders who trade 90 days and over, accounting for the remaining 8.09%, are combined into one group, given their small numbers.

Although small in number, traders of this fourth group are responsible for 59.8% of the trading volume and 38.12% of the trading days. Looking at the average net profits of these four groups, we notice that among the first three groups, as trading days increase, losses steadily rise, but that the loss of group four is smaller than the loss of group three. However, the median values show that as trading days increase, losses rise steadily among the four groups.

Insert Table 2 about here

The above demonstration of how aggregation conceals disparity among traders illustrates the necessity to examine investors separately. The dipper-shaped relationship between profitability and trading days further suggests not only we need to look at traders separately, but also we need to examine unprofitable traders and profitable traders separately. We report the results of this examination in Panel B of Table 2. Among all 132,021 traders, 91,546 (69.34%) are unprofitable, while 40,475 (30.66%) are profitable. Although the profitable group has an average profit of 1,590, higher than the average loss, in magnitude, of 1,452 for the unprofitable group, the latter has a higher median loss, in dollar amount, than the median gain for the former. Since the unprofitable group is more than double the profitable group in number of traders, we see why the overall traders have a net loss reported in Panel A. Going down the list from the groups with shorter trading days to those with longer trading days we see the mean and median losses or gains increase almost monotonically, indicating that longer trading days can be either detrimental or beneficial for traders' profitability.

Looking close, we also notice that the account numbers between the profitable and unprofitable traders tend to be linked to the number of trading days. As highlighted by the line under the group of 151-180 trading days in the table, for accounts that trade less than 180 days, the unprofitable traders have median account numbers more than double the profitable groups. After that, traders who trade between 181 and 330 days, the unprofitable traders still have a higher median account numbers, but for traders who trade more than 330 days, the profitable traders outnumber the unprofitable traders. Another notable difference between the two groups is the median profits or losses. As indicated by the bold-faced numbers in the table, the unprofitable traders have a higher dollar amount in loss than their profitable counterparts have in

profit for traders who trade less than 300 days and traders who trade between 451 and 480 days, while the profitable traders have a higher dollar amount in profit than the unprofitable traders have in loss for traders who trade over 300 days except for traders between 451 and 480 days. These detailed differences in dollar amount of profit versus loss clearly are hidden when we aggregate the traders into smaller groups such as the four groups, in increments of 30 days and over-90 days, as shown at the bottom of the table. With such a coarser grouping, we can only see the unprofitable traders having a larger dollar amount in loss than the profitable traders having profit. Furthermore, when traders are separated into only four groups, the difference in the number of accounts noted above are hidden again such that we only see that the unprofitable traders are more than twice in the number of accounts than the profitable traders. Finally, for the 10,426 traders with regular rounds of accumulation and offset phases of trades, 3,288 (31.54%) are profitable, with an average net gain of 10,279 and median of 1,604 while the remaining 7,138 traders are unprofitable with a smaller average net loss of 6,038 but larger median of 2,134.

These profitability and trading day results shed new light on the evidence on overconfidence in the literature. Typically, previously studies treat frequent trading as equivalent to excessive trading and conclude excessive trading due to overconfidence leads to reduced profits or even losses. The trend of increasing loss as trading days increase reported here is consistent with such conclusion. However, our results also show that traders who are profitable have higher profits as they trade more frequently, hence contradicting the conclusion in the literature. Without disaggregating traders into profitable and unprofitable and examine them separately, this new evidence would have been buried in aggregate. Adding another measure of trading activity, trading volume, we, therefore, conduct further examination comparing the profitable and unprofitable traders and report the results in Part 1 of Table 3.

In Panel A, as highlighted by the bold-faced numbers, among all traders, the unprofitable traders have higher median trading days, volume, and the absolute dollar amount of both net profit and gross profit. However, for traders with over 90 days of trading, Panel B shows that based on either mean or median, the profitable traders are more frequent traders—132 days versus 123 days in median and 154 days versus 140 days in mean—and have higher volume—508 contracts versus 382 contracts in median and 2,442 versus 875 in mean. This is also true for

the 10,426 traders with regular trading rounds. Together, Panels B and C show that among traders with over 90 days of trading and regular trading rounds, those who are profitable, although accounting for less than 1/3 in number, trade more frequently and have higher volume than their unprofitable counterparts.

Insert Table 3 about here

Clearly, Panels B and C show that in addition to the trading days, profitability varies with trading volume there are variations among traders regarding trading volume. So far, these two measures of trading activity are examined separately, whether and how they interact and affect the profitability among traders therefore requires further analysis. We do this by double sorting the traders: all traders are sorted by trading days into 10 decile groups and into 10 decile groups based on trading volume, resulting in 100 trading day and volume groups. We then examine the profitability among these 100 groups and report the results in Panel D of Table 3. To avoid clutter, only the means and medians are presented. To highlight the profit, we boldface those median numbers that are positive. Looking at the table, one immediately notices that groups in the upper diagonal are mostly unprofitable. Specifically, groups in the lowest and second lowest trading volume decile have losses in both means and medians across all trading day deciles. Among the groups with the third lowest trading volume deciles, only the 8th trading day decile group has a profit, based on either the median or mean values. As we move from lower to higher trading volume deciles and lower to higher trading day deciles, i.e., groups in the lower diagonal, we see most of them have a profit.

In sorting the traders, we separate them into 10 trading day decile groups in increments of roughly 40 days between groups: from the first group, that trades between 90 and 129 days, to the last group that trades between 451 and 491 days. The former has a total of 5,512 traders accounting for 52.87% of the sample traders, while the latter only boasts a total of 31 traders. Detailed statistics of trading day among the decile groups are reported in Panel A, Part 2 of Table 3. Similarly, traders are sorted into ten trading volume decile groups and detailed trading volume statistics among the groups are reported in Panel B. Among the groups, the first has 5,318 traders (51.01%) trading between 102 and 428 contracts and a total trading volume of 1,414,568

contracts, the second group has 2,465 traders (23.64%), trading between 428 and 830 contracts and a total trading volume of 1,451,885 contracts, and the tenth group, with 9 traders (less than 0.09 %) trade a median of 123,702 contracts with a total trading volume of 1,461,357 contracts. We also group the traders into five quintile groups in terms of the share of the total profit and loss, separately. Panel C shows that among the 3,288 profitable traders, the majority, 88.38% ($=2906 \div 3288$) are in the first quintile with a median net profit of 1,294. The remaining four quintile groups, with a total of 382 traders, represent only 11.62% of the profitable traders but earn large profit, ranging from 13,518 (NT\$2,703,600 or \$81,927) to 4,777,947 (NT\$955,589,400 or \$28,957,254). For the unprofitable traders reported in Panel D, we see that the least unprofitable quintile group, with a total of 5,235 traders representing 73.34% of total unprofitable traders, has an average loss of 1,625 (NT\$325,000 or \$9,848). On the other hand, the remaining four quintiles account for 26.66% of the unprofitable traders and have losses ranging from 3,975 (NT\$795,000 or \$24,091) to 3,566,781 (NT\$713,356,200, or \$21,616,855).

Due to the clustering of traders in the lower deciles/quintiles, the above decile/quintile sorting method results in the number of traders varies significantly among groups. To check for robustness of our results, we also employ an alternative sorting method that yield about the same number of traders in each group. It entails ranking the traders from the lowest to highest value in trading days, trading volume, profit, and loss, then dividing the traders into 10—for trading days and volume groups, or 5—for profit and loss groups with about equal number of traders. However, this method, called equal-number method, also has its undesirable consequence. Since most traders cluster around the first and/or second groups, as shown in all panels in Part 2 of Table 3, the equal-number method results in many groups in the lower order essentially coming from the lowest decile/quintile group reported above, while the last group in fact is a mixture of the higher decile/quintile traders who vary a great deal in trading characteristics, making the comparison between groups less meaningful. Surprisingly though, results based on these equal-number groups are qualitatively similar to the results based on the decile/quintile method reported. For this reason, to conserve space, the equal-number results are not reported but are available from the authors.

As a final step of our examination of profitability, we conduct ANOVA tests on the effect of trading days and trading volume on the profitability. We first conduct univariate tests separately for trading frequency and trading volume. We then perform bivariate test to examine whether profitability is affected by trading days, trading volume, and the interaction of trading days and volume. The results for the 10,687 traders who trade over 90 days and 10,426 traders with regular trading rounds are reported in Part 3 of Table 3. All test results are statistically significant, indicating that traders' profitability is affected by trading days and trading volume.

4.2 Risk Taking Behavior in the Event of Losses

The profitability results reported above show that trading days and trading volume affect profitability. The results reported in Panel B in Table 2 also show that frequent and high-volume trading can be either beneficial for or detrimental to profitability. This last result suggests that it is imperative to examine the profitable traders separately from the unprofitable traders and seek explanations as to why the former are profitable while the latter are not. The literature offers little guidance on this question and the only apparent clue comes from previous studies on the disposition effect that examine how investors deal with unrealized gains and losses of their investments. The issue behind these studies is investor's risk tolerance in the face of gains and losses. However, rather than following the method used in these studies, we employ our measure of risk-taking to examine how investors' risk-taking behaviors affect their profitability by examining whether and how profitable and unprofitable traders vary in their risk-taking behavior separately as we have done so far in examining the differences in their profitability.

To perform the analysis of risk-taking behavior using our method discussed in Section III, it is necessary that traders have sufficient trading and follow regular rounds of accumulation and offsetting trades. For this reason, we exclude traders who trade less than 90 days. Selected from among the 10,687 traders who trade 90-days and over, 10,426 traders follow regular rounds of trades⁶. As shown in Panel A of Table 2, representing only 7.90% of all accounts, these traders trade over 14.5 millions contracts, averaging 1,398.5 contracts per person and accounting for

⁶ Traders in the remaining 261 (=10,687-10,426) accounts that exhibit no such regularity in trade sequences typically accumulate a position and offset the position in the subsequent trade.

59.52% of all trading volume, They have a total trading days of over 1.5 million days, averaging 145 days ($= 1,510,825 \text{ total trading days} \div 10,426$) per person. Despite their large share of trading volume and frequent trading, their share of the total net loss is 13.58%.

Focusing on these 10,426 traders with regular rounds of accumulation and offsetting trades, we proceed with the analysis of their reactions to losses and gains by examining their risk-taking behavior using the method discussed in Section III. In the face of a threshold-level of loss, a zero reversal of loss suggests the trader take a risk-reducing action by offsetting the contracts accumulated during the accumulation phase of trades, while a positive reversal indicates a risk-taking behavior of delaying the offsetting bets. By examining the relative frequency of zero and positive reversals, PZROLs and PPROLs, we can tell how traders behave when they face losses. Table 4 reports the results of such an analysis based on 10,309 traders who have non-zero MPLs. As reported in Part 1, the average PZROL is 88.94%, indicating that faced with threshold-level losses, close to 89% of the traders choose to reduce risk by offsetting their positions, while only about 11% of them continue to accumulate contracts. This evidence suggests that instead of holding onto losses, traders as a group are quick to cut their losses and start unwinding their holdings.

Insert Table 4 about here

To see how the variations among the sample traders in trading characteristics transpire in the PZROLs, we examine and report the statistics of PZROLs among trading-day and trading-volume subgroups in Part 2 of Table 4. Among the trading-days groups, it is very clear in Panel A that the median PZROLs generally decline as traders trade more frequently, from 95.83% for Group 1, the group that trades least frequently, to 68.94% for Group 10, the group that trades most frequently. The trend is equally apparent in mean values. In Panel B, the declining trend also exists among the trading-volume groups: both medians and means mostly decrease from lower-volume to higher-volume groups. In Panel C, the declining tendency to offset, though still higher than 50% except the least profitable group, shows up among the profitable quintile groups too: the higher the profitability, the lower the PZROLs. For the most profitable group, the median and mean PZROLs are below 50%, 46.25% and 47.41% respectively, suggesting this

group is more likely to continue to increase position risk-taking. Examining in more detail, we see that the value for the three traders in this group is 15.38%, 46.24%, and 80.61%, respectively. Therefore, two of the three most profitable traders are more likely to take more risk by increasing their positions than reducing risk by offsetting their positions. On the other hand, the third trader tends to offset his position. This variation among profitable traders is not as great among the equal-number groups. As shown on the right hand side of Panel C, the medians and means steadily decline and are still high at 72.13% and 70.08, respectively. However, one thing actually stands out among the equal-number groups: the median value of 100% for the least profitable two groups, Groups 1 and 2, indicating over half, 300 of the traders in Group 1 and 310 of the traders in Group 2, tend to offset their positions whenever they reach the threshold-level losses. Even based on the quintile-grouping results reported on the left-hand side of Panel C, the median value of 90% among the 2,795 traders in Group 1, similarly suggests that these traders overwhelmingly offset their trades in the face of threshold-level losses. By doing so, the profit of these traders is the lowest among profitable traders. This evidence of low profitability among traders who reduce risk by starting to offset in the face of threshold losses and gains and the contrasting higher net profits among traders who choose to take more risk by continuing accumulating positions clearly suggests risk-taking can lead to higher profitability.

The declining tendency of PZROLs is equally apparent among the unprofitable traders. As shown in Panel D, from the least-unprofitable quintile group to the most-unprofitable quintile groups, the median steadily fall from 95.83% to 38.18%, and mean values, from 86.45% to 38.10% respectively. Similar to the profitable traders, the results among the equal-number groups reported on the right-hand side of the panel shows the steadily declining trend. However, before proceeding further, let's not overlook the opposite consequences of the similar trend of declining PZROLs reported in Panels C and D between profitable and unprofitable traders on the profitability of risk taking: instead of taking more risk by increasing their positions, the action to reduce risk by offsetting their positions by Group 1, as suggested by the high average (86.45%) and median (95.83%) PZROLs, unprofitable traders in this group save themselves from incurring larger losses. In contrast, the same behavior by Group 1 of the profitable traders keeps themselves from earning more profits. Vice Versa, by increasing their trade positions, hence taking more risk, as suggested by the lower average PZROLs of 38.10%, the Group 5

unprofitable traders incur the greatest losses, whereas their profitable Group 5 counterparts reap tremendous profits.

Not surprisingly, the apparent variations in PZROLs among subgroups show up in formal statistical tests. As reported in Part 1 of Table 5, the ANOVA tests clearly show that there is a statistically significant difference in PZROLs among the subgroups in terms of the number of trading days, volume, or profitability, suggesting traders indeed vary in their reaction to losses. We further test the difference in PZROLs between subgroups by performing t-tests as well as non-parametric Wilcoxon and Mann-Whitney tests. The results are similar. Therefore, to streamline the presentation and to highlight the sharp contrast, we only report in Part 2 of Table 5 the results on the t-test of the PZROLs between the highest and lowest groups in each of the four categories of trading characteristics. Panel A shows that Group 10, the most frequent traders, has a mean PZROL of 69.37% while Group 1, the group with the smallest number of trading days, has a mean of 90.51%. The difference of 21.14% between these two groups is statistically significant at less than 1% level. It is clear that although both groups show higher likelihood to stop continuing to load up their position—both have means over 50%—in the face of losses, the least frequent traders are more likely to do so. The comparison between the highest-volume and lowest-volume groups reported in Panel B shows similar results that although both groups tend unload their holding when faced with losses, it is the lowest-volume group that shows an overwhelming tendency, 94.04% of the time, to reduce their positions. Note that although the numbers of traders between the lowest and highest groups in Part 2 (e.g., based on trading days, Group 1 has 5,428 traders while Group 10 has 31 traders) are very different, results from the equal-number groupings are qualitatively the same. Therefore, we are convinced that the significant results reported here are not driven by statistical technicality.

Insert Table 5 about here

To answer whether the tendency to stop increasing positions or even to offset their contracts in the face of losses affects the profitability of trading, it's necessary to examine whether differences exist between groups of varying levels of profits and losses. We report the results of such examination in Panels C and D. Among the profitable traders, Panel C shows that

the most profitable group of traders has a mean PZROL of 47.41%, suggesting they are more likely to hang onto, than reduce, their bets, in the face of losses. In contrast, their least profitable counterparts, with a mean PZROL of 86.64%, show, instead of increasing their positions, a greater tendency to offset their contracts in the face of losses. For the unprofitable traders, Panel D shows that the smallest-loss group has a mean of PZROL of 93.48%, indicating a very high tendency to unload their bets, while their peers with the most losses have a mean PZROL of 47.93%, hence more likely to increase their positions.

Concurring with the results in Panels C and D in Table 4, the results reported in Panels C and D in Table 5 indicate that in the face of losses the degree of the tendency to unload contracts affects trading profitability. By hanging onto their bets, the most profitable traders eventually are rewarded with the highest profit. On the other hand, by unloading their bets, unprofitable traders are able to suffer smaller losses than those who hang onto their bets.

4.3 Risk Taking Behavior in the Event of Gains

We next investigate how traders behave when they are faced with gains by examining the reversal of gains and report the results in Table 6. Part 1 shows that as a group, traders have a significantly high average PZROG, 82.17%, indicating a strong tendency to stop the accumulation trades after the maximum possible gains occur. Looking at subgroups, the steadily declining trend reported for PZROLs reported in Table 4 is also present here. In Panels A through D, going from lower to higher decile or quintile groups, there is clearly a steadily falling PZROG. Overall, traders who are in groups with more frequent trading, have higher trading volume, are more profitable among the profitable traders, and have more losses among the unprofitable traders have smaller PZROGs, i.e., they tend to continue increasing their positions than their counterparts in group with lower trading frequency and volume as well as lower profits and losses. Examining Panels C and D more carefully, one notices that both the most profitable and most unprofitable groups have a median below 50%. Specifically, not shown in the table, two of the three most profitable traders, with a PZROG of 44.00% and 45.64%, respectively, are more likely to continue accumulating their positions than to offset their positions, while the third trader stops accumulating trades. In the case of the unprofitable groups, we find that the nine

traders have a mean and median PZROG lower than 40%. Clearly, both the most profitable and unprofitable traders have a lower tendency to unload trades or, in other words, a higher tendency to continue accumulating their trades in the face of gains.

Insert Table 6 about here

Given the apparent variations among traders in their trading characteristics, we further formally test whether the differences are statistically significant and report the results in Table 7. The ANOVA test results in Part 1 clearly indicate that there are statistically significant differences in PZROGs among traders in different subgroups based on the number of trading days, volume, profits, and losses.

Insert Table 7 about here

We then perform t-tests—and nonparametric tests but the results for which are not reported to conserve space—on PZROGs between subgroups and report the results in Part 2. Panel A shows that the average of 66.09% for the most frequent traders is statistically different from the average of 83.63% for the least frequent traders. Panel B shows that traders with the lowest volume are relatively more likely to stop increasing their bets in the face of gains than traders with the highest volume. These two results of whether traders continue to take risk by increasing their positions in the face of gains are similar to those reported in the previous section for traders facing threshold-level of losses. To see whether and how traders react to gains affect their profitability, we examine the difference in the reaction to threshold-level gains between traders with different levels of profitability and report the results in Panels C and D. For the most profitable traders, the average PZROG is 50.11%. In contrast, their least profitable peers report an average of 85.17%. This clearly suggests that more profitable traders have a higher tendency to take more risk, instead of reducing risk as their less profitable peers do. For traders with losses, the average of 86.45% reported in Panel D for traders who suffer the least amount of losses suggests that they tend to reduce their risk-taking when faced with a gain, while their peers with the largest losses are more likely to continue to increase risk-taking as indicated by the low average PZROG of 38.10%.

Overall, the results reported in this section show that traders who trade more frequently and in higher volume have lower PZROGs. Additionally, traders who are more profitable and traders who lose more also have lower PZROGs. Together, Tables 6 through 7 depict a very clear picture that when faced with threshold-level gains, traders exhibit a steadily declining offsetting pattern, from the lowest quintile group to the highest quintile group.

4.4 Behavior Differences Between Losses and Gains

So far we have shown that traders with different frequencies of trading and trading volume vary in their responses to losses and gains. We further examine whether they react to losses differently from the way they react to gains by comparing the difference between PZROLs and PZROGs. The results are reported in Table 8. Part 1 shows that the average PZROLs is 88.11%, while the average PZROGs is 81.96%. The difference is 6.16%, which is statistically significant at less than 1% level, suggesting that although traders tend to start offsetting trades, hence reduce risk, faced with both losses and gains as reported earlier, they are more likely to do so in the face of losses. We further examine whether this difference between PZROLs and PZROGs is a general phenomenon or vary among subgroups and report the results in Part 2. Panel A shows that for Group 1, the least frequent trading group, the difference between PZROL and PZROG is 6.14%, about the same as that for the total sample. For the next five groups, the difference remains positive. The differences are statistically significant at less than 1% level for Groups 1 through 5, and at 2.96% level for Group 6. In Groups 7 through 10, the differences are, respectively, 2.99%, -4.36%, -6.02, and 3.28%, but not statistically significant.

Insert Table 8 about here

Among the trading volume groups, for the first three groups, the difference is significantly positive and higher than the average difference for the total sample. The difference is also positive for Groups 4 to 6 and statistically significant. For Groups 7 and 8, the difference is positive but statistically insignificant. For the last two groups, the difference becomes negative and statistically significant. Therefore, it seems that traders with the highest trading volume have

higher PZROG than PZROL, i.e., they are more likely to start the offset in the face of gains as opposed to losses.

Among profitable traders, Group 1, the least profitable group, has a significantly positive difference of 1.24%. For the remaining groups, the difference is negative, suggesting a quicker offset in the face of gains than in the face of losses. The differences are statistically significant for Groups 2 and 3. For unprofitable traders, the difference is positive for all groups and statistically significant at less than one percent level except Group 5, the group with the largest losses, suggesting more likely to reduce risk in the face of losses than gains.

Overall, results reported in this section of higher PZROLs than PZROGs exhibit in many subgroups suggest they take more risk loading up their position in the face of gains. What's interesting is that the difference is more prevalent among traders who trade less frequently, have lower volume, are least profitable, and are unprofitable.

4.5 Regression of Profit and Losses on Trading Characteristics

Up to now, we have shown the risk-taking behavior of traders by examining their propensity to liquidate their positions in response to threshold level of losses and gains. We have also documented that there are variations in trading activities as well as in the reaction among profitable traders and among unprofitable traders. Given these variations, the immediate question is how the propensity to liquidate and traders' trading characteristics affect trading profitability. To answer this question, we run formal tests with the following regressions:

$$D_{profitgroup} = \beta_0 + \beta_1 PZROL + \beta_2 PZROG + \beta_3 D_{daygroup} + \beta_4 D_{volumegroup} \quad (5)$$

$$D_{unprofitgroup} = \gamma_0 + \gamma_1 PZROL + \gamma_2 PZROG + \gamma_3 D_{daygroup} + \gamma_4 D_{volumegroup} \quad (6)$$

Where

$D_{profitgroup} = 1, 2, \dots, 5$; one for the group with the least profit, two for the group with the next least profit, ..., and 5 for the most profitable group,

$D_{\text{unprofitgroup}} = -1, -2, \dots, -5$; -1 for the group with the least losses, -2 for the next least losses, ..., and -5 for the greatest losses,

$D_{\text{daygroup}} = 1, 2, \dots, 10$; one for the group with the smallest number of trading days, two for the next smallest, ..., and ten, for the largest number of trading days.

$D_{\text{volumegroup}} = 1, 2, \dots, 5$; one for the group with the smallest trading volume, two for the next smallest, ..., and five for the largest trading volume.

Notice that the indicator variable for unprofitable traders takes on negative value. This construction makes the interpretation of the coefficient estimates straightforward: a positive coefficient means the higher the value the variable takes on the higher the profitability—higher profits for profitable traders and lower losses for unprofitable traders. The results are reported in Table 9. From the results for Model 1, we see that β_1 has a statistically significant coefficient of -0.544, indicating the higher the PZROL, the less likely the traders will be in the higher profit quintile. Similarly, β_2 is a significant -0.212, suggesting the higher the PZROG, the less profitable the traders are. The coefficient for D_{daygroup} is also a significant -0.026, suggesting more frequent traders tend to be in the lower profit quintile group. The only positive coefficient is the significant 0.172 for $D_{\text{volumegroup}}$, indicating traders with higher volume are more profitable. Together, the regression results are consistent with the results reported in earlier sections that in the face of both losses and gains traders who wait tend to be more profitable. We also report the standardized coefficients. Among the four regressors, we see that volume has the largest standardized coefficient of 0.578, indicating trading volume has a greater effect on the profit among the profitable traders.

Insert Table 9 about here

Results for Model 2, for the unprofitable traders, show that the coefficients for PZROL, PZROG, and D_{daygroup} are significantly positive and the coefficient for $D_{\text{volumegroup}}$ is significantly negative. These results suggest that traders who tend to reduce risk-taking in the face of both losses and gains, and trade more frequently, are more likely to be in the lower loss quintile groups. In contrast, the coefficient for Volume is negative and statistically significant, indicating the more the traders trade the greater the losses they suffer. Similar to the result for profitable

trader, trading volume has the highest standardized coefficients, indicating it has the largest effect on the losses among the unprofitable traders.

V. Discussion and Conclusion

By tracking the trade-by-trade transaction histories of individual traders separately in the Taiwan Futures Exchange (TAIFEX), this paper is able to demonstrate that although as a group they are unprofitable, after accounting for all transaction costs, there are a large number of traders—roughly one third—who are quite profitable, especially among those who trade frequently and in high volume. This evidence of profitable, frequent, and high-volume traders contrasts sharply to the widely-cited evidence documented in Odean [1998] and similar studies on overconfidence suggesting excessive trading, due to overconfidence, results in reduced profitability and even losses. Our further analysis shows that trading volume has a significantly dominant effect on profitability. However, the effect can be either positive or negative. On the one hand, among the profitable traders, those who trade higher volume tend to be more profitable. On the other hand, among the unprofitable traders, higher trading volume leads to greater losses. Although the latter result on losses seems to be consistent with the conclusion in the literature regarding the effect of excessive trading on profitability, we are not aware of evidence in the literature indicating higher trading volume is associated with greater profit.

Our focused analysis of the frequent and high-volume traders on their risk-taking behavior by examining how they respond to losses and gains show that while overall they tend to offset their positions, hence reduce risk, after reaching some threshold levels of gains and losses, they have a greater tendency to reduce risk in the face of losses than when they are faced with gains. Further results from the linkage between trading profits and losses and traders' risk-taking behavior confirms that reducing risk-taking by these traders in the face of losses and gains have opposite effects on profitability between profitable traders and unprofitable traders. For profitable traders, the reduction in risk-taking in the face of both losses and gains leads to lower profit, suggesting that to be more profitable, they need to resist the temptation to unload their positions. In sharp contrast, for unprofitable traders, the reduction in risk-taking results in smaller

losses. As far as we know, the extant literature based on studies that only examine the aggregate trader offers no such evidence.

Using our method to analyze each trader individually, we link together trading frequency, volume, profitability, and the tendency to offset trades in the face of losses and gains and present results that challenge the general conclusion on overconfidence and shed a new light on the how risk-taking behavior affects profitability. These results suggest that studies that go beyond the aggregate trader open the door for new evidence on investor behaviors and offer the most potential for extending the literature on behavior finance.

To explain some of the results reported in this study that appear to contradict the widely-accepted conclusions on overconfidence we can look to theoretical studies that examine the survival of overconfident traders. If one accepts the idea that being profitable is a necessary and sufficient condition for the survival of a trader, the existence of the profitable frequent and high-volume traders documented here is consistent with the conclusion in Kyle and Wang [1997] that an overconfident trader may be profitable and dominate his rational opponent. Similarly, the conclusion in Wang [2001] of the eventual extinction of irrational traders—due to losses—who have negative sentiment (underconfidence or bearishness) or extremely positive sentiment (excess confidence or bullishness) may explain why unprofitable traders in this study incur losses. At the same time, the conclusion of the domination of irrational traders with moderately positive sentiment may match the profile of the profitable traders and help explain why they are profitable.

While theoretical studies like the aforementioned may offer clues to our results, to fully explain them theorists may have to go beyond their typical modeling assumptions that there are two types of traders, the informed versus noise traders, and that the informed traders gain information advantages over noise traders via observing the trading flow on the exchange floor. In contrast, the traders examined in this study are all individual traders, therefore they can be assumed to be equally uninformed based on the premise of existing theoretical studies. Furthermore, trading at TAIEX is done electronically, hence there is no trading floor for any traders to obtain information advantage over others. It's possible that by recognizing these facts

and making assumptions accordingly, theorists may be able to construct models that lead to a better explanation for the results documented here.

In addition to contributing to the literature, our results based on after-transaction-cost profits and losses also have practical implications for traders regarding their trading strategies. On the one hand, the evidence that a greater tendency to offset losses than gains results in smaller losses among the unprofitable traders makes it easier to accept and abide by the common investment advice of avoiding falling victim to the disposition effect. On the other hand, the same cannot be said in the case when traders are profitable. It is puzzling to look at the result that the similarly greater tendency to offset losses than gains is exhibited among the least profitable traders while the opposite of a greater tendency to offset gains than losses, though not statistically significant, shows up among more profitable traders. Equally puzzling too is the evidence on the opposite effects of trading volume on profitability depending on whether traders are profitable or not. Maybe the market environment, such as a rising market versus a declining market, also has something to do with profitability. Alternatively, maybe ability or discipline—as studied in Locke and Mann [2005]—are other determinants of profitability. Before new evidence becomes available, it's safe to say that the practical implication from the results presented in this study is that one needs to be aware that not all traders are equal and the effects of risk-taking strategy on profitability in the face of losses versus gains are not the same.

References

- Annaert, Jan, Dries Heyman, Michele Vanmaele, and Sofieke Van Osselaer, Disposition bias and overconfidence in institutional trades, Working Paper, 2008.
- Barber, Brad M., Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean, 2004a, "Do Individual Day Traders Make Money? Evidence from Taiwan," working paper, UC-Davis, Davis, CA.
- Barber, Brad M., Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean, 2004b, "Is the Aggregate Investor Reluctant to Realize Losses?" working paper, UC-Davis, Davis, CA.
- Barber, Brad M., Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean, 2006, "Just How Much Do Investor Lose from Trade? working paper, UC-Berkley, Berkley, CA
- Barber, Brad M., and Terrance Odean, 2000, "Trading Is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors," *Journal of Finance*, 55(2), 773-806.
- Barber, Brad M., and Terrance Odean, 2001, "Boys will Be Boys: Gender, Overconfidence, and Common Stock Investment," *Quarterly Journal of Economics*, 116, 261-292.
- Cheng, Teng-Yuan, Chun I Lee, Chao-Hsien Lin, and Hung-Chih Li, "A Direct Test of the Link between the Disposition Effect and Profitability in Futures Market," 2009, Working paper.
- Coval, Joshua D., David Hirshleifer, and Tyler Shumway, 2003, "Can Individual Investors Beat the Market?" unpublished working paper, Harvard Business School, Cambridge, MA.
- De Long, J. Bradford, A. Shleifer, Lawrence H. Summers, and Robert J. Waldmann, 1990, Noise trader risk in financial markets, *Journal of Political Economy* 98, 703-738.
- Dhar, Ravi, and Ning Zhu, 2006, Up Close and Personal: Investor Sophistication and the Disposition Effect, *Management Science* 52, 726-740.
- Figlewski, S. 1978, "Market Efficiency" in a Market with Heterogeneous Information, *Journal of Political Economy* 86, 581-597.
- Frino, Alex, David Johnstone, Hui Zheng, 2004, The propensity for local traders in future markets to ride losses: Evidence of irrational or rational behavior, *Journal of Banking & Finance* 28, 353-372..
- García, Diego, Francesco Sangiorgi, and Branko Urošević, 2007, Overconfidence and Market Efficiency with Heterogeneous Agents, *Economic Theory* 30, 313-336.
- Garvey, Ryan and Anthony Murphy, 2004, "Are Professional Traders Too Slow to Realize Their Losses?" *Financial Analyst Journal*, 60, 35-43.

- Garvey, Ryan and Anthony Murphy, and Fei Wu, 2007, "Do Losses Linger?" *Journal of Portfolio Management*, 75-83.
- Genesove, David, and Chris Mayer, 2001, Nominal loss aversion and seller behavior: Evidence from the housing market, *Quarterly Journal of Economics* 116, 1233-1260.
- Goetzmann, William N. and Kumar, Alok, 2005, "Why Do Individual Investors Hold Under-Diversified Portfolios?" Available at SSRN: <http://ssrn.com/abstract=627321>
- Grinblatt, Mark, and Matti Keloharju, 2000, "The Investment Behavior and Performance of Various Investor Types: A Study of Finland's Unique Data Set," *Journal of Financial Economics*, 55, 43-68. 22
- Heath, Chip, Steven Huddart, and Mark Lang, 1999, Psychological factors and stock option exercise, *Quarterly Journal of Economics* 114, 601-627.
- Heisler, Jeffrey, 1994, Loss Aversion in Futures Markets: An Empirical Test, *The Review of Futures Markets*, 13, 793-822.
- Ivkovich, Zoran, Clemens Sialm, and Scott J. Weisbenner, 2004, "Portfolio concentration and the Performance of Individual Investors," *Journal of Financial and Quantitative Analysis*, 43, 613-655.
- Ivkovich, Zoran, and Scott J. Weisbenner, 2006, "Local Does as Local Is: Information Content of the Geography of Individual Investors' Common Stock Investments," *Journal of Finance*, 60, 267-306.
- Kahneman, D., and Tversky, A., 1979, Prospect theory: An analysis of decision under risk, *Econometrica* 47, 263-291.
- Kyle, Albert S, and F. Albert Wang, 1997, Speculation duopoly with agreement to disagree: Can overconfidence survive the market test? *Journal of Finance* 52, 2073-2090.
- Linnainmaa, Juhani, 2003a, "The Anatomy of Day Traders," Available at SSRN: <http://ssrn.com/abstract=472182>
- Linnainmaa, Juhani, 2003b, "Who Makes the Limit Order Book? Implications for Contrarian Strategies, Attention-Grabbing Hypothesis, and the Disposition Effect" Available at SSRN: <http://ssrn.com/abstract=474222>.
- Locke, P., and Mann, S., 1999, Do professional traders exhibit loss aversion, Working Paper.
- Odean, Terrance, 1998, Are investors reluctant to realize their losses? *Journal of finance* 53, 1775-1798.

- Odean, Terrance, 1999, Do Investors Trade too Much? *American Economic Review* 89, 1279-1298.
- Ricciardi, Victor, 2008 “The Psychology of Risk: The Behavioral Finance Perspective”, in Chapter II.1.10 of *Handbook of Finance*, John Wiley & Sons, Inc.
- Sandroni, A., 2005, Efficient markets and Bayes’ rule, *Economic Theory* 26, 714–764.
- Schlarbaum, Gary G., Wilbur G. Lewellen, and Ronald C. Lease, 1978a, “The Common-Stock-Portfolio Performance Record of Individual Investors: 1964-70,” *Journal of Finance*, 33, 429-441.
- Schlarbaum, Gary G., Wilbur G. Lewellen, and Ronald C. Lease, 1978b, “Realized Returns on Common Stock Investments: The Experience of Individual Investors,” *Journal of Business*, 51, 299-325.
- Shefrin, H and Statman, M., 1985, The Disposition to Sell Winners Too Early and Ride Losers Too Long : Theory and Evidence, *Journal of Finance* 40, 777-790.
- Thaler, Richard H., Tversky, Amos, Kahneman, Daniel, and Alan Schwartz, 1997, “The Effect of Myopia and Loss Aversion on Risk Taking: An Experimental Test,” *The Quarterly Journal of Economics*, vol. 112(2), 647-61, May.
- Thaler, R., 1985, Mental Accounting and Consumer Choice, *Marketing Science* 4, 199–214.
- Wang, F., 2001, Overconfidence, investor sentiment and evolution, *Journal of Financial Intermediation* 10, 138~170.

Table 1. An Example of the Calculation of the Variables of Gains/Losses in Three Rounds of Trades

Trade sequence	Round	Trade phase	Buy/sell	Price	Number of contracts	Average cost	Open interest	Unrealized gain/loss	Realized gain/loss	Commission	Tax	Net realized gain/loss	Cumulative realized gain/loss	Net profit/loss	Maximum possible loss	Maximum possible gain	Reversal of loss	Reversal of gain
1	1	A	S	5951	5	5951.000	-5	0.000										
2	1	A	S	5950	1	5950.833	-6	5.000										
3	1	A	S	5951	4	5950.900	-10	-1.000										
4	1	A	S	5948	5	5949.933	-15	29.000										
5	1	A	S	5949	5	5949.700	-20	14.000										
6	1	A	S	5955	5	5950.760	-25	-106.000										
7	1	A	S	5959	5	5952.133	-30	-206.000							-206.000	29.000	0.000	-235.000
8	1	O	B	5945	2	5952.133	-28	199.733	14.267	24.000	19.045	-28.779	-28.779					
9	1	O	B	5945	1	5952.133	-27	192.600	7.133	0.750	0.595	5.789	-22.990					
10	1	O	B	5945	2	5952.133	-25	178.333	14.267	1.500	1.189	11.578	-11.412					
11	1	O	B	5946	5	5952.133	-20	122.667	30.667	3.750	2.973	23.944	12.531					
12	1	O	B	5948	3	5952.133	-17	70.267	12.400	2.250	1.784	8.366	20.897					
13	1	O	B	5948	2	5952.133	-15	62.000	8.267	1.500	1.190	5.577	26.474					
14	1	O	B	5948	1	5952.133	-14	57.867	4.133	0.750	0.595	2.789	29.263					
15	1	O	B	5948	4	5952.133	-10	41.333	16.533	3.000	2.379	11.154	40.417					
16	1	O	B	5949	1	5952.133	-9	28.200	3.133	0.750	0.595	1.788	42.205					
17	1	O	B	5949	4	5952.133	-5	15.667	12.533	3.000	2.380	7.154	49.359					
18	1	O	B	5951	5	0.000	0	0.000	5.667	3.750	2.976	-1.059	48.300	48.300				
19	2	A	S	5961	10	5961.000	-10	0.000										
20	2	A	S	5960	5	5960.667	-15	10.000										
21	2	A	S	5957	5	5959.750	-20	55.000										
22	2	A	S	5959	2	5959.682	-22	15.000										
23	2	A	S	5955	3	5959.120	-25	103.000										
24	2	A	S	5959	11	5959.083	-36	3.000										
25	2	A	S	5955	4	5958.675	-40	147.000										
26	2	A	S	5953	5	5958.044	-45	227.000										
27	2	A	S	5959	5	5958.140	-50	-43.000										
28	2	A	S	5962	5	5958.491	-55	-193.000										
29	2	A	S	5959	5	5958.533	-60	-28.000										
30	2	A	S	5956	15	5958.027	-75	152.000										
31	2	A	S	5955	5	5957.838	-80	227.000										
32	2	A	S	5954	10	5957.411	-90	307.000										
33	2	A	S	5946	5	5956.811	-95	1027.000										

* A round includes two phases of trades: the accumulation phase of trades when the number of contracts is rising in one trading direction, long or short, followed by the offsetting phase when the numbers of contracts are falling as traders offset the contracts accumulated in the earlier phase.

Table 1 (continued).

Trade sequence	round	Trade phase	Buy/sell	Price	Number of contracts	Average cost	Open interest	Unrealized gain/loss	Realized gain/loss	Commission	Tax	Net realized gain/loss	Cumulative realized gain/loss	Net gain/loss	Maximum possible loss	Maximum possible gain	Reversal of loss	Reversal of gain
34	2	A	S	5943	5	5956.120	-100	1312.000										
35	2	A	S	5944	4	5955.654	-104	1212.000										
36	2	A	S	5944	1	5955.543		1212.000										
37	2	A	S	5943	5	5954.973	-110	1317.000										
38	2	A	S	5938	5	5954.235	-115	1867.000										
39	2	A	S	5939	2	5953.974	-117	1752.000										
40	2	A	S	5937	3	5953.550	-120	1986.000										
41	2	A	S	5928	10	5951.585	-130	3066.000							-193.000	3066.000	3259.000	0.000
42	2	O	B	5957	1	5951.585	-129	-698.585	-5.415	98.250	77.966	-181.632	-181.632					
43	2	O	B	5957	4	5951.585	-125	-676.923	-21.662	3.000	2.383	-27.044	-208.676					
44	2	O	B	5957	1	5951.585	-124	-671.508	-5.415	0.750	0.596	-6.761	-215.437					
45	2	O	B	5957	1	5951.585	-123	-666.092	-5.415	0.750	0.596	-6.761	-222.198					
46	2	O	B	5957	1	5951.585	-122	-660.677	-5.415	0.750	0.596	-6.761	-228.959					
47	2	O	B	5957	2	5951.585	-120	-649.846	-10.831	1.500	1.191	-13.522	-242.481					
48	2	O	B	5961	5	5951.585	-115	-1082.769	-47.077	3.750	2.981	-53.807	-296.289					
49	2	O	B	5959	1	5951.585	-114	-845.354	-7.415	0.750	0.596	-8.761	-305.050					
50	2	O	B	5959	1	5951.585	-113	-837.938	-7.415	0.750	0.596	-8.761	-313.811					
51	2	O	B	5958	3	5951.585	-110	-705.692	-19.246	2.250	1.787	-23.284	-337.095	-1042.787				
52	3	A	S	6000	4	5953.690	-115	-5325.692										
53	3	A	S	5998	5	5955.536	-120	-5095.692										
54	3	A	S	6000	9	5958.638	-129	-5335.692										
55	3	A	S	5999	1	5958.949	-130	-5206.692							-5335.692	NA	129.000	NA
56	3	O	B	6023	10	5958.949	-120	-7685.254	-640.438	22.500	18.022	-680.960	-680.960					

* A round includes two phases of trades: the accumulation phase of trades when the number of contracts is rising in one trading direction, long or short, followed by the offsetting phase when the numbers of contracts are falling as traders offset the contracts accumulated in the earlier phase.

Table 2. Profitability and Trading Statistics

Panel A: Trading and Profitability for All Traders

Trading Days	Number of Accounts		Number of Contracts		Number of Trading days		Net Profit (in ticks)					
		%		%		%	Sum	%	Average	Median	Min	Max
All	132021	100.00	24496774	100.00	4045886	100.00	-68553921	100.00	-519	-159	-3566781	4777947
1-10	54902	41.59	691830	2.82	248340	6.14	-10277271	14.99	-187	-59	-170952	101100
11-20	22553	17.08	1094790	4.47	339193	8.38	-9540413	13.92	-423	-212	-227964	164617
21-30	13720	10.39	1233554	5.04	344851	8.52	-7554635	11.02	-551	-318	-182786	96417
31-40	9475	7.18	1364704	5.57	333773	8.25	-6987300	10.19	-737	-422	-227597	334964
41-50	6757	5.12	1215038	4.96	305982	7.56	-5714189	8.34	-846	-486	-240043	285214
51-60	4946	3.75	1175308	4.80	273457	6.76	-5639274	8.23	-1140	-594	-502218	241929
61-70	3880	2.94	1128020	4.60	253441	6.26	-5602539	8.17	-1444	-660	-968521	95223
71-80	2967	2.25	1023502	4.18	223461	5.52	-4189340	6.11	-1412	-767	-459516	145222
81-89	2134	1.62	921250	3.76	181016	4.47	-3643302	5.31	-1707	-811	-275649	73768
90-120	4814	3.65	3013890	12.30	497144	12.29	-8725642	12.73	-1813	-940	-1140125	700186
121-150	2456	1.86	2128548	8.69	329238	8.14	-1697411	2.48	-691	-1016	-3566781	4777947
151-180	1352	1.02	1874122	7.65	222009	5.49	-1690615	2.47	-1250	-1423	-180662	140759
181-210	822	0.62	1593456	6.50	159683	3.95	-1434796	2.09	-1745	-1434	-288797	229966
211-240	501	0.38	975354	3.98	112250	2.77	-872399	1.27	-1741	-1574	-195298	394631
241-270	281	0.21	916052	3.74	71553	1.77	-114596	0.17	-408	-1418	-695350	491667
271-300	199	0.15	998644	4.08	56562	1.40	931849	-1.36	4683	245	-109832	477353
301-330	110	0.08	846986	3.46	34556	0.85	1016175	-1.48	9238	-165	-86713	442415
331-360	65	0.05	665212	2.72	22441	0.55	922222	-1.35	14188	1373	-52723	146225
361-390	23	0.02	342044	1.40	8659	0.21	286878	-0.42	12473	1590	-286682	269221
391-420	21	0.02	189706	0.77	8451	0.21	493916	-0.72	23520	4297	-21160	226473
421-450	12	0.01	103552	0.42	5214	0.13	234743	-0.34	19562	6179	-19371	143819
451-480	19	0.01	724760	2.96	8726	0.22	641829	-0.94	33780	6683	-930570	1110426
481-537	12	0.01	276452	1.13	5886	0.15	602188	-0.88	50182	31115	308	146498
1-30	91175	69.06	3020174	12.33	932384	23.05	-27372320	39.93	-300	-102	-227964	164617
31-60	21178	16.04	3755050	15.33	913212	22.57	-18340763	26.75	-866	-474	-502218	334964
61-89	8981	6.80	3072772	12.54	657918	16.26	-13435180	19.60	-1496	-729	-968521	145222
≥ 90	10687	8.09	14648778	59.80	1542372	38.12	-9405658	13.72	-880	-1024	-3566781	4777947
Regular Rounds*	10426	7.90	14581086	59.52	1510825	37.34	-9311066	13.58	-893	-1061	-3566781	4777947

* A round includes two phases of trades: the accumulation phase of trades when the number of contracts is rising in one trading direction, long or short, followed by the offsetting phase when the numbers of contracts are falling as traders offset the contracts accumulated in the earlier phase.

Table 2 Continued

Panel B: Profitability of Profitable versus Unprofitable Traders

Trading Days	Unprofitable Traders								Profitable Traders							
	Number of Accounts	%	Net Profit	%	Mean	Median	Min	Max	of Accounts	%	Net Profit	%	Mean	Median	Min	Max
All	91546	100	-132901105	100.00	-1452	-399	-3566781	0	40475	100	64347184	100.00	1590	170	0	4777947
1-10	36305	39.66	-15118004	11.38	-416	-159	-170952	0	18597	45.95	4840733	7.52	260	61	0	101100
11~20	16209	17.71	-14415004	10.85	-889	-384	-227964	0	6344	15.67	4874591	7.58	768	190	0	164617
21-30	9893	10.81	-11887969	8.94	-1202	-557	-182786	0	3827	9.46	4333333	6.73	1132	303	0	96417
31-40	6912	7.55	-11484895	8.64	-1662	-719	-227597	0	2563	6.33	4497594	6.99	1755	392	0	334964
41-50	4873	5.32	-9244416	6.96	-1897	-836	-240043	0	1884	4.65	3530227	5.49	1874	482	0	285214
51-60	3605	3.94	-7987991	6.01	-2216	-989	-502218	-2	1341	3.31	2348717	3.65	1751	518	0	241929
61-70	2763	3.02	-8093238	6.09	-2929	-1161	-968521	0	1117	2.76	2490699	3.87	2230	628	1	95223
71-80	2156	2.36	-6102766	4.59	-2831	-1314	-459516	-2	811	2.00	1913426	2.97	2359	692	2	145222
81-89	1523	1.66	-5311533	4.00	-3488	-1410	-275649	-2	611	1.51	1668232	2.59	2730	937	1	73768
90-120	3469	3.79	-15755497	11.86	-4542	-1603	-1140125	-1	1345	3.32	7029855	10.92	5227	1059	1	700186
121-150	1663	1.82	-10557370	7.94	-6348	-2061	-3566781	0	793	1.96	8859959	13.77	11173	1365	2	4777947
151-180	937	1.02	-4822613	3.63	-5147	-2585	-180662	-3	415	1.03	3131998	4.87	7547	1756	15	140759
181-210	537	0.59	-4064494	3.06	-7569	-3141	-288797	-19	285	0.70	2629699	4.09	9227	2105	17	229966
211-240	320	0.35	-2726260	2.05	-8520	-3504	-195298	-22	181	0.45	1853861	2.88	10242	3284	27	394631
241-270	176	0.19	-1887931	1.42	-10727	-3469	-695350	-39	105	0.26	1773335	2.76	16889	2837	77	491667
271-300	95	0.10	-877730	0.66	-9239	-4862	-109832	-144	104	0.26	1809579	2.81	17400	3549	7	477353
301-330	56	0.06	-547019	0.41	-9768	-4306	-86713	-135	54	0.13	1563194	2.43	28948	5255	113	442415
331-360	29	0.03	-293361	0.22	-10116	-6790	-52723	-114	36	0.09	1215583	1.89	33766	20244	16	146225
361-390	9	0.01	-390655	0.29	-43406	-7548	-286682	-1488	14	0.03	677533	1.05	48395	8470	694	269221
391-420	7	0.01	-50488	0.04	-7213	-4279	-21160	-2206	14	0.03	544404	0.85	38886	11596	1288	226473
421-450	3	0.00	-29507	0.02	-9836	-5536	-19371	-4601	9	0.02	264251	0.41	29361	10415	1353	143819
451-480	6	0.01	-1252365	0.94	-208728	-52295	-930570	-5087	13	0.03	1894194	2.94	145707	23730	713	1110426
481-537	0	0.00	0	0.00	0	0	0	0	12	0.03	602188	0.94	50182	31115	308	146498
1~30	62407	68.17	-41420977	31.17	-664	-249	-227964	0	28768	71.08	14048657	21.83	488	100	0	164617
31-60	15390	16.81	-28717301	21.61	-1866	-813	-502218	0	5788	14.30	10376538	16.13	1793	449	0	334964
61-89	6442	7.04	-19507537	14.68	-3028	-1273	-968521	0	2539	6.27	6072357	9.44	2392	701	1	145222
>90	7307	7.98	-43255290	32.55	-5920	-2077	-3566781	0	3380	8.35	33849632	52.60	10015	1555	1	4777947
Regular Rounds*	7138	7.80	-43107719	32.43	-6039	-2134	-3566781	0	3288	8.12	33796653	52.52	10279	1604	1	4777947

Table 3. More Trading Statistics of Traders

Part 1: Profitable versus Unprofitable Traders

Panel A: All Accounts

	All Number of Accounts: 132021				Profitable Number of Accounts: 40475				Unprofitable Number of Accounts: 91546			
	Trading Day	Volume	Net Profit	Gross Profit	Trading Day	Volume	Net Profit	Gross Profit	Trading Day	Volume	Net Profit	Gross Profit
Mean	31	186	-519	-275	30	281	1590	1960	31	143	-1452	-1263
Median	15	30	-159	-113	13	26	170	229	16	32	-399	-322
Minimum	1	2	-3566781	-3477935	1	2	0	0	1	2	-3566781	-3477935
Maximum	537	336980	4777947	4892206	537	336980	4777947	4892206	478	154620	0	17823
Sum	4045886	24496774	-68553921	-36308753	1226708	11385756	64347184	79319167	2819178	13111018	-132901105	-115627920

Panel B: Accounts with 90 Trading Days and Over

	All Number of Accounts: 10687				Profitable Number of Accounts: 3380				Unprofitable Number of Accounts: 7307			
	Trading Day	Volume	Net Profit	Gross Profit	Trading Day	Volume	Net Profit	Gross Profit	Trading Day	Volume	Net Profit	Gross Profit
Mean	144	1371	-880	928	154	2442	10015	13232	140	875	-5920	-4763
Median	126	410	-1024	-474	132	508	1555	2382	123	382	-2077	-1442
Minimum	90	100	-3566781	-3477935	90	110	1	184	90	100	-3566781	-3477935
Maximum	537	336980	4777947	4892206	537	336980	4777947	4892206	478	154620	0	16097
Sum	1542372	14648778	-9405658	9919733	521954	8253682	33849632	44725811	1020418	6395096	-43255290	-34806078

Panel C: Accounts with Regular Trading Rounds

	All Number of Accounts: 10426				Profitable Number of Accounts: 3288				Unprofitable Number of Accounts: 7138			
	Trading Day	Volume	Net Profit	Gross Profit	Trading Day	Volume	Net Profit	Gross Profit	Trading Day	Volume	Net Profit	Gross Profit
Mean	145	1399	-893	952	155	2502	10279	13576	140	890	-6039	-4863
Median	126	420	-1061	-501	132	528	1604	2519	124	390	-2134	-1495
Minimum	90	102	-3566781	-3477935	90	110	1	184	90	102	-3566781	-3477935
Maximum	537	336980	4777947	4892206	537	336980	4777947	4892206	478	154620	0	16097
Sum	1510825	14581086	-9311066	9925618	509882	8227558	33796653	44638593	1000943	6353528	-43107719	-34712975

Table 3. Continued

**Panel D: Net Gains/Losses in Groups Double Sorted by Trading Days—1st decile: Smallest Number of Days & 10th decile: Largest Number of Days—
and Trading Volume—1st decile: Smallest Number of Contracts & 10th decile: Largest Number of Contracts**

		Trading Days Decile Group										Total	
		1	2	3	4	5	6	7	8	9	10		
Trading Volume Quintile Group	1	Observations	3871	1126	276	42	3	0	0	0	0	0	5318
		Mean	-1159	-1241	-1362	-1598	-2180						
		Median	-924	-1092	-1370	-1766	-1218						
	2	Observations	933	735	462	231	89	13	2	0	0	0	2465
		Mean	-1542	-1298	-1884	-1867	-1784	-2443	-478				
		Median	-1319	-1181	-1711	-1630	-1540	-1998	-478				
	3	Observations	403	316	245	170	83	60	14	6	1	0	1298
		Mean	-2235	-2727	-1920	-1441	-2224	-692	-3388	787	-5732		
		Median	-1680	-2182	-1890	-1357	-1949	-1134	-2461	288	-5732		
	4	Observations	179	150	121	99	63	30	19	9	3	2	675
		Mean	-912	489	-1337	-1232	-1776	928	-4774	-2881	-2300	2001	
		Median	-712	519	-2166	-309	-1524	797	-3067	-2526	-4601	2001	
	5	Observations	69	79	48	45	40	32	15	5	2	6	341
		Mean	-6060	-4380	-3467	-5127	3796	-5125	21181	2209	-8522	4774	
		Median	-407	-2709	-2174	-238	-2336	159	9423	4297	-8522	3495	
	6	Observations	27	32	24	20	19	13	14	3	6	6	164
		Mean	-8600	6931	-6155	-7864	7580	-5549	6793	33014	47116	-9771	
		Median	-22526	13140	-9243	-5787	6437	4052	18	37361	12316	3671	
7	Observations	15	12	7	9	16	9	6	4	4	5	87	
	Mean	-31417	18128	-28000	30347	39189	45282	23168	18233	58176	22279		
	Median	4431	15017	31408	5647	17068	48308	14749	10930	39881	23730		
8	Observations	9	1	5	2	6	8	4	2	1	10	48	
	Mean	-85531	87025	75027	-86419	112809	89969	55535	-132952	171423	97875		
	Median	-160492	87025	28560	-86419	34307	39778	56099	-132952	171423	69980		

9	Observations	5	2	5	1	2	3	1	2	0	0	21
	Mean	107687	102306	2559	75688	-315843	89532	96886	149584			
	Median	129479	102306	55048	75688	-315843	92557	96886	149584			
10	Observations	1	1	1	0	1	1	1	1	0	2	9
	Mean	-619271	102783	227528		135642	236577	146225	187391		89928	
	Median	-619271	102783	227528		135642	236577	146225	187391		89928	
	Total Observations	5512	2454	1194	619	322	169	76	32	17	31	10426

Table 3. Continued**Part 2: Subgroup Trading Statistics****A: Trading Days Decile Groups** (1st: Smallest Number of Days & 10th: Largest Number of Days)

	1	2	3	4	5	6	7	8	9	10	Total
Observations	5512	2454	1194	619	322	169	76	32	17	31	10426
Mean	107	147	187	227	268	306	346	388	428	471	
Median	105	146	186	225	268	305	347	390	424	465	
Minimum	90	130	170	210	250	290	330	371	411	451	
Maximum	129	169	209	249	289	329	368	406	448	537	

B: Trading Volume Quintile Groups (1st: Smallest Number of Contracts & 5th: Largest Number of Contracts)

	1	2	3	4	5	6	7	8	9	10	Total
Observations	5318	2465	1298	675	341	164	87	48	21	9	10426
Mean	266	589	1127	2173	4302	8946	16854	31251	67835	162373	
Median	258	568	1090	2104	4122	8680	16662	29139	65318	123702	
Minimum	102	428	830	1590	3106	6282	13264	22498	47046	106414	
Maximum	428	830	1590	3102	6226	13146	22466	46336	104454	336980	

C: Profitable Quintile Groups (in ticks; 1st: Lowest & 5th: Highest)

	1	2	3	4	5	Total
Observations	2906	261	88	30	3	3288
Mean	2313	25986	77421	229691	2196187	
Median	1294	23277	71434	195688	1110426	
Minimum	1	13530	49109	132385	700186	
Maximum	13518	48691	129479	491667	4777947	

D: Unprofitable Quintile Groups (in ticks; 1st: Lowest & 5th: Highest)

	1	2	3	4	5	Total
Observations	5235	1367	437	90	9	7138
Mean	-1625	-6333	-19865	-97318	-944724	
Median	-1476	-5772	-17753	-78053	-619271	
Minimum	-3974	-11133	-43299	-286682	-3566781	
Maximum	0	-3975	-11138	-43658	-288797	

Table 3. Continued**Part 3: ANOVA Tests of Difference between Groups****Panel A: Traders with Trading Days over 90 days**

	All Number of Accounts: 10687		Profitable Number of Accounts: 3380		Unprofitable Number of Accounts: 7307	
	F-Statistic	Significant Level	F-Statistic	Significant Level	F-Statistic	Significant Level
<u>Univariate Effect</u>						
Trading Days	3.013	0.001	4.333	0.000	12.717	0.000
Trading Volume	5.214	0.000	61.407	0.000	1106.718	0.000
<u>Bivariate Effect</u>						
Trading Days	14.988	0.000	84.935	0.000	409.725	0.000
Trading Volume	3.05	0.001	48.075	0.000	1120.492	0.000
Trading Days × Volume	4.607	0.000	24.516	0.000	157.199	0.000

Panel B: Traders with Regular Rounds

	All Number of Accounts: 10426		Profitable Number of Accounts: 3288		Unprofitable Number of Accounts: 7138	
	F-Statistic	Significant Level	F-Statistic	Significant Level	F-Statistic	Significant Level
<u>Univariate Effect</u>						
Trading Days	2.981	0.002	4.208	0.000	12.385	0.000
Trading Volume	5.090	0.000	59.601	0.000	1080.704	0.000
<u>Bivariate Effect</u>						
Trading Days	14.488	0.000	82.433	0.000	400.199	0.000
Trading Volume	2.937	0.002	46.579	0.000	1094.420	0.000
Trading Days × Volume	4.490	0.000	24.200	0.000	153.533	0.000

Table 4. Proportions of Zero Reversals of Losses (PZROL) versus Proportions of Positive Reversals of Losses (PPROL)

Part 1: Total Sample (10309 Observations)

	Average	Std. Dev.	T-Statistic	Significant Level
PZROL	0.8894	0.1380		
PPROL	0.1106	0.1380		
Difference	0.7787		286.44	0.0000

Part 2: PZROLs in Subgroups

Panel A: Trading Days Decile Groups (1st: Smallest Number of Days & 10th: Largest Number of Days)

Group	1	2	3	4	5	6	7	8	9	10
Observations	5428	2428	1188	618	322	169	76	32	17	31
Mean	0.0949	0.1108	0.1218	0.1438	0.1680	0.1950	0.2106	0.2029	0.2256	0.3063
Median	0.0417	0.0667	0.0857	0.1053	0.1300	0.1604	0.1651	0.1323	0.1562	0.3106
Std. dev.	0.1324	0.1358	0.1311	0.1455	0.1525	0.1533	0.1682	0.1915	0.1809	0.1673
Minimum	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0035	0.0000
Maximum	1.0000	0.7805	1.0000	0.8793	0.7470	0.6512	0.6667	0.6154	0.6097	0.6286

Panel B: Trading Volume Quintile Groups (in Number of Contracts; 1st: Lowest & 5th: Highest)

Group	1	2	3	4	5	6	7	8	9	10
Observations	5213	2453	1298	675	341	164	87	48	21	9
Mean	0.0596	0.1135	0.1568	0.2173	0.2669	0.3043	0.3590	0.3745	0.3652	0.3747
Median	0.0000	0.0769	0.1250	0.1837	0.2500	0.2721	0.3492	0.3840	0.2914	0.3551
Std. dev.	0.0987	0.1226	0.1381	0.1607	0.1603	0.1591	0.1623	0.1596	0.2107	0.1290
Minimum	0.0000	0.0000	0.0000	0.0000	0.0000	0.0339	0.0629	0.0515	0.0816	0.2264
Maximum	1.0000	1.0000	0.8947	0.8400	0.7692	0.6857	0.8793	0.7692	0.8462	0.5955

Table 4 (continued).**Part 2: PPROLs in Subgroups****Panel C: Profitable Groups (in ticks)**

Group	Quintile Groups (1 st : Lowest & 5 th : Highest)					Equal-number Groups				
	1	2	3	4	5	1	2	3	4	5
Observations	2796	261	88	30	3	612	622	630	656	658
Mean	0.1336	0.3590	0.4331	0.4345	0.5259	0.0754	0.0871	0.1303	0.1811	0.3355
Median	0.1000	0.3359	0.4135	0.4454	0.5375	0.0000	0.0422	0.1034	0.1548	0.3171
Std. dev.	0.1446	0.1755	0.1573	0.1477	0.3263	0.1112	0.1169	0.1400	0.1420	0.1774
Minimum	0.0000	0.0000	0.0816	0.1250	0.1939	0.0000	0.0000	0.0000	0.0000	0.0000
Maximum	1.0000	1.0000	0.7692	0.6857	0.8462	0.7500	1.0000	0.8462	0.7500	1.0000

Panel D: Unprofitable Groups (in ticks)

Group	Quintile Groups (1 st : Lowest & 5 th : Highest)					Equal-number Groups				
	1	2	3	4	5	1	2	3	4	5
Observations	5113	1365	437	90	9	1348	1394	1420	1426	1426
Mean	0.0652	0.1163	0.1960	0.2967	0.5207	0.0568	0.0585	0.0675	0.0910	0.1586
Median	0.0000	0.0909	0.1667	0.2524	0.5197	0.0000	0.0000	0.0274	0.0612	0.1250
Std. dev.	0.0974	0.1105	0.1380	0.1711	0.1658	0.0966	0.0914	0.0983	0.1048	0.1373
Minimum	0.0000	0.0000	0.0000	0.0433	0.1778	0.0000	0.0000	0.0000	0.0000	0.0000
Maximum	0.7000	0.6923	0.7143	0.8793	0.7317	0.6842	0.6250	0.7000	0.6667	0.8793

Table 5 Test of Difference of PPROLs between Groups

Part 1: ANOVA Test For PPROL

	<u>F-Statistic</u>	<u>Significant Level</u>
Trading Days	41.539	0.0000
Trading Volume	382.683	0.0000
Profit	246.053	0.0000
Loss	332.915	0.0000

Part 2: T-Test between Groups

<u>Group</u>	<u>Observation</u>	<u>Average</u>	<u>T-Statistic</u>	<u>Significant Level</u>
--------------	--------------------	----------------	--------------------	--------------------------

A: Trading Day

1 (Least)	5428	0.0949		
10 (Most)	31	0.3063		
Difference		-0.2114	-8.8462	0.0000

B: Trading Volume

1 (Lowest)	5213	0.0596		
5 (Highest)	9	0.3747		
Difference		-0.3151	-9.5637	0.0000

C: Profit

1 (Lowest)	2851	0.1336		
5 (Highest)	3	0.5259		
Difference		-0.3923	-4.6903	0.0000

D: Loss

1 (Lowest)	5174	0.0652		
5 (Highest)	9	0.5207		
Difference		-0.4555	-14.0007	0.0000

Table 6 Reversal of Gain (PNZROG versus PNROG)

Part 1: Total Sample (9671 Observations)

	Average	Std. Dev.	T-Statistic	Significant Level
PZROG	0.8217	0.2039		
PNROG	0.1783	0.2039		
Difference	0.6435		155.165	0.0000

Part 2: PZROGs in Subgroups

Panel A: Trading Days Subgroups (1st Decile: Smallest Number of Days & 10th Decile: Largest Number of Days)

Group	1	2	3	4	5	6	7	8	9	10
Observations	4942	2313	1165	610	319	166	76	32	17	31
Mean	0.1637	0.1809	0.1865	0.2206	0.2112	0.2310	0.2405	0.1593	0.2858	0.3391
Median	0.0805	0.1282	0.1429	0.1797	0.1605	0.1956	0.2065	0.1086	0.2759	0.3419
Std. dev.	0.2122	0.1996	0.1883	0.1950	0.1841	0.1644	0.1656	0.1386	0.1515	0.1328
Minimum	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Maximum	1.0000	1.0000	1.0000	1.0000	0.8000	0.7917	0.7083	0.5204	0.5394	0.5747

Panel B: Trading Volume Quintile Groups (1st: Smallest Number of Contracts & 5th: Largest Number of Contracts)

Group	1	2	3	4	5	6	7	8	9	10
Observations	4632	2404	1291	674	341	164	87	48	21	9
Mean	0.1263	0.1858	0.2223	0.2628	0.3143	0.3706	0.3851	0.3969	0.2646	0.2412
Median	0.0000	0.1429	0.1875	0.2286	0.2857	0.3766	0.3983	0.4048	0.1261	0.1759
Std. dev.	0.2010	0.1868	0.1884	0.1836	0.1947	0.1828	0.1702	0.1869	0.2707	0.1349
Minimum	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0464	0.0568	0.0426	0.0820
Maximum	1.0000	1.0000	1.0000	0.8571	0.9412	1.0000	0.7385	0.7447	0.9259	0.4434

Table 6 (continued).

Part 2: PNROGs in Subgroups

Panel C: Profitable Quintile Groups (in ticks; 1st: Lowest & 5th: Highest)

Group	Quintile Groups (1 st : Lowest & 5 th : Highest)					Equal-number Groups				
	1	2	3	4	5	1	2	3	4	5
Observations	2795	261	88	30	3	600	621	643	656	657
Mean	0.1483	0.3198	0.3975	0.4235	0.4989	0.1056	0.1112	0.1343	0.1878	0.3124
Median	0.1000	0.3036	0.4356	0.4535	0.5435	0.0000	0.0000	0.0833	0.1429	0.2857
Std. dev.	0.1746	0.1797	0.1857	0.2063	0.0920	0.1532	0.1564	0.1715	0.1796	0.1895
Minimum	0.0000	0.0000	0.0000	0.0739	0.3931	0.0000	0.0000	0.0000	0.0000	0.0000
Maximum	1.0000	0.8000	0.7385	0.9091	0.5600	1.0000	1.0000	1.0000	1.0000	0.9091

Panel D: Unprofitable Quintile Groups (in ticks; 1st: Lowest & 5th: Highest)

Group	Quintile Groups (1 st : Lowest & 5 th : Highest)					Equal-number Groups				
	1	2	3	4	5	1	2	3	4	5
Observations	4630	1328	437	90	9	1241	1230	1273	1339	1411
Mean	0.1355	0.2632	0.3523	0.4474	0.6190	0.1060	0.1177	0.1461	0.2011	0.3158
Median	0.0417	0.2308	0.3333	0.4613	0.6182	0.0000	0.0000	0.0667	0.1667	0.2973
Std. dev.	0.1876	0.2188	0.2155	0.2062	0.1622	0.1731	0.1763	0.1910	0.2132	0.2194
Minimum	0.0000	0.0000	0.0000	0.0000	0.3992	0.0000	0.0000	0.0000	0.0000	0.0000
Maximum	1.0000	1.0000	1.0000	1.0000	0.9259	1.0000	1.0000	1.0000	1.0000	1.0000

Table 7. Test of Difference in the PNROGs between Groups

Part 1: ANOVA Test For PNROGs

	F-Statistic	Sig. Level
Trading Days	11.721	0.0000
Trading Volume	113.819	0.0000
Profit	113.234	0.0000
Loss	255.496	0.0000

Part 2: T-Test between Groups

Group	Observation	Average	T-Statistic	Sig. Level
-------	-------------	---------	-------------	------------

A: Trading Day

1 (Least)	4942	0.1637		
10 (Most)	31	0.3391		
Difference		-0.1754	-4.5951	0.000

B: Trading Volume

1 (Lowest)	4632	0.1263		
5 (Highest)	9	0.2412		
Difference		-0.1149	-1.7130	0.0867

C: Profit

1 (Lowest)	2795	0.1483		
5 (Highest)	3	0.4989		
Difference		-0.3506	-3.4776	0.0010

D: Loss

1 (Lowest)	4630	0.1355		
5 (Highest)	9	0.6190		
Difference		-0.4835	-7.7252	0.0000

Table 8 Test of the Difference between the PNROGs and PPROLs

Part 1: Total Sample

	Mean	T-Statistic	Significant Level
PNROG	0.1804		
PPROL	0.1189		
Difference	0.0615	28.892	0.0001

Part 2: T-Test of the Differences between PNROGs and PPROLs between Groups

Panel A: Trading Days Decile Subgroups (1st: Smallest Number of Days & 10th: Largest Number of Days)

Group	1	2	3	4	5	6	7	8	9	10
Observations	4858	2287	1159	609	319	166	76	32	17	31
Mean difference	0.0614	0.0655	0.0626	0.0752	0.0417	0.0325	0.0299	-0.0436	0.0602	0.0328
T-Statistic	19.5984	15.4351	10.9455	9.5510	4.2130	2.1945	1.2334	-1.6856	1.7131	1.4368
Significance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0296	0.2213	0.1019	0.1060	0.1611

Panel B: Trading Volume Quintile Groups (in Number of Contracts; 1: Lowest & 5: Highest)

Group	1	2	3	4	5	6	7	8	9	10
Observations	4527	2392	1291	674	341	164	87	48	21	9
Mean difference	0.0615	0.0705	0.0647	0.0452	0.0474	0.0662	0.0261	0.0224	-0.1005	-0.1335
T-Statistic	19.5125	16.8948	11.3548	6.0233	3.9795	3.9054	1.2081	0.8334	-2.4130	-9.1222
Significance	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.2303	0.4088	0.0255	0.0000

Panel C: Profitable Quintile Groups (in ticks; 1st: Lowest & 5th: Highest)

	1	2	3	4	5
Observations	2740	261	88	30	3
Mean difference	0.0124	-0.0392	-0.0356	-0.0110	-0.0270
T-Statistic	3.4123	-2.8228	-1.7166	-0.2929	-0.1338
Significance	0.0007	0.0051	0.0896	0.7717	0.9058

Panel D: Unprofitable Quintile Groups (in ticks; 1st: Lowest & 5th: Highest)

	1	2	3	4	5
Observations	4569	1327	437	90	9
Mean difference	0.0643	0.1443	0.1564	0.1507	0.0984
T-Statistic	22.4458	23.0316	13.5029	5.1580	1.4913
Significance	0.0000	0.0000	0.0000	0.0000	0.1742

Table 9 Regressions of Profits and Losses on Trading Days, Trading Volume, PZROL, and PZROG

$$\text{Model 1: } D_{\text{profitgroup}} = \beta_0 + \beta_1 \text{PZROL} + \beta_2 \text{PZROG} + \beta_3 D_{\text{daygroup}} + \beta_4 D_{\text{volumegroup}}$$

$$\text{Model 2: } D_{\text{unprofitgroup}} = \gamma_0 + \gamma_1 \text{PZROL} + \gamma_2 \text{PZROG} + \gamma_3 D_{\text{daygroup}} + \gamma_4 D_{\text{volumegroup}}$$

Model 1						Model 2					
Dependent Variable: $D_{\text{Profitgroup}}$						Dependent Variable: $D_{\text{unprofitgroup}}$					
Regressor	Coeff.	Std.Dev.	Std. Coeff.	T-Stat.	Sig.	Regressor	Coeff.	Std.Dev.	Std. Coeff.	T-Stat.	Sig.
Constant	0.681	0.013		50.939	0.000	Constant	-0.722	0.014		-51.477	0.000
PZROL	0.544	0.048	0.177	11.302	0.000	PZROL	-0.491	0.067	-0.082	-7.368	0.000
PZROG	0.212	0.041	0.077	5.146	0.000	PZROG	-0.630	0.034	-0.193	-18.761	0.000
D_{daygroup}	-0.026	0.005	-0.087	-5.325	0.000	D_{daygroup}	0.027	0.006	0.050	4.537	0.000
$D_{\text{volumegroup}}$	0.172	0.005	0.578	31.450	0.000	$D_{\text{volumegroup}}$	-0.294	0.007	-0.519	-41.423	0.000
Observations		3122				Observations		6432			
Adj. R^2		0.448				Adj. R^2		0.397			

Note:

$D_{\text{profitgroup}} = 1$ for the group with the least profit, 2 for the group with the next least profit, ..., and 5 for the most profitable group,

$D_{\text{unprofitgroup}} = -1$ for the group with the smallest losses, -2 for the next smallest losses, ..., and -5 for the largest losses,

$D_{\text{daygroup}} = 1$ for the group with the smallest number of trading days, 2 for the next smallest... and 10 for the largest number of trading days.

$D_{\text{volumegroup}} = 1$ for the group with the smallest trading volume, 2 for the next smallest, and 5 for the largest trading volume.