A Direct Test of the Link between the Disposition Effect and Profitability in Futures Market

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Abstract

This paper investigates the link between the disposition effect and profitability of individual traders at the Taiwan Futures Exchange (TAIFEX). By tracking their trade-by-trade transaction histories, we examine how traders offset their positions, thereby realizing gains and losses. The results show that overall traders tend to quickly offset their positions. However, the tendency is higher when the offsets result in gains than losses, consistent with the disposition effect. Upon further examination, we find this tendency varies systematically among traders: traders who are profitable behave exactly opposite to the disposition effect, while those who are unprofitable exhibit the disposition effect. Because the latter outnumber the former, when traders are aggregated as a group, the unprofitable traders' tendency dominates and the disposition effect is observed in aggregate. Linking the disposition effect to profitability, we show that the relationship between the two is a negative one. Among the profitable traders this means the more profitable they are, the more they behave opposite to the disposition effect, i.e., they offset losses quicker than gains. For traders who are unprofitable, the disposition effect is directly related to loss: the higher the tendency, the larger the loss. Together these results provide us with strong evidence of a link between profitability and the disposition which undeniably indicates that the disposition effect is detrimental to profitability. Along with other findings, these results also offer clear and practical implications for traders' trading strategies. We also include trading volume in our analysis. Although we find trading losses increase volume among unprofitable traders, we also find trading volume to be positively related to profit among profitable traders. These mixed findings cast doubt on the conclusion drawn from previous studies on overconfidence suggesting excess trading only leads to reduced profitability.

I. Introduction

Many studies have documented the existence of the disposition effect—known as the tendency of investors holding onto losing investments while selling winning securities too quickly—in equity, futures, and other markets, as well as in various countries. This behavior trait attracts attention for being contrary to economists' typical view of rational attitude toward risk to the extent that it is considered a bias or even irrationality. As such, one should avoid succumbing to it, lest one be doomed to suffer a loss. Following this logic, we should then expect a direct link between this bias and reduced profitability. However, as far as we know, nobody has yet established such a link. Studies that come closest to address this issue are Odean [1998] and Garvey and Murphy [2004]. By constructing and comparing the portfolio of stocks investors realized for a gain with that of stocks investors realized for a loss, Odean [1998] shows that the former underperforms the latter. Similarly, Garvey and Murphy [2004] examine the average roundtrip profit of winning trades versus that of losing trades of 15 professional traders and drawn the inference that traders could increase their profits by holding winners longer and selling losers sooner. Results like these offer indirect evidence suggesting a linkage between the disposition effect and profitability. However, many methodological issues inherent in the measures used in these studies prevent them from offering a direct test of the linkage. While detailed discussion of these issues is provided in Section III, one of the main obstacles preventing previous studies from offering evidence of the existence of a direct linkage is the treatment of all investors as a group.

To constitute a clean and direct test of the linkage, one must investigate both the disposition effect and profitability at the individual level rather than at the group level. With the exception of Frino et al. [2004], Locke and Mann [2005], Feng and Seasholes [2005], and Dhar and Zhu [2006] this clearly has not been done even for the widely-examined disposition effect. Indeed, most studies treat all investors as if they were identical. Evidence based on this aggregate trader fails to account for the cross-sectional variations in the extent of the disposition effect that presumably—as shown in Dhar and Zhu [2006] and Feng and Seasholes [2005]—can result from differences among investors in ability, sophistication, and other characteristics, such as trading frequency and income level. It is plausible that these variations transpire in the cross-sectional

differences in profitability, but by aggregating all investors into one, the linkage, if exists, may well be kept under veil.

Granted, many factors, such as the limitation of data availability and the enormous task involved in calculating and tracking of gains/losses—especially when transaction data are involved, hinder previous studies from offering such a direct test. Overcoming the complexity and tremendous data processing requirements, this paper conducts such a test by examining both the disposition effect and profitability at the individual level. 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 all individual traders at the Taiwan Futures Exchange (TAIFEX), the sole futures exchange in Taiwan. Being able to examine the total trading population sets our study apart from previous studies. With the exception of Grinblatt and Keloharju [2000] that examine all investors in Finland, previous studies only examine a subset of their respective market (e.g., accounts in a brokerage house, a few mutual funds, and a subset of traders). This, along with the additional methodological advantages discussed in Section 3, allows us to obtain results that reflect the whole spectrum of the market. Our examination addresses the questions of how traders' reactions to unrealized gains and losses vary cross-sectionally and whether and how their after-transaction-cost profitability differs accordingly. We show that in aggregate traders tend to quickly offset their positions. This tendency is higher when the offsets result in realized gains than realized losses, consistent with the disposition effect. However, the tendency varies among traders systematically with their trading frequency and volume. Upon further examination, we find that traders who are profitable behave exactly opposite to the disposition effect, while those who are unprofitable exhibit the disposition effect. Because the latter outnumber the former, when we look at the aggregate, the disposition effect prevails. The primary finding of this study is that there is a negative relationship between the disposition effect and profitability. Among the profitable traders this means the more profitable they are, the more they behave opposite to the disposition effect, i.e., they offset their positions faster in the face of losses than gains. For traders who are unprofitable, the disposition effect is directly related to profitability: the more the tendency of the disposition effect, the larger the losses. Together these results confirm that the disposition effect is detrimental to profitability, which obviously have practical implications for traders for their

trading strategies Additionally, we also find that trading volume is positively related to profit, casting doubt on the findings in the literature regarding overconfidence that suggest high trading volume only leads to reduced profit.

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

The literature on the disposition effect in financial markets has been growing with evidence from various participants in different markets. To name just a few: in equity market, Odean [1998], Barber and Odean [2000], and Dhar and Zhu [2006] look at retail investors of a US discount brokerage house, Garvey and Murphy [2004] examine 15 proprietary stock traders, 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 floor traders of the currency and agriculture futures in CME, and Frino et al. [2004] examine local traders of three 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. These studies conclude that investors sell winning trades too quickly and hold onto their losing trades too long. 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.

With the exception of Frino et al. [2004], Locke and Mann [2005], Feng and Seasholes [2005], and Dhar and Zhu [2006], most of the evidence on the disposition effect is based on the examination of the behavior at the group level, treating all traders as if they were identical. Recognizing this shortcoming and using a methodology that refines the one used by Odean [1998], Frino et al. [2004] demonstrate that local (on-floor) traders exhibit stronger disposition effect than non-local (off-floor) traders. Similarly, Feng and Seasholes [2005] show that sophistication and trading experience together eliminate investors' reluctance to realize losses. Finally, Dhar and Zhu [2006] examine how the disposition effect varies with cross-sectional

differences in characteristics and show that investors who are wealthier and professional—presumably more sophisticated—and trade more frequently—hence considered to be more experienced—exhibit lesser extend of the disposition effect.

If the disposition effect is considered to be undesirable, it is only logical to expect investors who are more prone to it to generate less profit or even suffer more loss. By comparing the performance of the portfolio of stocks investors sold for a gain and that of the portfolio of stocks they sold for a loss, Odean [1998] concludes that this behavior bias results in reduced profitability. Odean [1999] analyzes the trading of investors from the same discount brokerage house used in Odean [1998] and finds that individual investors trade excessively—which he contributes to be due to overconfidence—in the sense that they trade even when the expected gains from the trade are not sufficient to cover the trading costs. He conjectures that the disposition effect may have contributed to the documented higher tendency of investors in his sample selling winning stocks. In showing the existence of the disposition effect among 15 proprietary traders, Garvey and Murphy [2004] also examine the average roundtrip profit of winning trades versus that of losing trades of and drawn the inference that traders could increase their profits by holding winners longer and selling losers sooner. Recent evidence in Locke and Mann [2005], however, of professional traders holding onto relatively large gains equally likely to lead to unsuccessful future trades as they holding onto losses, suggests that the disposition effect may not necessarily lead to losses. They show that trading discipline is responsible for professional traders' success despite their tendency of the disposition effect. Similarly, comparing on-floor locals versus off-floor non-local traders, Frino et al. [2004] suggest that riding the loss among locals is a rational behavior.

III. Data and Methodology

3.1. Data

Our data consist of the complete set of trades of the front-month[1] Taiwan Stock Exchange Capitalization Weighted Stock Index (TAIEX) Futures contracts (hereafter, TX, the tick symbol) from the Taiwan Futures Exchange (TAIFEX) that mature between March 2003 and December

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

2004. Introduced on July 21, 1998, TX is the first index product and the most active futures contract traded in Taiwan, accounting for close to 70% of the trading volume of the TAIFEX futures contracts. It is based on the major stock index of the Taiwan Stock Exchange (TSEC), TAIEX, which includes all stocks traded on the TSEC. By examining futures contracts, as opposed to stocks, we avoid the complicating issues typically associated with stocks of different values, sizes, frequency of trading, and risk levels, as well as the composition and rebalancing of portfolios. The examination of the disposition effect in stock market by comparing how investors selling, not buying, stocks to realize paper gains or losses apparently rule out portfolios of investors who engage in short-selling as they deal with buying, not selling, stocks to cover their short sales. The ability to take long as well short positions and subsequently to make offsetting trades in the futures markets clearly imposes no such limitation. 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. The absence of capital gain tax in Taiwan also eliminates tax-loss selling as a competing explanation for the disposition effect.

Compared with previous studies that examine only a subset of their respective market (e.g., accounts in a brokerage house, a few mutual funds, and a subset of traders)—with the exception of Grinblatt and Keloharju [2000] that examine all investors in Finland—our data include the trades of the total trading population in a country. By far, this is the most comprehensive dataset ever used in the study of the disposition effect[2]. As such, we avoid the problem inherent in previous studies regarding whether the subjects are representative of all traders. This allows us to obtain results that reflect the whole spectrum of the market. Additionally, most evidence in the literature is based on investors in the Western OECD countries such as US and Australia, little has been done to examine the non-Western countries, especially the vast Asian population, notably that of the Greater China Region, within which Taiwan plays a significant vibrant economic role. Whether the east-west cultural divide transpires in issues related to the disposition effect is undoubtedly an interesting question. An examination of Taiwan's market undoubtedly provides an opportunity to satisfy such intellectual curiosity.

[2] According to the estimates (July 2008) reported in the World Factbook of the US Central Intelligence Agency (cia.org), Finland has a population of 5,244,749 (July, 2008). In comparison, Taiwan has a population of 22,920,946.

Due to the dominance of individual traders in the TAIFEX[3], we exclude trades executed by institutional and proprietary traders. By focusing on individual traders, we believe the results still reflect the whole market, while, at the same time, offers two additional advantages: (1) unlike institutional traders, individuals trade for themselves, therefore their trades are not complicated by agency relationships or hedging motives usually associated with institutional traders. Instead, trading on one identical asset, their traders rarely are motivated by portfolio hedging and tax-loss selling given that Taiwan has capital gain tax. Driven purely by the motive to accumulate wealth in order to survive, they, therefore, are the ideal subjects for the analysis of behavior biases and their impact on profitability. (2) 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 masking or even distorting the behavior biases of individuals.

In total, there are a total of 126,024 accounts with 14,875,397 trades[4]. To track the profitability of the traders, we examine each account's complete trading history for each contract and trace back to the first day when the contract starts trading. This means for the March 2003 contract we have to go back as far as April 1, 2002 when the contract was first traded. 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. In addition to the typical information such as the time—to the second, date, price, volume—number of contracts—the contract, order number, and buy-sell indicator of the transaction, the trader's account number, and a code that allows us to distinctively identify whether the trader is an individual, institution, or proprietary trader.

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 her first trade of the contract. This entails that we search for trades that are

[3] 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.

[4] The total numbers of trades in 2002, 2003, and 2004 in the TAIFEX are 8,980,722 13,769,560 and 25,103,322 respectively. Out of these trades a total of 14,875,397 trades are executed by individuals on the spot-month TX contracts.

executed as far as 11 months before March 2003, therefore, our examination spans the period between April 2002 and December 2004. Once the first trade is identified we then track each subsequent trade. We mark to market after each trade and calculate and update all relevant statistics such as the open interests (OIs), weighted average costs, and realized and unrealized gains/losses until the contract matures. By continuously updating after each trade, we have a running tally of the OIs and unrealized and realized gains/losses. These calculations are detailed in the Appendix.

To investigate the disposition effect we examine how the unrealized gains/losses affect the decision to offset the positions traders have accumulated. The offsetting trade results in either a realized gain or loss. If the disposition effect exists, the trader is more inclined to offset her position when doing so results in a realized gain while loath to offset if it leads to a realized loss. This means we should see higher proportion of offsets that result in gains than those that result in losses. By calculating and comparing the proportion of offsets that result in a realized gain, called proportion of positive offset (PPO), and proportion of offsets that lead to a realized loss, called proportion of negative offset (PNO), as shown below, we therefore can demonstrate whether the disposition effect exists. And by examining PPO and PNO at individual level we can further investigate whether and how it varies among traders.

$$PPO_t = \frac{\#of\_contracts\_offset_t}{open\_interest_{t-1}} \qquad \text{when there is a realized gain at t} \qquad (1)$$

$$PNO_t = \frac{\#of\_contracts\_offset_t}{open\_interest_{t-1}} \qquad \text{when there is a realized loss at t} \qquad (2)$$

Although these two measures are similar to the Proportion of Gains Realized (PGR) and Proportion of Losses Realized (PLR) used in Odean [1998] and subsequent studies, the calculations of PPO and PNO are done after each offsetting trade. Therefore, they account for all opportunities to realize gains or losses. On the other hand, Odean [1998] aggregates multiple buys and sells of the same stock on the same day and calculates PGR and PLR only once a day, therefore misses many intraday selling opportunities. Odean [1998] also ignores the possibility that trades on a particular stock yield gains for some traders while result in losses for other traders. For the former, the stock is included the portfolio of stocks that investors sold for a gain

while for the latter, it is in the portfolio that investors sold for a loss. Although this may not affect the calculation of the PGR and PLR, it does bias the evaluation of the profitability of the two portfolios and the conclusion regarding the consequence of the disposition effect on traders' profitability. Furthermore, since the ratios are calculated only on days when a sale occurs, gain or loss realization opportunities on other days are also ignored. Feng and Seasholes [2005] also point out that PGR and PLR work only for studying the aggregate disposition effect, not at the individual account level, and because many individuals have only gains or only losses in some of their sale of stocks, they are far from smooth and continuous variables. In fact, based on their estimates, the frequency of these measures taking on a value of one or zero is as high as 30% of all accounts[5], rendering them, the difference between them, PGR – PLR, or the ratio of them, PGR/PLR, problematic variables in cross-sectional regressions. Additionally, the calculation of PGR and PLR treats stocks with different values and portfolios with different number of shares of the same stock, no matter how many shares, equally, hence cannot measure the variation in the disposition effect among individual traders. Finally, the elimination of sales at a price lying between the daily high and low also poses a problem in accurately measuring the profitability of traders.

Our measures, when applied chronologically to futures market after each trade, avoid many of these problems. This having been said, we duly recognize the tremendous insight gained from these studies. Theoretically, we should also have a third measure, call it proportion of zero offset, PZO, calculated similar to the above two measures for cases when the realized gains/losses is zero. However, we decide to exclude PZO for three reasons. First, incidents of zero realized gains/losses are rare—less than one percent of all trades. Second, the literature does not offer clear guidance on how to interpret what's behind a PZO other than contract expiration. Third, many studies, e.g., Odean [1998] and Frino et al. [2004] exclude similar ambiguous cases like these with no apparent loss in arriving at convincing results.

Since we track each trader from the first trade of each contract till the expiration of the contract, we are able to calculate a PPO or PNO for the trader whenever an offsetting trade takes place. For each trader, we then calculate the average PPO and PNO and use them along with other trading variables in our analysis. In addition to allowing us to treat each trader distinctively, hence avoiding the pitfall of the aggregate trader approach used in previous studies,

[5] In comparison, the corresponding frequency for PPO and PNO in our sample is less than 10%.

this methodology makes it possible to include all traders, whether they accumulate positions or not. This is an important methodological consideration, as it turns out, that most individual traders in Taiwan trade futures in a quick in-and-out fashion, i.e., they take a long (short) position in one trade and offset the position immediately on the following trade. On the other hand, there are many traders who tend to accumulate positions in a sequence of trades until they start the offsetting trades to unload their positions[6]. Therefore, this method preserves the heterogeneity of the traders and affords us to explore their diversity. Along with trading volume and trading days, we also separate traders who are profitable from those who are unprofitable to examine in detail the linkage between the disposition effect and profitability.

IV. Results

4.1 Trading and Profitability Statistics

In total, there are 126,024 accounts that trade the spot-month contracts. Out of these, 1,294 accounts either do not complete the round trip before expiration or have a zero value for both PPO and NPO. Due to the missing PPO and PNO, they are excluded from the examination. The remaining 124,730 accounts constitute the total sample and their trading and profitability statistics are reported in Part 1 of Table 1. On average, these accounts trade 32 days and 194 contracts over the 33-month sample period. On average, these traders exhibit a very high propensity to offset: 82.4% of the time when they have an unrealized gain and 84.2% unrealized loss. The median PPO of 99.6% and PNO of 100% further support this conclusion. Given that PNO has a higher mean and median than PPO does, contrary to what is expected if the disposition effect exists, this result is unique in view of the extant evidence in the literature. However, mindful of the pitfall of looking at all traders in aggregate, we separate the total sample into trading days and volume decile groups. The statistics reported in Part 2 offer a convincing argument for the necessity of such a detail analysis. It turns out, 99,871, over 80%, of the traders trade only an average of 15 days and 91,654, about 73%, of traders trade less than 26 contracts. As discussed below, these infrequent and less active traders exhibit different extent of

[6] In a separate paper, we examine these traders exclusively. See Lin et al. [2008].

the disposition effects from their more frequent and active counterparts, again reinforcing the importance of detailed analysis at the individual level.

Considering that the variations in the extent to which traders succumb to the disposition effect may transpire in their profitability, we also examine the profitable separately from the unprofitable traders and further separate each group into quintile groups based on the magnitude of profit and loss. Panel C and D show that there are 37,198 traders, about 29.8% who are profitable, while 87,531 traders, over 70%, are unprofitable. In aggregate, therefore, it is clear that after accounting for all transaction costs, traders have a net loss, consistent with the evidence in the literature. Among the profitable traders, 34,433, or over 92% of them, account for the lower 1/5th of the profits, while 23 traders, just a little over 0.06%, are responsible for the top 1/5th of the profits. The corresponding numbers for the unprofitable groups are similar: 68,959 traders, or over 78%, are responsible for the lower quintile of the losses, and 131 traders, about 0.15%, bear the upper quintile of all losses.

To be comprehensive, we also examine subsamples of traders who trade more frequently, who accumulate positions rather than offset positions immediately, and who have executed over ten round-trip trades. Results for these subsamples are similar, therefore, to conserve space, we only report those for the sample of traders who trade at least 90 days in Part 3 of Table 1. As shown, although only 11,048 in number, accounting for a mere 8.86% of the total sample, these traders trade a total of 15,049,311 contracts, contributing to over 62% of the volume. In contrast to the total sample, these frequent traders have a higher PPO than PNO: 84% versus 83% in mean and 89.2% versus 88.2% in median, consistent with the widely-documented disposition effect.

Table 1 also reports the profitability of trading. As reported in the last column of Part 1, after accounting for all transaction costs of commissions and taxes, the traders in the total sample have an average net loss of 548 ticks. With each tick worth 200 New Taiwan Dollars, NT$200, this translates to a net loss of NT$109,600, or $3,321, based on the exchange rate of NT$33/$ on 12/31/2003. Considering this loss is based on 33 months' sample period, it is not a huge loss. However, there are great variations among the traders, ranging from -3,566,781 ticks ($21,616,855) to 4,777,947 ticks ($28,957,255), indicating clearly that not all traders are equal, hence reinforce our argument for an in-depth examination of the traders at the individual level. Separating profitable traders from unprofitable traders, we gain further insights of profitability.

As shown in Panels C and D, 37,198 traders, accounting for about 30% of the total sample, are profitable and the remaining 70%, 87,531 traders, lose money. The average profit of the profitable traders is 1,699 ticks, compared with the average loss of 1,502 ticks for their unprofitable counterparts. Because the latter group outnumbers their profitable counterparts, we see why we have the average net loss of 548 reported for the total sample even though the profitable traders have a profit larger in dollar amount than the loss the unprofitable traders suffer. Compared with the evidence in the literature that can only show a net loss for all traders as a group, the results here paint a much clear and detailed picture of the cross-sectional variations in profitability that is available only by looking at traders at the individual level.

For the frequent and active traders, the corresponding profitability numbers in Part 3 show that they have higher average and median loss, 1,029 and 1,057 ticks respectively, and the largest profit and loss reported above for the total sample are from these traders. Detailed picture of the profitable versus unprofitable traders reported in Panels B and C show again that the profitable traders have an average profit of 9,963 ticks, while the unprofitable traders have an average loss of 6,017, but again due to the latter group outnumbers the former group (7,599 versus 3,449, or 68.7% versus 31.3%), the resulting average for all of them as a group is the reported negative average loss of 1,029.

Excluding traders who trade over 90 days, there are 113,682 traders who clearly trade less than 90 days. The statistics reported in Part 4 show that they trade an average of 21 days and 81 contracts. They certainly can be called infrequent and less active traders. With 113,682 accounts, accounting for a dominating 91% of the total sample, it's not surprising that their average loss of 501 ticks is close to the average loss of the total sample. Similarly, their average PPO and PNO, 0.823 and 0.843, respectively, are almost identical to those of the total sample.

Insert Table 1 about here

Overall, the contrasting results reported in Table 1 reveal clear cross-sectional variations among traders that are not available when one looks at the group as a whole. On the disposition effect, the results appear to show that among frequent and active traders, they have greater tendency to realize gains than losses while among their less frequent and inactive counterparts, and for the total sample, the opposite is true. Upon further investigation reported in the following

section, it turns out the extend of the disposition effect varies among traders and the variations very much hinge on whether traders are profitable or not, hence once again supporting the main theme of this study that an analysis of the disposition effect and related issues must be done at the individual level.

4.2 Test of Difference between PPO and PNO

We now turn the formal tests of the difference between PPO and PNO. Given that traders clearly are not equal, we expect the profitable traders to trade differently than the unprofitable traders do, we also perform the tests on the profitable and unprofitable traders separately. Results of these tests are report in Table 2. Panel A shows that based on either t-test or sign-test the differences in PPO and PNO are indeed statistically different among all samples. Clearly, the result of a higher PNO for the total sample is driven by the unprofitable traders who have an average PNO of 91.1% compared with an average PPO of 78.9%. In contrast, the profitable traders have a higher PPO, 90%, than PNO, 68%, a counter-intuitive result if one thinks the disposition effect, being a reflection of irrationality, to be bad for profitability. As discussed in previous section, this result is clearly due to the domination of the less frequent and inactive traders in the total sample. When we look at the frequent and active traders, we see that on average they have a higher PPO, 84%, than PNO, 83%, and the difference is statistically significant, hence exhibiting the disposition effect. What's more interesting is that it is among the unprofitable traders, who have an average PPO of 86.5% versus PNO of 84%, that this result appears. In contrast, the profitable traders actually have a lower PPO, with an average of 78.5%, than PNO that has an average of 80.7% and the difference statistically significant. The opposite results between the profitable and unprofitable traders are intuitively appealing if the disposition effect is considered irrational, hence detrimental to profitability. Because of this intuitively appealing result among the frequent and active traders, we will present and discuss results for this group first.

Insert Table 2 about here

4.3 In-depth Look at PPO and PNO

Before further examination of the disposition effect, we separately look at PPO and PNO in detail. Recognizing the cross-sectional variations among traders, hence the importance of accounting for them, we do so by examining how PPO and PNO vary among the trading-day and trading-volume decile groups as well as among the profitable and unprofitable quintile groups and report the results in Table 3. Panel A in Part 1 shows that among the trading-day groups, there is overwhelming evidence that as traders trade more frequently, their tendency to offset when they have unrealized gains steadily declines. This steadily declining tendency to offset also appears in Panels B, C, and D among the trading-volume, profitable, and unprofitable groups. For PNO, the results reported in Part 2 also show the steadily declining tendency to offset.

Insert Table 3 about here

This steadily declining trend of PPO and PNO among the frequent and active traders appears to be interrupted as we look at the total sample. Among the trading-day and trading-volume decile groups, both Panels A and B in Parts 3 and 4 show that Group One has a lower average PPO and PNO than Groups 2 and 3. Panel D in Part 3 also shows Group One among the unprofitable traders has a smaller PPO and Panel C in Part 4 reports Group One among the profitable traders have a smaller PNO. However, if we drop the first group in Panels A, B, and D in Part 3 and in Panels A, B, and C in Part 4, we have the steadily declining PPO and PNO among the remaining groups in all panels. Because this irregularity appears to be caused by Group One in these samples, we examine these first groups, especially the trading-day decile Group One. It turns out that among these 99,871 traders, who account for 80% of the total sample, the average number of days and the trading volume are merely 14 days and 26 contracts, while the medians numbers are 9 days and 18 contracts, considering these numbers are for the 33 months sample period, hence are extremely small, we can safely assume these traders simply don't have enough trading history and are most likely to be lack of experience, in trading frequency and volume, to allow their tendency of the disposition effect, if exists, to be revealed. Due to this reason, we decide to exclude this trading-day Group One from the total sample for most of the rest of the paper. Similar treatment of infrequent traders—with more stringent cut-off criteria—is found in Locke and Mann [2005] who only consider traders who executed at least five trades on at least ten different trading days in their one-year sample period and Frino et al. []

also exclude traders who trade less than ten days over their 61-day sample period. The remaining traders, total sample excluding trading-day Group One, with a total number of 24,857, are a little more than twice in number the size of the frequent and active traders who trade over 90 days.

Formal tests of the apparent, steadily declining tendency are conducted and reported in Table 4. Based on ANOVA tests, both Panels A and B in Part 1 show that the difference among the groups based on trading volume, trading days, profit, and losses are all statistically significant, indicating traders definitely exhibit great variations in PPOs and PNOs. To contrast the difference between groups, we also report the difference among the first and last subgroups in each category and report the results in Panel C. Not surprisingly, the differences are all statistically significant and large, especially for PPO among the profitable traders and PNO for the unprofitable traders. These results for the frequent and active traders also apply to the total sample excluding Group One as reported in Part 2 of Table 4.

Insert Table 4 about here

4.4 Tests of the Disposition Effect

The results reported earlier in Table 2 show that PPO is higher than PNO, i.e., the existence of the disposition effect, for the frequent and active traders as a group and for the unprofitable traders among them, but the opposite is true for the profitable traders and for the total sample. To investigate whether this is universal among subgroups, we look at the difference between PPO and PNO, PPO-PNO, among the trading-day and trading-volume decile groups and profitability quintile groups and report the results in Table 5. Panel A in Part 1 shows that among the trading-day groups, the difference is positive and statistically significant for Groups 1 through 3. It turns negative in Group 4, becomes more negative in higher decile groups and is statistically significant from Groups 7 to 10. This result suggests that less frequent traders exhibit the disposition effect and the more frequent traders are the less they are prone to the disposition effect, and as they trade even more frequently, starting when they are above the 7^{th} decile, they actually show a statistically significant opposite effect. For trading volume, only Group One reports a statistically significant disposition effect, the other four quintile have the opposite effect, which is statistically significant among Groups 3, 4 and 5. While these results are striking,

what is more interesting is the contrasting results between the profitable and unprofitable traders. On the one hand, as shown in Panel C, all profitable groups have a negative difference between PPO and PNO, hence exhibit the opposite of the disposition effect, and the more profitable the traders are the greater the difference becomes. On the other hand, all unprofitable traders report a positive difference between PPO and PNO, hence the existence of the disposition effect, and the more unprofitable the traders are the stronger they exhibit the effect. These results suggest that a link exists between profitability and the disposition effect: the greater the tendency of the disposition effect, the more the loss traders suffer, and the more tendency of the opposite effect, the more profit traders enjoy.

Insert Table 5 about here

For the total sample excluding trading-day Group One reported in Part 2, the results are even stronger. First, among the trading volume groups, the first four groups have a positive average which is statistically significant, while starting from Groups 6 the average is negative which is statistically significant except for Group 8. These results suggest a strong presence of the disposition effect for traders who are less active, it declines as they trade more, and eventually as they trade enough they are no longer succumb to the disposition effect and behave exactly the opposite. These variations among traders transpire differently again between the profitable and unprofitable traders. As show in Panel B, all profitable traders have a negative and statistically significant difference and the more profitable the groups are the greater the difference, clearly suggesting profit is negatively related to the disposition effect. This result is further corroborated by the result for the unprofitable traders. As shown in Panel C, the difference among all traders is positive and statistically significant. Furthermore, the more unprofitable they are the greater the difference becomes, clearly suggesting again a positive link between the disposition effect and loss. Overall, the results reported in both parts of Table 5

4.5 Profitability

Before we investigate the link between the disposition effect and profitability, we take another look at how profitability varies among traders. Given that there are variations in trading

characteristics among traders, it's logical to expect their profitability to vary in some way, hence an in-depth analysis is warranted. We do this via double sorting. For the sample of frequent and active traders, we separate them into 50 groups by sorting them into 10 trading-day decile groups and into five by trading-volume quintile groups. For the total sample, traders are separated into 100 groups by sorting them into ten trading-day decile groups and ten trading-volume decile groups. The results are reported in Table 6. To reduce clutter, only the means and medians are presented. To highlight the profit and loss, we boldface those median values that are positive. Looking at the numbers in Part 1, one immediately notices that the groups in the upper half are mostly unprofitable. Specifically, groups in the lowest two trading-volume quintiles have losses, in terms of means and medians, across all trading-day deciles. Among Group 3 traders, four trading-day deciles groups, 5^{th}, 7^{th}, 8^{th}, and 9^{th}, in terms of mean, and five groups, 6^{th} to 10^{th}, based on median, are profitable. As we move to higher trading-volume quintiles, i.e., groups in the lower half, we see most of them are profitable.

Insert Table 6 about here

A similar pattern exists for the total sample. Specifically, no traders in the first four trading-volume decile groups are profitable and for trading-volume Group 5, only traders in trading-day 9^{th} decile group are profitable. As we move to higher trading-volume deciles we see most traders are profitable. Together, the profitability statistics reported in Table 6 suggest that trading volume is directly related to profitability, while trading day show little evidence of a link.

4.6 Regression Tests of the Link between Profitability and the Disposition Effect

We have demonstrated how traders react to losses and gains, and variations in their reactions, by examining their propensity to offset their positions. We have also investigated whether traders exhibit the disposition effect and how they differ in the extent of the effect. In-depth analysis of profitability also reveals how it is related to traders' trading characteristics such as trading volume and trading days. More important to the main issue of this study, there appears to have a link between profitability and the disposition effect. To formerly investigate this, while at the same time incorporating trading characteristics, we run the following regressions:

Model 1: $profit = \beta_0 + \beta_1 PPO + \beta_2 PNO + \beta_3 day + \beta_4 vol$

Model 2: $loss = \gamma_0 + \gamma_1 PPO + \gamma_2 PNO + \gamma_3 day + \gamma_4 vol$

Model 3: $profit = \beta_0 + \beta_1 D_{disposition} + \beta_2 day + \beta_3 vol$

Model 4: $loss = \gamma_0 + \gamma_1 D_{disposition} + \gamma_2 day + \gamma_3 vol$

Where

profit = net gain after transaction cost.

loss = net loss after transaction cost.

day = trading days.

vol = trading volume.

$D_{disposition}$ = 1 if PPO > PNO, i.e., if the disposition effect is present, and 0 otherwise.

Model 1 investigates how the profit of the profitable traders is related to their tendency to offset in the face of gains and losses as well as their trading frequency and activity. Model 2 does the same for the unprofitable traders to see how their losses are determined. Considering the observed variations in traders' propensity to offset and their trading characteristics, it is possible that, due to these variations, the impacts of PPO and PNO on profit for profitable traders, as measured by the coefficients, β1 and β2, are different from the impacts on loss for unprofitable traders, as measured by γ1 and γ2. This is the reason why we choose to separate profitable traders from unprofitable traders and perform separate tests. Models 3 and 4 address the main question of the paper by testing the link between profitability and the disposition effect—captured by the indicator variable $D_{disposition}$ which takes on a value of one in the presence of the disposition effect, and zero otherwise.

To ensure the robustness of the results, we also run the following regressions using an indicator variable for each of the variables included in the above models. The main reason for doing this is that the values taken on by the variables, trading days, trading volume, and profitability, vary significantly among traders Specifically, as reported in Table 1, the values of profit and losses range from -3,566,781 to 4,777,947 and volume also has a range of 338,140. In contrast, PPO and PNO have relatively small values, i.e., between 0 and 1 by construction. By using the decile indicators for trading day, D_{day}, and volume, D_{volume}, which take on a value from one to ten, and quintile indicators for profitability, D_{profit} and D_{loss}, with values between one and

five, we in fact "standardize" the variables used in the regressions, hence reduce the standard errors while keeping the relationship between variable intact.

$$\text{Model I1: } D_{profit} = \beta_0 + \beta_1 PPO + \beta_2 PNO + \beta_3 D_{day} + \beta_4 D_{volume}$$

$$\text{Model I2: } D_{loss} = \gamma_0 + \gamma_1 PPO + \gamma_2 PNO + \gamma_3 D_{day} + \gamma_4 D_{volume}$$

$$\text{Model I3: } D_{profit} = \beta_0 + \beta_1 D_{disposition} + \beta_2 D_{day} + \beta_3 D_{volume}$$

$$\text{Model I4: } D_{loss} = \gamma_0 + \gamma_1 D_{disposition} + \gamma_2 D_{day} + \gamma_3 D_{volume}$$

Where

D_{profit} = 1 for the group with the least profit, 2 the next least profit, …, and 5 the most profitable group,
D_{loss} = 1 for the group with the smallest losses, 2 the next smallest losses, …, and 5 the largest losses,
D_{day} = 1 for the group with the smallest number of trading days, 2 the next smallest…, and 10 the largest number of trading days.
D_{volume} = 1 for the group with the smallest trading volume, 2 the next smallest, and 10 the largest trading volume.
$D_{disposition}$ = 1 if PPO > PNO, i.e., if the disposition effect is present, and 0 otherwise.

Results of these regressions are reported in Table 7. Focusing on the standardized coefficient, we see in Model 1 PPO has a statistically significant standardized coefficient of -0.094, indicating the higher the PPO, the less profit the traders earn. PNO also has a significant -0.065, suggesting the higher the PNO, the less profitable the traders are. Together, these results suggest that in the face of both losses and gains traders who wait, i.e., having a lower PPO or PNO, tend to be more profitable. The coefficient for trading day is also a significant -0.062, suggesting more frequent traders tend to earn lower profit. The only positive coefficient is the significant 0.341 for trading volume, indicating traders who trade more actively are more profitable. In addition to being positively related to the profit, we see that trading volume has the largest standardized coefficient among the four regressors, indicating trading volume has a greater effect on the profit among the profitable traders.

Insert Table 7 about here

To read the results for Model 2, we need to bear in mind that the dependent variable is the losses of the unprofitable traders. Because they are negative, a positive coefficient for a regressor means as the regressor increases in value, the loss is reduced. With this in mind, we see both PNO and Day have a positive coefficient, indicating the higher the PNO, i.e., the quicker traders offset their unrealized losses. and the more frequent they trade, the smaller the loss they suffer. On the other hand, trading volume has a significantly negative coefficient, suggesting the more they trade the more unprofitable they are. The coefficient for PPO is negative but statistically insignificant, therefore, for unprofitable traders. PPO doesn't seem to have an impact on their profitability. Again, similar to the results for their profitable counterparts, based on the standardized coefficient, volume has the largest impact on the losses among the unprofitable traders.

The trading day and volume results remain the same when we replace PPO and PNO with the indicator variable for the disposition effect, $D_{disposition}$, in the regression, as in Models 3 and 4 for the profitable and unprofitable traders respectively. For the profitable traders, we see that this indicator variable has a negative coefficient, indicating that the presence of the disposition effect reduces profit. Although an intuitive result, the coefficient is statistically insignificant. The statistical insignificance suggests that since the profitable traders on average don't exhibit the disposition effect, as reported in Table 5, this indicator variable is therefore not expected to be a significant determinant for their profitability. In contrast, for the unprofitable traders, it has a significantly negative coefficient in Model 4, indicating, the existence of the disposition effect contributes directly to the losses of the unprofitable traders. For these traders, trading volume also has a significantly positive coefficient, suggesting the more the traders trade the less they lose, while trading day has a negative coefficient, indicating the more frequently they trade the less loss they suffer.

Results based on the indicator variables for profitability, trading day, and trading volume are reported next. As expected, using these "standardized" variables results in better fit of the models, as indicated by the much higher adjusted R^2 for all models compared with their non-standardized counterparts in Models 1-4. We see in Model I1, all variables have the same signs as their counterparts in Models 1 and are all statistically significant. For Model I2, the signs are reversed because D_{loss} is now the dependent variable with positive values (1,2, 3, 4, or 5) while in Model 2, the dependent variable is the loss, a negative value. The only difference is that the

coefficient for PPO in Model 2 is not statistically significant. Similarly, results using the indicator variable for the disposition effect reported for Models I3 and I4 are also similar to those of their non-standardized counterparts in Models 3 and 4. To summarize, results for Models I1 – I4 collaborate with those for Models 1 – 4. For profitable traders, faster offset, in the face of either gains or losses, and longer trading days, place traders in lower profit quintile, while higher trading volume puts them among higher profit ranks. For unprofitable traders, the quicker they offset when they have unrealized gains and the slower they offset when they face unrealized losses, the higher the loss they find themselves in. In Models I3 and I4, we see that the more the profitable traders exhibit the disposition effect, the lower profit group they fall into, and for unprofitable trader, the more the disposition effect is present, the higher loss group they are in. Therefore, the disposition effect is clearly bad for the profitability of all traders.

We also run the same regressions for the total sample excluding trading-day Group One and report the results in Part 2 of Table 7. It is clear that they have essentially the same results as the frequent and active traders reported in Part 1, reinforcing the conclusion that disposition effect is bad for profitability.

V. Conclusion and Discussion

By tracking the trade-by-trade transaction histories of individual traders at the Taiwan Futures Exchange (TAIFEX), this paper is able to demonstrate how individual traders vary in their tendency to offset in the face of gains and losses and whether they exhibit the disposition effect. We also track their profitability and find it varies among them with trading frequency, trading activity, and, most importantly, whether they exhibit the disposition effect. In addition to offering these in-depth insights to traders' profitability and their determinants, the most important contribution of this paper is the demonstration that there exists a direct link between profitability and the disposition effect. As mentioned in the introduction, because we look at traders at the individual level we are able to conclude that the disposition effect leads to losses and the more traders are prone to the disposition effect, the more loss they will suffer.

If disposition effect is undesirable, by logic the opposite of the disposition effect should be good. This indeed is the case as we show that profitable traders actually behave opposite to the disposition effect, i.e., they liquidate their positions quicker in the face of losses than when

they are faced with gains. The more profitable they are the more they act opposite to the disposition effect. In addition to contributing to the literature, these results based on after-transaction-cost profit and losses have practical implications for traders regarding trading strategies. On the one hand, the evidence that losses are directly related to the tendency of the disposition effect among the unprofitable traders clearly suggests that it is advisable to avoid falling victim to the disposition effect. The evidence that profitable traders act opposite to the disposition effect and the more profitable they are the more they deviate from the disposition effect should further convince traders that disposition effect is definitely not good for profitability.

Finally, the evidence that volume is the most dominant determinant of profitability has both practical relevance and theoretical implications. The evidence that unprofitable traders suffer more losses as they trade more suggests that traders need to know themselves and be disciplined enough to quit, when they are losing money, before sinking further. On the other hand, the evidence that profitable traders are more profitable the more they trade poses a challenging task for theorists regarding the issue of overconfidence. Studies on this issue (e.g., Odean [1999] and Barber and Odean [2001]) usually posit that excess trading, reflected in high trading volume, leads to reduced profitability. Clearly, this is not the case for the profitable traders and therein lies the challenge for theorists to explain this contrary evidence perhaps by exploring determinants of profitability such as ability or discipline, as examined in Locke and Mann [2005].

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Appendix. Calculations of Costs, Unrealized and Realized Gains/Losses

A. Weighted Average Costs and Open Interests

As shown in Table A1, 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 (= (5,951×5 + 5,950) ÷ (5+1)) and an OI of -6.

Insert Table A1 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) × -6). Same calculations like these are repeated for the following five trades, Trade 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 result 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)× 2). To calculate the net profit, we subtract the commission and transaction tax, which is $1/100^{th}$ 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 tax[7] 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.

[7] 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.

Table A1. An Example of the Calculation of the Variables of Gains/Losses

Trade sequence	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	Proportion of positive offset	Proportion of negative offset
1	S	5951	5	5951.000	-5	0.000							
2	S	5950	1	5950.833	-6	5.000							
3	S	5951	4	5950.900	-10	-1.000							
4	S	5948	5	5949.933	-15	29.000							
5	S	5949	5	5949.700	-20	14.000							
6	S	5955	5	5950.760	-25	-106.000							
7	S	5959	5	5952.133	-30	-206.000							
8	B	5945	2	5952.133	-28	199.733	14.267	24.000	19.045	-28.779	-28.779	0.067	
9	B	5945	1	5952.133	-27	192.600	7.133	0.750	0.595	5.789	-22.990		
10	B	5945	2	5952.133	-25	178.333	14.267	1.500	1.189	11.578	-11.412		
11	B	5946	5	5952.133	-20	122.667	30.667	3.750	2.973	23.944	12.531		
12	B	5948	3	5952.133	-17	70.267	12.400	2.250	1.784	8.366	20.897		
13	B	5948	2	5952.133	-15	62.000	8.267	1.500	1.190	5.577	26.474		
14	B	5948	1	5952.133	-14	57.867	4.133	0.750	0.595	2.789	29.263		
15	B	5948	4	5952.133	-10	41.333	16.533	3.000	2.379	11.154	40.417		
16	B	5949	1	5952.133	-9	28.200	3.133	0.750	0.595	1.788	42.205		
17	B	5949	4	5952.133	-5	15.667	12.533	3.000	2.380	7.154	49.359		
18	B	5951	5	0.000	0	0.000	5.667	3.750	2.976	-1.059	48.300		
19	S	5961	10	5961.000	-10	0.000							
20	S	5960	5	5960.667	-15	10.000							
21	S	5957	5	5959.750	-20	55.000							
22	S	5959	2	5959.682	-22	15.000							
23	S	5955	3	5959.120	-25	103.000							
24	S	5959	11	5959.083	-36	3.000							
25	S	5955	4	5958.675	-40	147.000							
26	S	5953	5	5958.044	-45	227.000							
27	S	5959	5	5958.140	-50	-43.000							
28	S	5962	5	5958.491	-55	-193.000							
29	S	5959	5	5958.533	-60	-28.000							
30	S	5956	15	5958.027	-75	152.000							
31	S	5955	5	5957.838	-80	227.000							
32	S	5954	10	5957.411	-90	307.000							
33	S	5946	5	5956.811	-95	1027.000							
34	S	5943	5	5956.120	-100	1312.000							
35	S	5944	4	5955.654	-104	1212.000							
36	S	5944	1	5955.543	-105	1212.000							
37	S	5943	5	5954.973	-110	1317.000							
38	S	5938	5	5954.235	-115	1867.000							
39	S	5939	2	5953.974	-117	1752.000							
40	S	5937	3	5953.550	-120	1986.000							
41	S	5928	10	5951.585	-130	3066.000							

Table A1. Continued

Trade sequence	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	Proportion of positive offset	Proportion of negative offset
42	B	5957	1	5951.585	-129	-698.585	-5.415	98.250	77.966	-181.632	-181.632		0.0077
43	B	5957	4	5951.585	-125	-676.923	-21.662	3.000	2.383	-27.044	-208.676		
44	B	5957	1	5951.585	-124	-671.508	-5.415	0.750	0.596	-6.761	-215.437		
45	B	5957	1	5951.585	-123	-666.092	-5.415	0.750	0.596	-6.761	-222.198		
46	B	5957	1	5951.585	-122	-660.677	-5.415	0.750	0.596	-6.761	-228.959		
47	B	5957	2	5951.585	-120	-649.846	-10.831	1.500	1.191	-13.522	-242.481		
48	B	5961	5	5951.585	-115	-1082.769	-47.077	3.750	2.981	-53.807	-296.289		
49	B	5959	1	5951.585	-114	-845.354	-7.415	0.750	0.596	-8.761	-305.050		
50	B	5959	1	5951.585	-113	-837.938	-7.415	0.750	0.596	-8.761	-313.811		
51	B	5958	3	5951.585	-110	-705.692	-19.246	2.250	1.787	-23.284	-337.095		
52	S	6000	4	5953.690	-115	-5325.692							
53	S	5998	5	5955.536	-120	-5095.692							
54	S	6000	9	5958.638	-129	-5335.692							
55	S	5999	1	5958.949	-130	-5206.692							
56	B	6023	10	5958.949	-120	-7685.254	-640.438	22.500	18.022	-680.960	-680.960		0.0769

Table 1. Sample and Trading Statistics

Part 1: Total Sample (124,730 Observations)

	Number of Contracts	Trading Days	PPO	PNO	Net Profit (in Ticks)
Average	194	32	0.824	0.842	-548
Median	32	16	0.996	1.000	-172
Minimum	2	1	0.000	0.000	-3,566,781
Maximum	338138	537	1.000	1.000	4,777,947
1st Quartile	10	5	0.833	0.833	-714
3rd Quartile	104	41	1.000	1.000	30
Sum	24,231,693	4,033,756			-68,328,860

Part 2: Trading Statistic by Subgroups of Total Sample

Panel A: Trading Day Statistics by Groups

Decile Groups (1st: Lowest & 10th: Highest; in Trading Days)

	1	2	3	4	5	6	7	8	9	10
Obser.	99871	15920	5322	2044	889	392	170	61	25	36
Mean	15	71	121	172	222	272	323	373	422	472
Median	11	68	119	170	220	271	322	371	421	465
Min.	1	51	101	151	201	251	301	351	404	451
Max.	50	100	150	200	250	300	350	400	448	537

Panel B: Trading Volume Statistics by Groups

Decile Groups (1st: Smallest & 10th: Largest; in Number of Contracts)

	1	2	3	4	5	6	7	8	9	10
Obser.	91654	16666	8134	4274	2212	1065	458	180	69	18
Mean	26	145	298	567	1095	2275	5302	13478	35084	134272
Median	18	140	288	546	1048	2162	4969	12975	30796	114231
Min.	2	96	218	418	797	1591	3500	8828	20794	68570
Max.	96	218	418	797	1590	3500	8781	20757	65318	338138

Panel C: Profit Statistics for Profitable Traders and by Groups

Quintile Groups (1st: Lowest & 5th: Highest; in Ticks)

	Total	1	2	3	4	5
Obser.	37,198	34,433	2,136	462	144	23
Mean	1,699	367	5,920	27,357	88,552	544,166
Median	183	156	4,921	24,433	77,189	285,214
Min	0	0	2,750	14,748	53,471	193,112
Max	4,777,947	2749	14,748	53,001	192,035	4,777,947

Panel D: Loss Statistics for Unprofitable Traders and by Groups

Quintile Groups (1st: Lowest & 5th: Highest; in Ticks)

	Total	1	2	3	4	5
Obser.	87,531	68,959	12,697	4,599	1,146	131
Mean	-1,502	-381	-2,072	-5,721	-22,985	-200,439
Median	-416	-276	-1,936	-5,087	-18,599	-113,199
Min.	-3,566,781	-1,305	-3,463	-11,252	-71,437	-3,566,781
Max.	0	0	-1,305	-3,464	-11,261	-71,468

Table 1. Continued.

Part 3: Over-90-Day Sample (11,048 Observations)

Panel A: Basic Statistics

	Number of Contracts	Trading Days	PPO	PNO	Net Profit (in Ticks)
Average	1,362	145	0.840	0.830	-1,029
Median	408	126	0.892	0.882	-1,057
Minimum	100	90	0.012	0.060	-3,566,781
Maximum	338,138	537	1.000	1.000	4,777,947
1st Quartile	251	104	0.773	0.757	-3,005
3rd Quartile	820	167	0.959	0.956	429
Sum	15,049,311	1,605,854			-11,363,114

Panel B: Profit Statistics for Profitable Traders and by Groups

		Quintile Groups (1st: Lowest & 5th: Highest; in Ticks)				
	Total	1	2	3	4	5
Obser.	3,449	2,248	848	243	91	19
Mean	9,963	971	6,190	28,657	93,882	601,231
Median	1,558	800	5,080	26,733	83,597	332,708
Min	1	1	2,752	14,748	53,471	193,112
Max	4,777,947	2,749	14,748	52,313	192,035	4,777,947

Panel C: Loss Statistics for Unprofitable Traders and by Groups

		Quintile Groups (1st: Lowest & 5th: Highest; in Ticks)				
	Total	1	2	3	4	5
Obser.	7,599	2,514	2,731	1,786	503	65
Mean	-6,017	-649	-2,234	-5,838	-22,632	-248,936
Median	-2,105	-643	-2,163	-5,210	-18,971	-122,687
Min.	-3,566,781	-1,304	-3,462	-11,222	-70,840	-3,566,781
Max.	0	0	-1,308	-3,468	-11,261	-71,490

Part 4: Under-90-Day Sample (113,682 Observations)

	Number of Contracts	Trading Days	PPO	PNO	Net Profit (in Ticks)
Average	81	21	0.823	0.843	-501
Median	26	13	1.000	1.000	-155
Minimum	2	1	0.000	0.000	-968,520
Maximum	50,896	89	1.000	1.000	334,578
1st Quartile	8	5	0.836	0.833	-609
3rd Quartile	75	32	1.000	1.000	26

Table 2. Test of the Difference between PPO and PNO

Panel A: Total Sample (124,730 Observations)

	All		Profitable		Unprofitable	
	PPO	PNO	PPO	PNO	PPO	PNO
Average	0.824	0.842	0.907	0.680	0.789	0.911
Difference	-0.018		0.228		-0.122	
T-Statistic	-14.31		100.06		-93.44	
Sig. Level	0.000		0.000		0.000	
Sign-Rank	-4.86		-72.73		-44.39	
Sig. Level	0.000		0.000		0.000	
Observations	124,730		37,198		87,531	

Panel B: Over-90-Day Sample (11,048 Observations)

	All		Profitable		Unprofitable	
	PPO	PNO	PPO	PNO	PPO	PNO
Average	0.840	0.830	0.785	0.807	0.865	0.840
Difference	0.011		-0.022		0.025	
T-Statistic	11.09		-12.76		22.89	
Sig. Level	0.000		0.000		0.000	
Sign-Rank	9.56		-14.17		-21.46	
Sig. Level	0.000		0.000		0.000	
Observations	11,048		3,449		7,599	

Panel C: Under-90-Day Sample (113,682 Observations)

	All		Profitable		Unprofitable	
	PPO	PNO	PPO	PNO	PPO	PNO
Average	0.823	0.843	0.920	0.667	0.782	0.917
Difference	-0.020		0.253		-0.136	
T-Statistic	-15.1		102.9		-96.1	
Sig. Level	0.000		0.000		0.000	
Sign-Rank	-1.26		78.89		53.86	
Sig. Level	0.000		0.000		0.000	
Observations	113,682		33,750		79,932	

Table 3. Proportion of Offset, PPO and PNO, Among Groups

Part 1: PPO - Over-90-Day Sample

Panel A: Trading Days Decile Groups (1^{st}: Smallest & 10^{th}: Largest; 11048 Observations)

	1	2	3	4	5	6	7	8	9	10
Obser.	5835	2580	1272	665	341	172	90	38	19	36
Mean	0.865	0.839	0.825	0.780	0.755	0.718	0.701	0.742	0.627	0.477
Median	0.914	0.886	0.872	0.833	0.809	0.770	0.748	0.841	0.647	0.475
Min.	0.012	0.075	0.121	0.113	0.100	0.157	0.224	0.225	0.204	0.150
Max.	1.000	1.000	1.000	1.000	1.000	1.000	0.999	0.991	0.997	0.967

Panel B: Trading Volume Decile Groups (1^{st}: Lowest & 5^{th}: Highest; 11048 Observations)

	1	2	3	4	5
Obser.	8304	2057	525	133	29
Mean	0.876	0.772	0.639	0.504	0.519
Median	0.914	0.817	0.665	0.479	0.584
Min.	0.128	0.068	0.084	0.090	0.012
Max.	1.000	1.000	1.000	0.922	0.853

Panel C: Profitable Groups (1^{st}: Lowest & 5^{th}: Highest; 3,449 Observations)

Group	1	2	3	4	5
Obser.	3056	270	89	30	4
Mean	0.821	0.553	0.436	0.364	0.275
Median	0.871	0.561	0.401	0.314	0.304
Min.	0.082	0.075	0.068	0.084	0.012
Max.	1.000	0.966	0.915	0.758	0.479

Panel D: Unprofitable Groups (1^{st}: Lowest & 5^{th}: Highest; 7,599 Observations)

Group	1	2	3	4	5
Obser.	5621	1421	452	94	11
Mean	0.891	0.827	0.739	0.598	0.287
Median	0.924	0.856	0.779	0.602	0.339
Min.	0.099	0.162	0.090	0.141	0.043
Max.	1.000	1.000	0.992	0.985	0.450

Table 3. Continued.

Part 2: PNO - Over-90-Day Sample

Panel A: Trading Days Decile Groups (1st: Smallest & 10th: Largest; 11048 Observations)

Group	1	2	3	4	5	6	7	8	9	10
Obser.	5835	2580	1272	665	341	172	90	38	19	36
Mean	0.848	0.832	0.819	0.780	0.763	0.731	0.724	0.804	0.675	0.529
Median	0.899	0.877	0.872	0.830	0.816	0.800	0.744	0.847	0.723	0.505
Min.	0.060	0.136	0.104	0.095	0.113	0.216	0.129	0.279	0.293	0.068
Max.	1.000	1.000	1.000	1.000	1.000	1.000	0.998	0.997	1.000	0.963

Panel B: Trading Volume Decile Groups (1st: Lowest & 5th: Highest; 11048 Observations)

Group	1	2	3	4	5
Obser.	8304	2057	525	133	29
Mean	0.859	0.776	0.659	0.529	0.632
Median	0.902	0.827	0.702	0.495	0.775
Min.	0.136	0.088	0.060	0.076	0.068
Max.	1.000	1.000	0.995	0.971	0.956

Panel C: Profitable Groups (1st: Lowest & 5th: Highest; 3,449 Observations)

Group	1	2	3	4	5
Obser.	3056	270	89	30	4
Mean	0.839	0.599	0.487	0.448	0.404
Median	0.890	0.618	0.430	0.357	0.378
Min.	0.127	0.129	0.095	0.073	0.105
Max.	1.000	0.976	0.956	0.936	0.757

Panel D: Unprofitable Groups (1st: Lowest & 5th: Highest; 7,599 Observations)

Group	1	2	3	4	5
Obser.	5621	1421	452	94	11
Mean	0.874	0.780	0.682	0.544	0.260
Median	0.911	0.813	0.715	0.532	0.248
Min.	0.088	0.153	0.060	0.089	0.068
Max.	1.000	1.000	0.989	0.989	0.513

Table 3. Continued.

Part 3: PPO - Total Sample

Panel A: Trading Days Decile Groups (1st: Smallest & 10th: Largest; 124,730 Observations)

	1	2	3	4	5	6	7	8	9	10
Obser.	99871	15920	5322	2044	889	392	170	61	25	36
Mean	0.814	0.887	0.857	0.829	0.784	0.744	0.730	0.696	0.673	0.477
Median	1.000	0.933	0.904	0.876	0.838	0.799	0.781	0.765	0.680	0.475
Min.	0.000	0.041	0.012	0.122	0.105	0.100	0.157	0.224	0.204	0.150
Max.	1.000	1.000	1.000	1.000	1.000	1.000	0.999	0.991	0.997	0.967

Panel B: Trading Volume Decile Groups (1st: Lowest & 10th: Highest; 124,730 Observations)

	1	2	3	4	5	6	7	8	9	10
Obser.	91654	16666	8134	4274	2212	1065	458	180	69	18
Mean	0.814	0.893	0.860	0.816	0.769	0.695	0.608	0.532	0.487	0.538
Median	1.000	0.940	0.906	0.869	0.821	0.743	0.613	0.551	0.469	0.591
Min.	0.000	0.000	0.000	0.000	0.000	0.020	0.011	0.003	0.043	0.012
Max.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.957	0.891	0.853

Panel C: Profitable Groups (1st: Lowest & 5th: Highest; 37,198 Observations)

Group	1	2	3	4	5
Obser.	34433	2136	462	144	23
Mean	0.928	0.706	0.505	0.393	0.314
Median	1.000	0.737	0.500	0.339	0.260
Min.	0.000	0.000	0.003	0.010	0.012
Max.	1.000	1.000	1.000	1.000	0.671

Panel D: Unprofitable Groups (1st: Lowest & 5th: Highest; 87,532 Observations)

Group	1	2	3	4	5
Obser.	68959	12697	4599	1146	131
Mean	0.776	0.864	0.809	0.710	0.474
Median	1.000	0.935	0.874	0.776	0.472
Min.	0.000	0.000	0.000	0.000	0.000
Max.	1.000	1.000	1.000	1.000	1.000

Table 3. Continued.

Part 4: PNO - Total Sample

Panel A: Trading Days Decile Groups (1st: Smallest & 10th: Largest; 124,730 Observations)

Group	1	2	3	4	5	6	7	8	9	10
Obser.	99871	15920	5322	2044	889	392	170	61	25	36
Mean	0.839	0.869	0.842	0.820	0.788	0.752	0.750	0.726	0.726	0.529
Median	1.000	0.917	0.891	0.871	0.841	0.803	0.804	0.780	0.785	0.505
Min.	0.000	0.000	0.073	0.104	0.095	0.113	0.216	0.129	0.293	0.068
Max.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.997	1.000	0.963

Panel B: Trading Volume Decile Groups (1st: Lowest & 10th: Highest; 124,730 Observations)

Group	1	2	3	4	5	6	7	8	9	10
Obser.	91654	16666	8134	4274	2212	1065	458	180	69	18
Mean	0.842	0.874	0.846	0.810	0.765	0.705	0.628	0.542	0.532	0.674
Median	1.000	0.924	0.897	0.869	0.821	0.755	0.675	0.519	0.513	0.783
Min.	0.000	0.000	0.000	0.000	0.000	0.034	0.023	0.013	0.073	0.068
Max.	1.000	1.000	1.000	1.000	1.000	1.000	0.995	0.971	0.943	0.956

Panel C: Profitable Groups (1st: Lowest & 5th: Highest; 37,198 Observations)

Group	1	2	3	4	5
Obser.	34433	2136	462	144	23
Mean	0.681	0.715	0.535	0.460	0.388
Median	0.938	0.785	0.528	0.426	0.344
Min.	0.000	0.000	0.000	0.000	0.073
Max.	1.000	1.000	1.000	1.000	0.852

Panel D: Unprofitable Groups (1st: Lowest & 5th: Highest; 87,532 Observations)

Group	1	2	3	4	5
Obser.	68959	12697	4599	1146	131
Mean	0.935	0.854	0.774	0.664	0.435
Median	1.000	0.900	0.820	0.700	0.425
Min.	0.000	0.000	0.000	0.000	0.023
Max.	1.000	1.000	1.000	1.000	0.989

Table 4. Test of Difference in Proportion of Offset

Part 1: Over-90-Day Sample

Panel A: ANOVA Tests of Difference in PPO between Groups

	All		Profitable		Unprofitable	
Groups	F-	Sig. Level	F-Stat.	Sig. Level	F-Stat	Sig.Level
Trading Volume	702.6	0.000	226.6	0.000	388.3	0.000
Trading Days	85.11	0.000	31.61	0.000	35.86	0.000
Profitable (3,449 Obser.)	306.5	0.000	306.5	0.000	-	-
Unprofitable (7,599 Obser.)	370.7	0.000	-	-	370.7	0.000
Observations	11,048		3,449		7,599	

Panel B: ANOVA Tests of Difference in PNO between Groups

	All		Profitable		Unprofitable	
Groups	F-	Sig. Level	F-Stat.	Sig. Level	F-Stat	Sig. Level
Trading Volume	424.4	0.000	167.1	0.000	232.7	0.000
Trading Days	47.12	0.038	18.39	0.000	23.19	0.000
Profitable (3,449 Obser.)	245.8	0.000	245.8	0.000	-	-
Unprofitable (7,599 Obser.)	446.5	0.000	-	-	446.5	0.000
Observations	11,048		3,449		7,599	

Panel C: T-Test of PPO and PNO between Groups

	PPO				**PNO**			
	Average	Diff.	T-Stat.	Sig. Level	Average	Diff.	T-Stat.	Sig. Level
A: Trading Volume								
1 (Least)	0.876				0.859			
5 (Highest)	0.519	0.357	15.30	0.000	0.632	0.227	8.754	0.000
B: Trading Day								
1 (Lowest)	0.865				0.848			
10 (Highest)	0.477	0.388	15.61	0.000	0.529	0.319	11.99	0.000
C: Profit								
1 (Lowest)	0.821				0.839			
5 (Highest)	0.275	0.546	6.619	0.000	0.404	0.435	5.378	0.000
D: Loss								
1 (Lowest)	0.891				0.874			
5 (Highest)	0.287	0.603	17.59	0.000	0.260	0.613	16.31	0.000

Table 4. Continued.

Part 2: Total Sample

Panel A: ANOVA Tests of Difference in PPO between Groups

	All		Profitable		Unprofitable	
Groups	F-Stat.	Sig. Level	F-Stat.	Sig. Level	F-Stat.	Sig.Level
Trading Volume	191.8	0.000	976.0	0.000	262.1	0.000
Trading Days	102.2	0.000	360.4	0.000	195.9	0.000
Profitability(37,198)	2539	0.000	2539	0.000	-	-
Loss (87,532)	211.3	0.000	-	-	211.3	0.000
Observations	124,730		37,198		87,532	

Panel B: ANOVA Tests of Difference in PNO between Groups

	All		Profitable		Unprofitable	
Groups	F-Stat.	Sig. Level	F-Stat.	Sig. Level	F-Stat.	Sig. Level
Trading Volume	138.3	0.000	195.3	0.000	797.3	0.000
Trading Days	35.22	0.038	157.1	0.000	300.7	0.000
Profitability(37,198)	31.41	0.000	31.41	0.000	-	-
Loss (87,532)	2943	0.000	-	-	2934	0.000
Observations	124,730		37,198		87,532	

Panel C: T-Test of PPO and PNO between Groups

	PPO				**PNO**			
	Average	Diff.	T-Stat.	Sig. Level	Average	Diff.	T-Stat.	Sig. Level
A: Trading Volume								
1 (Least)	0.814				0.843			
10 (Highest)	0.538	0.276	3.32	0.001	0.674	0.169	2.29	0.022
B: Trading Day								
1 (Lowest)	0.814				0.839			
10 (Highest)	0.477	0.336	5.88	0.000	0.529	0.311	6.08	0.000
C: Profit								
1 (Lowest)	0.928				0.681			
5 (Highest)	0.314	0.444	21.03	0.000	0.388	0.293	3.33	0.001
D: Loss								
1 (Lowest)	0.776				0.935			
5 (Highest)	0.474	0.301	9.04	0.000	0.435	0.501	39.50	0.000

Table 5. Tests of the Disposition Effect—Difference between PPO and PNO, PPO-PNO

Part 1: Over-90-Day Sample

Panel A: Trading Days Decile Groups (1st: Smallest & 10th: Largest; 11048 Observations)

	1	2	3	4	5	6	7	8	9	10
Obser.	5835	2580	1272	665	341	172	90	38	19	36
Mean	**0.017**	**0.007**	**0.007**	-0.001	-0.008	-0.013	**-0.024**	**-0.062**	**-0.048**	**-0.051**
T-Stat.	13.442	3.869	2.473	-0.124	-1.517	-1.490	-1.723	-3.717	-2.602	-3.020
Sig. Level	**0.000**	**0.000**	**0.014**	0.901	0.130	0.138	**0.088**	**0.001**	**0.018**	**0.005**

Panel B: Trading Volume Decile Groups (1st: Lowest & 5th: Highest; 11048 Observations)

	1	2	3	4	5
Obser.	8304	2057	525	133	29
Mean	**0.017**	-0.004	**-0.020**	**-0.025**	**-0.113**
T-Stat.	16.662	-1.557	-3.539	-2.632	-5.206
Sig. Level	**0.000**	0.120	**0.000**	**0.009**	**0.000**

Panel C: Profitable Groups (1st: Lowest & 5th: Highest; 3449 Observations)

	1	2	3	4	5
Obser.	3056	270	89	30	4
Mean	**-0.018**	**-0.046**	**-0.052**	**-0.084**	-0.130
T-Stat.	-10.301	-6.063	-4.951	-3.873	-1.092
Sig. Level	**0.000**	**0.000**	**0.000**	**0.001**	0.355

Panel D: Unprofitable Groups (1st: Lowest & 5th: Highest; 7599 Observations)

	1	2	3	4	5
Obser.	5621	1421	452	94	11
Mean	**0.017**	**0.047**	**0.057**	**0.054**	0.027
T-Stat.	14.738	15.252	9.702	4.179	0.760
Sig. Level	**0.000**	**0.000**	**0.000**	**0.000**	0.465

Table 5. Continued.

Part 2: Total Sample Excluding Trading-Day Decile One

Panel A: Trading Volume Decile Groups (1st: Smallest & 10th: Largest)

	1	2	3	4	5	6	7	8	9	10
Obser.	1946	9551	6290	3570	1891	944	408	173	68	18
Mean	**0.029**	**0.023**	**0.015**	**0.005**	0.001	**-0.011**	**-0.019**	-0.010	**-0.045**	**-0.136**
Median	0.005	0.007	0.005	0.000	-0.003	-0.008	-0.020	-0.011	-0.036	-0.156
T-Stat.	14.59	24.05	11.96	2.95	0.42	-2.83	-2.95	-1.17	-3.14	-5.603
Sig. Level	**0.000**	**0.000**	**0.001**	**0.003**	0.671	**0.005**	**0.003**	0.245	**0.003**	**0.000**

Panel B: Profitable Groups (1st: Lowest & 5th: Highest)

	1	2	3	4	5
Obser.	5480	1318	317	105	21
Mean	**-0.005**	**-0.036**	**-0.045**	**-0.055**	**-0.088**
Median	0.000	-0.032	-0.040	-0.046	-0.093
T-Stat.	-3.74	-10.29	-6.32	-5.69	-2.53
Sig. Level	**0.000**	**0.000**	**0.000**	**0.000**	**0.020**

Panel C: Unprofitable Groups (1st: Lowest & 5th: Highest)

	1	2	3	4	5
Obser.	7980	5941	2870	733	94
Mean	**0.012**	**0.029**	**0.048**	**0.059**	**0.058**
Median	0.000	0.017	0.037	0.047	0.046
T-Stat.	13.52	23.52	22.09	12.41	4.33
Sig. Level	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

Table 6. Net Gains/Losses in Groups Double Sorted by Trading Days and Trading Volume

Part 1: Over-90-Day Sample

			Trading Day Decile Group (Trading Day Decile Group (1st: Smallest & 10th: Largest; 11,048 Observations)										
			1	2	3	4	5	6	7	8	9	10	Total
Trading Volume Decile Groups (1st: Lowest & 5th: Highest)	1	Obser.	5118	1980	796	296	98	14	2	0	0	0	8304
		Mean	-1255	-1238	-1674	-1934	-1707	-2393	-478				
		Median	-953	-1109	-1529	-1678	-1430	-1819	-478				
	2	Obser.	603	471	385	285	155	94	39	17	6	2	16666
		Mean	-1824	-1594	-1816	-1529	-2322	-571	-4285	-1759	-550	-1418	
		Median	-1580	-1593	-1699	-1327	-2027	-1134	-3038	-1627	-1457	-1418	
	3	Obser.	91	115	73	70	66	44	33	12	8	13	8134
		Mean	-6771	-131	-7280	-5002	**3859**	-5426	**15775**	**10491**	**33207**	-2256	
		Median	-1289	-972	-7345	-280	-281	**752**	**9256**	**7148**	**7749**	**2208**	
	4	Obser.	18	12	14	11	20	18	14	6	5	15	4274
		Mean	-102709	-43170	**4259**	-24662	**77365**	**60408**	**41283**	-41125	**80825**	**72670**	
		Median	-25486	-4524	**29984**	**5647**	**19761**	**38587**	**35203**	**10930**	**57688**	**51575**	
	5	Obser.	5	2	4	3	2	2	2	3	0	6	2212
		Mean	**211858**	-312776	**106365**	-47863	-279854	**64009**	**123040**	**162186**		**156330**	
		Median	**129479**	-312776	**81134**	**75688**	-279854	**64009**	**123040**	**187391**		**178235**	
		Total Obser.	5835	2580	1272	665	341	172	90	38	19	36	11048

Table 6. Continued.

Part 2: Total Sample

Trading Day Decile Groups(1^{st}: Smallest & 10^{th}: Largest; 124,730 Observations)

Trading Volume Decile Groups (1^{st}: Lowest & 10^{th}: Highest; in Number of Contracts)

		1	2	3	4	5	6	7	8	9	10	Total
	Obser.	89708	1946	0	0	0	0	0	0	0	0	91654
1	Mean	-280	-597	-	-	-	-	-	-	-	-	
	Median	-119	-501	-	-	-	-	-	-	-	-	
	Obser.	7115	8495	1048	8	0	0	0	0	0	0	16666
2	Mean	-879	-825	-996	-915	-	-	-	-	-	-	
	Median	-510	-650	-878	-755	-	-	-	-	-	-	
	Obser.	1844	3326	2282	622	57	3	0	0	0	0	8134
3	Mean	-1562	-1168	-1257	-1366	-1453	-2180	-	-	-	-	
	Median	-909	-867	-984	-1258	-1554	-1218	-	-	-	-	
	Obser.	704	1269	1143	717	341	90	10	0	0	0	4274
4	Mean	-1690	-1554	-1576	-1666	-1964	-1977	-1523	-	-	-	
	Median	-1152	-1262	-1253	-1514	-1719	-1787	-1533	-	-	-	
	Obser.	321	564	498	380	263	119	53	10	4	0	2212
5	Mean	-3974	-2552	-2327	-2614	-1556	-2266	-1671	-2099	**1137**	-	
	Median	-2148	-1468	-1844	-2027	-1212	-1919	-1821	-2576	**1783**	-	
	Obser.	121	221	215	204	144	89	41	19	7	4	1065
6	Mean	-5715	-6141	**582**	-2300	-2519	-1485	-1259	-2504	-1708	-454	
	Median	-1401	-3758	-17	-1427	-1055	-2308	-703	-2526	**880**	**510**	
	Obser.	50	72	95	72	53	51	38	14	5	8	458
7	Mean	-22934	-31569	-10998	**1178**	-5440	**3371**	**1653**	**21332**	**4553**	**7912**	
	Median	-21963	-7720	-1135	-7393	-758	**1741**	-296	**9627**	**10415**	**5878**	
	Obser.	7	24	28	28	23	27	16	12	7	8	180
8	Mean	-27696	-43658	-10129	-23249	-6145	**36900**	**20692**	**11867**	**69384**	**2229**	
	Median	**121749**	**1705**	**12262**	-9977	**5647**	**14538**	**15189**	**16776**	**22074**	**9769**	
	Obser.	1	3	11	9	6	12	10	5	2	10	69
9	Mean	**141342**	**250894**	-445693	**31942**	**116816**	**83347**	**92835**	**18504**	**100685**	**97856**	
	Median	**141342**	**366120**	-193112	**46396**	**22820**	**39778**	**52098**	**20778**	**100685**	**69980**	
	Obser.	0	0	2	4	2	1	2	1	0	6	18
10	Mean	-	-	**2079338**	**106365**	**109638**	**135642**	**123040**	**187391**	-	**156330**	
	Median	-	-	**2079338**	**81134**	**109638**	**135642**	**123040**	**187391**	-	**178235**	
	Total Obser.	99871	15920	5322	2044	889	392	170	61	25	36	124730

Table 7. Regressions of Profits and Losses on Trading Days, Trading Volume, PPO, and PNO

Part 1: Over-90-Day Sample

Model 1: $profit = \beta_0 + \beta_1 PPO + \beta_2 PNO + \beta_3 day + \beta_4 vol$

Dependent Variable: Profit

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	72981	7646		9.544	0.000
PPO	-41834	14432	-0.094	-2.899	0.004
PNO	-29807	14580	-0.065	-2.044	0.041
day	-79	21.8	-0.062	-3.628	0.000
vol	2.6	0.128	0.341	20.169	0.000
Obser.	3,449				
Adj. R^2	0.142				

Model 2: $loss = \gamma_0 + \gamma_1 PPO + \gamma_2 PNO + \gamma_3 day + \gamma_4 vol$

Dependent Variable: Loss

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	-23976	3462		-6.924	0.000
PPO	-2542	5380	-0.007	-0.473	0.637
PNO	20871	4664	0.067	4.474	0.000
day	74	8.9	0.079	8.354	0.000
vol	-8.9	0.146	-0.594	-60.782	0.000
Obser.	7,599				
Adj. R^2	0.358				

Model 3: $profit = \beta_0 + \beta_1 D_{disposition} + \beta_2 day + \beta_3 vol$

Dependent Variable: Profit

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	10278	3799		2.705	0.007
$D_{disppsition}$	-2133	2937	-0.012	-0.726	0.468
day	-39	21.5	-0.031	-1.797	0.072
vol	2.7	0.128	0.357	21.03	0.000
Obser.	3,449				
Adj. R^2	0.121				

Model 4: $loss = \gamma_0 + \gamma_1 D_{disposition} + \gamma_2 day + \gamma_3 vol$

Dependent Variable: Loss

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	-6644	1412		-4.705	0.000
$D_{disppsition}$	-1672	905	-0.017	-1.846	0.065
day	68	8.8	0.073	7.736	0.000
vol	-9.1	0.141	-0.607	-64.45	0.000
Obser.	7,599				
Adj. R^2	0.355				

Note:
profit = Net gain after transaction cost.
loss = Net loss after transaction cost.
day = trading days.
vol = trading volume.
$D_{disposition}$ = 1 if PPO > PNO, i.e., if the disposition effect is present, and 0 otherwise.

Table 7. Continued.

Part 1: Over-90-Day Sample

Model I1: $D_{profit} = \beta_0 + \beta_1 PPO + \beta_2 PNO + \beta_3 D_{day} + \beta_4 D_{volume}$

Dependent Variable: D_{profit}

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	1.718	0.060		28.594	0.000
PPO	-1.058	0.095	-0.268	-11.164	0.000
PNO	-0.379	0.094	-0.093	-4.044	0.000
D_{day}	-0.039	0.008	-0.071	-4.948	0.000
D_{volume}	0.252	0.007	0.543	34.401	0.000
Obser.	3,449				
Adj. R^2	0.548				

Model I2: $D_{loss} = \gamma_0 + \gamma_1 PPO + \gamma_2 PNO + \gamma_3 D_{day} + \gamma_4 D_{volume}$

Dependent Variable: D_{loss}

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	2.032	0.080		25.462	0.000
PPO	1.011	0.110	0.146	9.201	0.000
PNO	-2.380	0.093	-0.388	-25.655	0.000
D_{day}	-0.011	0.009	-0.013	-1.154	0.249
D_{volume}	0.329	0.009	0.453	38.203	0.000
Obser.	7599				
Adj. R^2	0.341				

Model I3: $D_{profit} = \beta_0 + \beta_1 D_{disposition} + \beta_2 D_{day} + \beta_3 D_{volume}$

Dependent Variable: D_{profit}

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	0.282	0.031		9.153	0.000
$D_{dispposition}$	-0.026	0.021	-0.016	-1.266	0.206
D_{day}	-0.048	0.009	-0.088	-5.591	0.000
D_{volume}	0.335	0.007	0.721	45.808	0.000
Obser.	3449				
Adj. R^2	0.453				

Model I4: $D_{loss} = \gamma_0 + \gamma_1 D_{disposition} + \gamma_2 D_{day} + \gamma_3 D_{volume}$

Dependent Variable: D_{loss}

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	0.523	0.034		15.362	0.000
$D_{disppsition}$	0.336	0.019	0.174	18.038	0.000
D_{dayg}	-0.019	0.010	-0.022	-1.937	0.053
D_{volume}	0.389	0.008	0.535	47.534	0.000
Obser.	7599				
Adj. R^2	0.356				

Note:
D_{profit} = 1 for the group with the least profit, 2 the next least profit,…, and 5 the most profitable group,
D_{loss} = 1 for the group with the smallest losses, 2 the next smallest losses,…, and 5 the largest losses,
D_{day} = 1 for the group with the smallest number of trading days, 2 the next smallest…,and 10 the largest number of trading days.
D_{volume} = 1 for the group with the smallest trading volume, 2 the next smallest, and 10 the largest trading volume.
$D_{disposition}$ = 1 if PPO > PNO, i.e., if the disposition effect is present, and 0 otherwise.

Table 7. Continued.

Part 2: Total Sample Excluding Trading Day Decile Group One

Model 1: $profit = \beta_0 + \beta_1 PPO + \beta_2 PNO + \beta_3 day + \beta_4 vol$

Dependent Variable: Profit

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig.Level.
Constant	46366	3880		11.95	0.000
PPO	-30415	6739	-0.090	-4.51	0.000
PNO	-17505	6774	-0.051	-2.58	0.010
day	-38.0	11.11	-0.041	-3.42	0.001
vol	2.56	0.087	0.341	29.37	0.000
Obser.	7,241				
Adj. R^2	0.140				

Model 2: $loss = \gamma_0 + \gamma_1 PPO + \gamma_2 PNO + \gamma_3 day + \gamma_4 vol$

Dependent Variable: Loss

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig.Level.
Constant	-18865	1633		-11.54	0.000
PPO	993	2498	0.004	0.39	0.691
PNO	15505	2158	0.067	7.18	0.000
day	54.5	4.24	0.081	12.85	0.000
vol	-9.04	0.10	-0.586	-90.87	0.000
Obser.	17,618				
Adj. R^2	0.348				

Model 3: $profit = \beta_0 + \beta_1 D_{disp} + \beta_2 day + \beta_3 vol$

Dependent Variable: Profit

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	3798	1475		2.57	0.010
$D_{disppsition}$	-1222	1391	-0.010	-0.87	0.380
day	-8.38	10.90	-0.009	-0.76	0.442
vol	2.66	0.088	0.354	30.36	0.000
Obser.	7,241				
Adj. R^2	0.123				

Model 4: $loss = \gamma_0 + \gamma_1 D_{disp} + \gamma_2 day + \gamma_3 vol$

Dependent Variable: Loss

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	-3192	508		-6.28	0.000
$D_{disppsition}$	-1477	416	-0.022	-3.55	0.000
day	49.29	4.21	0.074	11.70	0.000
vol	-9.26	0.097	-0.600	-95.47	0.000
Obser.	17,618				
Adj. R^2	0.344				

Note:
profit = Net gain after transaction cost.
loss = Net loss after transaction cost.
day = trading days.
vol = trading volume.
$D_{disposition}$ = 1 if PPO > PNO, i.e., if the disposition effect is present, and 0 otherwise.

Table 7. Continued.

Part 2: Total Sample Excluding Trading Day Decile Group One

Model I1: $D_{profit} = \beta_0 + \beta_1 PPO + \beta_2 PNO + \beta_3 D_{day} + \beta_4 D_{volume}$

Dependent Variable: D_{profit}

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	1.730	0.038		45.98	0.000
PPO	-0.917	0.056	-0.255	-16.35	0.000
PNO	-0.289	0.055	-0.079	-5.26	0.000
D_{day}	-0.028	0.006	-0.054	-4.99	0.000
D_{volume}	0.206	0.005	0.524	43.69	0.000
Obser.	7,241				
Adj. R^2	0.499				

Model I2: $D_{loss} = \gamma_0 + \gamma_1 PPO + \gamma_2 PNO + \gamma_3 D_{day} + \gamma_4 D_{volume}$

Dependent Variable: D_{loss}

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	2.036	0.049		41.22	0.000
PPO	0.654	0.068	0.095	9.66	0.000
PNO	-1.989	0.057	-0.327	-34.92	0.000
D_{day}	-0.002	0.007	-0.003	-0.36	0.718
D_{volume}	0.315	0.005	0.464	57.49	0.000
Obser.	17,618				
Adj. R^2	0.347				

Model I3: $D_{profit} = \beta_0 + \beta_1 D_{disposition} + \beta_2 D_{day} + \beta_3 D_{volume}$

Dependent Variable: D_{profit}

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	0.557	0.016		35.42	0.000
$D_{disposition}$	-0.024	0.012	-0.018	-1.95	0.051
D_{day}	-0.039	0.006	-0.076	-6.51	0.000
D_{volume}	0.272	0.005	0.693	59.16	0.000
Obser.	7241				
Adj. R^2	0.420				

Model I4: $D_{loss} = \gamma_0 + \gamma_1 D_{disposition} + \gamma_2 D_{day} + \gamma_3 D_{volume}$

Dependent Variable: D_{loss}

Regressor	Coeff.	Std. Dev.	Std. Coeff.	T-Stat.	Sig. Level
Constant	0.629	0.018		35.56	0.000
$D_{disposition}$	0.276	0.011	0.154	24.49	0.000
D_{day}	-0.017	0.007	-0.018	-2.36	0.018
D_{volume}	0.370	0.005	0.545	71.19	0.000
Obser.	17618				
Adj. R^2	0.306				

Note:
D_{profit} = 1 for the group with the least profit, 2 the next least profit,…, and 5 the most profitable group,
D_{loss} = 1 for the group with the smallest losses, 2 the next smallest losses,…, and 5 the largest losses,
D_{day} = 1 for the group with the smallest number of trading days, 2 the next smallest…,and 10 the largest number of trading days.
D_{volume} = 1 for the group with the smallest trading volume, 2 the next smallest, and 10 the largest trading volume.
$D_{disposition}$ = 1 if PPO > PNO, i.e., if the disposition effect is present, and 0 otherwise.