

Risk-Seeking Propensity, Trading Volume, and Trading Performance

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Keywords: Risk-Seeking; Prospect Theory; Trading Volume; Retail Trader; Proprietary Trader

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Risk-Seeking Propensity, Trading Volume, and Trading Performance

Abstract

We provide empirical evidence validating the implications of the prospect theory for risk-seeking propensity when futures traders accumulate more positions. We examine the variation in the propensity among futures traders and its relationship with trading performance. Consistent with theoretical predictions, traders exhibit both risk-seeking tendency in the face of gains as well as losses. While the consequence on profitability is positive for the former, it is negative for the latter. Furthermore, we show that the risk-seeking propensity interacts with trading volume to have a positive effect on profitability that offset the negative effect of trading volume.

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I. Introduction

As a descriptive model of how people manage risk and uncertainty, the prospect theory proposed by Kahneman and Tversky (1979) contributes enormously to the literature on human behaviors, as attested clearly by winning the 2002 Nobel Prize in Economic Sciences. Owing to diminishing sensitivity, its S-shaped value function is concave for gains and convex for losses, implying people are risk-averse in the domain of gains and risk seeking in the domain of losses. Formalizing with rigorous models with prospect theory preferences, recent theoretical studies have been able to arrive at predictions of investor behavior that is consistent with this implication (Barberis and Xiong, 2009; Henderson 2012). However, others have predicted investor behavior that is opposite in risk-taking implication: more risk-seeking after a gain than after a loss. (Barberis and Xiong, 2009; Hens and Vlcek, 2011). Together, these two opposite implications, more risk-seeking after gains versus losses, complement each other and render the prospect theory a solid framework for addressing financial risk-taking. Equipped with this theoretical foundation, the next logical step in furthering our understanding of financial decision making under risk is to empirically validate this new framework. We take on this task by tracking the trade-by-trade history of futures traders on the Taiwan Futures Exchange (TAIFEX) from January 2006 to December 2008 and conducting an in-depth examination of the risk-seeking propensity among traders as they accumulate more contracts to existing positions.

Except for hedging purpose, in making the accumulation trades, traders willingly take on more risk of price fluctuations while striving to make money. The pursuit of profit is especially true in the futures market given the potential for large gains due to the leverage afforded by margin. Without question, the promise of larger gains drives many traders to willingly take on greater risk. This risk-return tradeoff is one of the central concepts in finance and has been widely applied in investment and asset allocation decisions. Surprisingly, while futures traders

constantly take on risk when they accumulate contracts, little has been done to examine the associated behavioral tendencies and their consequences on trading performance. By contrast, voluminous studies have been devoted to the disposition effect that tackles the behavioral tendency in selling stocks or offsetting existing derivative positions, which are effectively acts of reducing risk, as investors realize gains and losses. This neglect is uncharacteristic and calls for an examination. We remedy this neglect by offering evidence on the behavioral tendencies of active traders and proprietary traders exhibit in accumulation decisions that complements the extant knowledge we have on the tendencies in selling decisions. As a result, the full picture of traders' behavioral tendencies throughout the trading/investment cycle, from the initial risk-taking to the eventual risk-reduction, becomes possible.

We compare the risk-seeking propensity of retail traders with that of proprietary traders.¹ In doing so, we explore the role sophistication plays in risk-taking propensity premised on the common belief and empirical evidence that retail traders are less sophisticated than proprietary traders.² For each type of traders, we further examine the within-group variation based on trading volume to gain insight on the effect of these experience-related factors on risk-seeking propensity. Finally, we link risk-seeking propensity to performance to explore the link between behavioral tendency and performance. The results from these comparative examinations offer insight that helps shed light on the mixed findings on relationship between overconfidence and performance. While Barber and Odean (2000) associate excessive trading to overconfidence and attribute it to the losses of most investors, Kuo and Lin (2013) find that excessive trading is hazardous only for overconfident losers, not winners. In two papers (Cheng et al. 2010 and 2012),

¹Given that the focus of this study is on risk-seeking, we need to make sure trades that are executed for hedging are not included in the sample. Although foreign institutions in Taiwan are known to be sophisticated, many of their trades are for hedging purpose, not purely for speculations. For this reason, we exclude foreign institutions from this study.

²To name just a few, Lin and Chiang (2015), Cheng et al. (2010, 2012)

traders who exhibit stronger reverse disposition effect and are more disciplined are shown to be more profitable the more they trade, whereas their counterparts, those who exhibit stronger disposition effect and are less disciplined, more trading leads to greater losses. In line with Cheng et al. (201? and 201?), we expect to show the double-edged effect of trading volume: greater volume is good for profitability if it is due to more risk-seeking after gains but detrimental if it results from more risk-seeking following losses.

Using three measures of risk-seeking propensity, based on the relative frequency of adding more positions, relative ratios of number of contracts added, as well as relative value of contracts added in the face of unrealized gains versus losses, we expect to find variation in risk-seeking propensity between retail and proprietary traders and among traders within each group and the resulting trading profitability. Based on the evidence in Feng and Seasholes (2005), Dhar and Zhu (2006), and Nicolosi et al. (2008) that sophisticated investors are less likely to be risk seeking after a loss, we expect to see proprietary traders to be generally more risk seeking after gains while retail traders to be more risk seeking after losses. We also expect to find traders with more trading experience, measured by trading volume and trading tenure, to be risk seeking when profitable and have positive profit, while those with less experience to be risk seeking in the face of losses and be unprofitable. We contribute to the literature by providing evidence that learning from experience leadstraders to be risk seeking in the face of gain and,consequently, be profitable.

II. Literature Review

Prospect theory has long been used in behavioral finance to explain, via examples and intuition without a proof, the widely documented disposition effect, the tendency of investors holding onto losses but realizing gains too quickly (Shefrin and Statman, 1985; Odean, 1998). This

behavioral tendency has been argued to be consistent with the widely accepted implication of the prospect theory—based on loss aversion and S-shaped value function, two of the critical relevant components—that investors exhibit risk aversion in the face of gains and risk-seeking when faced with losses. Attempting to formalize this intuition in rigorous models with prospect theory preferences, subsequent theoretical studies have been able to predict the disposition effect while others have yielded opposite prediction of investors realizing losses too eagerly while holding onto gains. As stated in Barberis and Xiong (2009), the implication of this new result is that "investor takes more risk after a gain than after a loss". Keeping in mind that while the primary aim of all these theoretical studies is to demonstrate with rigorous models whether the prospect theory can explain the disposition effect, the implications of their results pertaining to the behavioral tendency in risk-seeking (and risk aversion) are very relevant for this study and will be the focus of this review.

As mentioned before, owing to diminishing sensitivity—which is used interchangeably with the term concavity/convexity of the S-shaped value function, investors are risk-averse for gains and risk-seeking for losses. This implication is formerly derived from the aforementioned studies that demonstrate the existence of disposition effect (Barberis and Xiong, 2009; Henderson, 2012). On the other hand, Barberis and Xiong (2009) also show that in some instances, e.g., when the loss-aversion component of the prospect theory is in play and the expected return is high, people actually exhibit the opposite of the disposition effect, namely that investors have a greater propensity to sell a stock trading at a paper loss than one trading at a paper gain, therefore taking more risk after a gain than after a loss. Similar doubt on the link between the disposition effect and prospect theory is similarly raised by Hens and Vlcek (2011).³ To reconcile the opposite

³ Hens and Vlcek (2011) construct a two-period model to examine what they call ex-ante disposition effect, as opposed to ex-post disposition effect examined by Barberis and Xiong (2009). The latter use a one-period model

predictions, Li and Yang (2013) build a general equilibrium model and find that diminishing sensitivity predicts a disposition effect, while loss aversion predicts a reverse disposition effect.

A related strand of studies that deal with how prior outcomes, primarily losses, affect risk attitude similarly yields contradictory results: while some studies report greater risk-taking after a loss (Coval and Shumway, 2005), others find the opposite, less risk-taking after a loss (Liu et al., 2010). Imas (2016) reconciles this contradiction by distinguishing between losses that are unrealized versus realized. Together with cumulative prospect theory (Tversky and Kahneman, 1992), he assumes that investors integrate and evaluate unrealized losses jointly with prospective risky choices in the same bracket while realized losses are not “bracketed” with prospective risky choices (Read, et al., 1999; Rabin and Weizsacker, 2009). He demonstrates that following an unrealized loss, due to loss aversion, the individual becomes more likely to accept a lottery and results in taking on greater risk if it offers a chance to recover from the loss. In contrast, realization closes the bracket of prior outcomes and the individual internalizes the loss and updates the reference point. Without integration, the individual does not view accepting the lottery allowing her to recover the prior loss. As a result, the individual is predicted to take on less risk.

In addition to the above studies, Page et al. (2014) examine the risk-taking behavior of homeowners in Brisbane following the 2011 Australian floods. The results from this natural experimental show that victims of the floods who face large losses are 50% more likely to choose a risky gamble that has a small chance of winning \$500,000 than a sure amount of comparable value (\$10), consistent with the prediction of the prospect theory of a risk-seeking attitude after a loss. In line with the idea of the prospect theory of distinguishing risk attitude

with the investor already owning the risky investment. They find that while the prospect theory can explain ex-post disposition effect but not the ex-ante disposition effect.

toward gains from that toward losses, Rieger et al. (2015) conduct a 53-country survey. The results show that while the degree of risk aversion varies with economic conditions and cultural factors, there is a common attitude of risk aversion in gains and risk seeking in losses.

III. Data and Methodology

3.1 Data

Our data consists of the complete set of trades executed by active retail traders and proprietary traders of the Taiwan Stock Exchange Capitalization Weighted Stock Index (TAIEX) Futures contracts (hereafter, TX, the ticker symbol) traded on the Taiwan Futures Exchange (TAIFEX) over the three-year period from January 2, 2006 to December 31, 2008. 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 TAIFEX futures contracts. It is based on the major stock index of the Taiwan Stock Exchange (TWSE), TAIEX, which includes all stocks traded on the TWSE. It is important to point out that our focus on just one futures contract and three year is entirely due to the constraints of time and effort required in trade-by-trade tracking of all the trades for all traders. In line with previous studies that limit the traders to be actively trading in order to obtain enough observations to accurately gauge the behavioral tendency, we define active traders to be those who trade at least 10 times a month and they must have the roundtrip with accumulating position, excluding those traders establishing their position at one trade within a roundtrip. An additional advantage of this data criteria is that it is met by all proprietary traders, allowing us to rule out the possibility that any variation between retail traders and proprietary traders are the result of trading volume.

Methodologically, trade-by-trade tracking eliminates the need to make assumptions required in many previous studies such as zero open interests by the end of the day (e.g., Locke and Mann, 2005). It also frees us from choosing an arbitrary interval to measure return. We track the complete transaction histories of 209,462 traders, including 208,541 individual retail traders and the remaining institutional traders composed of 390 domestic proprietary traders. We use all of the trades of the front-month TX contracts. Each TX tick represents 200 times the TAIEX index value. By examining futures contracts, as opposed to stocks, we avoid the complications 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 settlement that compels futures traders to constantly evaluate their performance makes futures traders' trading a better instinctive reflection of their profit motives and offers a clearer view of traders' behavior biases.

In addition to the typical information such as time of trade—to the second, date, price, volume—number of contracts, and buy-sell indicator of the transaction, each record also includes an account number distinctively identifying whether the trader is an individual, institution, or proprietary trader. Since all traders are included, we can examine the differences between retail and proprietary traders along with the variation among traders within each type.

3.2 Methodology

For each trader, we track the trade-by-trade transactions of each month and tally after each trade basic trading statistics, such as the number of trades and profitability (total gross profit, net profit, and net profit per contract). Before measuring risk-seeking propensity, we are first faced with a practical decision of specifying which gain/loss we are dealing with, since it is not clearly stated in the prospect theory what it means in “when faced with a gain/loss”. In line with the vast literature on the disposition effect (notably, Odean (1998) among empirical studies and Barberis

and Xiong (2009)⁴ among theoretical studies) that uses paper gain/loss to mean “the gain/loss faced by investors” when they are deciding on whether to realize, we measure risk-seeking propensity likewise when the traders are faced with an unrealized gain/loss. This means that we analyze how they decide to take more risk by adding more contracts to existing positions, which at any time before eventually been offset should carry an unrealized gain or loss. Once this issue of gain/loss is settled, we construct three measures of risk-seeking propensity. The first measure constructed is based on the relative frequency that the trader adds positions in the face of unrealized gains and losses, RS_G^F and RS_L^F :

$$RS_G^F = \frac{Freq_G}{Freq_G + Freq_L} \quad (1)$$

$$RS_L^F = \frac{Freq_L}{Freq_G + Freq_L} \quad (2)$$

where $Freq_G$ and $Freq_L$ are the frequency that the trader continues to adds positions when he/she has an unrealized gain and loss, respectively and the superscript F in RS_G^F and RS_L^F is used to indicate that they are calculated based on frequency. Based on RS_G^F and RS_L^F , the difference between, $RS_G^F - RS_L^F$, is then used as a measure of risk-seeking propensity (RSP^F) of the traders:

$$RSP^F = RS_G^F - RS_L^F \quad (3)$$

As well-documented in studies of the disposition effect, many people take on more risk when they face unrealized losses and shun risk in the face of unrealized gains. Like many behavioral impulses, this tendency goes again the principle of good risk management and successful

⁴ “When paper gain/loss are in the value function, prospect theory often predicts the opposite of the disposition effect, namely that investors have a greater propensity to sell a stock trading at a paper loss than one trading at a paper gain. And takes more risk after a gain than after a loss. The propensity to sell is therefore lower after a gain than after a loss, contrary to the disposition effect.”

investment strategy that calls for cutting loss short and let profit run. To be profitable, traders therefore need to act against the impulse by taking risk while they are profitable and reducing risk in the face of losses. From the viewpoint of good investment practices, it is therefore advisable to have a relatively higher RS_G^F than RS_L^F , i.e., a positive RSP^F .

Because the frequency shows the equal weight for the accumulation transaction that trades either 1 contract or 100 contracts, we take the number of contracts into consideration to separate the different weight of trading quantity. The second measure, called number of contract-based risk-seeking propensity, RSP^N , where N stands for number of contracts, is constructed in a similar fashion. It is calculated based on the number of contracts added in the face of unrealized gains and losses, $Frac_G$ and $Frac_L$, respectively. Similar to equations (1) to (3), we have the following three equations for RSP^N :

$$RS_G^N = \frac{Frac_G^N}{Frac_G^N + Frac_L^N} \quad (1)'$$

$$RS_L^N = \frac{Frac_L^N}{Frac_G^N + Frac_L^N} \quad (2)'$$

$$RSP^N = RS_G^N - RS_L^N \quad (3)'$$

where $Frac_G^N$ and $Frac_L^N$ are the total number of contracts added when the trader has an unrealized gain and loss, respectively. Even though the different weight for the number of contracts is considered to separate the order size, however, a contract with the price 1 is deemed equal to the contracts with price 100. We further ruminant the difference by multiplying the number of contracts and the matching price to reflect the value impact on the investor's risk-seeking attitude. Hence, we similarly construct the third measure based on the relative fraction of dollar value of the contracts added. Using V to denote value, which is the product of price and number of contracts, this value-based risk-seeking propensity, RSP^V , is constructed as follows:

$$RS_G^V = \frac{Frac_G^V}{Frac_G^V + Frac_L^V} \quad (1)"$$

$$RS_L^V = \frac{Frac_L^V}{Frac_G^V + Frac_L^V} \quad (2)"$$

$$RSP^V = RS_G^V - RS_L^V \quad (3)"$$

where $Frac_G^V$ and $Frac_L^V$ are the total value of contracts added when the trader has an unrealized gain and loss, respectively.

In addressing how trading experience affect risk-seeking propensity, we use both trading volume and trading tenure to proxy for trading experience. Calculated as the total dollar value of all trades executed by the trader, these measures have been used in previous studies to proxy for trading experience. Regarding the effect of trading volume on risk-seeking propensity and, consequently, profitability, the evidence is mixed. Although Barber and Odean (2000) argue that excessive trading is hazardous to investment profitability, evidence in studies such as Kuo and Lin (2013) and Cheng et al. (2012) show that active trading under the right circumstances, e.g., with good discipline and less behavioral biases, can actually lead to greater profitability. Nevertheless, in general, one would expect experienced traders to be less prone to behavioral biases and have better performance. For example, Feng and Seasholes (2005) find that trading experience on its own attenuates up to 72% of the disposition effect of investors holding onto to losses while realizing gains too soon. Seru et al. (2010) also find evidence of investors learning helps reduce behavioral bias and improve performance.

IV. Empirical results

4.1 Summary Statistics

Only through the adding of contracts to existing positions, can a trader's risk-seeking propensity be revealed. For this reason, trades that are opened then closed out on the next trade are excluded. Table 1 reports the summary statistics of the sample. There are 12,163 retail traders in 2006, 12,968 in 2007, and 19,210 in 2008. To be expected, the number of proprietary traders are small, only 40, 38, and 42, respectively, in 2006, 2007, and 2008. We calculate the monthly total for each trader and report the number of trader-month observations. If traders trade every month and the traders meet the sample selection criteria, the total number of trader-month observations should be 36, 12 times the number of traders. This is clearly not the case for retail traders considering that the 33,027 trader-months in 2006 for them is only about 2.72 times of their number. For proprietary traders, the ratio, 10.43, is closer to, but still smaller, than 12. In terms of trading, the number of trades for retail traders are 2,855,107, 3,996,834, and 10,939,347, respectively in 2006, 2007, and 2008. For proprietary traders, the corresponding numbers are 885,417, 1,320,300, and 3,923,108. It is interesting to note that while retail traders are dramatically large in number than proprietary traders, with a ratio of 304.08 ($=12,163/40$), their numbers of trades, are only 3.22 ($= 2,855,107/ 885,417$) of their counterparts. This difference in trading activity is true for 2007 and 2008 and reflected in number of contracts traded. For example, the number of contracts for retail traders of 9,203,443 in 2006 is only 2.43 times that of the proprietary traders. The average number of trades, average number of contracts, and average daily number of contracts all depict the same picture of a dramatic difference in trading activities between retail and proprietary traders.

Insert Table 1 about Here

4.2 Risk-Seeking Propensity, Trading Volume, and Profitability

To see whether traders with different trading volume exhibit any discernible patterns in risk-seeking propensity, we sort traders into five groups based on trading volume and examine their propensity along with profitability. In Table 2, the five quintile groups have an average RSP of 0.08, -0.05, -0.10, -0.13, and -0.09, respectively. The fact that Q1 traders have a positive risk-seeking propensity while all other quintile traders have negative propensity as well as no apparent trend among these number from lower- to higher-quintiles suggests no discernible relationship between RSP and trading volume. The associated profitability measures—gross profit, net profit, gross profit per contract, and net profit per trade—do not seem to follow any trends either. For example, the average gross profit for Q1 is 131 ticks. It is negative for Q2, Q3, and Q4, but positive for Q5. We also separate the traders into profitable and unprofitable groups and report the same statistics. For RSP, the respective averages of 0.13, 0.01, -0.03, -0.06, and -0.01 for groups Q1 to Q5, do not suggest the existence of any pattern. Interestingly, the gross profit figures follow a steadily rising trend, from 666 ticks for Q1 steadily increased to 8,100 ticks for Q5. Similarly, net profit figures exhibit the same steady increase from lower- to higher-quintile groups. The per-contract figures for gross and net profit also exhibit a clear trend. However, the trend is a steadily falling one, from an average gross profit per contract of 27.1 ticks for Q1 to a much lower 8.25 ticks for Q5 and net profit per contract of 25.86 ticks for Q1 to 7.01 for Q5. For unprofitable traders, while the average RSP falls steadily from 0.02 for Q1 to -0.21 for Q4, but for Q5, its value of -0.19 is higher than Q4. For profitability measures, there is a clear steadily trend of losses that rise in magnitude from lower to higher quintile groups. Unlike the figures for profitable traders, the total and per-contract figures for unprofitable traders follow the same pattern as there total counterparts.

Insert Table 2 about Here

While risk-seeking propensity does not appear to be related to trading volume, as suggested by the lack of a discernible pattern reported in Table 2, its relationship with profitability appears to be positive judging from the subgroups profitability figures reported in Table 3. After sorting traders into five quintile groups based on RSP, we calculate the average RSP for each groups along with the profitability figures of the groups. Among the groups, the average RSP is -0.64, -0.33, -0.07, 0.20, and 0.55 for Q1 to Q5, respectively. The corresponding gross profit figures, -1,429, -515, 166, 621, and 1,450, appear to follow the same steadily increasing trend. Net profit, gross profit per contract, and net profit per contract also exhibit the similar trend of steadily improving profitability from lower to higher quintiles. Interestingly, trading volume among the groups exhibit the same pattern, from 253 contracts for Q1 steadily increase to 413 contracts for Q5. This pattern is supported by t-test results. As reported at the bottom for Q5-Q1, the difference between groups Q5 and Q1, for RSP is 1.19, which is statistically significant at better than one percent level. For all profitability measures, the differences are all positive and significant at the same level, indicating Q5 have a higher profit than Q1.

Insert Table 3 about Here

It is worthwhile to point out that the existence of a steadily rising trend in profitability among RSP groups in Table 3 is in contrast to the lack of pattern among volume groups. To further shed light on profitability among groups, we separate traders into 25 groups based on a double sorting of both RSP and volume. In Table 4, Panel A reports a steadily rising RSP within each volume quintile. As an example, the average RSP rises from -0.57 for R1 to 0.52 for R5 within the V1 group. While by design, RSP should rise in value from R1 to R5, the positive trend in profitability, based on all four measures, from lower to higher RSP groups, indicates that profitability indeed increases with RSP. There appears to be trends in profitability across volume groups within each RSP group too. Specifically, all the volume groups in R1 report a loss, which

is steadily increasing in magnitude, from an average of -456 ticks for Q1 to -4,215 ticks. The same trend of increasingly rising losses similarly exists among the volume groups in R2. For the groups in R3, there does not appear to be a trend, judging from the erratic average gross profits of -16, -51, -43, -49, and 975. Among the groups in R4 and R5, a pattern appears to exist. However, it is a steadily increasing trend, from 78 for Q1 to 2,385 for Q5 in R4 and 238 for Q1 to 6,070 for Q5 in R5. On per-contract basis, profitability among the volume groups within each RSP group also exhibits a pattern. In R1, the average net profit per contract is negative, -15.71 for V1, but steadily falls in magnitude, to -5.86 for V5. This is true also for the groups in R2 and R3. For the groups in R4, the average net profit per contract is positive for all groups, and steadily falls from V1 to V4, but for V5, its average net profit of 0.43 is higher than those for V3, 0.25, and V4, 0.13. Among the groups in R5, the average net profit steadily falls from V1, 8.4, to V5, 3.36.

Overall, results reported in Table 4 are in line with those in Table 3 that suggest a positive link between profitability and RSP. Although they indicate some patterns in profitability among the volume groups, the patterns are not consistent, in line with the lack of a consistent pattern in profitability among the volume groups reported in Table 2.

Insert Table 4 about Here

4.3 Relationship between Profitability and Its Determinants

The patterns reported so far suggest that profitability is related to risk-seeking propensity and, to some extent, trading volume. To formerly examine these relationships, we perform regression analysis. In this analysis, we include a market volatility variable, measured as the standard deviation of the returns on the market index in Taiwan, which is the Taiwan Stock Exchange

Weighted Index (TAIEX), and the gross profit of the previous month, $\text{gross profit}_{t-1}$. Before presenting the regression results, we first report the correlation coefficients among all variables. In Table 5, RSP is positively correlated with volume and all profitability measures, but negatively correlated with volatility. Interestingly, it is positively correlated with the per-contract gross profit of the previous month, suggesting a link between risk-seeking propensity and the profitability of the previous month. For volume, its correlation is positive with gross profit, negative with net profit, and insignificant with both per-contract gross and net profit, and prior-month per-contract gross profit. For volatility, it is clearly negatively correlated with all profitability measures. Finally, all profitability measures are positively correlated.

Insert Table 5 about Here

In line with the positive correlation coefficient reported in Table 5, the regression result reported in Table 6 for Model 1, shows that the coefficient for RSP, 2,415.35, is positive and statistically significant at the one percent level. In Model 2, after the addition of market volatility and gross profit of the prior-month, Profit_{t-1} , the coefficient for RSP remains significantly positive. The coefficient for market volatility is -3.32 and that for $\text{gross profit}_{t-1}$, is 0.13, both are statistically significant at the one percent level. In Model 3, the coefficient for volume, 0.89, is statistically significant at the one percent level. With the addition of market volatility and $\text{gross profit}_{t-1}$, the coefficient for volume in Model 4 remains positive and significant the one percent level. In Model 5, which includes all the variables in Models 1 to 4, the sign of the coefficients stays the same as those in Models 1 to 4. Although the coefficient for volume stays positive and significant in Models 1 to 5, the inconsistent patterns reported in Tables 2 and 4 lead us to question whether there is more to it. To answer this question, we include volume square, volume^2 , in the regression. Furthermore, we suspect an interaction between RSP and volume that potentially affects profitability as well. To examine this possibility, we also include an

interaction term of $RSP \times volume$ in the regression. In Model 6, after the inclusion of $RSP \times volume$, the coefficient for volume is changed from positive to negative and, at a value of -0.42, it is significant at the one percent level. The coefficient for $RSP \times volume$ is positive and, at a value of 4.05, it is significant at the one percent level, indicating indeed an interaction effect on profitability. In Model 7, with $volume^2$ included in the model, the coefficient for volume remains positive at 1.09, which is significant at the one percent level, while the coefficient for $volume^2$ is negative, at a value of -5.75 and significant at the one percent level. This result suggest a non-linear relationship between profitability and trading volume. Finally the results in Model 8, which include all variables in Models 1 to 7, shows that the coefficient for volume is -0.02, which is not significant. The coefficients for $volume^2$, at a value of -12.36, is significant at the one percent level while the coefficients for volatility, $profit_{t-1}$, and $RSP \times volume$ remain effectively the same as those in Model 6, with a value of -3.05, 0.12, and 4.18, respectively.

For proprietary traders, volatility is not significant, suggesting its lack of impact on proprietary traders, possibly because of the ability of these traders to handle market volatility. The results for RSP and volume are similar to those for retail trader: RSP is positively associated with profitability and volume exhibits a non-linear relationship with profitability. The difference, however, appears in Model 8, where the coefficient for RSP remains positive but becomes insignificant. At the same time, the coefficient for volume is negative but turns significant. The change in sign for volume from positive in Model 7 to negative after the inclusion of the interaction term of $RSP \times volume$ is similarly true for retail traders, but for the latter it is not significant. These two changes, insignificance of RSP and significance of volume, can be interpreted as follows: when examined by themselves, RSP and volume, clearly are positively related to profitability. For proprietary traders, it is the interaction of RSP and volume that matters the most. The fact that the coefficient for the interaction term has a value of 33.17 that is greater than 31.01, the coefficient for RSP, suggests that the positive effect of RSP is now

replaced by and completely reflected in the positive effect of its interaction with volume, which simultaneously turns the coefficient of volume significant, so that the same overall effect is captured. The fact that the adjusted R2 for Model 8 is relatively high, 38.7%, indicates that it is a model that offers a sufficient account for the profitability of proprietary traders. From this prospective, the conclusion above for retail traders, about RSP, volume, and their interaction applies here for proprietary traders.

Insert Table 6 about Here

V. Conclusion

Based on the predictions from the recent theoretical expositions of the prospect theory, investors can exhibit risk-seeking tendency in the face of both gains and losses. We provide empirical evidence validating these predictions and their implications on trading performance. Traders indeed exhibit risk-seeking tendency in the face of both gains and losses. While the consequence on profitability is positive from the former tendency, it is negative for the latter. Furthermore, we show that although in regression models that include only volume terms, trading volume appears to have a non-linear relationship with profitability—positive between profitability and volume and negative between profitability and volume square, the relationship between profitability and volume ceases to be significant in models that include risk-seeking propensity and its interaction term with volume and others. Instead, it is replaced by the positive effect of the interaction between risk-seeking propensity and trading volume. This novice evidence on trading volume helps shed light on trading volume which is typically associated with overconfidence in extant studies.

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Table 1. Summary Statistics of the Sample: Retail and Proprietary Traders

This table reports the summary statistics of the sample. We calculate the monthly total for each trader. Column (2) reports the number of trader-month observations. Only trades that add new contracts to an existing position are included; therefore, trades that are opened then closed out on the next trade are excluded. Column (3) reports the number of transactions during sample period; Column (4) is the number of contracts traded during sample period. Column (5) reports the average trades by each trader within a month; Column (6) represents the average number of contracts traded by each trader within a month. Column (7) shows the average daily number of contracts traded by each trader.

		(1)	(2)	(3)	(4)	(5)=(3)/(2)	(6)=(4) /(2)	(7)
	Traders	Number of traders	Number of trader-months	Number of trades	Number of contracts traded	Average number of trades	Average number of contracts traded	Average daily number of contracts traded
2006	Retail traders	12,163	33,027	2,855,107	9,203,443	86.4	278.6	18.4
	Proprietary traders	40	417	885,417	3,781,152	2,123.3	9,067.5	442.9
2007	Retail traders	12,968	35,207	3,996,834	10,802,039	113.5	306.8	19.7
	Proprietary traders	38	400	1,320,300	4,449,947	3,300.7	11,124.8	537.1
2008	Retail traders	19,210	54,693	10,939,347	20,191,578	200.0	369.2	23.6
	Proprietary traders	42	425	3,923,108	7,346,389	9,230.8	17,285.6	829.6
All	Retail traders	33,718	122,927	17,791,288	40,197,060	144.7	327.0	21.1
	Proprietary traders	47	1242	6,128,825	15,577,488	4,934.6	12,542.3	605.6

Table 2. Risk Seeking Propensity among Trading-Volume and Tenure Quintile Groups

This table reports the risk-seeking-propensity (RSP) of retail and proprietary traders among the quintile groups based on the trading volume (the number of contracts traded) and tenure (the number of trading days within the sample month) of futures traders on the Taiwan Futures Exchange over the three-year sample period from January 2, 2006 to December 31, 2008. RSP reported here is RSP_F defined as the propensity of adding positions, instead of realization, when the trader has an unrealized gain and loss. The details are described on Section III data and methodology. Gross (net) profit is the total profit before (after) transaction cost for each observation (trader-month, one trader within a sample month). Gross (net) profit/contract is gross (net) profit per contract before (after) transaction cost. All profit figures are in terms of ticks and one tick is about 200 Taiwan Dollars, approximately US\$6.13 per tick, based on the exchange rate on December 29, 2006. The table reports the statistics for all observations over the three-year sample period and for profitable and unprofitable traders separately on ex post basis.

Panel A: Retail Traders

	All					Profitable					Unprofitable				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
RSP:	0.08	-0.05	-0.10	-0.13	-0.09	0.13	0.01	-0.03	-0.06	-0.01	0.02	-0.12	-0.18	-0.21	-0.19
Gross profit:	131	-58	-87	-168	590	666	882	1,148	1,840	8,100	-785	-1,075	-1,404	-2,314	-9,162
Net profit:	-18	-1,248	-2,048	-396	-933	634	816	1,029	1,610	6,269	-816	-1,141	-1,521	-2,541	-10,284
Gross profit/contract	0.91	-1.07	-0.86	-0.84	-0.11	27.10	16.12	11.81	9.80	8.25	-31.14	-19.65	-14.38	-12.21	-10.95
Net profit/contract:	-0.30	-2.30	-2.10	-2.08	-1.34	25.86	14.89	10.56	8.56	7.01	-32.32	-20.88	-15.61	-13.46	-12.18

Panel B: Proprietary Traders

	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
	RSP:	0.09	0.10	0.13	0.17	0.14	0.25	0.25	0.21	0.29	0.28	-0.05	-0.07	0.02	0.05
Gross profit:	-963	142	-2,639	45,817	32,407	9,062	20,415	48,351	227,718	387,131	-10,748	-24,257	-67,662	-136,083	-328,084
Net profit:	-1,396	-1,795	-9,142	27,434	-16,421	8,594	18,364	41,487	208,496	336,426	-11,146	-26,058	-73,708	-153,628	-375,007
Gross profit/contract:	-1.91	0.04	-0.59	1.87	0.66	32.37	14.70	10.49	13.56	10.75	-35.36	-17.59	-14.72	-9.82	-9.59
Net profit/contract:	-3.16	-1.29	-1.91	0.56	-0.63	31.16	13.33	9.16	12.22	9.43	-36.66	-18.89	-16.03	-11.11	-10.85

Table 3. Profitability among Risk Seeking Propensity (RSP) Quintile Groups

This table reports the RSP value and profitability of retail and proprietary traders among the quintile groups based on the Risk Seeking Propensity (RSP) of futures traders on the Taiwan Futures Exchange over the three-year sample period from January 2, 2006 to December 31, 2008. RSP, Gross (Net) profit, Gross (Net) profit/contract, and trading volume are defined in Table 2. "T-test p-value" presents the test results of the difference between Q5 and Q1 and Proprietary traders – retail traders. "Wilcoxon p-value" stands for the p value for the nonparametric Wilcoxon test. All profit figures are in ticks; one tick is 200 Taiwan Dollars, approximately US\$6.13 per tick based on the exchange rate on December 29, 2006.

		RSP		Gross Profit		Net Profit		Gross Profit/Contract		Net Profit/Contract		Trading Volume	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Retail Traders	Q1	-0.64	-0.63	-1,429	-209	-1,733	-392	-6.40	-1.5	-7.62	-2.68	253	125
	Q2	-0.33	-0.33	-515	-37	-818	-179	-3.38	-0.29	-4.6	-1.47	257	96
	Q3	-0.07	-0.07	166	56	-204	-79	-0.52	0.51	-1.75	-0.67	308	87
	Q4	0.20	0.20	621	157	153	19	2.04	1.34	0.8	0.14	404	87
	Q5	0.55	0.50	1,450	278	926	128	6.30	2.59	5.05	1.36	413	78
	Q5 – Q1		1.19		2,879		2,658		12.69		12.67		159
	T-test p-value		<.001		<.001		<.001		<.001		<.001		<.001
	Wilcoxon p-value		<.001		<.001		<.001		<.001		<.001		<.001
Proprietary Traders	Q1	-0.37	-0.30	-117,458	-18,753	-126,825	-20,146	-18.91	-9.9	-20.19	-11.26	7,170	1,754
	Q2	-0.04	-0.04	-51,591	-3,025	-73,534	-8,536	-4.14	-1.68	-5.41	-3.10	19,858	9,501
	Q3	0.13	0.13	-16,334	512	-33,963	-2,208	-0.29	0.40	-1.57	-0.90	15,017	7,765
	Q4	0.32	0.32	87,030	7,408	72,963	1,870	8.02	2.99	6.65	1.46	10,966	4,552
	Q5	0.60	0.58	174,031	13,821	160,982	11,091	15.47	7.33	14.17	5.98	9,692	2,902
	Q5 – Q1		0.96		291,489		287,807		34.38		34.36		2,522
	T-test p-value		<.001		<.001		<.001		<.001		<.001		0.02
	Wilcoxon p-value		<.001		<.001		<.001		<.001		<.001		.005
Propriet. - Retail			0.18		14,896		71		0.41		0.34		12,215
P-value			<.001		0.09		0.99		0.68		0.73		<.001
Wilcoxon p-value			<.001		.008		<.001		0.21		0.14		<.001

Table 4. Risk Seeking Propensity and Profits among Traders Groups Double Sorted by RSP and Trading Volume

This table reports the RSP value and profitability of retail and proprietary traders among traders groups double sorted by RSP (R1, R2,...,R5) and trading volume (V1, V2,...,V5) of futures traders on the Taiwan Futures Exchange over the three-year sample period from January 2, 2006 to December 31, 2008. RSP, Gross (Net) profit, Gross (Net) profit/contract and Trading volume are the same as the descriptions on Table 2. The profit is represented by tick; one tick is 200 Taiwan Dollars, approximately 6.13 US dollars per tick by exchange rate on December 29, 2006.

	Retail Trader					Proprietary Trader				
	V1	V2	V3	V4	V5	V1	V2	V3	V4	V5
Panel A: RSP Value										
R1	-0.57	-0.61	-0.64	-0.66	-0.66	-0.43	-0.41	-0.32	-0.29	-0.29
R2	-0.32	-0.33	-0.34	-0.34	-0.34	-0.06	-0.02	-0.06	-0.02	-0.04
R3	-0.06	-0.07	-0.08	-0.08	-0.08	0.13	0.14	0.13	0.13	0.11
R4	0.24	0.21	0.20	0.19	0.18	0.32	0.32	0.32	0.31	0.32
R5	0.52	0.55	0.57	0.56	0.56	0.63	0.61	0.55	0.60	0.59
Panel B: Gross Profit										
R1	-456	-487	-543	-929	-4,216	-8,045	-21,934	-107,261	-214,096	-489,309
R2	-169	-204	-284	-525	-1,424	-4,146	-1,230	-1,547	-78,903	-109,539
R3	-16	-51	-43	-49	975	-776	-1,170	9,800	9,838	-86,206
R4	78	108	156	282	2,385	4,661	14,686	43,049	125,602	273,891
R5	238	329	478	892	6,070	5,197	15,644	33,937	329,250	583,591
Panel C: Net Profit/Contract										
R1	-15.71	-9.87	-6.76	-5.90	-5.86	-23.26	-16.74	-24.18	-18.37	-16.86
R2	-7.27	-5.05	-4.14	-3.83	-3.00	-12.35	-2.44	-2.10	-6.33	-4.39
R3	-2.30	-2.23	-1.66	-1.60	-0.88	-2.66	-1.66	0.61	-0.67	-3.72
R4	2.04	0.72	0.25	0.13	0.43	7.09	7.68	8.10	4.92	5.06
R5	8.40	4.69	3.81	3.35	3.36	18.43	10.63	6.10	18.36	16.41

Net profit and Gross Profit/Contract are omitted. Only Gross profit and Net profit per contract are reported.

Table 5. Correlation Coefficients

This table reports the correlation coefficient of the variables of retail and proprietary traders on the Taiwan Futures Exchange over the three-year sample period from January 2, 2006 to December 31, 2008. RSP, Volume, Tenure, Gross (Net) profit and Gross (Net) profit/contract are the same as the descriptions on Table 2. Volatility is the monthly standard deviation of daily market returns. Gross profit_{t-1} is the trader's gross profit per contract traded on the prior month. Pearson correlation coefficients are on the upper and Spearman correlation coefficients are on the lower diagonal. Except for those specifically indicated in parentheses, all correlation coefficients have a p-value significant less than 0.001.

Panel A: Retail Trader

	RSP	Volume	Tenure	Volatility	Gross profit	Net profit	Gross Profit/contract	NetProfit /Contract	Gross Profit _{t-1}
RSP	1	0.042	-0.162	-0.038	0.052	0.048	0.130	0.129	0.017
Volume	-0.151	1	0.171	0.028	0.067	-0.016	0.004	0.004	0.060
							(0.210)	(0.187)	
Tenure	-0.163	0.545	1	0.027	0.012	-0.003	0.030	0.029	0.012
							(0.270)		
Volatility	-0.042	0.107	0.043	1	-0.014	-0.013	-0.021	-0.016	-0.009
									(0.007)
Gross Profit	0.199	0.052	0.051	-0.004	1	0.996	0.283	0.283	0.120
									(0.154)
Net Profit	0.199	-0.101	-0.042	0.004	0.955	1	0.284	0.284	0.115
									(0.163)
Gross Profit/contract	0.195	-0.036	-0.003	-0.022	0.912	0.911	1	1.000	0.030
									(0.363)
Net profit/contract	0.193	-0.034	-0.004	-0.004	0.911	0.913	0.999	1	0.031
									(0.200)
Gross Profit _{t-1}	0.072	0.091	0.039	-0.004	0.113	0.077	0.078	0.077	1
									(0.248)

Observations: 122,927 (89,041 for Unit_Profit_{t-1})

Panel B: Proprietary Trader

	RSP	Volume	Tenure	Volatility	Gross profit	Net profit	Gross profit/trade	Net profit/trade	Gross profit _{t-1}
RSP	1	-0.006	0.112	-0.038	0.344	0.344	0.383	0.382	0.045
									(0.117)
Volume	0.036	1	0.272	0.160	0.053	-0.011	0.020	0.021	0.081
									(0.005)
	(0.208)				(0.059)	(0.697)	(0.486)	(0.453)	
Tenure	0.067	0.503	1	0.083	0.019	-0.003	0.040	0.040	0.079
									(0.006)
	(0.019)			(0.003)	(0.499)	(0.924)	(0.157)	(0.163)	
Volatility	-0.029	0.058	0.132	1	-0.004	-0.007	0.005	0.011	0.130
									(0.130)
	(0.312)	(0.042)			(0.894)	(0.797)	(0.850)	(0.710)	
Gross Profit	0.444	0.029	0.012	0.012	1	0.997	0.404	0.404	0.196

		(0.312)	(0.674)	(0.662)					
Net Profit	0.443	-0.102	-0.051	0.024	0.967	1	0.403	0.403	0.192
			(0.075)	(0.408)					
Gross profit/contract	0.492	0.015	0.028	0.043	0.863	0.860	1	0.999	0.085
		(0.607)	(0.332)	(0.129)					(0.003)
Net profit/contract	0.489	0.016	0.027	0.057	0.862	0.861	0.999	1	0.086
		(0.579)	(0.348)	(0.046)					(0.003)
Gross Profit _{t-1}	0.038	0.039	0.084	0.033	0.084	0.076	0.076	0.074	1
	(0.188)	(0.169)	(0.004)	(0.246)	(0.003)	(0.008)	(0.008)	(0.011)	

Observations: 1,242 (1,193 for Unit_Profit_{t-1})

Table 6. Regression of Profitability on RSP and Trading Volume

This table reports the regression results of profitability, which is gross profit, on RSP, volume, the interaction of RSP with volume (RSP×volume) and control variables, including volatility, and profit_{t-1} over the three-year period from January 2, 2006 to December 31, 2008. All variables are defined in Table 2 and 5.

	Model							
	1	2	3	4	5	6	7	8
Panel A: Retail Traders								
Dependent Variable: Gross Profit								
Regressors								
RSP	2,415.35***	2,861.62***			2,699.49***	1,301.56***		1,232.41***
Volume			0.89***	0.81***	0.77***	-0.42***	1.09***	-0.02
Volume ² (x10 ⁻⁶)							-5.75***	-12.36***
Volatility (x10 ⁴)		-3.32***		-4.43***	-3.83***	-3.02***		-3.05***
Profit _{t-1}		0.13***		0.13***	0.13***	0.12***		0.12***
RSFxvolume						4.05***		4.18***
Adj. R ²	0.003	0.017	0.004	0.004	0.021	0.031	0.005	0.032
Observations	122,927	122,927	122,927	122,927	122,927	122,927	122,927	122,927
VIF	1.000	1.002	1.000	1.000	1.007	1.843	2.572	3.128
Panel B: Proprietary Trader								
Regressors								
RSP	309,521***	310,666***			310,938***	47,634*		31,010
Volume			0.79*	0.65	0.68*	-0.54	2.35***	-3.82***
Volume ² (x10 ⁻⁶)							-13.16***	-26.70***
Volatility (x10 ⁴)		-71.49		-155.66	-99.89	2.90		-23.17
Profit _{t-1}		0.18***		0.19***	0.18***	0.12***		0.13***
RSFxvolume						32.31***		35.17***
Adj. R ²	0.118	0.153	0.002	0.039	0.154	0.372	0.006	0.387
Observations	1,242	1,242	1,242	1,242	1,242	1,242	1,242	1,242
VIF	1.000	1.019	1.000	1.041	1.042	1.439	3.535	1.597

* for 10% significant level, ** for 5%, *** for 1%