Price Manipulation and Market Prediction: Evidence from a Small Market

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ABSTRACT

Theoretically, betting against rational speculators in the small market, based on irrational beliefs, may be profitable when noise trader herdings are large enough to form a trend. But, intuitively, the result may be in reverse when rational speculators herd and manipulate the price. In this study, we use daily public data from two main exchanges in Taiwan to calculate rational speculators' layouts of stock index futures and options and then to investigate their next-day predictability. These speculators are classified into four trader types: FINIs (foreign institutional investors), Dealers, Top 10 and Top 5 large traders. The predictability is decomposed into two parts: manipulation and information. One interesting part in our empirical findings is that the predictability comes from the manipulation and that "Top 5 large traders", is the only trader type who is able to manipulate the Taiwan stock index when their layout of options is significant. Finally, from the layouts of options, we show that betting on the same direction with Top 5 or Top 10 large traders is profitable.

Keyword: Rational Speculator, Price Manipulation, Market Prediction

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I. INTRODUCTION

Understanding the process of how the smart money exploits irrational amateurs is an interesting issue in behavioral finance. Contrary to common sense, Palomino (1996) argued theoretically that in the incomplete competitive market:

"…bets against rational speculators, based on irrational beliefs, may be profitable."

He argued that in a small market, if the profits from irrational belief induce imitation, then noise traders perform better than rational speculators do. As De Long, Sheleifer, Summers and Waldmann (1990) defines, noise traders

"falsely believe that they have special information about the future price of risky assets,"

So once arbitrageurs can't cognize noise traders' herding, their misperception will induce an additional risk beyond the fundamental one. At this situation, "betting against rational speculators" is very possible to earn profits. This argument inspires us to look at the opposite view: when rational speculators herd or deploy to trade market trends, it seems not smart to bet against these bandwagonists, because they have two advantages: information and capital. Information advantage lets them know the news that will affect the market direction in advance, and capital advantage lets them manipulate the market direction in short term.

Consequently, the purpose of this study is to investigate the timing of price manipulation taken by rational speculators and verify whether it is a profitable strategy to follow them at that time. In other words, proceeding market prediction at that time is just adequate, not at all the time. Price manipulation is feasible, a lot of theoretical researches in finance provide such argument, e.g. Allen and Gale (1992), Kumar and Seppi (1992), Jarrow (1994), Gerard and Nanda (1993), Zhou and Mei (2003), Van and Bommel (2003). Notable empirical studies include Khwaja and Mian (2005), Jiang, Mahoney and Mei (2005), Merrick, Naik and Yadav(2005), Allen, Litov and Mei (2006), Aggarwal and Wu (2006), Huang and Chan (2011), and Huang and Chang (2013).

Different to the data types in aforementioned papers, such as prosecuted cases, unique dataset and hand-collect data, ours are publicly observable every day. In the context of manipulation, the theoretical foundation of this study is Kumar and Seppi (1992). They argue that the manipulator takes a position in futures with "cash settlement" in advance, then artificially improves the spot price for a better settlement price to him around delivery dates of futures. Further, they also argue that adding the manipulators who are uncoordinated will decrease the profit from manipulation. However, it seems impossible that large traders or major institutional traders in a small market do not have any motivation to coordinate. Similar study, like Froot, Scharfstein, and Stein (1992), show that "herding equilibria" are possible if traders have sufficiently short holding period. The daily market data of major institutional traders and large traders disclosed in Taiwan Futures Exchange is just a description of herding of them in such a short term. This induces us to conjecture that the price manipulation on stock index in Taiwan won't be limited to expiry dates of index futures and options. Once these reported rational speculators' positions of futures and options are far away from neutral, i.e., the incentive to manipulate is large enough, it is a good time to trigger the price manipulation in the spot market. Hence, we use "Relative Bear Indices" (RBI in short), for measuring the manipulation incentive, to be the key variables to predict the spot market direction on the next day.

With the sample of a small market like Taiwan, this study has three contributions in empirical research. First, we find that market direction is predictable at some time and

the reason behind is that rational speculators carry price manipulation out, rather than information advantage. Second, the timings of manipulation are around expiry dates, not just at those dates. In addition, the situation when their positions of derivatives deviate neutrality far enough is also reasonable timings. Finally, based on the above findings, we provide a daily deploy strategy. It is profitable verified by backtesting. Further, its profit decreases as the number of rational speculators increase. This means that the theoretical model provided by Kumar and Seppi (1992) is feasible to Taiwan markets. Beside, we adopt the opposing argument to Palomino (1996) and induce the contrary conclusion: when rational speculators herd, betting against them is not a good idea. However, we should not bet following them all the time.

The rest of this study is organized as follows. Section II presents theoretical base and the important variables computed from open interest for market prediction, then establishes the empirical tests. Section III presents the empirical results and Section IV gives the deploy strategy inspired by the above empirical observations. Section V concludes.

II. OPEN INTEREST AND MARKET PREDICTION

1. Theoretical base

This study argues that rational speculators in the small market make money by exploiting noise traders and the methods they employ are market manipulations. Putniņš (2012) has a comprehensive review on this issue. He categories market manipulations into three types: runs, market power techniques and contract-based manipulation. Runs have two forms: 'pump-and-dump' and 'bear raid'. Both are that the manipulator have a position in stock in advance, then inflates or deflates the stock price while attracting the joint of noise traders. And finally reverses his position without any hesitation to exploit his followers. Market techniques also have two forms: 'corner' and 'squeeze'. Both are that the manipulator forces his opponents to surrender and accept harmful trades by inflating price to unreasonable high level or collecting the target security to deflate its supply seriously. Finally, the contract-based manipulation is to control settlement prices of the derivatives and the skill includes 'marking the open', 'marking the close' and 'capping/pegging'. The final form of market manipulation is the focus of this study.

Kumar and Seppi (1992) is among the pioneer papers of contract-based manipulation. It applies to futures with 'cash settlement'. The modified Kyle (1985) model, in which initial market participants includes the noise trader, the informed trader and the market maker, adds a new kind of trader, i.e., the uninformed manipulator. The manipulative equilibrium exists in this market structure and shows that this kind of uninformed trader can earn positive expected return. The scenario is as follows. The manipulator has a long position in futures (and can be extended to other derivatives), then bid up the spot price before expiration, i.e., inflate the settlement price, to profit from the position of futures, and vice versa.

To the context of option trading and the spot price, the literature can be traced back to sequential trading model in Glosten and Milgrom (1985). The risk-neutral market maker, without information about the asset value, computes the conditional expected value of the asset value by buy or sell orders and the ratio of informed traders. The price is quoted by letting the expected return of any trader to be zero, so the information about the asset value is embedded. Easley and O'Hara (1987) allows different trade sizes for the elasticity of adjusting speed of information discovery. Easley, O'Hara and Srinivas (1998) further assume that the derivatives is a venue for information-based trading. In

this multiple markets model, if the pooling equilibrium exists, option trading will provide information about the future price movement.

Back and Baruch (2004) extends Glosten and Milgrom (1985) model to replicate the equilibrium of continuous time version of Kyle (1985), then we can see a great resemblance between Kyle (1985) and Glosten and Milgrom (1985) frameworks. Hence, the relationship of market prediction and derivatives trading can be investigated from either 'information-based trading' or 'contract-based manipulation.'

In the context of manipulation scale, price manipulation or predictability on the individual stock is verified, e.g. Ni, Pearsons, and Poteshman (2005) and Pan and Poteshman (2006), but the those on the total market or stock index has not been found, at least like SPX, OEX and NDX. However, the possibility of the small market, for example of Taiwan, to be manipulated is not low. Chang, Hsieh, and Lai (2009) finds that the option positions of foreign institutional investors (henceforth FINIs) have information of the market direction, but not significant on expiration dates. Chow, Hung, Liu and Shiu (2012) finds that the performance of FINIs is poorer than that of Dealers with the evidence of index futures positions and then concludes that the maturity effect of Taiwan stock market can partly explained by the manipulation of dealers: marking the close. In spite that the conclusions about influence of large traders in these two papers are different, we cannot further investigate the issue of manipulation on a small market because of the exclusiveness of their dataset.

As Kumar and Seppi (1992) describes, in case that Taiwan market is manipulated, the manipulator will drive the spot price to favor the position of his futures. 'Cash settlement' let he turn the 'paper' capital gain into cash without the need to deliver the mispriced underlying. In practice, at days before expiration dates, price manipulation also provides favor market situation for 'offsetting' of his position of futures. By the way, Pan and Poteshman (2006) finds that the publicly observable signal of options can predict the stock return in next day, at most next two days. Therefore, we conjecture that once larger traders' deployment significantly tilts to one direction, i.e. the motivation to manipulate the spot price is large enough, they will attempt to influence the spot price in the next day.

2. Empirical specification

Most of studies about the stock index and its derivatives focus on Expiration day effects, but conclude diversely[1]. Mayhew (2000) reviews broadly and then concludes:

"there is little evidence of a strong, systematic price effect around expiration"

But Whaley (2003) argues that there is possibly expiration day effect on derivatives with cash settlement. In case of Taiwan stock market, Chow et al. (2012) finds that it is the result of dealers' manipulation for their futures positions, but Chang, Hsieh, and Lai (2009) finds there is information in large traders' options trading during normal days, not the expiration dates. This is contrast to the finding of Pan and Poteshman (2006). The reason they provide is that to get the information of a market privately is very difficult.

For searching the solution of the above debate, we try first to investigate the existence of information content of derivatives in normal days and the reason behind it. Then we

[1] Related papers are as follows. Buraschi and Jiltsov(2006)，Chakravarty, Galen and Mayhew (2004)，Chamberlain, Cheung and Kwan (1989)，Chow, Yung and Zhang (2003)，Chow and Hseu (2008)，Herbst and Maberly (1990,1991)，Hsieh (2009)，Karolyi(1996)，Klemkosky(1978)，Pope and Yadav (1992)，Stoll and Whaley(1986,1990,1991)。

further find the unusual effect relating expiration days, and finally we provide a simple method to detect the timing of price manipulation.

1.1. Predictability Test

To see whether the derivatives trading contains information about the stock index, we extend the main test in Pan and Poteshman (2006) to run the predictability test of Taiwan stock market. R_t is the daily rate of return of stock index at day t and X_{t-1} is the information variable computed from open interests on the previous day, i.e. the day t-1. We run the following regression:

$$R_t = \alpha + \beta \times X_{t-1} + \varepsilon_t \quad (1)$$

The null hypothesis is $\beta = 0$. If the manipulative equilibrium exists, we should get the result of rejecting it.

Then we want to investigate the issue what kind of contract-based manipulation by bandwagonists, e.g. major institutional traders or large traders, can explain the predictability. Two types of the above manipulation, such as 'marking the close' and 'marking the open', are possible to appear in every trade day, and therefore we divide the daily rate of return into two parts like the following:

$$R_t = \frac{P_t^{Close} - P_{t-1}^{Close}}{P_{t-1}^{Close}} = \frac{P_t^{Close} - P_t^{Open}}{P_{t-1}^{Close}} + \frac{P_t^{Open} - P_{t-1}^{Close}}{P_{t-1}^{Close}} \quad (2)$$

The right hand side of the above equation is just the 'daily bar' and the 'opening gap' in practice, but only in the form of ratio. Opening gap may be due to either the spill-over effect of American markets to Asian ones or the 'marking the open' made by rational speculators, as defined in De Long et al. (1990), for triggering the positive feedback trading of noise traders. The daily bar is the close price minus the open one at the same day and includes the result of 'marking the close'. It may describe the process of price manipulation made by rational speculators for 'marking to market' with capital management or for a better price to offset their positions on derivatives. This behavior is consistent with the price pressure of Kumar and Seppi (1992), i.e. using a series of orders to bid up or push down the spot price before the market closes. So we call this kind of manipulation 'marking the day' for convenience.

When the result of predictability is rejecting the null hypothesis, we can further substitution daily bar and opening gap individually into the following Y_t to see the source of predictability.

$$Y_t = \alpha + \beta \times X_{t-1} + \varepsilon_t \quad (3)$$

X_t is computed from the open interests of TAIEX futures and options of major institutional traders or larger traders, which are publicly available after the market closes. It can be used to measure the deploy of some type of traders, or in other word the motivation strength of price manipulation on next day. We define the first information variable, i.e., X_t of option buyers, as the following:

$$X_t^{Option\_Buyer} = \frac{OI_t^{Put\_Buyer}}{OI_t^{Put\_Buyer} + OI_t^{Call\_Buyer}} \quad (4)$$

Then define it from the side of option seller as:

$$X_t^{Option\_Seller} = \frac{OI_t^{Call\_Seller}}{OI_t^{Put\_Seller} + OI_t^{Call\_Seller}} \quad (5)$$

Eq(4) and eq(5) are different in the numerator. As Ni et al. (2005) arguments, the manipulation motivation of the option seller should not strong because the maximum of profit is limited at premiums. In contrast, the motivation of the option buyer to manipulate should be stronger because the profit is not limited and has leverage effect. X_t will between 0 and 1. When at 0.5, the position is neutral. The larger it is than 0.5, the more bear the position means; the lesser it is than 0.5, the more bull the position means. X_t is just the famous put-call ratio, however, we call it the relative bear index (RBI for short) not only for convenience but also for the position at the futures:

$$X_t^{Futures} = \frac{OI_t^{Futures\_Short}}{OI_t^{Futures\_Short} + OI_t^{Futures\_Long}} \quad (6)$$

In the context of relation to leverage these three kinds of relative bear indices will be the following sequence: futures, option buyer and option seller. In other words, the success of price manipulation will reflect on the profit of position at these RBIs at the same order. In the context of its magnitude, the larger the RBI, the stronger the motivation to push down the spot price; the small the RBI, the stronger the motivation to bid up the spot price. Hence, if rational speculators' deploys of derivatives have predictability, we will see the β will be negative significantly and then find the source of predictability is what kind of manipulation. If that is 'marking the open', substitution of opening gap into the dependent variable of eq(3) will make the β negative; if that is 'marking the day', substitution of daily bar into the same equation will make the β negative.

1.2. Expiration Effect Test

We investigate the third kind of contract-based manipulation: capping/pegging. Theoretically Kumar and Seppi (1992) arguments that manipulating at expiration will turn the "paper" capital gain into realized profit, and Ni et al. (2005) finds supporting evidence that individual stock prices will cluster on strike prices at expiration dates, but only limited on individual stocks. However, Chang et al. (2009) finds that the index options in Taiwan stock market have predictability merely not on expiration dates. Based on above observations, we conjecture that price manipulation may be carried out not just on expiration dates and create a dummy variable, D^E, to represent the "(work) days to expiration".

$$D^E = \begin{cases} 1 & Ddays \\ 0 & o.w. \end{cases} \quad (7)$$

We set three kinds of Ds: 1, 3 and 5. The first is just at the expiration date, the second is just the week of expiration because TAIEX index derivatives' settlement dates are stipulated at the third Wednesday each month. The final one is just for comparison. These newly set dummy variables will be used for the following test:

$$Y_t = \alpha + \beta \times X_{t-1} + \gamma \times X_{t-1} D_{t-1} + \varepsilon_t \quad (8)$$

Y_t is daily rate of return, daily bar and opening gap in turn; X_{t-1} is also RBI of futures, option buyers and option sellers in turn. We call this "Expiration effect test" for the dummy variable with relation to the expiration date and hope to find some distinctions about expiration dates. If there is any distinction near the expiration date, γ will be

negative significantly, then we can see the predictability of open interests of rational speculators comes from which kind of manipulation.

1.3. Manipulation Segment Detect

If the manipulation can proceed before expiration dates, we can reasonably deduce that the profit of derivative positions may be larger than the loss of spot position after manipulation. So we think when rational speculators' deploys in derivatives deviate from neutrality significantly, the possibility of price manipulation on the next day should not be neglected, and then our RBIs will have predictability on spot price. Therefore we create a new dummy variable for measuring the motivation of price manipulation:

$$D^M = \begin{cases} 1 & X \le 0.5 - p, X \ge 0.5 + p \\ 0 & o.w. \end{cases}$$

Where p is the threshold used to segment normal days and manipulated days. The segment method is:

$$Y_t = D^N(\alpha^N + \beta^N X_{t-1} + \varepsilon_t^N) + D^M(\alpha^M + \beta^M X_{t-1} + \varepsilon_t^M) \quad (9)$$

Where $D^N + D^M = 1$

after a trial work, we can get the following equation:

$$Y_t = \alpha^N + \beta^N X_{t-1} + \gamma D^M X_{t-1} + \delta D^M + \varepsilon_t \quad (10)$$

Where $\delta = \alpha^M - \alpha^N$, $\gamma = \beta^M - \beta^N$

The larger the p we choose, the more the deploy deviates from neutrality and the larger the motivation of price manipulation is. If this argument works, we can see a negative γ . hence, this null hypothesis is:

$$H_0 : \gamma = 0 \quad (11)$$

If we can reject it, we can indirectly have the supporting evidence that the price manipulation is carried out by which type of rational speculators.

III. EMPIRICAL RESULT

1. Data

We use the publicly available market data every work day, which includes four prices of TAIEX index, TAIEX futures(ticker symbol: TX) and Taiwan Top 50 ETF(ticker symbol: 0050): open, highest, lowest and close prices. The data of open interests of major institutional trader and large traders are near-month contracts: TAIEX futures and TAIEX options(ticker symbol: TXO).

1.1 Data source

The total dataset comes from Taiwan Economic Journal(TEJ). Data period is from 2007/07/02 to 2012/08/30, in sum of 1537 days. The data of mutual funds, one of major institutional traders, is discarded for rare record. The number of dealers is at least 31 during that period; the number of FINIs is more than 800. Large traders are Top 5 and Top 10, excluding specified institutional investors.

1.2. Description statistics

Features of Taiwan stock market and TAIEX index futures market are presented in table 1. As expected, the futures price is volatile than the spot price and we can easily see it from the quartiles

Similar statistics of all RBIs of each type of traders are summarized in table 2. The positions of futures and options of FINIs are most flexible because they have the largest number. Dealers have the second large number.

(Insert table 1, 2 here)

2. Result

2.1. Predictability of relative bear indices

The RBIs, computed daily from open interests of bandwagonists, have been input into eq (1) to test its predictability on stock index return on the next day and then the result is presented in table 3. If the β is negative significantly, we can reject the hull hypothesis, the result is presents in 3 panels: futures, option buyers and option sellers. This order is decided by the profit speed geared to a correct view. If the view of the trader is correct, the profit reflects on the position of futures at the highest speed, then on the position of option buyers at the second speed. At last the option sellers need a not short time to earn on their view. Just as Ni et al. (2005) mentions, the motivation of option sellers to manipulate is most week because that the maximum of profit is just the premium.

We can obviously see from Panel A that futures RBIs of bandwagonists, excluding dealers, have predictability and FINIs are the most among them with the $\beta = -1.3386$.

Panel C shows that RBIs of Top 10 and Top 5 large traders are significant, same as the observation in practical. This means that these large traders are really "smart money" because that they exploit noise traders by selling expensive options.

Panel B shows that none of bandwagonists' RBIs has predictability. One thing deserves to be mentioned is that the RBI of option buyers is just the common put-call ratio, but our finding is the same as that of Pan and Poteshman (2006). However, Chang et al. (2009) finds that FINIs have predictability in the same market as this study, but we don't have the same finding. The reason conceals in the details of data. Ours is free but rough, but we have a method to make up for this deficiency in later section.

(Insert table 3 here)

Furthermore, we decompose the predictability into 'marking the day' and 'marking the open' and the result is put into table 4 and table 5. First, in view of futures RBI, these coefficients of FINIs, Top 10 and Top 5 are significantly negative in table 4, but not table 5. This means that their predictability of futures RBI comes from "marking the day", not 'marking the open'. In other words, this supports the kind of manipulation of Kumar and Seppi (1992), not that of De Long et al. (1990). FINIs are also the most obvious. Second, the part of option buyers is neglected for no predictability. Finally, by the RBIs of option sellers, we can see that the predictability of Top 10 and Top 5 large traders is from 'marking the open', not from 'marking the day'. Intuitively, since 'marking the day' is more difficult than 'marking the open' by the capital management, we think their motivation of manipulation for the position of option sellers is week, unless near the expiration date or the amount of money is large. Hence, we conduct tests in next two subsections in turn.

(Insert table 4 and table 5 here)

2.2. Expiration effect tests

We use the eq(8) to run expiration effect tests. First, we adopt the dummy variable of expiration date, i.e. $D^E = 1$ at the expiration day. The dependent variables are daily return rate, daily bar and opening gap and the results are presented in table 6, 7 and 8. We can easily see that none of γ is negative significantly. It means that at expiration

days our RBIs have not any impact on spot price. The pane B in table 7 is the same as Chang et al. (2009) and the results are the same. However, it may be caused by the dilution that the time of 'making the close' is one tenth of one of 'marking the day', so we cannot detect the expiration day effect.

(Insert table 6, 7 and 8 here)

Second, we change the dummy variable to be 1 when the week of expiration and the results are presented in table 9,10 and 11. Table 9 shows that these RBIs of all traders have no predictability because that none of γ is negative significantly. Table 11 have also no finding and this implies that 'marking the open' for triggering the day trend is not significant. However, table 10 have some findings. In view of RBI of futures, those of all kinds of traders, except for FINIs, are negative a little significantly, but that of FINIs are almost the same by the p-value 0.0644. In view of RBIs of option buyers, traders having significantly negative γ are FINIs and Dealers; In view of that of option sellers, traders having significantly negative γ are Top 10 and Top 5 traders. How an interesting coincidence, but one thing deserves mention that Top 10 traders may partly be FINIs or partly be Dealers. However, the findings of this table imply that rational speculators will proceed price manipulation, 'marking the day' here, for their positions of derivatives in advance of expiration days, if only their positions are large enough.

(insert table 9,10 and 11 here)

Finally, we change the condition of dummy variable being 1 to 5 days to expiration and the results are showed in table 12, 13 and 14. The findings are only that FINIs and Dealers have 'marking the day' in view of RBIs of option buyers in table 14.

(Insert table 12, 13 and 14 here)

To sum up, the empirical result in this subsection shows that the 'capping/pegging', one of contract-based manipulation, is not significant and the reason we guess is that the computing period of settlement price is only a half of hour, which is only one tenth of all day, and the manipulation is then diluted out in daily view. The 'marking the day' is significant in the expiration weeks. This reflect the fact that the deploys of rational speculators are almost finished in that week and they can offset their positions in advance to reduce the risk exposure, not necessary to keep the position until expiration.

2.3. Manipulation segment detection

For measuring the motivation of manipulation, we design a new dummy variable with a threshold, p as described above. The lager the p, the stronger the motivation to manipulate. Theoretically, the price manipulations are carried out at expiration days; however, the price manipulation can be carried out in advance in the expiration week as the finding in the above subsection.

We use the settings of p with threshold values of 0.025, 0.05, 0.1, 0.2 and 0.3 respectively in the regression of eq(10) and part of results are presented in table 15, 16 and 17($p = 0.05$) and table 18, 19 and 20 ($p = 0.1$). We neglect the result of threshold value 0.025 because of no findings in it. This conforms to feature of RBI as an index measuring the motivation of manipulation. We also neglect the results of threshold values of 0.2 and 0.3 because that the data numbers of these two cases are not enough. We can see that none of γ s in table 15 and 17 is negative significantly, but the result in table 16 is different. In the context of RBIs of option buyers, the γ s in daily return rate part of Dealers and Top 5 traders are negative significantly. It implies that these traders' RBI have predictability. However, their γ s in daily bar part are different. That

of Top 5 traders is still negative significant, but that of Dealers is not. So we can say that the predictability of Top 5 traders' RBI is from the 'marking the day' form of manipulation.

(insert table 15,16 and 17 here)

We raise the threshold value to 0.1 and analysis with the similar way in table 18, 19 and 20. RBIs of futures and option buyers in table 18 and tale 19 have no findings, but in table 20, i.e. those of option sellers show that Top 5 have predictability, referring γ =-1.7447 significantly and the source is 'marking the day' by γ =-1.3626 significantly.

(insert table 18,19 and 20 here)

To sum up, the results of table 16 and 20 shows that Top 5 traders will manipulate with the form of 'marking the day' for their positions of options and then their RBIs have the predictability. The fact that the threshold of RBIs of option sellers to manipulate is larger than that of option buyers rejects the argument of Ni et al. (2005) and we conclude that when the position of option sellers is accumulated enough, it is possible to be the time to manipulate the spot price, although the profit of the position is limited individually.

IV. THE EFFECTIVENESS OF RELATIVE BEAR INDICES

Since rational speculators tend to disguise their real views, finding the indirect evidence of manipulation is really a tough job. However, we find the evidence of manipulation existing in Top 5 traders' RBIs. Thus, we plan to develop a daily deploy strategy extended from such findings. Further, the profit room increases as the price variation, investigating the relation between RBI and the daily range of stock index in the next-day is an interesting issue. So we discuss these two issues in the next two subsections.

1. Daily deploy strategy and RBIs

This strategy is as follows. When the opening gap is less than $\pm$ 0.5%, i.e. no 'triggering the trend' exists, we long or short 1000 shares of Taiwan Top 50 ETF(ticker symbol: 0050) by the signal of RBI in previous day, then compute the paper profit or loss with the close price in this day. Repeat this strategy day-by-day. We show the performance of it with backtesting in practice, i.e. compute the following number in the total sample period: winning rate, odds, maximum loss, deploy days and expect return. Since we adopt the form of international odds, the expected return larger than 1 means that is a winner strategy. We set up three scenarios with threshold value, e.g. 0.025, 0.05 and 0.1, to backtest the performance of RBI individually and the result is presented in table 21. Thus, we can see whether betting on rational speculators' view, in other words deploying in the same way, in such a small market as Taiwan is a smart strategy. First, based on the signal of futures RBIs, betting on rational speculators excluding Dealers is a good deal no matter what threshold. The reason why Dealers' futures RBI don't work might be that the futures is merely the hedging tool for these market makers of options. Second, based on the signal of option buyers RBIs, betting on Top 10 and Top 5 traders seems workable if the threshold is high enough, e.g. more than 0.05. Finally, based on the signal of option sellers RBIs, betting on each type of rational speculator is good. This may be caused by the stylized fact in option markets: options are more expensive than their theoretical values. These findings can be sum up in a few words. Betting on rational speculators in a small market is a profitable strategy, if only the opening gap is not too large.

In the context of measuring the motivation of manipulation, RBIs work very well in this strategy. This is because that this strategy takes advantage of 'marking the day'

form of manipulation. The supporting evidence is as clear as day. For example of Top 5 traders, the higher the threshold value, the larger the profit. In view of futures RBIs, the expected returns are as follows: 1.0971, 1.1416 and 1.1479; In view of option buyers RBIs, those are as follows: 0.9870, 1.0560 and 1.0586; and finally in view of option sellers RBIs, those are 1.0307, 1.0461 and 1.1389. Thus, the positive relation between RBIs and motivation of manipulation is clearly and easy to see.

At last, we want to investigate the situation deduced in Kumar and Seppi (1992): when the number of manipulator increases, the profit from the manipulation will decrease, even to zero. By the observation on the panel of threshold value 0.1 in table 21, i.e. the situation of the strongest motivation of manipulation, as the number of rational speculators increase, for example, Top 5, Top 10 traders, Dealers an FINIs, those profits from RBIs of option sellers will be: 1.1389, 1.1227, 1.0256 and 0.0061. it is significantly decreasing. The same observation exists in RBIs of option buyer. But the observation on futures RBIs is different. The profit following futures RBIs of FINIs is the largest among them and this will not support the above argument. However, the reason is simple. When more than eight hundreds of FINIs deploy in the same direction, i.e. their views are the same, a trend is to form inevitable. Taking advantage of a trend is profitable as a matter of course. To sum up, Taiwan stock market as a whole exists price manipulation as Kumar and Seppi (1992) describes, and betting against rational speculators in such a small market is not suggested by this study.

(insert table 21 here)

2. Next-day profit room and RBIs

Daily profit room comes from daily price range. We use Garman and Klass (1980) formula to estimate the daily volatility (so-called GK volatility) like:

$$\hat{\sigma}^2 = 0.5*[\ln(P_t^{High}) - \ln(P_t^{Low})]^2 - [2\ln(2) - 1]*[\ln(P_t^{Open}) - \ln(P_t^{Close})]^2 \quad (12)$$

And estimate True Range with the following equation:

$$TR = Max(P_t^{High}, P_{t-1}^{Close}) - Min(P_t^{Low}, P_{t-1}^{Close}) \quad (13)$$

In practice, the timing of offsetting to realized the profit is not always at the close of the market, thus the daily rate of return will not track the real performance of a trade well. Using these two equations can complement the function of daily rate of return.

We transform the RBI into the Relative Volatile Index(RVI for short) like this:

$$Z_t = \left| X_t - 0.5 \right| \Big/ 0.5 \quad (14)$$

The range of RVI is from 0 to 1 and designed for measuring the extent of deviating from neutrality. The larger the RVI, the more risk exposure the trader has and the more daily price variation is expected. We also compute the RVIs of futures, option buyers and option sellers and then run regression like this:

$$V_t = \alpha + \beta \times Z_{t-1} + \varepsilon_t \quad (15)$$

Where V_t represents GK volatility or True Range. The result of regression is presented in table 22. When β is positive significantly, we can say that the deployment of the rational speculator will affect the daily profit room in the next day. This is another indirect evidence of price manipulation. Table 22 shows obviously that all β are positive significantly, so we can conclude that these rational speculators have power in Taiwan stock market and that RBIs have good effectiveness.

(insert table 22 here)

V. CONCLUSION

In this study, we investigate the relation between open interests of index derivatives of rational speculators in Taiwan and the direction of stock index in the next day. Prior empirical researches have verified the feasibility of price manipulation, but being limited to individual stocks, and hence we verify the feasibility of price manipulation on the total market with evidence from Taiwan. Just as the common sense, this should be limited in small markets, which implies that Taiwan stock market is still not well developed.

To our knowledge, in the area of contract-based manipulation, this study is the first to decompose the predictability into 'marking the day' and 'marking the open', and we find that the source of predictability is the 'marking the day' type of price manipulation, where 'marking the day' includes 'marking the close'. This concept is based on Kumar and Seppi(1992). Other types of contract-based manipulation, e.g. capping/pegging, is not obvious in our study because of the data type.

The relative bear index (RBI) proposed in this paper, which follows the form of put-call ratio, can measure the strength of motivation of price manipulation and further be developed to a profitable deployment strategy. Besides, the profit from the strategy verifies the argument of Kumar and Seppi (1992) about the number of manipulators. The RBI can also be transformed into the relative volatility index (RVI) to predict the profit room in the next day. One thing deserves mentioning is that the daily rate of return cannot track the real performance of a day trade because of the delay of open interest disclosure and the opening gap. The strategy developed in this study amend this deficit. Finally, we prove that following rational speculators in a small market is smart because of the existence of price manipulation.

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Table 1 Description statistics of stock index and index futures in Taiwan

Stock index	Return	Bar	Gap	TX	Return	Bar	Gap
Mean	0.0028	-0.1260	0.1288	Mean	0.0061	0.0038	0.0023
Std Dev	1.4329	1.0848	1.0859	Std Dev	1.6618	1.2451	1.1640
Median	0.0799	-0.1019	0.1975	Median	0.0689	0.0138	0.0379
Max	6.7422	5.8424	6.2338	Max	7.1362	9.7918	6.9972
Min	-6.5133	-5.2220	-6.6599	Min	-8.4018	-7.6460	-7.2284
75th percentile	0.7663	0.4704	0.6012	75th percentile	0.8355	0.6059	0.4855
25th percentile	-0.6516	-0.6780	-0.2328	25th percentile	-0.6905	-0.5749	-0.3946
interquartile range	1.4179	1.1483	0.8340	interquartile range	1.5260	1.1808	0.8801

Statistics is presented in percentage. These daily data is from 2007/07/022 to 2013/08/30, and the number of data is 1537.

Table 2 Description statistics of 3 kinds of RBIs of 4 kinds of traders

Futures	**FINI**	**Dealer**	**Top 10**	**Top 5**
Mean	0.4768	0.5006	0.4928	0.4798
Std Dev	0.0953	0.1531	0.0638	0.0749
Median	0.4857	0.4911	0.4891	0.4785
Max	0.6964	0.9226	0.7057	0.7121
Min	0.1756	0.1273	0.3212	0.2628
75th percentile	0.5459	0.6079	0.5401	0.5364
25th percentile	0.4255	0.3952	0.4439	0.4210
interquartile range	0.1204	0.2127	0.0962	0.1154
Option Buyers	**FINI**	**Dealer**	**Top 10**	**Top 5**
Mean	0.4959	0.4940	0.5165	0.5139
Std Dev	0.2533	0.2139	0.0682	0.0766
Median	0.4626	0.4803	0.5218	0.5187
Max	0.9823	0.9509	0.7305	0.7595
Min	0.0306	0.0585	0.3123	0.2831
75th percentile	0.7230	0.6749	0.5582	0.5622
25th percentile	0.2848	0.3265	0.4755	0.4688
interquartile range	0.4381	0.3485	0.0827	0.0934
Option Sellers	**FINI**	**Dealer**	**Top 10**	**Top 5**
Mean	0.5264	0.5339	0.5205	0.5164
Std Dev	0.2483	0.2323	0.1009	0.1062
Median	0.5679	0.5545	0.5095	0.5051
Max	0.9791	0.9565	0.8125	0.8065
Min	0.0189	0.0390	0.2296	0.2330
75th percentile	0.7320	0.7271	0.5883	0.5876
25th percentile	0.3108	0.3396	0.4491	0.4389
interquartile range	0.4212	0.3875	0.1392	0.1487

Table 3 RBIs' predictability on the next-day stock index return

Panel A：Futures	FINI	Dealer	Top 10	Top 5	R-square
0.6638***	-1.3863***				0.85
(0.0004)	(0.0003)				
0.0489		-0.0921			0.01
(0.6959)		(0.7001)			
0.8572**			-1.7335**		0.60
(0.0026)			(0.0025)		
0.6024*				-1.2496*	0.43
(0.0111)				(0.0105)	
1.0858***	-1.3386*	-0.3211	-1.1737	0.6136	0.79
(0.0006)	(0.0121)	(0.2340)	(0.5222)	(0.6725)	
Panel B：Option Buyers	**FINI**	**Dealer**	**Top 10**	**Top 5**	**R-square**
0.1026	-0.2011				0.13
(0.2022)	(0.1638)				
0.1613		-0.3208			0.23
(0.0797)		(0.0607)			
-0.0467			0.0959		0.00
(0.8674)			(0.8583)		
-0.1334				0.2651	0.02
(0.5909)				(0.5790)	
0.3060	0.0639	-0.3817	-2.7618	2.4908	0.10
(0.3470)	(0.8089)	(0.2172)	(0.1725)	(0.1657)	
Panel C：Option Sellers	**FINI**	**Dealer**	**Top 10**	**Top 5**	**R-square**
-0.0669	0.1324				0.05
(0.4356)	(0.3691)				
-0.0967		0.1863			0.09
(0.2919)		(0.2369)			
0.6347***			-1.2140***		0.73
(0.0009)			(0.0008)		
0.5044**				-0.9713**	0.52
(0.0054)				(0.0048)	
0.9828**	-0.3005	0.0769	-5.1555**	3.5258*	0.88
(0.0015)	(0.5026)	(0.8747)	(0.0033)	(0.0302)	

This table is the regression result using eq(1). The dependent variable is daily rate of return and the independent variable is the Relative Bear Index (RBI) of each type of traders: Futures, Option Buyers and Option Sellers and the results are listed in 3 panels. The former 5 columns are estimated coefficients of intercepts and slopes and their p-values in parentheses. The last is R-square value in percentage. *, ** and *** represents significance of 5%, 1% and 0.1%.

Table 4 RBIs' predictability on the next-day 'making the day'

Panel A：Futures	FINI	Dealer	Top 10	Top 5	R-square
0.6483***	-1.6241***				2.03
(0.0000)	(0.0000)				
-0.3011**		0.3498			0.24
(0.0015)		(0.0532)			
0.5217*			-1.3142**		0.60
(0.0154)			(0.0024)		
0.3393				-0.9698**	0.45
(0.0586)				(0.0087)	
0.5928*	-1.6715***	0.0398	-0.3528	0.4837	1.80
(0.0130)	(0.0000)	(0.8447)	(0.7984)	(0.6582)	
Panel B：Option Buyers	**FINI**	**Dealer**	**Top 10**	**Top 5**	**R-square**
-0.2451***	0.2401*				0.31
(0.0001)	(0.0281)				
-0.2380***		0.2267			0.20
(0.0006)		(0.0800)			
0.1435			-0.5218		0.11
(0.4980)			(0.1993)		
0.0826				-0.4058	0.08
(0.6604)				(0.2617)	
-0.0356	0.2353	-0.0226	-0.9693	0.5928	0.11
(0.8852)	(0.2398)	(0.9230)	(0.5270)	(0.6629)	
Panel C：Option Sellers	**FINI**	**Dealer**	**Top 10**	**Top 5**	**R-square**
0.0274	-0.2915**				0.45
(0.6721)	(0.0089)				
0.0315		-0.2950*			0.40
(0.6498)		(0.0133)			
0.0116			-0.2644		0.06
(0.9364)			(0.3357)		
-0.0089				-0.2268	0.05
(0.9483)				(0.3845)	
0.7145	-0.3226	-0.2324	-1.8373	0.7936	0.80
(0.0023)	(0.3419)	(0.5293)	(0.1670)	(0.5192)	

This table is the regression result using eq(3). The dependent variable is daily bar and the independent variable is the Relative Bear Index (RBI) of each type of traders: Futures, Option Buyers and Option Sellers and the results are listed in 3 panels. The former 5 columns are estimated coefficients of intercepts and slopes and their p-values in parentheses. The last is R-square value in percentage. *, ** and *** represents significance of 5%, 1% and 0.1%.

Table 5 RBIs' predictability on the next-day 'marking the open'

Panel A：Futures	FINI	Dealer	Top 10	Top 5	R-square
0.0154	0.2378				0.04
(0.9131)	(0.4140)				
0.3501***		-0.4419*			0.39
(0.0002)		(0.0147)			
0.3355			-0.4193		0.06
(0.1204)			(0.3346)		
0.2631				-0.2798	0.04
(0.1436)				(0.4499)	
0.4930*	0.3329	-0.3609	-0.8209	0.1299	0.22
(0.0406)	(0.4112)	(0.0785)	(0.5559)	(0.9063)	
Panel B：Option Buyers	**FINI**	**Dealer**	**Top 10**	**Top 5**	**R-square**
0.3476***	-0.4412***				1.06
(0.0000)	(0.0001)				
0.3993***		-0.5475***			1.16
(0.0000)		(0.0000)			
-0.1902			0.6177		0.15
(0.3694)			(0.1289)		
-0.2160				0.6709	0.22
(0.2505)				(0.0637)	
0.3415	-0.1713	-0.3590	-1.7925	1.8980	1.11
(0.1639)	(0.3900)	(0.1237)	(0.2402)	(0.1612)	
Panel C：Option Sellers	**FINI**	**Dealer**	**Top 10**	**Top 5**	**R-square**
-0.0943	0.4239***				0.94
(0.1451)	(0.0001)				
-0.1281		0.4813***			1.06
(0.0640)		(0.0001)			
0.6231***			-0.9496***		0.78
(0.0000)			(0.0005)		
0.5133***				-0.7445**	0.53
(0.0002)				(0.0043)	
0.2683	0.0222	0.3094	-3.3182*	2.7322*	1.24
(0.2515)	(0.9478)	(0.4019)	(0.0125)	(0.0264)	

This table is the regression result using eq(3). The dependent variable is opening gap and the independent variable is the Relative Bear Index (RBI) of each type of traders: Futures, Option Buyers and Option Sellers and the results are listed in 3 panels. The former 5 columns are estimated coefficients of intercepts and slopes and their p-values in parentheses. The last is R-square value in percentage. *, ** and *** represents significance of 5%, 1% and 0.1%.

Table 6 Expiration effect tests of RBIs' predictability on stock index return: on expiration days

Panel A：Futures	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	0.6639***	-1.3846***	-0.0375	0.85
	(0.0004)	(0.0003)	(0.9146)	
Dealer	0.0499	-0.0789	-0.3255	0.07
	(0.6900)	(0.7420)	(0.3276)	
Top 10	0.8590**	-1.7298**	-0.1556	0.61
	(0.0025)	(0.0025)	(0.6523)	
Top 5	0.6031*	-1.2439*	-0.1527	0.44
	(0.0110)	(0.0109)	(0.6654)	
Panel B：Option Buyers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	0.1018	-0.1876	-0.2526	0.17
	(0.2056)	(0.1968)	(0.4078)	
Dealer	0.1597	-0.3119	-0.1179	0.24
	(0.0830)	(0.0707)	(0.6979)	
Top 10	-0.0519	0.1121	-0.1242	0.01
	(0.8529)	(0.8352)	(0.6986)	
Top 5	-0.1384	0.2810	-0.1256	0.03
	(0.5777)	(0.5579)	(0.6947)	
Panel C：Option Sellers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	-0.0665	0.1286	0.0628	0.06
	(0.4385)	(0.3862)	(0.8273)	
Dealer	-0.0967	0.1869	-0.0093	0.09
	(0.2919)	(0.2386)	(0.9741)	
Top 10	0.6334**	-1.2038***	-0.1590	0.75
	(0.0010)	(0.0009)	(0.6183)	
Top 5	0.5025**	-0.9600**	-0.1591	0.53
	(0.0056)	(0.0054)	(0.6177)	

This table is the regression result using eq(8). The dependent variable is daily rate of return and the independent variable is the Relative Bear Index (RBI), i.e. Futures, Option Buyers and Option Sellers, of each type of traders, and then the results are listed in 3 panels. The dummy variable of D^E=1 at expiration days. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 5%, 1% and 0.1%.

Table 7 Expiration effect tests of RBIs' predictability on 'marking the day': on expiration days

Panel A：Futures	Alpha	Beta	Gamma	R-square
FINI	0.6481***	-1.6301***	0.1351	2.05
	(0.0000)	(0.0000)	(0.6079)	
Dealer	-0.3016**	0.3437	0.1514	0.27
	(0.0015)	(0.0580)	(0.5471)	
Top 10	0.5210*	-1.3157**	0.0612	0.60
	(0.0156)	(0.0024)	(0.8148)	
Top 5	0.3389	-0.9727**	0.0776	0.45
	(0.0589)	(0.0085)	(0.7714)	

Panel B：Option Buyers	Alpha	Beta	Gamma	R-square
FINI	-0.2448***	0.2354*	0.0881	0.32
	(0.0001)	(0.0324)	(0.7027)	
Dealer	-0.2368***	0.2201	0.0879	0.21
	(0.0007)	(0.0921)	(0.7021)	
Top 10	0.1475	-0.5343	0.0951	0.12
	(0.4867)	(0.1902)	(0.6950)	
Top 5	0.0864	-0.4180	0.0956	0.09
	(0.6463)	(0.2496)	(0.6928)	

Panel C：Option Sellers	Alpha	Beta	Gamma	R-square
FINI	0.0279	-0.2959**	0.0729	0.45
	(0.6672)	(0.0084)	(0.7377)	
Dealer	0.0316	-0.2957*	0.0120	0.40
	(0.6490)	(0.0137)	(0.9560)	
Top 10	0.0119	-0.2668	0.0373	0.06
	(0.9348)	(0.3323)	(0.8779)	
Top 5	-0.0083	-0.2304	0.0504	0.05
	(0.9518)	(0.3782)	(0.8348)	

This table is the regression result using eq(8). The dependent variable is daily bar and the independent variable is the Relative Bear Index (RBI), i.e. Futures, Option Buyers and Option Sellers, of each type of traders, and then the results are listed in 3 panels. The dummy variable of D^E=1 at expiration days. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 5%, 1% and 0.1%.

Table 8 Expiration effect tests of RBIs' predictability on 'marking the open': on expiration days

Panel A：Futures	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	0.0157	0.2455	-0.1726	0.07
	(0.9115)	(0.3994)	(0.5167)	
Dealer	0.3515***	-0.4225*	-0.4770	0.62
	(0.0002)	(0.0197)	(0.0578)	
Top 10	0.3381	-0.4142	-0.2168	0.11
	(0.1176)	(0.3406)	(0.4085)	
Top 5	0.2642	-0.2711	-0.2303	0.09
	(0.1419)	(0.4643)	(0.3901)	
Panel B：Option Buyers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	0.3466***	-0.4230***	-0.3406	1.20
	(0.0000)	(0.0001)	(0.1387)	
Dealer	0.3966***	-0.5320***	-0.2058	1.22
	(0.0000)	(0.0000)	(0.3689)	
Top 10	-0.1994	0.6464	-0.2193	0.20
	(0.3472)	(0.1132)	(0.3664)	
Top 5	-0.2248	0.6990	-0.2212	0.28
	(0.2324)	(0.0543)	(0.3609)	
Panel C：Option Sellers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	-0.0944	0.4245***	-0.0101	0.94
	(0.1451)	(0.0002)	(0.9631)	
Dealer	-0.1283	0.4826***	-0.0213	1.06
	(0.0639)	(0.0001)	(0.9217)	
Top 10	0.6215***	-0.9370***	-0.1963	0.82
	(0.0000)	(0.0007)	(0.4169)	
Top 5	0.5108***	-0.7296**	-0.2095	0.58
	(0.0002)	(0.0052)	(0.3856)	

This table is the regression result using eq(8). The dependent variable is opening gap and the independent variable is the Relative Bear Index (RBI), i.e. Futures, Option Buyers and Option Sellers, of each type of traders, and then the results are listed in 3 panels. The dummy variable of D^E=1 at expiration days. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 5%, 1% and 0.1%.

Table 9 Expiration effect tests of RBIs' predictability on stock index return: on expiration weeks

Panel A：Futures	Alpha	Beta	Gamma	R-square
FINI	0.6627***	-1.3434***	-0.2853	0.96
	(0.0004)	(0.0005)	(0.1833)	
Dealer	0.0577	-0.0585	-0.3807	0.23
	(0.6448)	(0.8073)	(0.0666)	
Top 10	0.8752**	-1.7277**	-0.3037	0.73
	(0.0021)	(0.0025)	(0.1545)	
Top 5	0.6093*	-1.2246*	-0.2820	0.54
	(0.0102)	(0.0122)	(0.1948)	
Panel B：Option Buyers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	0.1015	-0.1615	-0.2773	0.26
	(0.2067)	(0.2716)	(0.1469)	
Dealer	0.1568	-0.2830	-0.2095	0.31
	(0.0887)	(0.1048)	(0.2792)	
Top 10	-0.0752	0.1903	-0.2720	0.12
	(0.7887)	(0.7252)	(0.1705)	
Top 5	-0.1624	0.3621	-0.2791	0.15
	(0.5141)	(0.4530)	(0.1590)	
Panel C：Option Sellers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	-0.0719	0.1703	-0.1950	0.13
	(0.4024)	(0.2600)	(0.2630)	
Dealer	-0.1031	0.2266	-0.1914	0.17
	(0.2617)	(0.1610)	(0.2682)	
Top 10	0.6328**	-1.17318**	-0.2649	0.85
	(0.0010)	(0.0012)	(0.1799)	
Top 5	0.4986**	-0.9220**	-0.2688	0.64
	(0.0060)	(0.0077)	(0.1732)	

This table is the regression result using eq(8). The dependent variable is daily rate of return and the independent variable is the Relative Bear Index (RBI), i.e. Futures, Option Buyers and Option Sellers, of each type of traders, and then the results are listed in 3 panels. The dummy variable of D^E=1 on expiration weeks. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 5%, 1% and 0.1%.

Table 10 Expiration effect tests of RBIs' predictability on 'marking the day': on expiration weeks

Panel A：Futures	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	0.6472***	-1.5792***	-0.2983	2.25
	(0.0000)	(0.0000)	(0.0644)	
Dealer	-0.2934**	0.3796*	-0.3367*	0.54
	(0.0020)	(0.0363)	(0.0319)	
Top 10	0.5429*	-1.3074**	-0.3574*	0.92
	(0.0117)	(0.0025)	(0.0268)	
Top 5	0.3477	-0.9393*	-0.3428*	0.73
	(0.0524)	(0.0110)	(0.0372)	
Panel B：Option Buyers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	-0.2463***	0.2866**	-0.3260*	0.64
	(0.0001)	(0.0099)	(0.0241)	
Dealer	-0.2443***	0.2798*	-0.2948*	0.46
	(0.0005)	(0.0341)	(0.0443)	
Top 10	0.1157	-0.4297	-0.2655	0.31
	(0.5855)	(0.2940)	(0.0771)	
Top 5	0.0557	-0.3162	-0.2578	0.27
	(0.7673)	(0.3864)	(0.0856)	
K BAR vs. Option Sellers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	0.0227	-0.2560*	-0.1825	0.57
	(0.7263)	(0.0251)	(0.1657)	
Dealer	0.0256	-0.2583*	-0.1739	0.51
	(0.7125)	(0.0346)	(0.1832)	
Top 10	0.0093	-0.2152	-0.3192*	0.36
	(0.9488)	(0.4345)	(0.0334)	
Top 5	-0.0157	-0.1684	-0.3176*	0.34
	(0.9088)	(0.5202)	(0.0339)	

This table is the regression result using eq(8). The dependent variable is daily bar and the independent variable is the Relative Bear Index (RBI), i.e. Futures, Option Buyers and Option Sellers, of each type of traders, and then the results are listed in 3 panels. The dummy variable of D^E=1 on expiration weeks. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 5%, 1% and 0.1%.

Table 11 Expiration effect tests of RBIs' predictability on 'marking the open': on expiration weeks

Panel A：Futures	Alpha	Beta	Gamma	R-square
FINI	0.0155	0.2359	0.0130	0.04
	(0.9128)	(0.4196)	(0.9365)	
Dealer	0.3511***	-0.4380*	-0.0440	0.39
	(0.0002)	(0.0159)	(0.7795)	
Top 10	0.3323	-0.4203	0.0537	0.07
	(0.1244)	(0.3335)	(0.7404)	
Top 5	0.2616	-0.2852	0.0608	0.05
	(0.1461)	(0.4417)	(0.7127)	

Panel B：Option Buyers	Alpha	Beta	Gamma	R-square
FINI	0.3478***	-0.4481***	0.0487	1.07
	(0.0000)	(0.0001)	(0.7356)	
Dealer	0.4011***	-0.5629***	0.0853	1.19
	(0.0000)	(0.0000)	(0.5595)	
Top 10	-0.1909	0.6200	-0.0066	0.15
	(0.3691)	(0.1308)	(0.9650)	
Top 5	-0.2182	0.6783	-0.0213	0.23
	(0.2475)	(0.0636)	(0.8872)	

Panel C：Option Sellers	Alpha	Beta	Gamma	R-square
FINI	-0.0946	0.4264***	-0.0126	0.94
	(0.1444)	(0.0002)	(0.9238)	
Dealer	-0.1287	0.4850***	-0.0175	1.06
	(0.0634)	(0.0001)	(0.8933)	
Top 10	0.6235***	-0.9579***	0.0543	0.79
	(0.0000)	(0.0005)	(0.7170)	
Top 5	0.5143***	-0.7535**	0.0488	0.54
	(0.0002)	(0.0041)	(0.7444)	

This table is the regression result using eq(8). The dependent variable is opening gap and the independent variable is the Relative Bear Index (RBI), i.e. Futures, Option Buyers and Option Sellers, of each type of traders, and then the results are listed in 3 panels. The dummy variable of D^E=1 on expiration weeks. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 5%, 1% and 0.1%.

Table 12 Expiration effect tests of RBIs' predictability on stock index return: on last five days

Panel A：Futures	Alpha	Beta	Gamma	R-square
FINI	0.6650***	-1.3552***	-0.1433	0.89
	(0.0004)	(0.0004)	(0.4185)	
Dealer	0.0583	-0.0612	-0.2220	0.12
	(0.6420)	(0.7989)	(0.1918)	
Top 10	0.8705**	-1.7193**	-0.1782	0.66
	(0.0022)	(0.0027)	(0.3080)	
Top 5	0.6076*	-1.2227*	-0.1625	0.48
	(0.0104)	(0.0124)	(0.3625)	
Panel B：Option Buyers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	0.1018	-0.1602	-0.1755	0.21
	(0.2054)	(0.2822)	(0.2633)	
Dealer	0.1584	-0.2783	-0.1614	0.29
	(0.0855)	(0.1141)	(0.3156)	
Top 10	-0.0644	0.1667	-0.1538	0.06
	(0.8183)	(0.7585)	(0.3500)	
Top 5	-0.1536	0.3424	-0.1591	0.08
	(0.5376)	(0.4797)	(0.3331)	
Panel C：Option Sellers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	-0.0691	0.1532	-0.0687	0.07
	(0.4210)	(0.3194)	(0.6362)	
Dealer	-0.1007	0.2130	-0.0782	0.11
	(0.2739)	(0.1967)	(0.5863)	
Top 10	0.6325**	-1.1784**	-0.1342	0.77
	(0.0010)	(0.0012)	(0.4082)	
Top 5	0.4994**	-0.9309**	-0.1310	0.56
	(0.0059)	(0.0074)	(0.4201)	

This table is the regression result using eq(8). The dependent variable is daily rate of return and the independent variable is the Relative Bear Index (RBI), i.e. Futures, Option Buyers and Option Sellers, of each type of traders, and then the results are listed in 3 panels. The dummy variable of D^E=1 on last 5 days. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 5%, 1% and 0.1%.

Table 13 Expiration effect tests of RBIs' predictability on 'marking the day': on last five days

Panel A：Futures	Alpha	Beta	Gamma	R-square
FINI	0.6500***	-1.5803***	-0.2021	2.18
	(0.0000)	(0.0000)	(0.1294)	
Dealer	-0.2913**	0.3822*	-0.2328	0.46
	(0.0021)	(0.0354)	(0.0703)	
Top 10	0.5411*	-1.2936**	-0.2592	0.85
	(0.0120)	(0.0028)	(0.0501)	
Top 5	0.3473	-0.9286*	-0.2484	0.67
	(0.0528)	(0.0121)	(0.0658)	
Panel B：Option Buyers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	-0.2461***	0.2997**	-0.2557*	0.62
	(0.0001)	(0.0078)	(0.0311)	
Dealer	-0.2426***	0.2943*	-0.2569*	0.49
	(0.0005)	(0.0272)	(0.0348)	
Top 10	0.1232	-0.4405	-0.1765	0.24
	(0.5615)	(0.2831)	(0.1561)	
Top 5	0.0604	-0.3207	-0.1754	0.21
	(0.7488)	(0.3815)	(0.1587)	
Panel C：Option Sellers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	0.0248	-0.2670*	-0.0809	0.48
	(0.7030)	(0.0217)	(0.4610)	
Dealer	0.0277	-0.2698*	-0.0735	0.43
	(0.6907)	(0.0306)	(0.4985)	
Top 10	0.0080	-0.2058	-0.2213	0.27
	(0.9561)	(0.4566)	(0.0725)	
Top 5	-0.0170	-0.1604	-0.2148	0.25
	(0.9015)	(0.5425)	(0.0813)	

This table is the regression result using eq(8). The dependent variable is daily bar and the independent variable is the Relative Bear Index (RBI), i.e. Futures, Option Buyers and Option Sellers, of each type of traders, and then the results are listed in 3 panels. The dummy variable of D^E=1 on last 5 days. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 5%, 1% and 0.1%.

Table 14 Expiration effect tests of RBIs' predictability on 'marking the open': on last five days

Panel A：Futures	Alpha	Beta	Gamma	R-square
FINI	0.0150	0.2251	0.0588	0.06
	(0.9159)	(0.4418)	(0.6627)	
Dealer	0.3496***	-0.4434*	0.0108	0.039
	(0.0002)	(0.0148)	(0.9333)	
Top 10	0.3294	-0.4257	0.0809	0.08
	(0.1277)	(0.3274)	(0.5425)	
Top 5	0.2603	-0.2940	0.0859	0.06
	(0.1480)	(0.4281)	(0.5261)	
Panel B：Option Buyers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	0.3480***	-0.4599***	0.0802	1.09
	(0.0000)	(0.0000)	(0.4981)	
Dealer	0.4010***	-0.5726***	0.0955	1.20
	(0.0000)	(0.0000)	(0.4310)	
Top 10	-0.1876	0.6072	0.0228	0.15
	(0.3773)	(0.1395)	(0.8551)	
Top 5	-0.2139	0.6631	0.0162	0.23
	(0.2569)	(0.0708)	(0.8963)	
Panel C：Option Sellers	**Alpha**	**Beta**	**Gamma**	**R-square**
FINI	-0.0939	0.4202***	0.0122	0.94
	(0.1476)	(0.0003)	(0.9113)	
Dealer	-0.1284	0.4829***	-0.0047	1.06
	(0.0645)	(0.0001)	(0.9655)	
Top 10	0.6245***	-0.9726***	0.0871	0.81
	(0.0000)	(0.0004)	(0.4788)	
Top 5	0.5164***	-0.7705**	0.0838	0.56
	(0.0002)	(0.0035)	(0.4958)	

This table is the regression result using eq(8). The dependent variable is opening gap and the independent variable is the Relative Bear Index (RBI), i.e. Futures, Option Buyers and Option Sellers, of each type of traders, and then the results are listed in 3 panels. The dummy variable of D^E=1 on last 5 days. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 5%, 1% and 0.1%.

Table 15 Manipulation segment detection: RBI of futures with threshold value of 0.05

Daily Return	Alpha	Beta	Gamma	Delta	R-square	Daily Bar	Alpha	Beta	Gamma	Delta	R-square	Opening Gap	Alpha	Beta	Gamma	Delta	R-square
FINI	1.9006*	-3.8907*	2.6216	-1.2831	0.96	**FINI**	0.8909	-2.1539	0.5893	-0.2548	2.07	**FINI**	1.0097	-1.7368	2.0323	-1.0284	0.16
	(0.0588)	(0.0536)	(0.2018)	(0.2098)			(0.2391)	(0.1556)	(0.7030)	(0.7408)			(0.1869)	(0.2572)	(0.1934)	(0.1865)	
Dealer	-0.2351	0.5698	-0.6646	0.2709	0.05	**Dealer**	-0.5283	0.8515	-0.5045	0.2215	0.26	**Dealer**	0.2933	-0.2817	-0.1601	0.0494	0.40
	(0.8580)	(0.8293)	(0.8023)	(0.8373)			(0.5948)	(0.6701)	(0.8015)	(0.8243)			(0.7678)	(0.8879)	(0.9364)	(0.9605)	
Top 10	1.0850	-2.2254	0.5714	-0.2489	0.62	**Top 10**	0.4644	-1.2193	-0.0925	0.0666	0.61	**Top 10**	0.6206	-1.0061	0.6638	-0.3155	0.08
	(0.2218)	(0.2118)	(0.7614)	(0.7906)			(0.4897)	(0.3661)	(0.9483)	(0.9252)			(0.3577)	(0.4574)	(0.6425)	(0.6578)	
Top 5	0.7446	-1.6144	0.5135	-0.1805	0.49	**Top 5**	0.3537	-1.0477	0.1580	-0.0328	0.49	**Top 5**	0.3908	-0.5667	0.3555	-0.1477	0.06
	(0.4302)	(0.3924)	(0.7931)	(0.8532)			(0.6206)	(0.4634)	(0.9151)	(0.9646)			(0.5856)	(0.6926)	(0.8110)	(0.8420)	

This table is the result of regression using eq(10). The dependent variable is Daily rate of return, Daily Bar and Opening Gap respectively. The independent variables are RBIs and its dummy variable with threshold value of 0.05. There are 3 kinds of RBIs: futures, option Buyers and option sellers. The RBI in this table is futures one. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 10%, 5% and 1%.

Table 16 Manipulation segment detection: RBI of option buyers with threshold value of 0.05

Daily Return	Alpha	Beta	Gamma	Delta	R-square	Daily Bar	Alpha	Beta	Gamma	Delta	R-square	Opening Gap	Alpha	Beta	Gamma	Delta	R-square
FINI	-1.0766	2.1596	-2.3636	1.1799	0.15	FINI	-2.1295	4.0644	-3.8292	1.8829	0.42	FINI	1.0529	-1.9048	1.4657	-0.7030	1.08
	(0.6098)	(0.6068)	(0.5735)	(0.5762)			(0.1819)	(0.2003)	(0.2279)	(0.2382)			(0.5081)	(0.5473)	(0.6435)	(0.6588)	
Dealer	-2.9573*	5.9420*	-6.2779*	3.1262*	0.44	Dealer	-1.9391	3.6634	-3.4451	1.7037	0.31	Dealer	-1.0182	2.2786	-2.8328	1.4225	1.24
	(0.0886)	(0.0881)	(0.0719)	(0.0723)			(0.1405)	(0.1650)	(0.1922)	(0.1960)			(0.4372)	(0.3860)	(0.2817)	(0.2784)	
Top 10	-1.1056	2.2232	-2.2847	1.1202	0.12	Top 10	-1.3169*	2.3420*	-3.1697**	1.6322**	0.43	Top 10	0.2112	-0.1188	0.8850	-0.5120	0.0025
	(0.2308)	(0.2215)	(0.2305)	(0.2491)			(0.0591)	(0.0885)	(0.0278)	(0.0264)			(0.7624)	(0.9312)	(0.5396)	(0.4866)	
Top 5	-1.7760*	3.5507*	-3.4945*	1.7383*	0.24	Top 5	-1.2146*	2.1793	-2.7579*	1.3815*	0.32	Top 5	-0.5614	1.3714	-0.7366	0.3568	0.25
	(0.0599)	(0.0575)	(0.0709)	(0.0763)			(0.0890)	(0.1234)	(0.0596)	(0.0627)			(0.4323)	(0.3328)	(0.6152)	(0.6310)	

This table is the result of regression using eq(10). The dependent variable is Daily rate of return, Daily Bar and Opening Gap respectively. The independent variables are RBIs and its dummy variable with threshold value of 0.05. There are 3 kinds of RBIs: futures, option Buyers and option sellers. The RBI in this table is option buyers one. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 10%, 5% and 1%.

Table 17 Manipulation segment detection: RBI of option sellers with threshold value of 0.05

Daily Return	Alpha	Beta	Gamma	Delta	R-square	Daily Bar	Alpha	Beta	Gamma	Delta	R-square	Opening Gap	Alpha	Beta	Gamma	Delta	R-square
FINI	0.1105	-0.0807	0.2166	-0.1860	0.08	FINI	-0.2423	0.3845	-0.6737	0.2622	0.48	FINI	0.3527	-0.4652	0.8904	-0.4482	0.94
	(0.9594)	(0.9852)	(0.9604)	(0.9317)			(0.8824)	(0.9070)	(0.8379)	(0.8730)			(0.8293)	(0.8875)	(0.7866)	(0.7843)	
Dealer	0.7530	-1.3719	1.5671	-0.8638	0.14	Dealer	0.4138	-0.9083	0.6208	-0.3964	0.47	Dealer	0.3392	-0.4636	0.9463	-0.4675	0.0107
	(0.6782)	(0.7052)	(0.6659)	(0.6345)			(0.7629)	(0.7403)	(0.8209)	(0.7729)			(0.8043)	(0.8654)	(0.7296)	(0.7331)	
Top 10	0.2175	-0.2978	-0.8856	0.3760	0.79	Top 10	-0.1878	0.1593	-0.4194	0.1897	0.07	Top 10	0.4053	-0.4571	-0.4662	0.1862	0.83
	(0.8375)	(0.8886)	(0.6816)	(0.7277)			(0.8156)	(0.9214)	(0.7982)	(0.8171)			(0.6139)	(0.7766)	(0.7756)	(0.8199)	
Top 5	0.6964	-1.2433	0.3333	-0.2552	0.61	Top 5	0.6570	-1.5310	1.3566	-0.7028	0.11	Top 5	0.0394	0.2878	-1.0233	0.4476	0.63
	(0.5075)	(0.5555)	(0.8761)	(0.8112)			(0.4101)	(0.3388)	(0.4031)	(0.3860)			(0.9605)	(0.8571)	(0.5276)	(0.5802)	

This table is the result of regression using eq(10). The dependent variable is Daily rate of return, Daily Bar and Opening Gap respectively. The independent variables are RBIs and its dummy variable with threshold value of 0.05. There are 3 kinds of RBIs: futures, option Buyers and option sellers. The RBI in this table is option sellers one. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 10%, 5% and 1%.

Table 18 Manipulation segment detection: RBI of futures with threshold value of 0.1

Daily Return	Alpha	Beta	Gamma	Delta	R^2	Daily Bar	Alpha	Beta	Gamma	Delta	R^2	Opening Gap	Alpha	Beta	Gamma	Delta	R^2
FINI	1.0587***	-2.1475***	0.8650	-0.4856	0.95	**FINI**	0.4396	-1.1770**	-0.7677	0.2999	2.17	**FINI**	0.6191**	-0.9705	1.6328**	-0.7855**	0.39
	(0.0080)	(0.0071)	(0.3537)	(0.2831)			(0.1431)	(0.0497)	(0.2740)	(0.3783)			(0.0412)	(0.1090)	(0.0213)	(0.0224)	
Dealer	-0.4538	0.9959	-1.1526	0.5032	0.16	**Dealer**	-0.7953**	1.4000*	-1.1148	0.5038	0.44	**Dealer**	0.3415	-0.4041	-0.0378	-0.0007	0.40
	(0.3373)	(0.2947)	(0.2406)	(0.3063)			(0.0262)	(0.0515)	(0.1333)	(0.1755)			(0.3401)	(0.5743)	(0.9595)	(0.9986)	
Top 10	1.1080***	-2.2636***	1.4887	-0.6082	0.76	**Top 10**	0.7521***	-1.7711***	1.1613	-0.6108	0.72	**Top 10**	0.3559	-0.4925	0.3274	0.0026	0.26
	(0.0022)	(0.0019)	(0.2073)	(0.2991)			(0.0061)	(0.0013)	(0.1939)	(0.1685)			(0.1956)	(0.3732)	(0.7150)	(0.9953)	
Top 5	1.0960***	-2.2652***	2.1771**	-0.9659**	0.72	**Top 5**	0.4937*	-1.3038**	0.8835	-0.3473	0.57	**Top 5**	0.6024**	-0.9613*	1.2936*	-0.6185*	0.22
	(0.0024)	(0.0019)	(0.0354)	(0.0468)			(0.0705)	(0.0181)	(0.2595)	(0.3451)			(0.0278)	(0.0820)	(0.0997)	(0.0937)	

This table is the result of regression using eq(10). The dependent variable is Daily rate of return, Daily Bar and Opening Gap respectively. The independent variables are RBIs and its dummy variable with threshold value of 0.1. There are 3 kinds of RBIs: futures, option Buyers and option sellers. The RBI in this table is futures one. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 10%, 5% and 1%.

Table 19 Manipulation segment detection: RBI of option buyers with threshold value of 0.1

Daily Return	Alpha	Beta	Gamma	Delta	R-square	Daily Bar	Alpha	Beta	Gamma	Delta	R-square	Opening Gap	Alpha	Beta	Gamma	Delta	R-square
FINI	-0.2012	0.4189	-0.6270	0.3066	0.14	**FINI**	-0.8014	1.4919	-1.2653	0.5465	0.50	**FINI**	0.6002	-1.0729	0.6383	-0.2400	1.16
	(0.7670)	(0.7591)	(0.6481)	(0.6540)			(0.1184)	(0.1486)	(0.2231)	(0.2904)			(0.2410)	(0.2977)	(0.5378)	(0.6417)	
Dealer	0.0775	-0.1635	-0.1607	0.0882	0.23	**Dealer**	-0.6793	1.0817	-0.8737	0.4590	0.28	**Dealer**	0.7568*	-1.2452	0.7129	-0.3708	1.21
	(0.8944)	(0.8896)	(0.8926)	(0.8816)			(0.1245)	(0.2252)	(0.3324)	(0.3057)			(0.0859)	(0.1611)	(0.4272)	(0.4061)	
Top 10	-0.2401	0.4762	-0.6387	0.3209	0.03	**Top 10**	0.1548	-0.5552	0.0192	0.0288	0.12	**Top 10**	-0.3949	1.0314	-0.6579	0.2920	0.22
	(0.5786)	(0.5700)	(0.5604)	(0.5811)			(0.6361)	(0.3816)	(0.9816)	(0.9478)			(0.2277)	(0.1043)	(0.4282)	(0.5072)	
Top 5	0.0259	-0.0093	0.4713	-0.3469	0.11	**Top 5**	-0.0109	-0.2202	-0.2791	0.1357	0.09	**Top 5**	0.0368	0.2109	0.7504	-0.4826	0.40
	(0.9507)	(0.9909)	(0.6399)	(0.5115)			(0.9726)	(0.7213)	(0.7144)	(0.7345)			(0.9076)	(0.7325)	(0.3250)	(0.2275)	

This table is the result of regression using eq(10). The dependent variable is Daily rate of return, Daily Bar and Opening Gap respectively. The independent variables are RBIs and its dummy variable with threshold value of 0.1. There are 3 kinds of RBIs: futures, option Buyers and option sellers. The RBI in this table is option buyers one. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 10%, 5% and 1%.

Table 20 Manipulation segment detection: RBI of option sellers with threshold value of 0.1

Daily Return	Alpha	Beta	Gamma	Delta	R-square	Daily Bar	Alpha	Beta	Gamma	Delta	R-square	Opening Gap	Alpha	Beta	Gamma	Delta	R-square
FINI	-0.7699	1.4862	-1.3714	0.7176	0.12	**FINI**	-0.5609	0.8797	-1.1846	0.5950	0.53	**FINI**	-0.2090	0.6065	-0.1868	0.1226	0.95
	(0.2728)	(0.2829)	(0.3245)	(0.3106)			(0.2903)	(0.4001)	(0.2600)	(0.2658)			(0.6931)	(0.5614)	(0.8588)	(0.8184)	
Dealer	-0.8999	1.6294	-1.4838	0.8518	0.29	**Dealer**	-0.2240	0.2070	-0.5111	0.2621	0.42	**Dealer**	-0.6760	1.4225	-0.9728	0.5897	1.29
	(0.1548)	(0.1959)	(0.2426)	(0.1831)			(0.6397)	(0.8281)	(0.5947)	(0.5882)			(0.1564)	(0.1343)	(0.3096)	(0.2216)	
Top 10	0.4739	-0.8741	-0.3753	0.1659	0.75	**Top 10**	-0.1891	0.1527	-0.4894	0.2310	0.10	**Top 10**	0.6630**	-1.0268	0.1141	-0.0651	0.78
	(0.2545)	(0.2965)	(0.6921)	(0.7365)			(0.5493)	(0.8102)	(0.4966)	(0.5374)			(0.0355)	(0.1056)	(0.8737)	(0.8617)	
Top 5	-0.2362	0.6103	-1.7447*	0.7595	0.90	**Top 5**	-0.5748*	0.9609	-1.3626*	0.6277*	0.36	**Top 5**	0.3385	-0.3506	-0.3822	0.1318	0.62
	(0.5643)	(0.4604)	(0.0577)	(0.1074)			(0.0648)	(0.1259)	(0.0509)	(0.0796)			(0.2765)	(0.5764)	(0.5837)	(0.7127)	

This table is the result of regression using eq(10). The dependent variable is Daily rate of return, Daily Bar and Opening Gap respectively. The independent variables are RBIs and its dummy variable with threshold value of 0.1. There are 3 kinds of RBIs: futures, option Buyers and option sellers. The RBI in this table is option sellers one. The numbers are estimated coefficients with p-values in parentheses and R-square values in percentage. *, ** and *** represents significance of 10%, 5% and 1%.

Table 21 Paper profit and loss of our daily deploy strategy betting on rational speculators

Threshold	0.025					0.05					0.1				
Futures	**Winning Rate**	**Odds**	**Max Loss**	**Deploy Days**	**Winner**	**Winning Rate**	**Odds**	**Max Loss**	**Deploy Days**	**Winner**	**Winning Rate**	**Odds**	**Max Loss**	**Deploy Days**	**Winner**
FINI	0.5229	2.1511	-2080	874	1.1248	0.5266	2.1585	-980	659	1.1366	0.5281	2.3371	-980	267	1.2342
Dealer	0.4749	1.9711	-25330	1015	0.9360	0.4759	1.9491	-25770	870	0.9275	0.4852	1.9687	-13570	610	0.9553
Top 10	0.5287	2.1777	-2680	836	1.1514	0.5404	2.1963	-3210	557	1.1869	0.5179	2.1804	-3190	112	1.1291
Top 5	0.5186	2.1154	-2870	885	1.0971	0.5299	2.1544	-2110	636	1.1416	0.5169	2.2207	-2650	207	1.1479
Option Buyers	**Winning Rate**	**Odds**	**Max Loss**	**Deploy Days**	**Winner**	**Winning Rate**	**Odds**	**Max Loss**	**Deploy Days**	**Winner**	**Winning Rate**	**Odds**	**Max Loss**	**Deploy Days**	**Winner**
FINI	0.4858	1.9881	-13400	1089	0.9657	0.4870	2.0029	-10400	1037	0.9754	0.4896	2.0167	-6680	911	0.9873
Dealer	0.4859	1.9746	-16870	1062	0.9594	0.4903	1.9724	-13190	983	0.9671	0.4863	2.0115	-7940	802	0.9782
Top 10	0.5024	1.9833	-3390	828	0.9964	0.5086	2.1289	-2080	523	1.0828	0.5093	2.0058	-1640	161	1.0216
Top 5	0.4905	2.0122	-4260	844	0.9870	0.5122	2.0619	-1640	576	1.0560	0.5025	2.1065	-980	197	1.0586
Option Sellers	**Winning Rate**	**Odds**	**Max Loss**	**Deploy Days**	**Winner**	**Winning Rate**	**Odds**	**Max Loss**	**Deploy Days**	**Winner**	**Winning Rate**	**Odds**	**Max Loss**	**Deploy Days**	**Winner**
FINI	0.5082	1.9581	-7830	1098	0.9951	0.5095	1.9626	-6600	1050	1.0000	0.5146	1.9552	-7670	925	1.0061
Dealer	0.5188	1.9493	-7180	1093	1.0112	0.5192	1.9429	-8600	1017	1.0087	0.5229	1.9612	-8290	872	1.0256
Top 10	0.5028	2.0861	-3990	907	1.0488	0.5058	2.0956	-2340	694	1.0599	0.5385	2.0850	-130	351	1.1227
Top 5	0.5021	2.0528	-3060	944	1.0307	0.5067	2.0645	-3390	744	1.0461	0.5424	2.0997	-850	389	1.1389

This table is the result of daily deploy strategy betting on rational speculators, e.g. FINIs, Dealers, Top 10 and Top 5 larger traders, by the bear/bull signal of their RBIs of Futures, Option Buyers or Option Sellers. The signal comes from whether the RBI crosses over the threshold, then be used as the reference to buy/sell 1000 shares of Taiwan Top 50 ETF after the market opens without overreaction and hold until the market closes. The backtesting period is from 2007/07/02 to 2013/08/30, in total of 1537 days. The winning rate is the ratio of profitable days to total days, good if it is larger than 0.5. Odds is adopted as European style, good if it is larger than 2. Max loss is the maximum of accumulated loss, a reference for capital management. Deploy Days is the number of trading days. 'Winner' or not depends on whether it is larger than 1.

Table 22 Relative volatility indices and next-day volatility of stock index: Daily volatility of Garman and Klass (1980) and True range

Panel A: Futures					
Alpha	**FINI**	**Dealer**	**Top 10**	**Top 5**	**R-square**
10.0550***	14.7925***				6.71
(0.0000)	(0.0000)				
10.7040***		6.3235***			2.49
(0.0000)		(0.0000)			
11.0336***			11.5444***		1.30
(0.0000)			(0.0000)		
10.6312***				12.6989***	2.30
(0.0000)				(0.0000)	
Panel B：Option Buyers					
Alpha	**FINI**	**Dealer**	**Top 10**	**Top 5**	**R-square**
8.5318***	8.4534***				8.38
(0.0000)	(0.0000)				
10.1008***		5.9581***			3.46
(0.0000)		(0.0000)			
11.6530***			5.4955*		0.42
(0.0000)			(0.0113)		
11.6402***				5.0855**	0.45
(0.0000)				(0.0085)	

Panel A: Futures					
Alpha	**FINI**	**Dealer**	**Top 10**	**Top 5**	**R-square**
1.3319***	2.2098***				6.90
(0.0000)	(0.0000)				
1.4824***		0.7275***			1.52
(0.0000)		(0.0000)			
1.5277***			1.2591***		0.71
(0.0000)			(0.0009)		
1.4752***				1.4517***	1.39
(0.0000)				(0.0000)	
Panel B：Option Buyers					
Alpha	**FINI**	**Dealer**	**Top 10**	**Top 5**	**R-square**
1.1376***	1.1876***				7.61
(0.0000)	(0.0000)				
1.3847***		0.7636***			2.61
(0.0000)		(0.0000)			
1.5340***			1.1501***		0.84
(0.0000)			(0.0003)		
1.5437***				0.9630***	0.74
(0.0000)				(0.0007)	

Table 22 Relative volatility indices and next-day volatility of stock index: Daily volatility of Garman and Klass (1980) and True range - continue

Panel C: Option Sellers						**Panel C: Option Sellers**					
Alpha	**FINI**	**Dealer**	**Top 10**	**Top 5**	**R-square**	**Alpha**	**FINI**	**Dealer**	**Top 10**	**Top 5**	**R-square**
9.5439***	6.2200***				4.26	1.2944***	0.8404***				3.58
(0.0000)	(0.0000)					(0.0000)	(0.0000)				
9.7635***		6.1582***			4.00	1.3205***		0.8408***			3.43
(0.0000)		(0.0000)				(0.0000)		(0.0000)			
9.7194***			15.7543***		7.67	1.2475***			2.5653***		9.37
(0.0000)			(0.0000)			(0.0000)			(0.0000)		
10.1432***				12.2952***	4.72	1.3103***				2.0382***	5.98
(0.0000)				(0.0000)		(0.0000)				(0.0000)	

This table is the result of regression using eq(15) with two dependent variables on each side, the left is daily volatility estimated with Garman and Klass (1980) and the right is true range estimated with eq(13). The independent variables are rational speculators'' relative volatility indices(RVI), transformed from relative bear indices(RBI), estimated from open interest of futures, option buyers and option sellers and the result is showed in panel A, B and C in turn. The numbers in each panel are estimated coefficients and their individual p-value in parenthesis. The last column is R-square value in percentage. *, ** and *** represents significance of 5%, 1%, and 0.1%.