Do Superstitious Traders Lose Money?

Utpal Bhattacharya
Department of Finance
Hong Kong University of Science and Technology
Clear Water Bay, Kowloon
Hong Kong
ubhattac@ust.hk

Wei-Yu Kuo
Department of International Business and Risk and Insurance Research Center
National Chengchi University
Taipei City
Taiwan
wkuo@nccu.edu.tw

Tse-Chun Lin
Faculty of Business and Economics
University of Hong Kong
Pok Fu Lam Road
Hong Kong
tsechunlin@hku.hk

Jing Zhao
Faculty of Business and Economics
University of Hong Kong
Pok Fu Lam Road
Hong Kong
zhj8834@hku.hk

This version: October 2014

Keywords: superstition, cognitive abilities, limit order clustering, investment performance, individual investors

JEL Classifications: D14, G02, G14, G15

We thank the Taiwan Futures Exchange for providing the data. Tse-Chun Lin gratefully acknowledges the research support from the Faculty of Business and Economics, the University of Hong Kong and the Research Grants Council of the Hong Kong SAR government. We also thank Darwin Choi, Mark Grinblatt, Craig Holden, Stacey Jacobsen, and Noah Stoffman for their comments. Any remaining errors are ours.

Do Superstitious Traders Lose Money?

Abstract

Superstition, which is defined as a belief that is not based on reason, has been a part of the human condition since humans began. But does superstition adversely affect human welfare? We answer this question in the context of trading in the Taiwan Futures Exchange, where we exploit the Chinese superstition that the number "8" is lucky and the number "4" is unlucky. Defining a "superstition index" of a trader as the proportion of limit order submissions at prices ending at "8" minus the proportion of limit order submissions at prices ending at "4," we find that individual investors are superstitious but institutional investors are not. Further, amongst individual investors, there is a negative correlation between trading profits and the superstition index. We find that these losses arise from poor trades at nearly all price points for a superstitious trader, not just at "8" and "4," suggesting that superstition may be a symptom of a general cognitive disability in making financial decisions. Nevertheless, superstition does decrease as agents learn from trading.

Superstition, which is defined as a belief that is not based on reason, has been a part of the human condition since humans began. [1] Michael Jordan, arguably the greatest basketball player of all time, wore his University of North Carolina shorts under his uniform every time he led the Chicago Bulls to their six NBA championships.[2] The European governing body of Formula 1 auto racing, which is based in Paris and Geneva, bans the number "13" in its entry list for cars.[3] India's Independence Day falls a day after Pakistan's because astrologers in India insisted that August 14, 1947, was an inauspicious day to become independent.[4] The Games of the XXIX Summer Olympics opened in Beijing on August 8, 2008, at 8:08 p.m. because the number "8" is a lucky number in Chinese cultures. In contrast, Chinese culture considers the number "4" to be unlucky. For instance, some buildings in China have no fourth floor (Kramer and Block, 2008) and there is an unwritten rule in the Taiwan Navy that the digits of a naval vessel's number should not add up to four (Tsang, 2004).

It is surprising, considering how pervasive superstition is globally, that there is no academic research, as far as we know, on the effect of superstition on individual trading decisions and subsequent trading profits.[5] This paper is one such piece of research. Specifically, we investigate whether some investors carry their superstitious beliefs in numbers over to their trading, how this type of superstitious trading behavior is related to their investment performance, and, lastly,

[1] Miller and Taylor (2002) and Kramer and Block (2008) provide some theoretical underpinnings to explain the effect of superstitious beliefs on decision making.

[2] http://www.mensfitness.com/life/sports/10-most-superstitious-athletes

[3] https://joesaward.wordpress.com/2009/12/01/why-there-is-no-number-13-in-formula-1/

[4] http://mukto-mona.net/Articles/mehul/superstition_india271205.htm

[5] A growing literature, however, exists of the effect of superstition on other economic decisions, including decisions in financial markets. We discuss some of this literature in the next few pages.

whether learning by trading helps investors alleviate their numerical superstition. These are important research questions to answer because, as superstition is irrational, it is important to know whether this type of irrationality impairs the trading prowess of individuals.

We answer these questions by examining limit order submissions in the Taiwan Futures Exchange (TAIFEX). In the language of Mandarin (the official language in Taiwan), the pronunciation of the number "4" sounds like "death." The number "4" is thus viewed as inauspicious. On the contrary, the number "8" is considered auspicious as its pronunciation sounds like "good fortune." If Mandarin-speaking investors do have preference for the number "8" and dislike the number "4", their numerical superstition could be manifested in their decisions on limit order submission. Thus, we might observe disproportionately more limit orders submitted at prices ending with the number "8" and disproportionately less limit orders submitted at prices ending with the number "4". Therefore, we first construct a superstition index for each investor by calculating the difference between his limit order submission ratios with the prices ending at "8" and at "4." The higher the superstition index, the higher is the degree of number superstition for an investor.

Next, we investigate the effect of investor's numerical superstition on their investment performance. We do this by checking whether there is a correlation between the superstition index of an investor and his trading profits. Superstitious investors may lose money because their investment decisions are not based on reason. In this case, we would expect to find a negative association between the superstition index and investment performance. Alternatively, superstitious investors may not lose money if their superstitious beliefs in numbers, though interesting in their own right, is orthogonal to trading prowess.

Taking advantage of the account-level trades and quotes records of index futures in TAIFEX, we first show that individual investors are affected by the number superstition when submitting limit orders. The submission ratio at "8," calculated as the limit orders submitted at prices ending with "8" over all submitted limit orders, is 0.098.[6] This ratio is significantly higher than 0.063, the submission ratio at prices ending with "4." The difference in submission ratios at these two numbers is not evident for both domestic institutional investors and Qualified Foreign Institutional Investors (QFIIs). In particular, for domestic institutional investors, the submission ratio at "8" is 0.103, while the submission ratio at "4" is 0.100. The submission ratio at "8" ("4") of QFIIs is 0.097 (0.094). The results indicate that individual investors use heuristics that are based on numerical superstition when making investment decisions, whereas institutional investors, domestic or foreign, do not. We, therefore, focus our attention on the effect of superstition on the investment performance of individual investors.

After sorting individual investors into five groups based on their superstition indices in the current year, we find that more superstitious individual investors have significantly lower intraday, 1-day, and 5-day mark-to-market index returns of their limit orders in the subsequent year. In particular, the superstitious individuals within the top-quintile of the superstition index underperform their non-superstitious counterparts within the bottom-quintile of the superstition index by 1.6 basis points within a trading day. The underperformance deteriorates to 2.4 (6.3) basis points one (five) day(s) after the transactions. In addition, we find similar underperformance of superstitious individual investors for their market orders and round-trip trades. Specifically, the

[6] We find that the limit orders submission ratios at prices ending with "0" and "5" of individual investors are 0.249 and 0.148, respectively. This is consistent with the notion that individual investors' limit order tend to cluster at round numbers (Kuo, Lin, and Zhao, 2014).

underperformance of intraday market orders is 1.3 basis points, which is similar in magnitude as the underperformance of the intraday limit order returns.

Multivariate regressions confirm our findings from the univariate tests. We regress the performance of limit orders, market orders, and round-trip trades of each investor in the current year on their superstition indices in the previous year. We control for several known factors that might affect the investment performance, including the round-number submission ratio (Kuo, Lin, and Zhao, 2014), the number of limit orders submitted in the previous year, the disposition effect, and the past performance. The results show that the investment performance is significantly negatively associated with the numerical superstition of individual investors.

We also perform a placebo test where we construct a pseudo superstition index using the difference between submission ratios at "7" and "3." The numbers "7" and "3" are viewed as neither lucky nor unlucky in Chinese culture. We find that the pseudo superstition index is not correlated with investment performance, which lends further support to our main findings.

One explanation consistent with the negative relation between superstition and investment performance is that numerical superstition reveals an investor's cognitive disability in financial decision making. Individual investors with lower cognitive abilities tend to rely more on superstitious heuristics in numbers captured by our superstition index when making investment decisions. Given that the results hold after controlling for the limit order submission ratios at round numbers, also a cognitive ability measure in Kuo, Lin, and Zhao (2014), our superstition index reveals a different dimension of cognitive disability in making financial decisions. We refer to this as the indirect price of numerical superstition.

An alternative explanation which is also compatible with our findings is that investors pay a direct price for their superstition. In other words, investment losses incurred by superstitious

traders arise only from their trades with transaction prices ending with "8" – as this price may be distorted upwards (downwards) by higher than normal buys (sells) of individual investors at this price point – but not from their trades at transaction prices ending with other numbers.

The results show that the underperformance of superstitious individual investors, compared with their non-superstitious counterparts, exists not only for the limit orders submitted at prices ending with "8" but also for limit orders submitted at other price points. Superstitious investors underperform by 1.7, 1.4, 2.0, and 2.1 basis points for their limit orders submitted at prices ending with "8," "4," "0," and all other prices, respectively. Collectively, the results are more in line with the hypothesis that the poor investment performance of the superstitious individual investors is due to their low cognitive abilities. In other words, the numerical superstition may be a symptom of general cognitive disability in financial decision making.

Finally, since superstition can be a sign of general cognitive disability, investors might become less affected by the superstitious number heuristics when they learn from their past trading experience. [7] To test this learning-by-trading conjecture, we regress the difference of superstition index between two years on the number of limit orders submitted, mark-to-market limit order returns, and control variables in the previous year. We find that an individual investor's superstition index is negatively associated with past trading frequency and past investment performance, suggesting that superstition declines with trading experience.

Our paper contributes to the individual investor behavior literature in two dimensions. First, we show that individual investors tend to submit more (less) limit orders at prices ending with a

[7] The reduction of some behavioral biases associated with longer trading experience has been shown in many papers. See, for example, Feng and Seasholes (2005), Dhar and Zhu (2006), and Seru, Shumway and Hoffman (2010). Chiang, Hirshleifer, Qian and Sherman (2011) show that IPO investors learn from experience.

lucky (unlucky) number. In other words, the financial decision making of individual investors is guided by their numerical superstition. This is related to but distinct from existing studies documenting that stock prices or IPO listing codes cluster at lucky numbers (e.g., Brown and Mitchell (2008) and Hirshleifer, Jian, and Zhang (2012), respectively). Unlike transacted prices or IPO listing codes, limit orders at deliberately chosen prices are actively submitted by individual investors, and this can directly reveal their preference for certain numbers. Thus, we are able to construct an investor-level superstition index, which is reflected by their own actions. Second, this is the first paper documenting a negative association between superstition and investment performance. Most importantly, we show that superstitious investors underperform at both limit orders and market orders at all price points, suggesting that the numerical superstition constitutes a separate dimension of an investor's cognitive disability in making financial decisions.

The rest of the paper proceeds as follows. Section I discusses the literature and hypothesis development. Section II describes our data sources and sample construction. The evidence for superstition and its association with investment performance are presented in Sections III and IV, respectively. We further investigate the returns of limit orders submitted at various prices in Section V. Section VI analyzes whether superstition can be mitigated by trading experience. We conclude in Section VII.

I. Hypotheses Development from the Literature

A. Limit Orders Submitted at Prices Ending with Lucky and Unlucky Numbers

The psychology literature has shown that superstitious beliefs affect individuals' optimism in everyday life (e.g., Darke and Freedman, 1997). Using cognitive priming experiments, Jiang, Cho, and Adaval (2009) find that Asian individuals who are exposed to lucky numbers give higher

estimates of their chances of winning a lottery, are more willing to participate in a lottery or a risky promotional game, and express greater willingness to make risky financial investments. The recent research on real estate prices also show that housing prices are inflated when the floor number or the number in the address is a lucky one.[8]

In the context of financial markets, there is limited evidence that financial decisions are also affected by superstitious beliefs. Hirshleifer, Jian, and Zhang (2012) find that the newly-listed Chinese firms are more likely to have lucky numbers in their listing codes. The firms with lucky listing codes are traded at a premium. Brown, Chua, and Mitchell (2002) and Brown and Mitchell (2008) show that the daily opening and closing prices cluster at the number "8" in Asian Pacific and Chinese stock markets. However, both IPO listing codes and transacted prices do not directly reflect the number preference of individual investors as the list codes or prices are not determined by them.

Investors certainly determine at which price they should submit limit orders. The question is which digit of the four digit TAIFEX index are investors most likely to focus on when they determine the price at which to submit their limit order. Though the price of index futures in TAIFEX ranges from 4,011 to 9,934 during our sample period, the average daily standard deviation is only around 26 index points. This means that in nearly all days in our sample period, only the last two digits of the four digit index moves. Further, since a tick size is one index point, and since an investor can only see the five best asks and bids in the limit order book, the effect of superstitious beliefs are most likely to appear in the last digit of the four digit index. Therefore, if individual investors take lucky/unlucky numbers into account when submitting limit orders, it

[8] See, for example, Agarwal, He, Liu, Png, Sing, and Wong (2014), Shum, Sun, and Ye (2014), and Fortin, Hill, and Huang (2014).

would lead to a disproportionately large (small) volume of limit orders submitted at prices ending with lucky (unlucky) numbers. This gives us our first hypothesis:

Hypothesis 1: Individual investors submit a disproportionately large volume of limit orders at prices ending with "8," and submit a disproportionately small volume of limit orders at prices ending at "4." Moreover, institutional investors, particularly QFII, are not subject to this numerical superstition.

Domestic institutional investors may be less affected by the numerical superstition if their limit order submissions are more based on their rational and professional analyses. For the foreign institutional investors, as the numerical superstition originates from the Mandarin language, this superstition should be even more irrelevant to their financial decision making.[9] We thus expect limit order submissions to be more uniform for institutional investors.

B. Superstition and Investment Performance

Following the logic of Hypothesis 1, we construct a superstition index for each investor defined as the difference between his/her limit order submission ratios with the prices ending with "8" and at "4." The higher the index, the higher the degree of number superstition of an investor. If superstitious investors suffer from poor investment performance because their investment decisions tend to be based more on irrational foundations and less on information, the correlation between the superstition index and investment performance should be negative. This gives us our second hypothesis:

Hypothesis 2: The superstition index of an individual investor, defined as the proportion of limit order submissions at prices ending with "8" minus the proportion of limit order submissions

[9] Note that the institutional investors from China, who may be subject to the same numerical superstition, were not allowed to trade in the Taiwanese financial markets during our sample period.

at prices ending with "4," is negatively associated with investors' subsequent investment performance.

C. Direct or Indirect Price of Superstition

There are two potential explanations consistent with the negative association between the superstition index and investment performance. The first explanation is that superstition in numbers can be viewed as a reflection of cognitive disability in making financial decisions. When facing complicated situations without much relevant information or skills, people with lower cognitive ability might rely on certain heuristics to make decisions, such as using (avoiding) lucky (unlucky) numbers. If this is the case, the superstitious investors would underperform the rational investors. Such underperformance can be manifested by their limit orders submitted at prices ending with lucky numbers, unlucky numbers, other numbers, and market orders. We dub this the "indirect price" of superstition. From this perspective, our paper is also related to a stream of papers documenting that an investor's IQ is associated with his stock market participation, investment performance, and mutual fund choice (Grinblatt, Keloharju, and Linnainmaa, 2011; Grinblatt, Keloharju, and Linnainmaa, 2012; Grinblatt, Keloharju, Ikäheimo, and Knüpfer, 2014).

The second explanation is that prices may be distorted upwards (downwards) by higher than normal buys (sells) of individual investors at price point "8. Individual investors may know this, and may be willing to bear losses at "8" for an emotional gain of trading at "8", or be compensated by profits at other price points. Individual investors also may not know this. Whatever the reason, individual investors do worse when trading at prices ending at "8". [10] We dub this the "direct price" of superstition. This explanation is in the same spirit of the studies

[10] Using the same logic, individual investors do better if they trade at prices ending at "4". But since most of them do not trade at prices ending at "4", this reason cannot explain their actual losses.

showing that housing prices are higher (lower) when the floor number or the number in the address is lucky (unlucky), e.g., Agarwal, He, Liu, Png, Sing, and Wong (2014). It is also in the same spirit as in Bhattacharya, Holden and Jacobsen (2012), who show that buying (selling) by liquidity demanders below (above) round numbers yield losses approaching $1 billion per year in the U.S. This gives us a pair of mutually exclusive third hypotheses:

Hypothesis 3.A (Indirect price of superstition): Superstition in numbers is a reflection of cognitive disability in making financial decisions. The negative association between superstition index and investment performance can be found for limit orders submitted at prices ending with lucky numbers, unlucky numbers, other numbers, and market orders among superstitious investors.

Hypothesis 3.B (Direct price of superstition): Superstitious traders underperform their non-superstitious counterparts only for their limit orders submitted at prices ending with the number "8." There is no performance differentiation for limit orders submitted at other prices and market orders.

D. Learning by Trading

The investor learning literature has shown that trading experience could have impact on investment decisions. If superstition is a sign of general cognitive disability, investors might become less affected by the superstitious number heuristics when they gain more trading experience. We thus examine how the past trading experience affects the limit order submission at the lucky and unlucky numbers. We get our fourth and final hypothesis:

Hypothesis 4: (Investor Learning): The difference in an investor's superstition index between two years is negatively associated with investor's trading experience in the previous year.

II. Data Description

A. The Taiwan Futures Exchange

TAIFEX employs an Electronic Trading System (ETS) to process orders submitted by market participants from 8:45 a.m. to 1:45 p.m. The two major types of product traded in TAIFEX include the Taiwan Stock Exchange Index Futures (hereafter TXF) and the Mini-Taiwan Stock Exchange Index Futures (hereafter MXF). The TXF is based on all listed stocks on the Taiwan Stock Exchange and the MXF is a mini version of the TXF with a quarter of the margin and payoff for the TXF. One index point increase in the transaction price yields a profit of 200 (50) TWD for one TXF (MXF) contract. Both types of index futures have five maturity months: the spot month, the next calendar month, and the next three quarterly months. Each type of index futures with a certain maturity month is traded as one unique product in TAIFEX. The tick size of both contracts is one index point.[11]

B. Submitted and Executed Limit Orders

We make use of the complete limit order submission and execution records in TAIFEX during the period from January 2003 to September 2008. The data contain detailed information about investor account identity and investor type (individual investors, domestic proprietary investors, or Qualified Foreign Institutional Investors (QFIIs)). We are thus able to examine the superstition behavior at the investor level and distinguish among different investor types.

Panel A of Table I shows that there are 108 million limit orders submitted by market participants during the sample period. Among these orders, 61.87% are from individual investors, 34.17% from domestic proprietary investors, and 3.96% from QFIIs. Panels B of Table I shows

[11] More institutional details for TAIFEX can be found in Liu, Tsai, Wang, and Zhu (2010), Li, Lin, Cheng, and Lai (2012), Kuo and Lin (2013), and Kuo, Lin, and Zhao (2014).

that there are 143 million limit order contracts transacted during our sample period.[12] Individual investors account for 73.20% of the transaction volume, while domestic institutional investors and QFIIs together account for the rest. Notice that one very important feature in the Taiwan index futures market is that individual investors, instead of institution investors, are the major market participants. This market, therefore, provides us with an ideal environment to study the numerical superstition in trading among individual investors. Its second advantage is that index futures, unlike stocks, is a single product with a single large and liquid market, and so we do not have to control for various cross-sectional firm-specific stock characteristics.

(INSERT TABLE I HERE)

When investigating the link between the numerical superstition and the investment performance, we require that investors submit at least ten limit orders in both of the two consecutive years to generate a meaningful estimate of the superstition index.[13] After applying this requirement, we obtained 125 million trades and 156,171 investor-year observations.

III. Limit Orders at Prices Ending with Lucky and Unlucky Numbers

A. Limit Order Submissions among Different Investor Types

To identify the numerical superstition, we focus on the last digit of limit order prices. For example, if the limit order price is 6,508, we characterize the order as submitted at a price ending with the lucky number "8." Similarly, the limit order with a price of 6,504 is treated as an order submitted at a price ending with the unlucky number "4." The same logic is applied to other

[12] Individual investors typically trade one or two contracts in one order, while institutional investors typically trade more contracts in one order. The overall execution ratio for submitted contracts is around 0.444.
[13] The same data filter is adopted in Kuo, Lin, and Zhao (2014).

numbers in the last digit. We then calculate the limit order submission ratios at prices ending with a number "X" for the individual investors, domestic institutional investors, and qualified foreign institutional investors (QFIIs):

$$SubRatio_X = \frac{Number\ of\ limit\ orders\ submitted\ at\ "X"}{Total\ number\ of\ submitted\ limit\ orders} \quad (1)$$

The submission ratio measures the proportion of limit orders submitted at prices ending with "X" (X is an integer ranging from 0 to 9). Theoretically, if investors trade index futures based on information or hedging needs, their limit orders should be equally likely to be submitted at prices ending with any integer ranging from 0 to 9. However, if investors are affected by the superstition heuristic, they would submit disproportionately more limit orders at prices ending with "8" (the lucky prices) and fewer limit orders at prices ending with "4" (the unlucky prices).[14]

The limit order submission ratio is plotted by the last one digit of the limit order prices in Figure 1 separately for individual investors, domestic institutions, and QFIIs. Figure 1.A. shows that individual investors indeed submit more limit orders at "8" than those at "4." The submission ratio is 0.098 at "8," which is much higher than the 0.063 at "4." The statistical significance of the difference in these two submission ratios will be presented in the regression analysis in the next sub-section. Figure 1.A. also shows that individual investors tend to submit more limit orders at round numbers "0" and "5." This is consistent with the limit order clustering at round number prices documented in Kuo, Lin, and Zhao (2014).

[14] In addition to the superstition for price, we also consider the superstition for date. We examine the proportion of limit orders submitted on each date of the month. The logic is that if investors prefer the number 8 over 4, they might submit more limit orders on the 8th of the month relative to the 4th of the month. However, we do not find supportive evidence for date superstition. Figure 1 in the Appendix shows that the submission ratio on the 8th of the month is not higher than that on the 4th of the month.

Figure 1.B. shows a fairly uniform distribution for domestic institutions. In particular, the submission ratio at "8" is 0.103, while the submission ratio at "4" is 0.100. A similarly flat pattern for QFIIs can be observed in Figure 1.C., where the submission ratios at "8" and "4" are 0.097 and 0.094, respectively.

B. Multivariate Regression Analyses

In this sub-section, we test the statistical significance of the numerical superstition through regressions. For each limit order, we are able to tell if it is submitted by an individual investor, a domestic institution, or a QFII, and if it is to trade the MXF or the TXF. For each year, order type, and investor type, we are able to calculate the proportion of limit orders submitted at "X," and then perform the following regression:

$$
\begin{aligned}
SubRatio_X - 0.1 &= \alpha + \beta_1 D_8 + \beta_2 D_4 + \beta_3 D_0 + \beta_4 D_5 + (\beta_5 D_8 + \beta_6 D_4 + \beta_7 D_0 + \beta_8 D_5) \times D_{indv} \\
&+ (\beta_9 D_8 + \beta_{10} D_4 + \beta_{11} D_0 + \beta_{12} D_5) \times D_{QFII} + (\beta_{13} D_8 + \beta_{14} D_4 + \beta_{15} D_0 + \beta_{16} D_5) \\
&\times D_{MXF} + (\beta_{17} D_8 + \beta_{18} D_4 + \beta_{19} D_0 + \beta_{20} D_5) \times D_{indv} \times D_{MXF} \\
&+ (\beta_{21} D_8 + \beta_{22} D_4 + \beta_{23} D_0 + \beta_{24} D_5) \times D_{QFII} \times D_{MXF} + \beta_{25} D_{indv} + \beta_{26} D_{QFII} \\
&+ \beta_{27} D_{MXF} + \varepsilon_X \qquad (2)
\end{aligned}
$$

The dependent variable is the deviation of the actual submission ratio at prices ending with "X" from its theoretical value assuming uniform distribution of the limit order prices for their last digit numbers. Each year, $SubRatio_X$ is calculated separately for individual investors, domestic institutions, and QFIIs, and for MXF and TXF orders. D_8, D_4, D_0, and D_5 are dummy variables for X=8, 4, 0, and 5, respectively. Controlling for the round numbers, 0 and 5, helps us to remove the round-number effect. D_{indv} and D_{QFII} are indicators for individual and QFII investors. D_{MXF} is equal to 1 if the order is to trade MXF, and 0 otherwise.

β_1, β_5, and β_9 measure the extent to which submission ratio is abnormal at prices ending at "8" for domestic institutions, individual investors, and QFIIs, respectively. Here "abnormal" means that it is different from the mean submission ratio at the six other price points, "1", "2", "3", "6", "7" and "9". Similarly, β_2, β_6, and β_{10} measure whether or not the submission ratio is abnormal at prices ending at "4" these three groups, respectively.

Model 2 of Table II provides supportive evidence that individual investors tend to submit more limit orders at "8" than at "4". The proportion of limit orders submitted at "8" is 0.020 higher than the proportion of limit orders submitted at prices ending with a number other than "4," "0," and "5." The submission ratios at "4" is 0.013 lower than the proportion of limit orders submitted at prices ending with a number other than "8," "0," and "5". The F-test shows that the difference between β_5 and β_6 is significant. For institutional investors, the submission ratios are not significantly higher or lower at "8" and "4." Model 5 of Table II shows that when we incorporate the triple-interaction terms, the insignificant coefficient β_{17} suggests that individual investors are affected by their superstitious beliefs when submitting both MXF and TXF orders at prices ending at "8". The significant and negative coefficient β_{18} suggests that in prices ending at "4" individual investors are affected by their superstitious beliefs more when submitting MXF than TXF.

In summary, individual investors exhibit a much more significant and economically meaningful superstition heuristic in lucky and unlucky numbers when submitting limit orders. Institutional investors, domestic or foreign, do not exhibit statistically discernible patterns in number superstition, and the magnitude is dwarfed by that of the individual investors.

(INSERT TABLE II HERE)

IV. Superstition and Investment Performance

In this section, we construct an investor-level superstition index to measure the extent to which an investor's number superstition is revealed by his limit order submission. We then examine the association between the superstition index and investment performance.

A. The Superstition Index

Each year, we calculate the superstition index for each investor as the following:

$$SI_{i,t} = \frac{Number\ of\ limit\ orders\ submitted\ at\ "8" - Number\ of\ limit\ orders\ submitted\ at\ "4"}{Total\ number\ of\ limit\ orders\ submitted\ by\ investor\ i} \quad (3)$$

To ensure a meaningful calculation of the superstition index, we require that an investor submits at least 10 limit orders in both years for two consecutive years. Table III presents the descriptive statistics of the superstition index. As superstitious traders prefer trading more at prices ending at "8" compared to prices ending at "4", we assume that the index for a non-superstitious trader is 0. Not surprisingly, Panel A shows that individual investors exhibit the highest degree of numerical superstition, with the mean and median being significantly higher than zero. Besides, the mean and median of superstition index appear to be persistent as well. In particular, the mean superstition index of individual investors slightly increases from 0.0365 in 2003 to 0.0493 in 2008. Further, the variation is large among these investors, with a high standard deviation around 0.09 in 2008. Domestic institutional investors seem to exhibit some degree of numerical superstition in general. On the contrary, the QFIIs do not show much favor (disfavor) in submitting limit orders at prices ending with "8" ("4").

(INSERT TABLE III HERE)

B. Superstition Index and Other Investor Traits

We now report correlations between the superstition index and other investor traits analyzed in the literature. Panel A of Table IV shows that the superstition index of an individual investor persists over time. The correlation between the past and current superstition index is 0.42. This implies that superstition is likely to be an investor's innate trait. Panel A also shows that investors who exhibit more disposition effect tend to be more affected by their superstitious beliefs in numbers, while superstition index has a very low correlation with trading frequency. Panels B and C of Table IV show that the superstition index is also persistent for domestic institutions and QFIIs, but with a smaller magnitude.

(INSERT TABLE IV HERE)

C. Superstition Index and Limit Order Returns—Quintile Analysis

We sort investors into quintiles by the superstition index in one year and look at their investment performance in the subsequent year. For the remainder of this paper, investors with higher (lower) superstition index are referred to as Q5 (Q1) investors. That is, Q5 (Q1) investors are viewed as more (less) superstitious. The performance metrics we use to measure investment performance are the limit order returns, market order returns, as well as the performance of the round-trip trades. As the average round-trip duration for index futures in TAIFEX is about two days, we look at the mark-to-market returns at the horizon of intraday, one day, and five days after transactions.

The first return metric we examine is the mark-to-market return of limit orders which initiates a long or short position.[15] Following Bhattacharya, Holden, and Jacobsen (2012), we calculate the intraday returns using the difference between the daily closing price and the initiated limit order's transaction price, divided by the transaction price. This calculation assumes that the initiated limit orders are covered (closed-out) at the closing price of the trading day. For each investor-year observation, we first calculate the average intraday returns, and then we average them with equal weights for all of the observations in each quintile. We also calculate 1-day and 5-day mark-to-market returns with closing prices at t+1 and t+5, respectively.

Table V presents the statistical tests between the investors with the top and the bottom quintiles of superstition index. The Q5 individual investors underperform their Q1 counterparts by 1.7 basis points within a trading day. The inferior performance of the Q5 investors continues to deteriorate, and the performance gap widens to 2.4 (6.3) basis points for the 1-day (5-day) mark-to-market returns. For domestic institutions and QFIIs, the differences in investment performance between the Q5 and Q1 investors are not statistically significant.

Table V also indicates that individual investors in all quintiles experience negative mark-to-market returns in their limit orders, whereas only those institutional investors with high superstition index incur large losses. This is consistent with the findings in Barber and Odean (2000) and Barber, Lee, Liu, and Odean (2009) who find that individual investors lose money on their investments.

[15] We only use initiated limit orders and market orders to evaluate the mark-to-market returns because the sum of mark-to-market returns for an initiated order and that for a closing order do not necessarily reflect the true performance of a round-trip trade. If the initiated and closing orders are executed in two different days, we are essentially using two different daily closing prices to calculate the returns. Hence, the sum of the two returns is an inaccurate calculation of the investor's performance.

(INSERT TABLE V HERE)

D. Superstition Index and Market Order Returns—Quintile Analysis

The mark-to-market intraday return of market orders is calculated in the same way, i.e., assuming that the initiated market order is covered at the closing price of the trading day. For each investor-year observation, we first calculate the average intraday returns in the current year, and then average them with equal weights among all of the observations in each quintile. Results for mark-to-market 1-day and 5-day returns are also presented.

Panel A of Table VI shows that Q5 individual investors underperform the Q1 individual investors by 1.3 basis points in their market orders within a trading day. The magnitude is similar to that of the intraday returns for limit orders. The underperformance deteriorates to 3.0 (5.6) basis points one day (five days) after the transactions. Panel B of Table VI shows that the performance difference is, however, not significant between Q1 and Q5 domestic institutional investors. Interestingly, we find a slightly better performance for Q5 investors, compared with Q1 investors, among the QFIIs.

(INSERT TABLE VI HERE)

E. Superstition Index and Performance of Round-trip Trades—Quintile Analysis

We follow Jordan and Diltz (2003) and Feng and Seasholes (2005) to calculate the performance of round-trip trades. A round-trip trade is defined as a newly initiated position being covered. To adjust for the cross-sectional variation in the round-trip duration, and to facilitate the comparison with the mark-to-market returns of limit and market orders, we focus on the round-trip daily profit and daily index returns for the investors.

The round-trip profit is calculated as the number of index points earned or lost times 200 (50) TWD for the TXF (MXF) contracts. We calculate the round-trip index return as the profit

divided by the mean transaction price of all buy orders within a round-trip trade.[16] The round-trip daily profit (index return) is thus determined by dividing the average round-trip profit (index return) with the average round-trip duration.[17] Similar to the mark-to-market returns, all items are first calculated for each investor and then averaged with equal weights for each quintile.

Panel A of Table VII shows that the Q5 individual investors underperform Q1 individual investors by 1,199 TWD for daily profits. The realized underperformance in terms of round-trip daily index return is about 10.6 basis points per trading day. To have a better picture of the economic losses, we estimate the total realized profit for each investor in each quintile per year (by multiplying rows 1, 3, and 4 of each panel in Table VII). The Q5 individual investors lose 105,341 TWD (roughly 3,200 USD) more than their Q1 counterparts per year during our sample period.[18] This loss is economically significant. It is also in line with our hypothesis that the investment performance of individual investors is negatively associated with their numerical superstition. For domestic institutions and QFIIs, the pattern is mostly insignificant.

Table VII also shows that the duration of losing round-trip trades is longer than that of winning ones. This is consistent with the findings in Odean (1998) that investors are affected by the disposition effect when making their buying and selling decisions. Therefore, when we conduct the multivariate regression analysis, we control for the disposition effect to single out the effect of superstition on investment performance.

[16] A round-trip trade may contain several buys and sells before the position is back to zero.

[17] As round-trip trades sometimes have very short durations, the extremely short durations may lead to extremely large daily profits and daily index returns if we calculate the daily performance on a per round-trip basis. To mitigate this potential outlier issue, we first calculate the average round-trip duration and average profit for each investor, and then we calculate the investor's daily profit as average round-trip profit divided by average duration. Round-trip daily index returns are calculated in the same way.

[18] These incremental losses of Q5 individual investors are not driven by the excessive trading documented in Barber and Odean (2000) and Barber, Lee, Liu, and Odean (2009). In fact, though not tabulated, Q5 investors trade less than their Q1 counterparts.

(INSERT TABLE VII HERE)

F. Superstition Index and Investment Performance—Multivariate Regression Analysis

We now perform the following cross-sectional regression:

$$Return_{i,t} = \alpha + \beta_1 SI_{i,t-1} + \beta_2 SubRatio_{0,i,t-1} + \beta_3 Ln(N_{i,t-1}) + \beta_4\, Disposition_{i,t-1} + \beta_5 Return_{i,t-1} + \varepsilon_{i,t}, \quad (5)$$

where $Return_{i,t}$ and $Return_{i,t-1}$ are the average mark-to-market returns or round-trip returns for investor *i* in the years *t* and *t-1*. $SI_{i,t-1}$ is investor *i*'s superstition index in the year *t-1*, calculated as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4." The coefficient of particular interest is β_1, as it measures how the number superstition is associated with investment performance.

$SubRatio_{0,i,t-1}$ is investor *i*'s submission ratio at prices ending with "0," which measures the cognitive ability related to round-number heuristics in Kuo, Lin, and Zhao (2014). $Ln(N_{i,t-1})$ is the log of number of limit orders submitted in the previous year. $Disposition_{i,t-1}$ is the difference between the duration of losing and winning round-trips, divided by the average of the two. We, therefore, control for the round-number effect and the disposition effect. This helps us to single out the effect of superstition on investment performance. We also control for the past performance to account for the time-invariant skill of the investors.

The first three columns of Table VIII show significantly negative coefficients of the superstition index for individual investors. The estimated β_1 for intraday limit order return equals -0.065, implying that a one-standard-deviation increase in the superstition index (0.084) leads to a 0.55 basis points decrease in the mark-to-market intraday returns for individual investors, after

controlling for cognitive limitation, trading experience, disposition effect, and past returns. Similar results hold for the mark-to-market 1-day and 5-day returns.

We find a similar negative association between the superstition index and the market order performance. The middle three columns of Table VIII show that the parameter estimates on the superstition index are significantly negative for individual investors. Specifically, a one-standard-deviation increase in the superstition index (0.084) leads to a 0.72 basis points decrease in the mark-to-market 1-day return of market orders. The results are similar but less significant for the intraday and 5-day returns.

The last two columns of Table VIII Panel A present the multivariate regression results for the round-trip trades. The round-trip performance is negatively associated with the superstition index. A one-standard-deviation increase in the superstition index (0.084) leads to a lower (175 TWD) round-trip daily profit and a lower (1.66 basis points) daily index return.

Panels B and C of Table VIII show no significant result for domestic institutional investors and QFIIs. This implies that the investment performance of institutional investors is not associated with number superstitions. However, this could also be partly due to a much smaller sample size for the institutional investors.

Notice that the negative association between the superstition and investment performance remains after controlling for the $SubRatio_{0,i,t-1}$, which indicates that our superstition measure captures a different investor characteristic from the cognitive limitation in Kuo, Lin, and Zhao (2014). This is an important result because, as the number superstition heuristic and the round-

number heuristic both measure cognitive disability, it might seem that they are both alike in the first glance.[19]

Further, we find that $Disposition_{i,t-1}$ is also negatively related to investment performance, suggesting that the more an investor exhibits the disposition effect, the lower are the returns of their investments. This is in line with the findings in Odean (1998).

To summarize, both the quintile analysis and the regression exercise show that the superstition index is negatively associated with investment performance for individual investors. The more an investor is affected by superstitious beliefs when deciding at which price to submit a limit order, the poorer is his investment performance is. This is true for individual investors, but not true for institutional investors. The results provide compelling evidence to support our Hypothesis 2.

(INSERT TABLE VIII HERE)

G. A Placebo Test

We perform a placebo test to verify that the above mentioned results are indeed driven by the numerical superstition. We construct a pseudo superstition index using the difference between the submission ratios at "7" and "3," and repeat the regression analysis of equation (5). The numbers "7" and "3" are viewed as neither lucky nor unlucky in Chinese culture. Therefore, the pseudo superstition index should not capture the degree of superstition among investors, and it should not be related to investment performance.

[19] We also perform a double sorting analysis where we sort investors into quintiles by the superstition index and the submission ratio at the round number prices (the cognitive ability measure in Kuo, Lin, and Zhao, 2014). The result shows that the underperformance of Q5 investors is larger for investors with lower submission ratio at round number prices. This indicates that our superstition index is different from the cognitive ability measure. These results are reported in the Appendix Table I.

Panel A of Table IX confirms that the negative association does not exist between the pseudo superstition index and investment performance among individual investors. The parameter estimates of β_1 are not significant at the 10% level. This corroborates our hypothesis that superstitious individual investors, who tend to favor the number "8" and avoid the number "4," perform worse in their investments.

(INSERT TABLE IX HERE)

V. Direct or Indirect Price of Superstition

We had proposed two hypotheses to interpret the negative relationship between superstition and investment performance. The "indirect price for superstition" hypothesis predicts that superstitious investors experience poor performance for limit order submissions at all price points. The "direct price for superstition" hypothesis predicts that losses are mainly driven by orders submitted at "8" (the lucky prices) and not submitted at "4." We examine the performance of the limit orders submitted at various prices and test these two hypotheses in the following sub-sections.

A. Superstition Index and Performance of Limit Orders Submitted at "8," "4," "0," and Other prices—Quintile Analysis

As in the previous section, we sort investors into quintiles according to their superstition index in one year, and look at the subsequent year's performance of limit orders submitted at "8," "4," "0," and other prices. The return metrics are first calculated for each investor and then averaged up with equal weights in each quintile.

Panel A of Table X shows that individual investors with high superstition index experience significantly lower intraday, 1-day, and 5-day returns, not only for their limit orders submitted at

"8," but also for limit orders at "4," "0," and other prices. For example, when we look at the intraday returns, Q5 individual investors underperform their Q1 counterparts by 1.7 basis points for their limit orders submitted at "8." The underperformance of their orders submitted at "4," "0," and other prices are 1.1, 2.0, and 2.1 basis points, respectively. The underperformances of these four groups of limit orders are similar in magnitude.

As shown in Panels B and C of Table X, there is no significant return difference between Q5 and Q1 institutional investors. Our results indicate that superstitious individual investors underperform their counterparts at all prices. This set of results is in line with the "indirect price of superstition" hypothesis and suggests that superstition is a symptom of low cognitive ability.

(INSERT TABLE X HERE)

B. Superstition Index and Performance of Limit Orders Submitted at "X"—Quintile Analysis

We take a closer look at the performance differences between the Q5 and Q1 investors regarding their limit orders submitted at each of the ten last-digit prices, i.e. at each of the ten different "X"s. The performance at "X" is the equal-weighted average mark-to-market return of limit orders submitted at prices ending with "X", and it is calculated for Q5 and Q1 investors separately.[20]

Figure 2.A. shows that the orders from Q5 individual investors have lower intraday returns than those from Q1 individual investors at all prices. Results are similar for 1-day and 5-day mark-to-market returns. Figures 2.B and 2.C. show that this difference is neither strong nor consistent for the institutional investors.

(INSERT FIGURE 2 HERE)

[20] Here we calculate the performance by equal-weighting each order submitted by Q5 or Q1 investors, as this would help us to answer the question: do orders submitted by Q5 investors have lower returns. This is an order-level analysis.

Panel A of Table XI presents the number of "X"s where Q5 individual investors underperform their Q1 counterparts. It shows that the intraday underperformance is significant at the 1% level for all ten different last digits. Similar results also hold for 1-day and 5-day returns. This is consistent with the Hypothesis 3.A that the numerical superstition is a symptom of low cognitive ability and associated with poor investment performance. Panels B and C of Table XI show that this result does not hold for institutional investors.

(INSERT TABLE XI HERE)

C. Superstition Index and Performance of Limit Orders Submitted at "X"—Regression Analysis

For each year, for each investor, we calculate the performance of limit orders submitted at various "X" prices, and perform the following regression:

$$Return_{X,i,t} = \alpha + \beta_1 SI_{i,t-1} + (\beta_2 D_8 + \beta_3 D_4 + \beta_4 D_0) \times SI_{i,t-1} + \beta_5 D_8 + \beta_6 D_4 + \beta_7 D_0 + \beta_8 SubRatio_{0,i,t-1} + \beta_9 Ln(N_{i,t-1}) + \beta_{10} Disposition_{i,t-1} + \beta_{11} Return_{i,t-1} + \varepsilon_{X,i,t} \quad (6)$$

where $Return_{X,i,t}$ is the performance of limit orders submitted at prices ending with "X" for investor *i* at year *t*. D_8, D_4, and D_0 are dummy variables for X=8, 4, and 0, respectively. $SI_{i,t-1}$ is the superstition index in year *t-1*. $SubRatio_{0,i,t-1}$ is the submission ratio at prices ending with "0." $Ln(N_{i,t-1})$ is the log of the number of limit orders submitted in year *t-1*. $Disposition_{i,t-1}$ is the disposition effect. $Return_{i,t-1}$ is the average intraday, 1-day, or 5-day mark-to-market return in year *t-1*.

The parameters of particular interest are (a) β_1, as it measures how superstition index is associated with investment performance, and (b) β_2, β_3 and β_4, as they measure whether this association is particularly stronger and weaker for limit orders submitted at "8," "4," or "0."

Panel A of Table XII shows that individual investors' superstition index is negatively associated with investment performance. The relationship is not significantly more negative for limit orders at "8", nor is it significantly less negative for limit orders at "4" or "0." This corroborates Hypothesis 3.A that submitting a disproportionately large (small) volume of limit orders at lucky-number (unlucky-number) prices is an indicator of investors' cognitive abilities, which is associated with low limit order mark-to-market returns. Given that the results remain after controlling for the limit order submission ratios at round numbers, our superstition index captures a different dimension of financial cognitive disability.

(INSERT TABLE XII HERE)

VI. Superstition and Learning by Trading

In this section, we examine how learning-by-trading affects investors' superstition index. Specifically, we perform the following regression:

$$SI_{i,t} - SI_{i,t-1} = \alpha + \beta_1 Ln(N_{i,t-1}) + \beta_2 Return_{i,t-1} + \beta_3 SI_{i,t-1} + \beta_4 Disposition_{i,t-1} + \beta_5 SubRatio_{0,i,t-1} + \varepsilon_X \quad (7)$$

$SI_{i,t}$ and $SI_{i,t-1}$ are the superstition indices in year *t* and *t-1*. The two learning measures are $Ln(N_{i,t-1})$ and $Return_{i,t-1}$. $Ln(N_{i,t-1})$ is the log of the number of limit orders submitted in year *t-1*. $Return_{i,t-1}$ is the mark-to-market intraday return of limit orders, which is calculated as the difference between the trade price and the daily closing price divided by the trade price. We also control for the past superstition index, disposition effect, and the round-number submission ratio. The superstition index is expressed in percentage to ensure readability of parameter estimates.

The parameters of interest are β_1 and β_2 as they measure whether investors learn from past trading frequency and past performance.

Panel A of Table XIII shows that the change in the superstition index is negatively related to the number of limit orders submitted in the previous year for individual investors. According to the estimated β_1 in Model 3, a one-standard-deviation increase in the number of limit orders submitted in the previous year (51 limit orders) will reduce the superstition index by 0.0018 in the subsequent year. This indicates that individual investors learn from their past trading frequency and become less affected by superstitious heuristics in their subsequent investment. The result also shows that the past performance is negatively associated with the change in superstition index. The parameter estimates on $Return_{i,t-1}$ are significantly negative at the 1% level.

Panel B shows that, for domestic institutions, only past trading frequency helps to reduce their superstition. We find no significant evidence of learning for QFII investors, as is shown in Panel C. In sum, our results are consistent with the hypothesis that individual investors learn by trading to reduce their number superstition in submitting limit orders.

(INSERT TABLE XIII HERE)

VII. Conclusion

This paper documents that Taiwanese individual investors exhibit numerical superstition when submitting limit orders. The limit order submission ratio at the lucky number "8" is 0.098, which is higher than the 0.063 submission ratio at the unlucky "4." We also find that there exist both persistence and cross-sectional heterogeneity in the degree that investors are affected by their superstitious beliefs.

We construct an investor-level superstition index based on the limit order submission ratios at lucky and unlucky numbers and show that this index is negatively related to investment performance. Specifically, we find that more superstitious individual investors have significantly lower intraday, 1-day, and 5-day mark-to-market index returns of their limit orders in the subsequent year. We find similar underperformance of superstitious individual investors for their market orders and round-trip performance.

Finally, we find that the underperformance of superstitious individual investors occurs at all price points, and not just at the lucky or unlucky numbers, suggesting that superstition is a symptom of a general cognitive disability in making financial decisions. The good news is that we find that investors can learn from their trading experience and become less superstitious.

References

Agarwal S., J. He, H. Liu, I.P.L. Png, T.F. Sing, and W.K Wong, 2014, Superstition and asset markets: Evidence from Singapore housing, Working paper.

Barber, B. M., and T. Odean, 2000, Trading is hazardous to your wealth: The common stock investment performance of individual investors, *Journal of Finance* 55, 773–806

Barber, B. M., Y. Lee, Y. Liu, and T. Odean, 2009, Just how much do individual investors lose by trading? *Review of Financial Studies* 22, 609–632.

Bhattacharya, U., C.W. Holden, and S. Jacobsen, 2012, Penny wise, dollar foolish: Buy-sell imbalances on and around round numbers, *Management Science* 58 (2), 413–431.

Brown, P., A. Chua, and J. Mitchell, 2002, The influence of cultural factors on price clustering: Evidence from Asia-Pacific stock markets, *Pacific-Basin Finance Journal* 10, 307–332.

Brown, P. and J. Mitchell, 2008, Culture and stock price clustering: Evidence from The Peoples' Republic of China, *Pacific-Basin Finance Journal* 16, 95–120.

Chiang, Y.M., D. Hirshleifer, Y. Qian, and A.E. Sherman, 2011, Do investors learn from experience? Evidence from frequent IPO investors, *Review of Financial Studies* 24 (5), 1560–1589.

Darke, P.R., and J.L. Freedman, 1997, The belief in good luck scale, *Journal of Research in Personality* 31, 486–511.

Dhar, R. and N. Zhu, 2006, Up close and personal: An individual level analysis of the disposition effect, *Management Science* 52 (5), 726–740.

Feng, L., and M. Seasholes, 2005, Do investor sophistication and trading experience eliminate behavioral biases in financial markets? *Review of Finance* 9, 305–351.

Fortin, N, A. Hill and J. Huang, 2014, Superstition in Housing Market, *Economic Inquiry* 52, 974-993.

Grinblatt, M., M. Keloharju, and J. Linnainmaa, 2011. IQ and stock market participation. *Journal of Finance* 66: 2121–2164.

Grinblatt, M., M. Keloharju, and J. Linnainmaa, 2012. IQ, trading behavior, and performance. *Journal of Financial Economics* 104: 339–362.

Grinblatt, M., M. Keloharju, S. Ikäheimo, and S. Knüpfer, 2014, IQ and Mutual Fund Choice, Working paper.

Hirshleifer, D., M. Jian, and H. Zhang, 2012, Superstition and financial decision making, Working Paper.

Jiang, Y., A. Cho, and R. Adaval, 2009, The unique consequences of feeling lucky: Implications for consumer behavior, *Journal of Consumer Psychology* 19, 171–184.

Jordan, D., and D. Diltz, 2003, The profitability of day traders, *Financial Analysts Journal* 59, 85–95.

Kramer, T. and L. Block, 2008, Conscious and non-conscious components of superstitious beliefs in judgment and decision making, *Journal of Consumer Research* 34 (6), 783-793.

Kuo, W.Y. and T.C. Lin, 2013, Overconfident individual day traders: Evidence from Taiwan Futures Market, *Journal of Banking and Finance* 37 (9), 3548–3561.

Kuo, W.Y., T.C. Lin, and J. Zhao, 2014, Cognitive limitation and investment performance: Evidence from limit order clustering, *Review of Financial Studies*, forthcoming.

Li, H. C., C. H. Lin, T. Y. Cheng, and S. Lai, 2012, How different types of traders behave in the Taiwan Futures Market? *Journal of Futures Markets* 00, 1–21.

Liu, Y., C. Tsai, M. Wang, and N. Zhu, 2010, Prior consequences and subsequent risk taking: New field evidence from the Taiwan Futures Exchange, *Management Science* 56, 606–620.

Miller, D.T. and B.R. Taylor, 2002, Counterfactual Thought, Regret, and Superstition: How to Avoid Kicking Yourself, *Heuristics and Biases: The Psychology of Intuitive Judgment*, edited by Gilovich, T., D. Griffin, and D. Kahneman, Cambridge University Press, UK, 367-378.

Odean, T., 1998, Are investors reluctant to realizes their losses? *Journal of Finance* 53, 1775–1798.

Seru, A., T. Shumway, and N. Stoffman, 2010, Learning by trading, *Review of Financial Studies* 23, 705-729.

Shum, M., W. Sun, and G. Ye, 2014, Superstition and "lucky" apartments: Evidence from transection level data, *Journal of Comparative Economics* 42, 109–117.

Tsang, E.W.K., 2004, Superstition and Decision-Making: Contradiction or Complement? *Academy of Management Executive* 18 (4), 92-104.

Table I. Descriptive Statistics of Limit Order Quotes and Trades

This table reports the summary statistics of the limit orders quotes and trades for two major Taiwan index futures in the Taiwan Futures Exchange from January 2003 to September 2008. In 2008, we only have orders and trades data from January to September. The number of limit orders submitted and the number of limit order contracts executed are reported in Panels A and B, respectively. The number of limit orders (contracts) is reported separately for individual investors, domestic institutions, and Qualified Foreign Institutional Investors (QFII) and for Taiwan Stock Exchange Futures (TXF) and Mini-Taiwan Stock Exchange Futures (MXF).

Panel A: Number of Limit Orders Submitted

Year	Total	Investor type			Product type	
		Individual	Domestic Institutions	QFII	TXF	MXF
2003	8,391,970	7,874,288	450,329	67,353	5,931,492	2,460,478
2004	11,756,902	10,436,137	1,181,927	138,838	7,935,143	3,821,759
2005	9,336,187	7,171,025	1,866,537	298,625	6,853,377	2,482,810
2006	16,080,187	10,088,540	5,160,370	831,277	11,136,616	4,943,571
2007	26,218,095	13,297,493	11,732,794	1,187,808	15,728,641	10,489,454
2008	36,699,943	18,251,513	16,677,852	1,770,578	21,843,993	14,855,950
Total	108,483,284	67,118,996	37,069,809	4,294,479	69,429,262	39,054,022
Ratio	100%	61.87%	34.17%	3.96%	64.00%	36.00%

Panel B: Number of Limit Order Contracts Executed

Year	Total	Investor type			Product type	
		Individual	Domestic Institutions	QFII	MXF	TXF
2003	15,662,806	13,369,496	1,960,223	333,087	13,029,382	2,633,424
2004	21,609,094	17,067,248	3,667,074	874,772	17,722,556	3,886,538
2005	16,011,798	11,495,469	3,445,196	1,071,133	13,834,750	2,177,048
2006	23,351,164	16,690,861	5,288,886	1,371,417	19,829,998	3,521,166
2007	29,554,384	20,294,809	6,882,178	2,377,397	23,626,300	5,928,084
2008	36,963,929	25,873,811	8,470,446	2,619,672	25,871,823	11,092,106
Total	143,153,175	104,791,694	29,714,003	8,647,478	113,914,809	29,238,366
Ratio	100%	73.20%	20.76%	6.04%	79.58%	20.42%

Table II. Submission Ratio at Prices Ending with "X"

This table reports the parameter estimates of the following regression:

$$SubRatio_X - 0.1 = \alpha + \beta_1 D_8 + \beta_2 D_4 + \beta_3 D_0 + \beta_4 D_5 + (\beta_5 D_8 + \beta_6 D_4 + \beta_7 D_0 + \beta_8 D_5) \times D_{indv} + (\beta_9 D_8 + \beta_{10} D_4 + \beta_{11} D_0 + \beta_{12} D_5) \times D_{QFII} + (\beta_{13} D_8 + \beta_{14} D_4 + \beta_{15} D_0 + \beta_{16} D_5) \times D_{MXF} + (\beta_{17} D_8 + \beta_{18} D_4 + \beta_{19} D_0 + \beta_{20} D_5) \times D_{indv} \times D_{MXF} + (\beta_{21} D_8 + \beta_{22} D_4 + \beta_{23} D_0 + \beta_{24} D_5) \times D_{QFII} \times D_{MXF} + \beta_{25} D_{indv} + \beta_{26} D_{QFII} + \beta_{27} D_{MXF} + \varepsilon_X$$

The dependent variable is the deviation of the actual submission ratio at prices ending with "X" from its theoretical value assuming uniform distribution of the limit order prices (X is an integer ranging from 0 to 9). Each year, the submission ratio at "X" is calculated separately for individual investors, domestic institutions, and QFII investors, and for MXF and TXF orders. D_8, D_4, D_0, and D_5 are dummy variables for X=8, 4, 0, and 5, respectively. D_{indv} and D_{QFII} are indicators for individual and QFII investors. D_{MXF} is equal to 1 if the order is to trade MXF, and 0 if it is to trade TXF. In the last three rows we report the F-tests for the equality of coefficients. Standard errors are adjusted for heteroskedasticity. *, **, and *** indicate significance level at 0.1, 0.5 and 0.01, respectively.

Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5
D_8	0.013***	0.004	0.011***	0.002	0.002
	(0.000)	(0.134)	(0.000)	(0.479)	(0.544)
D_4	-0.004	0.002	-0.003	0.003	-0.002
	(0.243)	(0.456)	(0.359)	(0.418)	(0.503)
D_0	0.111***	0.041***	0.086***	0.016	0.037***
	(0.000)	(0.000)	(0.000)	(0.182)	(0.000)
D_5	0.045***	0.009***	0.035***	-0.001	0.008**
	(0.000)	(0.008)	(0.000)	(0.810)	(0.021)
Double Interactions					
$D_8 \times D_{indv}$		0.020***		0.020***	0.021***
		(0.000)		(0.000)	(0.000)
$D_4 \times D_{indv}$		-0.013***		-0.013***	-0.007*
		(0.001)		(0.001)	(0.067)
$D_0 \times D_{indv}$		0.142***		0.142***	0.124***
		(0.000)		(0.000)	(0.000)
$D_5 \times D_{indv}$		0.069***		0.069***	0.060***
		(0.000)		(0.000)	(0.000)
$D_8 \times D_{QFII}$		0.005		0.005	0.006
		(0.382)		(0.372)	(0.225)
$D_4 \times D_{QFII}$		-0.007		-0.006	0.003
		(0.394)		(0.399)	(0.572)
$D_0 \times D_{QFII}$		0.068***		0.068***	0.024*
		(0.006)		(0.003)	(0.099)
$D_5 \times D_{QFII}$		0.039***		0.039***	0.018**
		(0.000)		(0.000)	(0.033)
$D_8 \times D_{MXF}$			0.004	0.004	0.005
			(0.277)	(0.264)	(0.412)
$D_4 \times D_{MXF}$			-0.002	-0.002	0.009
			(0.801)	(0.720)	(0.149)
$D_0 \times D_{MXF}$			0.050**	0.050***	0.008
			(0.030)	(0.002)	(0.672)
$D_5 \times D_{MXF}$			0.021**	0.021***	0.002
			(0.028)	(0.003)	(0.793)
Triple Interactions					
$D_8 \times D_{indv} \times D_{MXF}$					-0.001
					(0.927)
$D_4 \times D_{indv} \times D_{MXF}$					-0.012**
					(0.042)
$D_0 \times D_{indv} \times D_{MXF}$					0.036*
					(0.091)
$D_5 \times D_{indv} \times D_{MXF}$					0.017**
					(0.032)

$D_8 \times D_{QFII} \times D_{MXF}$					-0.001
					(0.903)
$D_4 \times D_{QFII} \times D_{MXF}$					-0.019
					(0.134)
$D_0 \times D_{QFII} \times D_{MXF}$					0.089**
					(0.034)
$D_5 \times D_{QFII} \times D_{MXF}$					0.042**
					(0.019)
D_{indv}		-0.022***		-0.022***	-0.022***
		(0.000)		(0.000)	(0.000)
D_{QFII}		-0.008**		-0.008**	-0.008**
		(0.015)		(0.015)	(0.016)
D_{MXF}			-0.006**	-0.006**	-0.006**
			(0.025)	(0.014)	(0.015)
Constant	-0.012***	-0.002	-0.009**	0.001	0.001
	(0.008)	(0.613)	(0.023)	(0.806)	(0.821)
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Number of obs.	357	357	357	357	357
Adjusted R^2	0.581	0.751	0.606	0.779	0.797
F-test					
$D_8 - D_4$	0.017***	0.002	0.014***	-0.001	0.004
	(0.000)	(0.578)	(0.000)	(0.833)	(0.305)
$D_8 \times D_{indv} - D_4 \times D_{indv}$		0.033***		0.033***	0.028***
		(0.000)		(0.000)	(0.000)
$D_8 \times D_{QFII} - D_4 \times D_{QFII}$		0.012		0.011	0.003
		(0.161)		(0.157)	(0.685)
$D_8 \times D_{MXF} - D_4 \times D_{MXF}$			0.006	0.006	-0.004
			(0.394)	(0.260)	(0.624)
$D_8 \times D_{indv} \times D_{MXF} - D_4 \times D_{indv} \times D_{MXF}$					0.011
					(0.169)
$D_8 \times D_{indv} \times D_{MXF} - D_4 \times D_{indv} \times D_{MXF}$					0.018
					(0.247)

Table III. Descriptive Statistics of the Superstition Index

In this table, we report the summary statistics of the investor-level superstition index. Each year, we calculate the superstition index for each investor as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4." To ensure a reasonable magnitude of the superstition index, we require that the investors have to submit at least 10 limit orders for two consecutive years. In 2008, we only have data for the first nine months.

Panel A: Individual Investors

Year	Mean	Median	Standard Deviation	20th Percentile	40th Percentile	60th Percentile	80th Percentile
2003	0.0365	0.0292	0.0764	0.0000	0.0152	0.0435	0.0805
2004	0.0408	0.0323	0.0799	0.0000	0.0185	0.0462	0.0833
2005	0.0413	0.0323	0.0848	0.0000	0.0172	0.0476	0.0889
2006	0.0425	0.0324	0.0836	0.0000	0.0189	0.0465	0.0857
2007	0.0424	0.0303	0.0855	0.0000	0.0175	0.0439	0.0833
2008	0.0493	0.0333	0.0909	0.0000	0.0213	0.0474	0.0882

Panel B: Domestic Institutions

Year	Mean	Median	Standard Deviation	20th Percentile	40th Percentile	60th Percentile	80th Percentile
2003	0.0273	0.0158	0.0820	-0.0187	0.0000	0.0321	0.0690
2004	0.0359	0.0241	0.0828	-0.0083	0.0124	0.0364	0.0667
2005	0.0285	0.0223	0.0733	-0.0098	0.0114	0.0364	0.0684
2006	0.0186	0.0132	0.0660	-0.0114	0.0040	0.0270	0.0588
2007	0.0221	0.0146	0.0613	-0.0144	0.0000	0.0258	0.0601
2008	0.0328	0.0192	0.0712	-0.0065	0.0088	0.0313	0.0696

Panel C: Qualified Foreign Institutional Investors

Year	Mean	Median	Standard Deviation	20th Percentile	40th Percentile	60th Percentile	80th Percentile
2003	0.0005	0.0063	0.0356	-0.0258	0.0048	0.0157	0.0232
2004	0.0084	0.0124	0.0223	0.0037	0.0055	0.0140	0.0204
2005	-0.0087	-0.0037	0.0447	-0.0134	-0.0055	0.0000	0.0198
2006	0.0172	0.0063	0.0334	-0.0010	0.0034	0.0098	0.0335
2007	0.0150	0.0099	0.0347	-0.0131	0.0044	0.0176	0.0336
2008	0.0227	0.0131	0.0488	-0.0003	0.0077	0.0233	0.0549

Table IV. Superstition Index and Related Investor Traits

In this table we report the correlations between the superstition index and other investor traits. SI_t is the superstition index in year *t*, which is calculated as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4." SI_{t-1} is the superstition index in year *t-1*. $Ln(N_t)$ is the log of the number of limit orders submitted in year *t*. $SubRatio_{0,t}$ is the submission ratio at prices ending with "0" in year *t*. $Disposition_t$ is the disposition effect, which is calculated as the difference between winning and losing round-trip trades, divided by the average of the two. Results for individual investors, domestic institutions, and QFIIs are reported separately. To ensure a reasonable magnitude of the superstition index, we require that investors must submit at least 10 limit orders in each of the two consecutive years.

Panel A: Individual Investors

Correlations	SI_t	SI_{t-1}	$Ln(N_t)$	$Disposition_t$
SI_t	1.0000			
SI_{t-1}	0.4205	1.0000		
$Ln(N_t)$	0.0037	0.0011	1.0000	
$Disposition_t$	0.0408	0.0399	0.0916	1.0000

Panel B: Domestic Institutions

Correlations	SI_t	SI_{t-1}	$Ln(N_t)$	$Disposition_t$
SI_t	1.0000			
SI_{t-1}	0.2872	1.0000		
$Ln(N_t)$	-0.0475	-0.0756	1.0000	
$Disposition_t$	-0.0143	-0.0037	-0.0040	1.0000

Panel C: Qualified Foreign Institutional Investors

Correlations	SI_t	SI_{t-1}	$Ln(N_t)$	$Disposition_t$
SI_t	1.0000			
SI_{t-1}	0.2390	1.0000		
$Ln(N_t)$	-0.1331	-0.0673	1.0000	
$Disposition_t$	0.1684	0.1088	-0.1541	1.0000

Table V. Superstition Index and Mark-to-market Returns of Limit Orders

In this table we sort investors into quintiles by the superstition index in one year, and report the mark-to-market return of limit orders in the subsequent year. Quintile-5 (Q5) investors are more superstitious. Each year, we calculate the superstition index for each investor as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4." Mark-to-market intraday return is the difference between the trade price and the daily closing price divided by the trade price. Mark-to-market 1-day and 5-day returns are calculated in a similar fashion. All items are first calculated for each investor-year observation and then averaged in each quintile with equal weights. Results for individual investors, domestic institutions, and QFIIs are reported separately. To ensure a reasonable magnitude of superstition index, we require that investors must submit at least 10 limit orders in each of the two consecutive years. The Satterthwaite p-value assumes unequal variances of investor performance in quintiles 1 and 5. *, **, and *** indicate significance levels of 0.1, 0.05, and 0.01, respectively.

Panel A: Individual Investors

Quintile Ranks	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Intraday (%)	-0.078	-0.088	-0.087	-0.086	-0.095	-0.017***	0.000
1-day (%)	-0.111	-0.136	-0.126	-0.128	-0.135	-0.024***	0.000
5-day (%)	-0.179	-0.240	-0.219	-0.211	-0.242	-0.063***	0.000

Panel B: Domestic Institutions

Quintile Ranks	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Intraday (%)	0.009	0.008	-0.001	-0.026	-0.008	-0.017	0.404
1-day (%)	-0.064	-0.020	-0.041	0.014	0.010	0.075	0.121
5-day (%)	-0.057	-0.119	-0.063	0.019	-0.046	0.010	0.919

Panel C: Qualified Foreign Institutional Investors

Quintile Ranks	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Intraday (%)	0.021	0.010	0.002	-0.011	-0.028	-0.049	0.551
1-day (%)	0.036	0.020	0.076	0.038	-0.094	-0.130	0.421
5-day (%)	-0.015	0.263	0.200	0.091	0.151	0.166	0.619

Table VI. Superstition Index and Mark-to-market Returns of Market Orders

In this table we sort investors into quintiles by the superstition index in one year, and report the mark-to-market return of market orders in the subsequent year. Quintile-5 (Q5) investors are more superstitious. Each year, we calculate the superstition index for each investor as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4." Mark-to-market intraday return is the difference between the trade price and the daily closing price divided by the trade price. Mark-to-market 1-day and 5-day returns are calculated in a similar fashion. All items are first calculated for each investor-year observation and then averaged up in each quintile with equal weights. Results for individual investors, domestic institutions, and QFIIs are reported separately. To ensure a reasonable magnitude of superstition index, we require that investors must submit at least 10 limit orders in each of the two consecutive years. The Satterthwaite p-value assumes unequal variances of investor performance in quintiles 1 and 5. *, **, and *** indicate significance levels of 0.1, 0.05, and 0.01, respectively.

Panel A: Individual Investors

Quintile Ranks	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Intraday (%)	-0.039	-0.055	-0.048	-0.055	-0.052	-0.013**	0.015
1-day (%)	-0.070	-0.097	-0.101	-0.099	-0.099	-0.030**	0.011
5-day (%)	-0.146	-0.191	-0.192	-0.195	-0.203	-0.056**	0.015

Panel B: Domestic Institutions

Quintile Ranks	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Intraday (%)	-0.082	-0.046	0.021	-0.003	-0.009	0.073	0.143
1-day (%)	-0.114	-0.140	-0.163	0.052	-0.093	0.020	0.858
5-day (%)	-0.215	-0.267	-0.157	0.364	-0.009	0.206	0.380

Panel C: Qualified Foreign Institutional Investors

Quintile Ranks	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Intraday (%)	-0.210	-0.108	0.040	0.018	0.077	0.287**	0.048
1-day (%)	-0.544	0.237	0.103	0.134	0.135	0.679*	0.079
5-day (%)	-1.168	0.548	-0.008	0.895	-0.021	1.147*	0.070

Table VII. Superstition Index and Round-trip Performance

In this table we sort investors into quintiles by the superstition index in one year, and report the performance of round-trip trades in the subsequent year. Quintile-5 (Q5) investors are more superstitious. Each year, we calculate the superstition index for each investor as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4." Round-trip duration is the number of trading days between the initiating and closing position of a round-trip. For each investor, we calculate the round-trip daily profit and daily index return as the average round-trip profit or index return divided by the average round-trip duration. All items are first calculated for each investor-year observation and then averaged up in each quintile with equal weights. Results for individual investors, domestic institutions, and QFIIs are reported separately. To ensure a reasonable magnitude of superstition index, we require that investors must submit at least 10 limit orders in each of the two consecutive years. The Satterthwaite p-value assumes unequal variances of investor performance in quintiles 1 and 5. *, **, and *** indicate significance levels of 0.1, 0.05, and 0.01, respectively.

Panel A: Individual Investors

Quintile Ranks	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Round-trip daily profit (TWD)	-1,002	-1,690	-1,526	-2,322	-2,201	-1,199.2*	0.096
Round-trip daily index return (%)	-0.076	-0.135	-0.134	-0.195	-0.181	-0.106*	0.065
Number of round-trip trades	61	58	67	54	43	-17.977***	0.000
Round-trip duration (day)	2.256	2.555	2.273	2.293	2.570	0.314***	0.000
Duration of winning round-trips (day)	1.922	2.130	1.908	1.875	2.086	0.164***	0.000
Duration of losing round-trips (day)	3.010	3.456	3.109	3.204	3.619	0.609***	0.000

Panel B: Domestic Institutions

Quintile Ranks	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Round-trip daily profit (TWD)	40,470	18,966	38,771	19,933	25,148	-15,322	0.575
Round-trip daily index return (%)	3.453	1.882	3.688	1.826	1.876	-1.576	0.427
Number of round-trip trades	62	55	109	47	41	-20.839	0.184
Round-trip duration (day)	4.862	4.930	5.207	3.943	3.056	-1.806***	0.000
Duration of winning round-trips (day)	4.685	4.576	5.366	3.785	3.031	-1.654***	0.000
Duration of losing round-trips (day)	5.282	5.655	4.918	4.069	3.266	-2.016***	0.000

Panel C: Qualified Foreign Institutional Investors

Quintile Ranks	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Round-trip daily profit (TWD)	441,356	105,783	916,879	543,699	69,907	-371,449	0.242
Round-trip daily index return (%)	26.754	7.250	65.884	41.107	5.534	-21.219	0.303
Number of round-trip trades	13	20	25	22	26	13.842*	0.061
Round-trip duration (day)	9.529	9.555	7.821	7.824	7.841	-1.688	0.290
Duration of winning round-trips (day)	9.935	10.068	8.341	8.027	7.713	-2.223	0.214
Duration of losing round-trips (day)	9.355	8.569	6.504	6.531	8.206	-1.149	0.545

Table VIII. Superstition Index and Investment Performance

In this table we report the parameter estimates for the following panel regression:

$Return_{i,t} = \alpha + \beta_1 SI_{i,t-1} + \beta_2 SubRatio_{0,i,t-1} + \beta_3 Ln(N_{i,t-1}) + \beta_4\ Disposition_{i,t-1} + \beta_5 Return_{i,t-1} + \varepsilon_{i,t}$

where $Return_{i,t}$ and $Return_{i,t-1}$ are the average mark-to-market returns or round-trip performance for investor *i* at year *t* and year *t-1*. $SI_{i,t-1}$ is investor *i*'s superstition index, calculated as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4." $SubRatio_{0,i,t-1}$ is investor *i*'s submission ratio at prices ending with "0." $Ln(N_{i,t-1})$ is the log of number of limit orders submitted in the previous year. $Disposition_{i,t-1}$ is the difference between the duration of losing and winning round-trips, divided by the average of the two. Mark-to-market return of limit (market) orders is the return assuming that the initiating limit (market) orders are covered at the closing price of a trading day. The round-trip daily profit and daily index return are calculated as the average round-trip profit or index return divided by the average round-trip duration for each investor. Results for individual and institutional investors are reported separately. Standard errors are adjusted for heteroskedasticity. To ensure a reasonable magnitude of the superstition index, we require that investors must submit at least 10 limit orders in each of the two consecutive years. *, **, and *** indicate significance levels of 0.1, 0.05, and 0.01, respectively.

Panel A: Individual Investors

Independent	Mark-to-market Return of Limit Orders (%)			Mark-to-market Return of Market Orders (%)			Round-trip Performance	
Variable	Intraday	1-day	5-day	Intraday	1-day	5-day	Daily profit (TWD)	Daily index return (%)
$SI_{i,t-1}$	-0.065***	-0.072***	-0.142***	-0.030	-0.086*	-0.118	-2,084.231	-0.197*
	(0.000)	(0.000)	(0.001)	(0.185)	(0.072)	(0.240)	(0.178)	(0.097)
$SubRatio_{0,i,t-1}$	-0.051***	-0.103***	-0.211***	-0.065***	-0.142***	-0.191***	-1,566.019**	-0.171***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.020)	(0.001)
$Ln(N_{i,t-1})$	0.010***	0.015***	0.020***	0.011***	0.015***	0.018***	1,166.606***	0.106***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)
$Disposition_{i,t-1}$	-0.019***	-0.049***	-0.157***	-0.016***	-0.044***	-0.124***	-4,743.308***	-0.410***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Return_{i,t-1}$	0.051***	0.024***	0.010***	0.025***	0.001	0.015***	0.000	0.000
	(0.000)	(0.000)	(0.006)	(0.000)	(0.912)	(0.010)	(0.342)	(0.321)
Constant	-0.110***	-0.148***	-0.268***	-0.055***	-0.072***	-0.150***	-6,173.179***	-0.525***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	145,470	145,449	145,051	67,090	66,956	64,929	145,382	145,382
Adjusted R^2	0.021	0.011	0.019	0.005	0.004	0.005	0.003	0.004

Panel B: Domestic Institutions

Independent	Mark-to-market Return of Limit Orders (%)			Mark-to-market Return of Market Orders (%)			Round-trip Performance	
Variable	Intraday	1-day	5-day	Intraday	1-day	5-day	Daily profit (TWD)	Daily index return (%)
$SI_{i,t-1}$	-0.111	0.301	0.012	0.270	0.453	0.720	-41,272.467	-3.617
	(0.218)	(0.135)	(0.980)	(0.169)	(0.269)	(0.389)	(0.478)	(0.422)
$SubRatio_{0,i,t-1}$	-0.201***	-0.253***	-0.698***	-0.143	0.055	0.445	-59,041.649*	-2.583
	(0.000)	(0.010)	(0.001)	(0.141)	(0.803)	(0.325)	(0.061)	(0.274)
$Ln(N_{i,t-1})$	-0.004	-0.009	-0.012	0.013	-0.026	0.004	-6,297.007	0.554
	(0.374)	(0.308)	(0.510)	(0.200)	(0.230)	(0.926)	(0.497)	(0.398)
$Disposition_{i,t-1}$	-0.044***	-0.102***	-0.205***	-0.009	0.019	-0.040	-58,616.462***	-4.302***
	(0.000)	(0.000)	(0.000)	(0.686)	(0.696)	(0.666)	(0.000)	(0.000)
$Return_{i,t-1}$	0.021	-0.025	0.004	-0.006	-0.049	0.101	-0.034	-0.070
	(0.562)	(0.499)	(0.896)	(0.896)	(0.548)	(0.130)	(0.719)	(0.493)
Constant	0.075	0.044	0.089	0.016	0.215	0.094	117,861.405**	4.762
	(0.117)	(0.566)	(0.586)	(0.817)	(0.159)	(0.787)	(0.011)	(0.163)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	1,805	1,805	1,799	767	762	737	1,761	1,761
Adjusted R^2	0.033	0.029	0.023	0.007	0.010	0.013	0.018	0.021

Panel C: Qualified Foreign Institutional Investors

Independent	Mark-to-market Return of Limit Orders (%)			Mark-to-market Return of Market Orders (%)			Round-trip Performance	
Variable	Intraday	1-day	5-day	Intraday	1-day	5-day	Daily profit (TWD)	Daily index return (%)
$SI_{i,t-1}$	0.462	-0.610	-1.105	2.053	-2.294	-8.198	191,754.770	31.336
	(0.129)	(0.453)	(0.358)	(0.109)	(0.394)	(0.238)	(0.914)	(0.823)
$SubRatio_{0,i,t-1}$	-0.192	-0.064	0.042	-0.083	0.625	1.418	968,480.679*	78.010*
	(0.131)	(0.805)	(0.928)	(0.814)	(0.245)	(0.225)	(0.100)	(0.084)
$Ln(N_{i,t-1})$	0.013*	0.020	0.037	0.012	0.016	0.148	108,686.921**	8.537**
	(0.076)	(0.373)	(0.309)	(0.585)	(0.748)	(0.227)	(0.048)	(0.046)
$Disposition_{i,t-1}$	-0.028	-0.144**	-0.366***	0.047	-0.103	-0.475*	-1144707.647***	-86.245***
	(0.157)	(0.036)	(0.001)	(0.236)	(0.365)	(0.075)	(0.000)	(0.000)
$Return_{i,t-1}$	0.080	0.092	0.028	-0.009	0.083	-0.070	0.120	0.083
	(0.282)	(0.292)	(0.744)	(0.945)	(0.405)	(0.614)	(0.151)	(0.209)
Constant	0.009	0.054	0.472	-0.050	-0.245	-0.910	462,746.134	42.407
	(0.916)	(0.788)	(0.265)	(0.835)	(0.598)	(0.484)	(0.646)	(0.608)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	167	167	165	83	81	79	161	161
Adjusted R^2	0.047	0.044	0.090	-0.067	-0.055	0.003	0.293	0.294

Table IX. A Placebo Test: Pseudo Superstition Index and Investment Performance

In this table we report the parameter estimates for the following panel regression:
$Return_{i,t} = \alpha + \beta_1 SI_{i,t-1} + \beta_2 SubRatio_{0,i,t-1} + \beta_3 Ln(N_{i,t-1}) + \beta_4 Disposition_{i,t-1} + \beta_5 Return_{i,t-1} + \varepsilon_{i,t}$
where $Return_{i,t}$ and $Return_{i,t-1}$ are the average mark-to-market returns or round-trip performance for investor *i* at year *t* and year *t-1*. $SI_{i,t-1}$ is investor *i*'s pseudo superstition index, calculated as the difference between limit order submission ratio at prices ending with "7" and that at prices ending with "3." $SubRatio_{0,i,t-1}$ is investor *i*'s submission ratio at prices ending with "0." $Ln(N_{i,t-1})$ is the log of number of limit orders submitted in the previous year. $Disposition_{i,t-1}$ is the difference between the duration of losing and winning round-trips, divided by the average of the two. Mark-to-market return of limit (market) orders is the return assuming that the initiating limit (market) orders are covered at the closing price of a trading day. The round-trip daily profit and daily index return are calculated as the average round-trip profit or index return divided by the average round-trip duration for each investor. Results for individual and institutional investors are reported separately. Standard errors are adjusted for heteroskedasticity. To ensure a reasonable magnitude of the superstition index, we require that investors must submit at least 10 limit orders in each of the two consecutive years. *, **, and *** indicate significance levels of 0.1, 0.05, and 0.01, respectively.

Panel A: Individual Investors

Independent	Mark-to-market Return of Limit Orders (%)			Mark-to-market Return of Market Orders (%)			Round-trip Performance	
Variable	Intraday	1-day	5-day	Intraday	1-day	5-day	Daily profit (TWD)	Daily index return (%)
$SI_{i,t-1}$	-0.000	0.010	-0.034	-0.016	0.039	0.050	-30,014.274	-2.439
	(0.999)	(0.743)	(0.602)	(0.610)	(0.562)	(0.709)	(0.351)	(0.349)
$SubRatio_{0,i,t-1}$	-0.054***	-0.110***	-0.233***	-0.065***	-0.138***	-0.197***	3,670.609	0.261
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.365)	(0.426)
$Ln(N_{i,t-1})$	0.010***	0.014***	0.014***	0.012***	0.015***	0.014**	1,356.758	0.126
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.027)	(0.399)	(0.320)
$Disposition_{i,t-1}$	-0.022***	-0.028***	-0.024***	-0.021***	-0.035***	-0.029***	6,726.030	0.546
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.010)	(0.213)	(0.213)
$Return_{i,t-1}$	0.055***	0.028***	0.011***	0.023***	0.001	0.017***	0.332***	0.310***
	(0.000)	(0.000)	(0.005)	(0.000)	(0.921)	(0.005)	(0.000)	(0.001)
Constant	-0.111***	-0.156***	-0.290***	-0.060***	-0.081***	-0.159***	-13,147.996	-1.116
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.174)	(0.152)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	144,979	144,958	144,506	66,961	66,830	64,806	144,807	144,807
Adjusted R^2	0.020	0.007	0.010	0.005	0.003	0.003	0.000	0.000

Panel B: Domestic Institutions

Independent	Mark-to-market Return of Limit Orders (%)			Mark-to-market Return of Market Orders (%)			Round-trip Performance	
Variable	Intraday	1-day	5-day	Intraday	1-day	5-day	Daily profit (TWD)	Daily index return (%)
$SI_{i,t-1}$	0.281*	0.920**	1.318*	0.266	0.202	-1.120	-12,244.717	0.213
	(0.068)	(0.013)	(0.074)	(0.260)	(0.738)	(0.431)	(0.866)	(0.968)
$SubRatio_{0,i,t-1}$	-0.180***	-0.293***	-0.757***	-0.107	0.035	0.794*	-8,292.758	1.210
	(0.000)	(0.006)	(0.002)	(0.275)	(0.882)	(0.085)	(0.830)	(0.681)
$Ln(N_{i,t-1})$	-0.002	-0.009	-0.002	0.008	-0.042*	0.030	6,327.329	1.422**
	(0.668)	(0.361)	(0.941)	(0.398)	(0.051)	(0.521)	(0.534)	(0.046)
$Disposition_{i,t-1}$	-0.029***	-0.027	0.027	-0.005	0.007	0.046	4,486.550	0.185
	(0.001)	(0.192)	(0.532)	(0.827)	(0.902)	(0.695)	(0.578)	(0.721)
$Return_{i,t-1}$	0.003	-0.043	0.077**	-0.004	-0.049	0.137*	0.242*	0.155
	(0.937)	(0.251)	(0.038)	(0.927)	(0.595)	(0.068)	(0.072)	(0.276)
Constant	0.032	0.033	0.003	0.028	0.285*	-0.134	31,515.297	-1.388
	(0.538)	(0.702)	(0.987)	(0.700)	(0.058)	(0.689)	(0.547)	(0.715)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	1,764	1,764	1,757	748	744	721	1,731	1,731
Adjusted R^2	0.019	0.020	0.010	0.000	0.010	0.015	0.015	0.012

Panel C: Qualified Foreign Institutional Investors

Independent	Mark-to-market Return of Limit Orders (%)			Mark-to-market Return of Market Orders (%)			Round-trip Performance	
Variable	Intraday	1-day	5-day	Intraday	1-day	5-day	Daily profit (TWD)	Daily index return (%)
$SI_{i,t-1}$	0.007	-2.233	0.128	-1.400	-0.556	-10.342	-2838323.456	-251.078
	(0.990)	(0.214)	(0.949)	(0.247)	(0.865)	(0.183)	(0.262)	(0.210)
$SubRatio_{0,i,t-1}$	-0.318**	-0.444	0.160	0.027	0.781	2.327*	433,810.516	39.398
	(0.031)	(0.143)	(0.856)	(0.940)	(0.201)	(0.095)	(0.460)	(0.372)
$Ln(N_{i,t-1})$	0.017*	0.040*	0.125***	0.010	0.061	0.262**	186,638.007***	14.542***
	(0.055)	(0.082)	(0.003)	(0.700)	(0.238)	(0.047)	(0.009)	(0.010)
$Disposition_{i,t-1}$	-0.019	0.030	0.120	-0.056	-0.069	-0.090	89,808.637	10.613
	(0.444)	(0.525)	(0.266)	(0.229)	(0.554)	(0.735)	(0.724)	(0.575)
$Return_{i,t-1}$	0.052	0.055	0.036	-0.050	0.140	-0.035	0.184	0.149
	(0.580)	(0.643)	(0.769)	(0.694)	(0.199)	(0.790)	(0.123)	(0.123)
Constant	0.044	-0.000	-0.310	-0.061	-0.740	-2.249*	-168,170.226	-10.601
	(0.709)	(0.999)	(0.536)	(0.794)	(0.143)	(0.070)	(0.874)	(0.902)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	174	174	173	88	86	84	166	166
Adjusted R^2	0.064	0.048	0.042	-0.073	-0.012	-0.035	0.082	0.078

Table X. Superstition and Mark-to-market Returns of Limit Orders at "8," "4," "0," and other Numbers

In this table we sort investors into quintiles by the superstition index in one year, and report the subsequent year's mark-to-market return of limit orders submitted at prices ending with "8," "4," "0," and other numbers. Quintile-5 (Q5) investors are more superstitious. Each year, we calculate the superstition index for each investor as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4." Mark-to-market intraday return is the difference between the trade price and the daily closing price divided by the trade price. Mark-to-market 1-day and 5-day returns are calculated in a similar fashion. All items are first calculated for each investor-year observation and then averaged up in each quintile with equal weights. Results for individual investors, domestic institutions, and QFIIs are reported separately. To ensure a reasonable magnitude of superstition index, we require that investors must submit at least 10 limit orders in each of the two consecutive years. The Satterthwaite p-value assumes unequal variances of investor performance in quintiles 1 and 5. *, **, and *** indicate significance levels of 0.1, 0.05, and 0.01, respectively.

Panel A: Individual Investors

Quintile Ranks	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Mark-to-market returns of limit orders submitted at prices ending with "8"							
Intraday (%)	-0.056	-0.056	-0.055	-0.068	-0.073	-0.017***	0.002
1-day (%)	-0.076	-0.102	-0.084	-0.109	-0.110	-0.034***	0.002
5-day (%)	-0.063	-0.153	-0.117	-0.134	-0.166	-0.103***	0.000
Mark-to-market returns of limit orders submitted at prices ending with "4"							
Intraday (%)	-0.054	-0.061	-0.059	-0.061	-0.065	-0.011*	0.099
1-day (%)	-0.081	-0.103	-0.097	-0.095	-0.089	-0.008	0.535
5-day (%)	-0.148	-0.176	-0.172	-0.175	-0.154	-0.006	0.821
Mark-to-market returns of limit orders submitted at prices ending with "0"							
Intraday (%)	-0.074	-0.089	-0.089	-0.084	-0.094	-0.020***	0.000
1-day (%)	-0.111	-0.128	-0.126	-0.119	-0.131	-0.021**	0.016
5-day (%)	-0.185	-0.241	-0.208	-0.183	-0.221	-0.036**	0.042
Mark-to-market returns of limit orders submitted at other prices							
Intraday (%)	-0.076	-0.086	-0.085	-0.084	-0.097	-0.021***	0.000
1-day (%)	-0.110	-0.132	-0.123	-0.128	-0.138	-0.027***	0.000
5-day (%)	-0.179	-0.223	-0.216	-0.217	-0.243	-0.065***	0.000

Panel B: Domestic Institutions

Quintile Ranks	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Mark-to-market returns of limit orders submitted at prices ending with "8"							
Intraday (%)	-0.024	-0.026	-0.042	-0.052	0.001	0.024	0.566
1-day (%)	-0.040	-0.040	-0.087	-0.090	-0.064	-0.023	0.793
5-day (%)	0.067	-0.224	-0.205	-0.186	-0.185	-0.252	0.170
Mark-to-market returns of limit orders submitted at prices ending with "4"							
Intraday (%)	-0.010	-0.006	-0.031	0.024	-0.021	-0.011	0.804
1-day (%)	-0.059	-0.102	0.048	0.003	-0.086	-0.028	0.737
5-day (%)	0.008	-0.080	-0.196	0.140	-0.055	-0.063	0.741
Mark-to-market returns of limit orders submitted at prices ending with "0"							
Intraday (%)	0.040	0.015	0.021	-0.024	0.035	-0.005	0.897
1-day (%)	-0.008	0.086	-0.042	0.077	0.120	0.127	0.128
5-day (%)	-0.023	-0.136	-0.192	0.049	0.092	0.115	0.434
Mark-to-market returns of limit orders submitted at other prices							
Intraday (%)	0.011	0.008	0.003	-0.014	-0.005	-0.016	0.519
1-day (%)	-0.089	-0.073	-0.042	0.004	-0.005	0.085	0.129
5-day (%)	-0.024	-0.165	-0.003	0.032	-0.059	-0.034	0.777

Panel C: Qualified Foreign Institutional Investors

Quintile Ranks	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Mark-to-market returns of limit orders submitted at prices ending with "8"							
Intraday (%)	-0.062	0.069	-0.079	-0.031	0.057	0.119	0.172
1-day (%)	0.073	0.154	-0.038	0.144	0.165	0.092	0.662
5-day (%)	0.295	0.421	0.049	-0.040	0.773	0.478	0.294
Mark-to-market returns of limit orders submitted at prices ending with "4"							
Intraday (%)	0.016	0.024	0.034	-0.061	-0.051	-0.067	0.383
1-day (%)	-0.072	0.081	0.069	0.030	-0.074	-0.002	0.995
5-day (%)	-0.141	0.106	0.103	0.111	-0.213	-0.072	0.917
Mark-to-market returns of limit orders submitted at prices ending with "0"							
Intraday (%)	-0.057	0.014	0.025	-0.026	0.029	0.086	0.365
1-day (%)	-0.010	0.147	0.162	0.132	-0.124	-0.115	0.552
5-day (%)	0.070	0.392	0.132	-0.012	0.185	0.115	0.801
Mark-to-market returns of limit orders submitted at other prices							
Intraday (%)	0.064	0.030	0.001	0.013	-0.041	-0.105	0.225
1-day (%)	0.114	0.167	0.054	-0.024	-0.095	-0.208	0.276
5-day (%)	-0.015	0.246	0.302	0.105	0.057	0.072	0.848

Table XI. Number of "X"s Where Superstitious Investors Underperform

In this table, we sort investors into quintiles based on their superstition index in one year, and look at the subsequent year's performance of limit orders submitted at prices ending with "X" (X is an integer ranging from 0 to 9). We report the number of "X"s where Quintile-5 investors (significantly) underperform Quintile-1 investors. Quintile-5 (Q5) investors are more superstitious. Each year, we calculate the superstition index for each investor as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4." The underperformance is determined by looking at the intraday, 1-day, as well as 5-day mark-to-market return of limit orders. Mark-to-market intraday return is the difference between the trade price and the daily closing price divided by the trade price. Mark-to-market 1-day and 5-day returns are calculated in a similar fashion. Results for individual investors, domestic institutions, and QFIIs are reported separately. To ensure a reasonable magnitude of superstition index, we require that investors must submit at least 10 limit orders in each of the two consecutive years. The Satterthwaite p-value assumes unequal variances of investor performance in quintiles 1 and 5. *, **, and *** indicate significance levels of 0.1, 0.05, and 0.01, respectively.

Panel A: Individual Investors

Significance	Number of "X"s where Quintile-5 investors underperform Quintile-1 investors		
Level	Intraday	1-day	5-day
p<1	10	10	10
p<0.1	10	10	10
p<0.05	10	10	10
p<0.01	10	10	10

Panel B: Domestic Institutions

Significance	Number of "X"s where Quintile-5 investors underperform Quintile-1 investors		
Level	Intraday	1-day	5-day
p<1	3	0	0
p<0.1	0	0	0
p<0.05	0	0	0
p<0.01	0	0	0

Panel C: Qualified Foreign Institutional Investors

Significance	Number of "X"s where Quintile-5 investors underperform Quintile-1 investors		
Level	Intraday	1-day	5-day
p<1	1	0	0
p<0.1	1	0	0
p<0.05	1	0	0
p<0.01	0	0	0

Table XII. Superstition and Mark-to-market Returns of Limit Orders at Prices Ending with "X"

In this table we report the parameter estimates from the following regression:

$$Return_{X,i,t} = \alpha + \beta_1 SI_{i,t-1} + (\beta_2 D_8 + \beta_3 D_4 + \beta_4 D_0) \times SI_{i,t-1} + \beta_5 D_8 + \beta_6 D_4 + \beta_7 D_0 + \beta_8 SubRatio_{0,i,t-1} + \beta_9 Ln(N_{i,t-1}) + \beta_{10} Disposition_{i,t-1} + \beta_{11} Return_{i,t-1} + \varepsilon_X$$

$Return_{X,i,t}$ is the performance of limit orders submitted at prices ending with "X" for investor *i* at year *t* (X is an integer ranging from 0 to 9). D_8, D_4, and $D_0$are dummy variables for X=8, 4, and 0, respectively. Mark-to-market intraday return is the difference between the trade price and the daily closing price divided by the trade price. Mark-to-market 1-day and 5-day returns are calculated in a similar fashion. $SI_{i,t-1}$ is the superstition index in year t-1, and it is calculated as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4." $SubRatio_{0,i,t-1}$ is the submission ratio at prices ending with "0" in year *t-1*. $Ln(N_{i,t-1})$ is the log of the number of limit orders submitted in year *t-1*. $Disposition_{i,t-1}$ is the disposition effect, which is calculated as the difference between winning and losing round-trip trades, divided by the average of the two. $Return_{i,t-1}$ is the average intraday, 1-day, or 5-day mark-to-market return in year *t-1*. Results for individual investors, domestic institutions, and QFIIs are reported separately. To ensure a reasonable magnitude of the superstition index, we require that investors must submit at least 10 limit orders in each of the two consecutive years. *, **, and *** indicate significance levels of 0.1, 0.05, and 0.01, respectively.

Panel A: Individual Investors

Independent Variable	Mark-to-market Return of Limit Orders (%)		
	Intraday	1-day	5-day
$SI_{i,t-1}$	-0.077***	-0.105***	-0.211***
	(0.000)	(0.000)	(0.001)
$SI_{i,t-1} \times D_8$	-0.009	-0.002	-0.112
	(0.734)	(0.963)	(0.318)
$SI_{i,t-1} \times D_4$	0.022	0.008	0.043
	(0.560)	(0.923)	(0.798)
$SI_{i,t-1} \times D_0$	-0.015	0.018	0.156
	(0.551)	(0.720)	(0.140)
D_8	0.019***	0.021***	0.074***
	(0.000)	(0.000)	(0.000)
D_4	0.018***	0.020***	0.028**
	(0.000)	(0.000)	(0.015)
D_0	0.001	0.002	0.004
	(0.714)	(0.518)	(0.601)
$SubRatio_{0,i,t-1}$	-0.058***	-0.108***	-0.234***
	(0.000)	(0.000)	(0.000)
$Ln(N_{i,t-1})$	0.010***	0.015***	0.015***
	(0.000)	(0.000)	(0.000)
$Disposition_{i,t-1}$	-0.023***	-0.028***	-0.021***
	(0.000)	(0.000)	(0.000)
$Return_{i,t-1}$	0.017***	0.006***	0.005**
	(0.000)	(0.005)	(0.031)
Constant	-0.108***	-0.151***	-0.255***
	(0.000)	(0.000)	(0.000)
Year fixed effect	Yes	Yes	Yes
Number of obs.	427,904	427,070	413,971
Adjusted R^2	0.006	0.002	0.003

Panel B: Domestic Institutions

Independent Variable	Mark-to-market Return of Limit Orders (%)		
	Intraday	1-day	5-day
$SI_{i,t-1}$	-0.136	0.106	-0.654
	(0.317)	(0.700)	(0.289)
$SI_{i,t-1} \times D_8$	0.666**	0.281	-0.314
	(0.021)	(0.676)	(0.810)
$SI_{i,t-1} \times D_4$	-0.121	0.109	2.015
	(0.709)	(0.860)	(0.192)
$SI_{i,t-1} \times D_0$	0.209	0.166	1.180
	(0.389)	(0.743)	(0.253)
D_8	-0.077***	-0.072*	-0.193**
	(0.000)	(0.073)	(0.020)
D_4	-0.012	0.013	-0.042
	(0.465)	(0.724)	(0.599)
D_0	0.012	0.087**	-0.025
	(0.451)	(0.010)	(0.710)
$SubRatio_{0,i,t-1}$	-0.236***	-0.394***	-0.958***
	(0.000)	(0.000)	(0.000)
$Ln(N_{i,t-1})$	0.002	-0.010	-0.010
	(0.550)	(0.234)	(0.561)
$Disposition_{i,t-1}$	-0.028***	-0.049***	0.013
	(0.000)	(0.003)	(0.708)
$Return_{i,t-1}$	0.002	-0.000	0.039*
	(0.898)	(0.996)	(0.056)
Constant	0.035	0.055	0.116
	(0.335)	(0.447)	(0.445)
Year fixed effect	Yes	Yes	Yes
Number of obs.	5,766	5,756	5,612
Adjusted R^2	0.014	0.011	0.006

Panel C: Qualified Foreign Institutional Investors

Independent Variable	Mark-to-market Return of Limit Orders (%)		
	Intraday	1-day	5-day
$SI_{i,t-1}$	0.108	-0.875	-1.583
	(0.764)	(0.393)	(0.351)
$SI_{i,t-1} \times D_8$	0.385	0.789	2.528
	(0.455)	(0.561)	(0.248)
$SI_{i,t-1} \times D_4$	-2.617**	-2.566	-10.949
	(0.038)	(0.659)	(0.490)
$SI_{i,t-1} \times D_0$	0.260	1.450	3.275
	(0.649)	(0.296)	(0.294)
D_8	-0.026	0.016	-0.092
	(0.378)	(0.832)	(0.550)
D_4	0.029	0.060	-0.110
	(0.450)	(0.417)	(0.589)
D_0	-0.003	0.061	0.029
	(0.929)	(0.366)	(0.863)
$SubRatio_{0,i,t-1}$	-0.210**	-0.198	-0.173
	(0.050)	(0.438)	(0.765)
$Ln(N_{i,t-1})$	0.013*	0.033**	0.111***
	(0.058)	(0.027)	(0.004)
$Disposition_{i,t-1}$	-0.003	0.029	0.162**
	(0.844)	(0.381)	(0.025)
$Return_{i,t-1}$	0.021	0.066	0.061
	(0.414)	(0.303)	(0.409)
Constant	0.055	-0.082	-0.222
	(0.432)	(0.581)	(0.539)
Year fixed effect	Yes	Yes	Yes
Number of obs.	637	635	630
Adjusted R^2	0.026	0.015	0.036

Table XIII. Superstition and Learning by Trading

In this table we report the parameter estimates from the following regression:

$$SI_{i,t} - SI_{i,t-1} = \alpha + \beta_1 Ln(N_{i,t-1}) + \beta_2 Return_{i,t-1} + \beta_3 SI_{i,t-1} + \beta_4 Disposition_{i,t-1} + \beta_5 SubRatio_{0,i,t-1} + \varepsilon_X$$

$SI_{i,t}$ and $SI_{i,t-1}$ are the superstition indices in year *t* and *t-1*, and they calculated as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4" in each year. $Ln(N_{i,t-1})$ is the log of the number of limit orders submitted in year *t-1*. $Return_{i,t-1}$ is the mark-to-market intraday return of limit orders, which is calculated as the difference between the trade price and the daily closing price divided by the trade price. $Disposition_{i,t-1}$ is the disposition effect, which is calculated as the difference between winning and losing round-trip trades, divided by the average of the two. $SubRatio_{0,i,t-1}$ is the submission ratio at prices ending with "0" in year *t-1*. Results for individual investors, domestic institutions, and QFIIs are reported separately. To ensure a reasonable magnitude of the superstition index, we require that investors must submit at least 10 limit orders in each of the two consecutive years, and we express the superstition index in percentage. *, **, and *** indicate significance levels of 0.1, 0.05, and 0.01, respectively.

Panel A: Individual Investors

Independent Variables	$SI_{i,t} - SI_{i,t-1}$		
	Model 1	Model 2	Model 3
$Ln(N_{i,t-1})$	-0.054***		-0.046***
	(0.001)		(0.006)
$Return_{i,t-1}$		-0.384***	-0.368***
		(0.000)	(0.000)
$SI_{i,t-1}$	-0.563***	-0.560***	-0.560***
	(0.000)	(0.000)	(0.000)
$Disposition_{i,t-1}$	0.313***	0.299***	0.304***
	(0.000)	(0.000)	(0.000)
$SubRatio_{0,i,t-1}$	-1.270***	-1.205***	-1.262***
	(0.000)	(0.000)	(0.000)
Constant	3.009***	2.733***	2.946***
	(0.000)	(0.000)	(0.000)
Year fixed effect	Yes	Yes	Yes
Number of obs.	146,254	145,898	145,898
Adjusted R^2	0.256	0.254	0.254

Panel B: Domestic Institutions

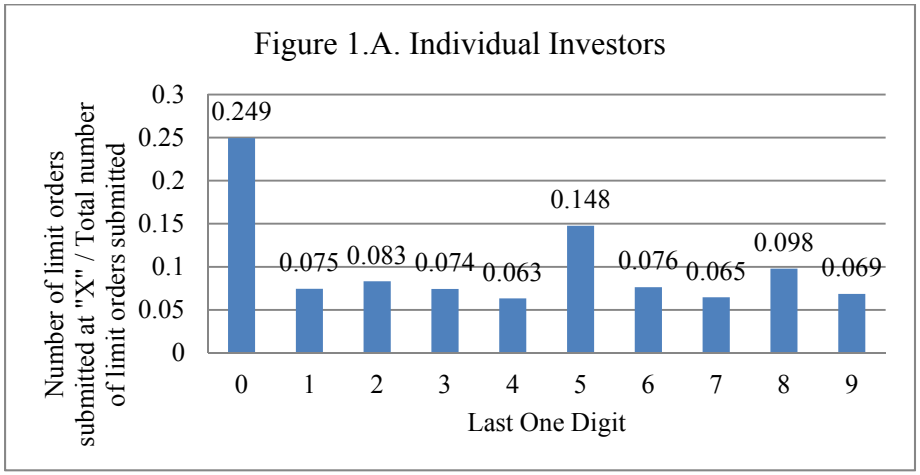
Independent Variables	$SI_{i,t} - SI_{i,t-1}$		
	Model 1	Model 2	Model 3
$Ln(N_{i,t-1})$	-0.286***		-0.300***
	(0.002)		(0.001)
$Return_{i,t-1}$		-0.045	-0.056
		(0.936)	(0.920)
$SI_{i,t-1}$	-0.675***	-0.673***	-0.674***
	(0.000)	(0.000)	(0.000)
$Disposition_{i,t-1}$	0.048	0.079	0.047
	(0.794)	(0.670)	(0.800)
$SubRatio_{0,i,t-1}$	0.783	1.693*	0.840
	(0.404)	(0.051)	(0.370)
Constant	3.643***	2.126***	3.691***
	(0.000)	(0.000)	(0.000)
Year fixed effect	Yes	Yes	Yes
Number of obs.	1,822	1,812	1,812
Adjusted R^2	0.352	0.350	0.353

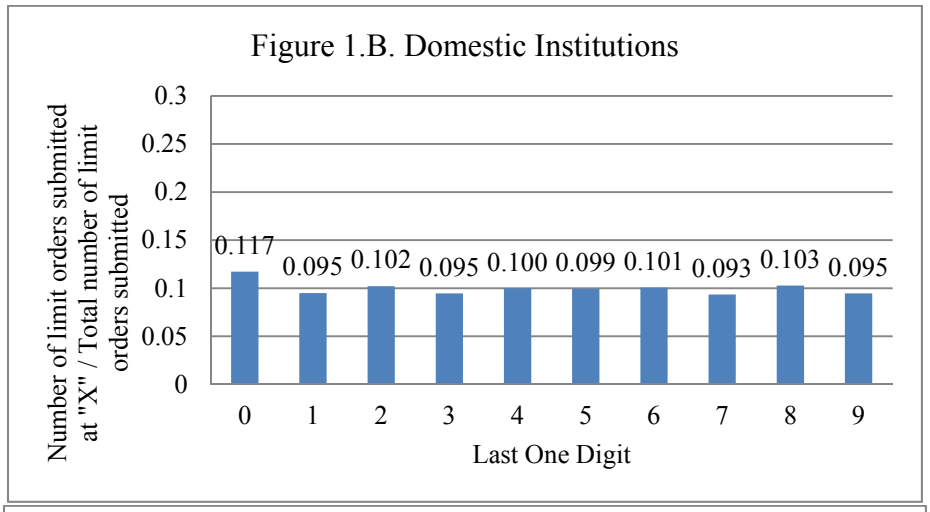
Panel C: Qualified Foreign Institutional Investors

Independent Variables	$SI_{i,t} - SI_{i,t-1}$		
	Model 1	Model 2	Model 3
$Ln(N_{i,t-1})$	-0.175		-0.150
	(0.143)		(0.236)
$Return_{i,t-1}$		-1.323	-0.852
		(0.220)	(0.449)
$SI_{i,t-1}$	-0.882***	-0.866***	-0.881***
	(0.000)	(0.000)	(0.000)
$Disposition_{i,t-1}$	0.254	0.329	0.292
	(0.353)	(0.237)	(0.296)
$SubRatio_{0,i,t-1}$	1.007	2.648*	2.120
	(0.566)	(0.079)	(0.195)
Constant	2.335**	0.301	1.655
	(0.026)	(0.558)	(0.197)
Year fixed effect	Yes	Yes	Yes
Number of obs.	169	167	167
Adjusted R^2	0.647	0.657	0.658

Figure 1. Limit Order Submission Ratios at Various Prices

In this figure, we report the proportion of limit orders submitted at prices ending with "X" (X is an integer ranging from 0 to 9). The submission ratio is calculated as the number of limit orders submitted at "X" divided by the total number of limit orders submitted. We report the figures separately for individual investors, domestic institutions, and Qualified QFIIs.





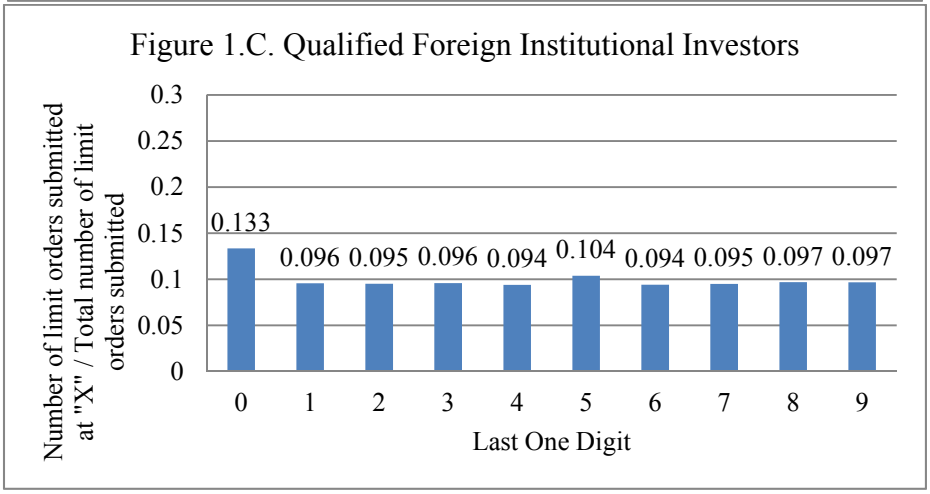
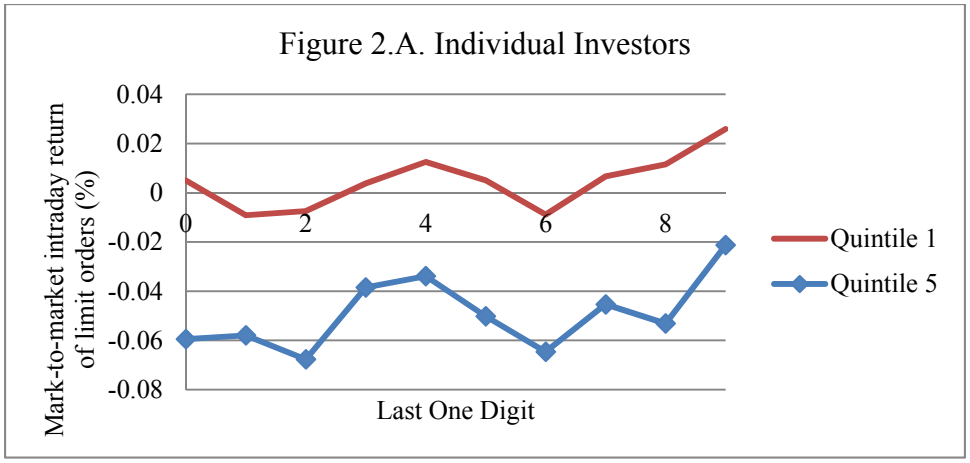
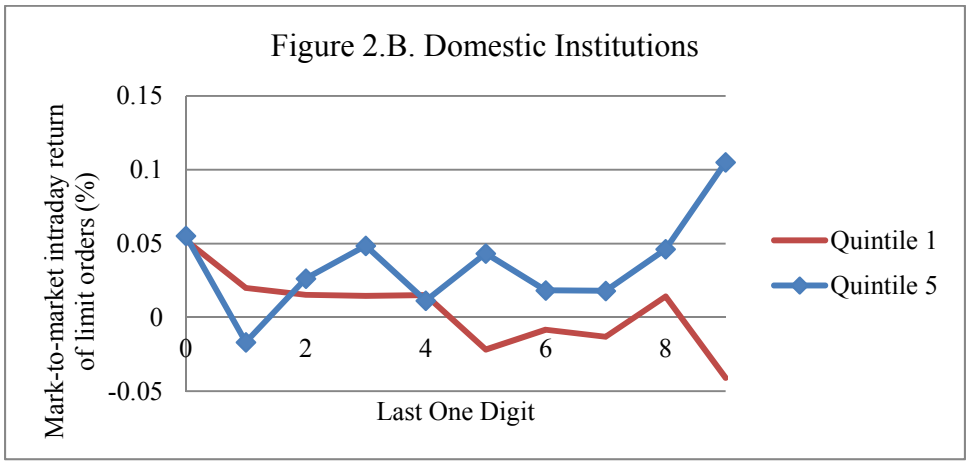
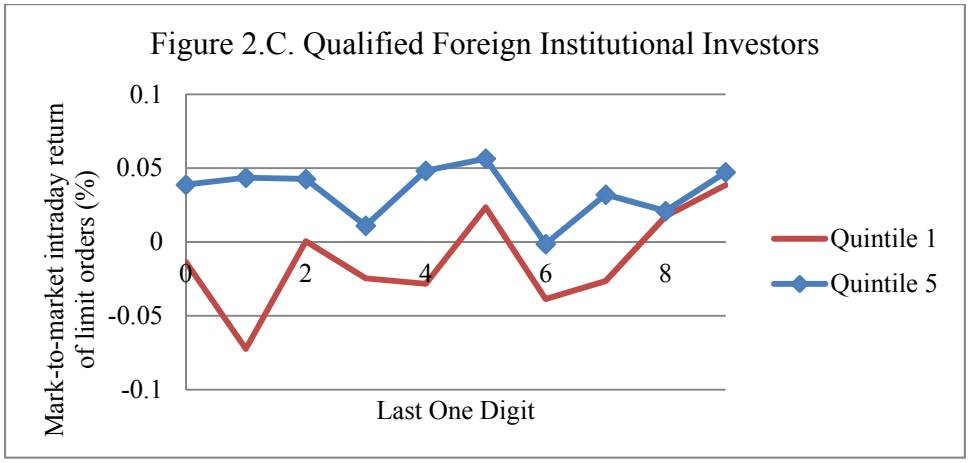


Figure 2. Superstition and Intraday Returns of Limit Orders Submitted at "X"

In this table we sort investors into quintiles by the superstition index in one year, and plot the mark-to-market return of limit orders submitted at prices ending with "X" in the subsequent year (X is an integer ranging from 0 to 9). Quintile-5 (Q5) investors are more superstitious. Each year, we calculate the superstition index for each investor as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4." Mark-to-market intraday return is the difference between the trade price and the daily closing price divided by the trade price. Results for individual investors, domestic institutions, and QFIIs are reported separately.







Appendix Table I. Superstition, Cognitive Limitation, and Intraday Mark-to-market Returns of Limit Orders

In this table we double sort investors into quintiles by the superstition index and the submission ratio at round number prices in one year, and report the subsequent year's intraday mark-to-market return of limit orders. Quintile-5 (Q5) investors are more superstitious or with higher submission ratios at round number prices. Each year, we calculate the superstition index for each investor as the difference between limit order submission ratio at prices ending with "8" and that at prices ending with "4." The submission ratio at round number prices is the proportion of limit orders submitted at prices ending with "0." Mark-to-market intraday return is expressed in percentage, and it is the difference between the trade price and the daily closing price divided by the trade price. All items are first calculated for each investor-year observation and then averaged up in each quintile with equal weights. Results for individual investors, domestic institutions, and QFIIs are reported separately. To ensure a reasonable magnitude of superstition index, we require that investors must submit at least 10 limit orders in each of the two consecutive years. The Satterthwaite p-value assumes unequal variances of investor performance in quintiles 1 and 5. *, **, and *** indicate significance levels of 0.1, 0.05, and 0.01, respectively.

Panel A: Individual Investors

Quintile ranks of $SubRatio_{0,t-1}$	Quintile ranks of SI_{t-1}						
	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Q1	-0.057	-0.058	-0.059	-0.074	-0.088	-0.032***	0.000
Q2	-0.077	-0.069	-0.070	-0.075	-0.092	-0.014***	0.003
Q3	-0.082	-0.074	-0.090	-0.079	-0.098	-0.015***	0.004
Q4	-0.092	-0.100	-0.095	-0.096	-0.103	-0.012*	0.051
Q5	-0.102	-0.109	-0.110	-0.106	-0.102	-0.000	0.990
Diff (Q5-Q1)	-0.045***	-0.050***	-0.051***	-0.032***	-0.014*		
p-value	0.000	0.000	0.000	0.000	0.051		

Panel B: Domestic Institutions

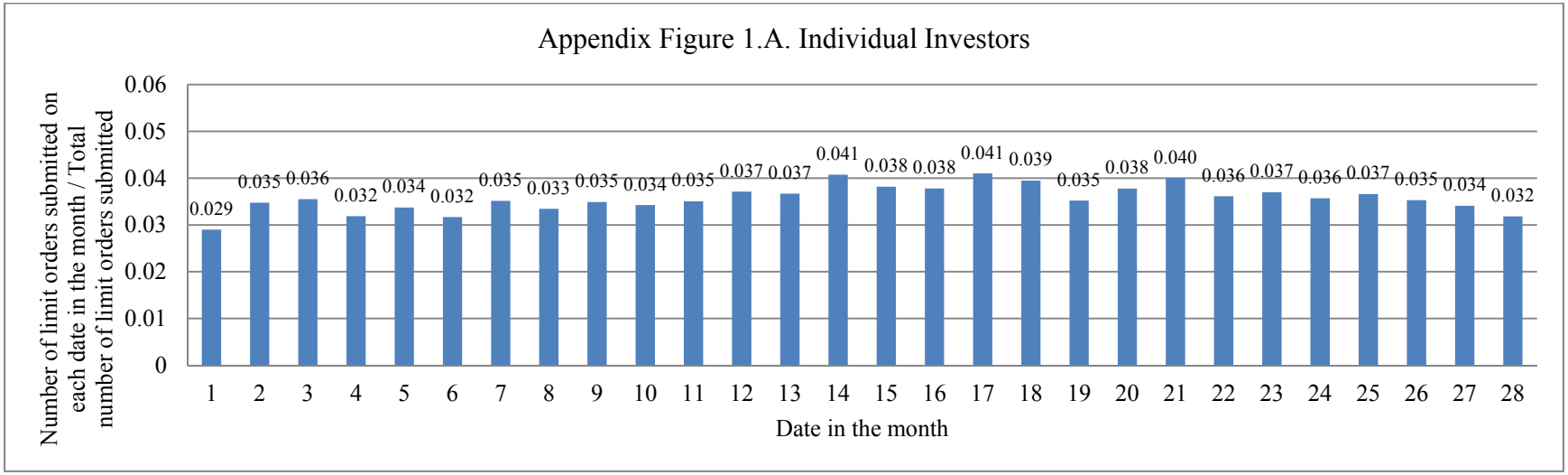
Quintile ranks of $SubRatio_{0,t-1}$	Quintile ranks of SI_{t-1}						
	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Q1	0.018	0.087	-0.004	-0.021	-0.021	-0.039	0.287
Q2	0.037	0.031	0.034	-0.028	0.007	-0.031	0.458
Q3	-0.010	0.036	0.036	-0.021	0.022	0.032	0.577
Q4	-0.030	0.006	-0.024	-0.034	0.031	0.061	0.219
Q5	0.026	-0.100	-0.077	-0.026	-0.076	-0.101*	0.072
Diff (Q5-Q1)	0.008	-0.187***	-0.073*	-0.006	-0.055		
p-value	0.885	0.006	0.097	0.920	0.171		

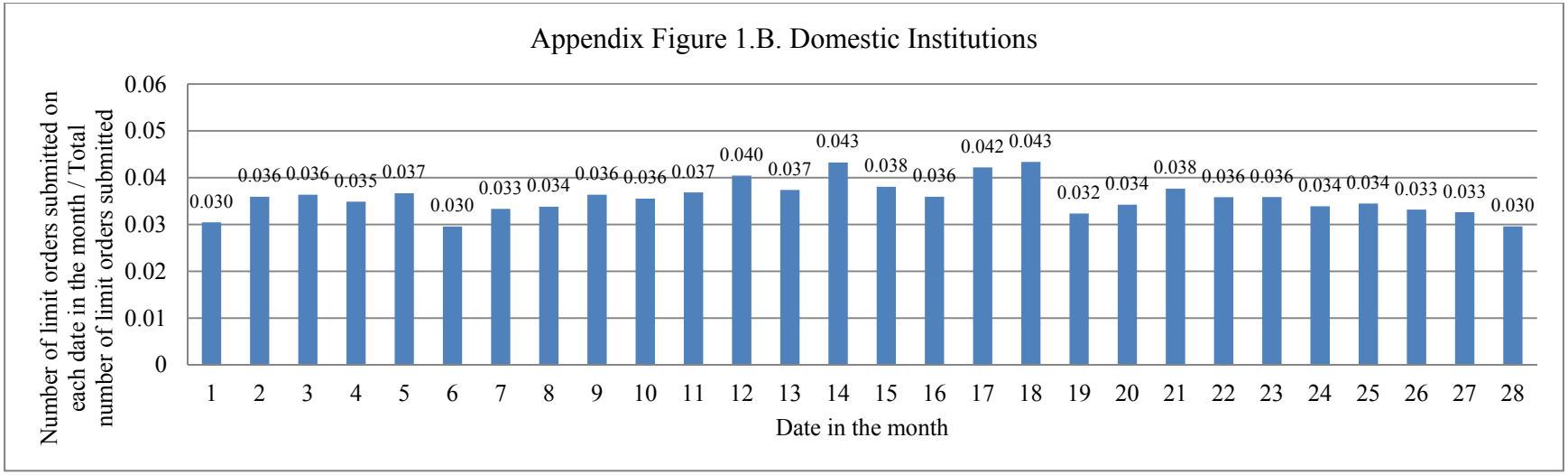
Panel C: Qualified Foreign Institutional Investors

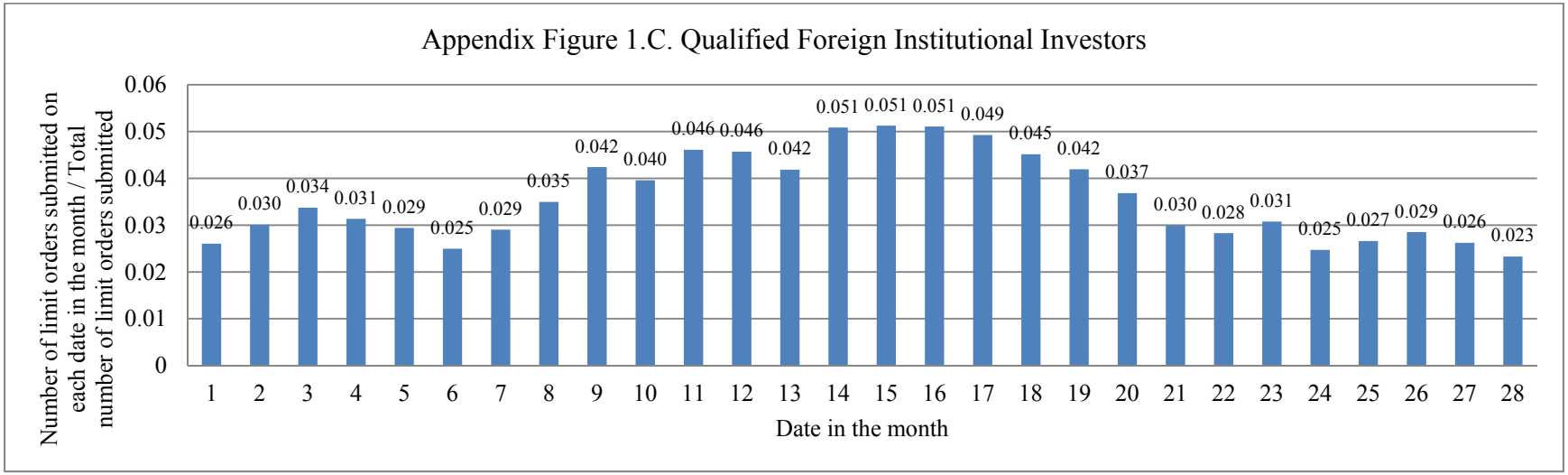
Quintile ranks of $SubRatio_{0,t-1}$	Quintile ranks of SI_{t-1}						
	Q1	Q2	Q3	Q4	Q5	Diff (Q5-Q1)	p-value
Q1	0.096	-0.006	-0.082	-0.050	0.023	-0.073	0.615
Q2	-0.020	0.130	0.048	0.042	0.030	0.050	0.818
Q3	0.035	-0.071	-0.065	0.111	0.082	0.048	0.500
Q4	-0.112	-0.239	0.044	-0.051	-0.179	-0.067	0.731
Q5	-0.012	-0.027	0.076	-0.087	0.023	0.035	0.930
Diff (Q5-Q1)	-0.108	-0.021	0.159	-0.037	-0.000		
p-value	0.790	0.812	0.458	0.704	0.999		

Appendix Figure 1. Limit Order Submission Ratios on Various Days of the Month

In this figure, we report the proportion of limit orders submitted on various dates in the month. The submission ratio is calculated as the number of limit orders submitted on each date of the month divided by the total number of limit orders submitted in the month. We report the figures separately for individual investors, domestic institutions, and Qualified QFIIs.




Appendix Figure 1.B. Domestic Institutions
Number of limit orders submitted on each date in the month / Total number of limit orders submitted
0.06
0.05
0.04
0.03
0.02
0.01
0
0.030 0.036 0.036 0.035 0.037 0.030 0.033 0.034 0.036 0.036 0.037 0.040 0.037 0.043 0.038 0.036 0.042 0.043 0.032 0.034 0.038 0.036 0.036 0.034 0.034 0.033 0.033 0.030
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Date in the month


Appendix Figure 1.C. Qualified Foreign Institutional Investors
Number of limit orders submitted on each date in the month / Total number of limit orders submitted
0.06
0.05
0.04
0.03
0.02
0.01
0
0.026 0.030 0.034 0.031 0.029 0.025 0.029 0.035 0.042 0.040 0.046 0.046 0.042 0.051 0.051 0.051 0.049 0.045 0.042 0.037 0.030 0.028 0.031 0.025 0.027 0.029 0.026 0.023
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Date in the month