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Journal of Financial Markets 16 (2013) 227–252

Journal of FINANCIAL MARKETS

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Microstructure-based manipulation: Strategic behavior and performance of spoofing traders ☆

Eun Jung Lee[a], Kyong Shik Eom[b,c,*], Kyung Suh Park[d]

[a]*Department of Finance, Hanyang University, Sa 3-dong, Sangrok-gu, Ansan-si, Gyeonggi-do, Republic of Korea*
[b]*Department of Business Administration, University of Seoul, Siripdae-gil 13, Dongdaemun-gu, Seoul, Republic of Korea*
[c]*Department of Economics, University of California at Berkeley, 508-1 Evans Hall # 3880, Berkeley, CA 94720-3880, USA*
[d]*Business School, Korea University, 5-1 Anam-dong, Sungbuk-gu, Seoul, Republic of Korea*

Received 1 June 2011; accepted 25 May 2012
Available online 1 November 2012

Abstract

We examine how investors strategically spoof the stock market by placing orders with little chance of being executed, but which mislead other traders into thinking there is an imbalance in the order book. Using the complete intraday order and trade data of the Korea Exchange (KRX) in a custom data set identifying individual accounts, we find that investors strategically placed spoofing orders which, given the KRX's order-disclosure rule at the time, created the impression of a substantial order book imbalance, with the intent to manipulate subsequent prices. This manipulation, which made use of specific features of the market microstructure, differs from previously studied forms of manipulation based on information or transactions. Roughly half of the spoofing orders were placed in conjunction with day trading. Stocks targeted for manipulation had higher return volatility, lower market capitalization, lower price level, and lower managerial transparency. We also find that spoofing traders achieved substantial extra profits. The frequency of spoofing orders decreased drastically after the KRX altered its order-disclosure rule.
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JEL classification: G14

Keywords: Spoofing order; Microstructure-based manipulation; Pre-trade transparency

☆ The authors are very grateful for use of a custom data set provided by the Korea Exchange (KRX), for intensive discussions with Bob Anderson, and for helpful comments by the referee. All errors are the responsibility of the authors.
*Corresponding author at: Department of Business Administration, University of Seoul, Siripdae-gil 13, Dongdaemun-gu, Seoul, Republic of Korea. Tel.: +82 2 2210 5362; fax: +82 2 2246 0570.

E-mail addresses: ejunglee@hanyang.ac.kr (E.J. Lee), kseom@uos.ac.kr, kseom2@gmail.com (K.S. Eom), kspark@korea.ac.kr (K.S. Park).

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http://dx.doi.org/10.1016/j.finmar.2012.05.004

1. Introduction

There is a large theoretical literature regarding stock market manipulation. However, empirical evidence of manipulation remains scarce, and the evidence is essentially limited to regulatory enforcement (and thus subject to sample selection bias), and the use of spam email in connection with pump-and-dump strategies.

In this paper, we provide empirical evidence of stock market manipulation by examining a custom data set that allows us to determine whether the same party placed a buy (sell) and a subsequent sell (buy) order. Moreover, we demonstrate that a specific market design, which was originally intended to provide additional information to traders, in practice facilitated manipulation. We refer to strategies that exploit specific features of the market microstructure to manipulate the market as "*microstructure-based manipulation*;" this paper provides the first evidence of microstructure-based manipulation.

Consider a microstructure in which the total quantity on each side of the order book is disclosed, but the price of each order is not disclosed. We define a "*spoofing order*" as an order submitted to a stock exchange, without the intention of execution, in order to mislead other investors by injecting misleading information regarding the demand or supply of a stock. A spoofing trader later submits his real order, taking advantage of the price change resulting from his earlier spoofing order.

Here is a specific example of a spoofing trading strategy. Suppose an investor intends to sell shares of a firm. He first submits a large limit-buy order with a bid well below the current market price, making the buy side of the order book seem large, in hopes of raising the price of the stock. Once the stock price increases, the spoofing trader submits a market-sell order for the same stock, and subsequently cancels the original buy order. The efficacy of such a spoofing trading strategy depends on the specific form of pre-trade transparency inherent in this microstructure: other investors can see that a large order has been placed, but cannot determine at what price it was placed.

The Korea Exchange (KRX) is a pure electronic order-driven market. Until the end of 2001, the KRX disclosed the total quantity on each side of the order book without fully disclosing the prices at which the orders were placed.[1] The KRX originally introduced this order-disclosure rule into its microstructure with the intent of providing investors with more information regarding the demand and supply of a stock. However, this additional information created an opportunity for microstructure-based manipulation, since spoofing orders altered the information posted on the order book, and other investors were unable to differentiate these spoofing orders from orders that were actually to be executed.

Placing a spoofing order has roughly the same effect as a pump-and-dump strategy, which is illegal. The legality of spoofing orders, as defined here, lies in a legal gray area. The Korean Securities Exchange Act (article 188-4(2)) prohibits "spoofing orders," defined therein as "orders intended to deceive [other traders into believing] that trade is flourishing in order to influence the market price.[2]" However, the exact scope of the prohibited behavior is unclear. Wash trading, in which a single trader sells securities to himself in

[1]In January 2002, to prevent further manipulation, the KRX stopped disclosing the total number of shares on each side of the order book. In addition to the total quantity, the KRX also disclosed the 5 best buy/sell prices and the quantities at those prices; in January 2002, this was increased from 5 to 10. For the description of this event and its effects on market quality, see Eom, Ok, and Park (2007) and Eom (2011).

[2]When the Korean Securities Exchange Act was consolidated into the Financial Investment Services and Capital Markets Act in February 2009, article 188-4(2) became article 176-2(1).

order to increase the reported trade volume or influence the market price, seems clearly prohibited. The use of the term "order" rather than "trade" in the definition seems also to prohibit spoofing in the broader sense used in our paper: the placing of unexecuted orders, with the intent to influence the market price. Thus, spoofing orders in the broader sense used in this paper are arguably illegal, and at best reside within a legal gray area.

At the same time, it would be difficult to enforce a prohibition against spoofing orders, in the broad sense used here, without ruling out many legitimate trading strategies. For example, it is perfectly legitimate for a trader who believes the current market price is correct to place simultaneous limit orders to buy/sell at a certain percentage under/over the current market price; the trader hopes to benefit from market volatility, and is supplying liquidity to the market; a regulation prohibiting the placing of simultaneous buy and sell orders on the same stock would rule out many legitimate transactions that provide benefit to the market. Thus, any enforcement regime would have to target the manipulative intent of the traders in placing the spoofing order. Intent is inherently difficult to prove, and thus the control of this form of manipulation via regulatory measures is problematic. The solution is to redesign the microstructure by changing the order-disclosure rule to one that does not facilitate spoofing.

Our analysis makes use of a custom data set generated by the KRX at our request. This data set contains every order placed, the time and price of execution (if applicable), the time the order was withdrawn without being executed (if applicable), and the customer account number of the person who placed the order.[3] Thus, our data set allows us to follow each investor's order activity throughout a trading day.[4] The data period is November 1, 2001 through February 28, 2002. The exchange stopped disclosing the total quantity on each side of the order book on January 2, 2002, so that spoofing orders could no longer be used to mislead investors.[5] Therefore, we can clearly observe the behavior of spoofing traders during the first two months of our sample period (November 1, 2001 to December 31, 2001) and we can also observe the effects of the change in the microstructure of the order-disclosure rule on traders' behavior during the second two months of our sample period (January 2, 2002 to February 28, 2002).

Our findings are as follows:

- We demonstrate that the unique microstructure of the KRX during our sample period facilitated a new form of manipulation—microstructure-based manipulation—which is defined as a strategy that takes advantage of a unique aspect of the market microstructure (in this case, the order-disclosure rule) to manipulate the market. We show that this form of manipulation generates extra profits in the range of 67–83 basis points over the course of approximately 45 minutes, and must therefore be viewed as an effective strategy for manipulation. While we cannot directly observe traders' intent, our

[3]The data set does not allow us to determine the identity of the person placing the order.

[4]Korea has consistently enforced the uptick rule and prohibited naked short-selling. Following the 1997 Asian Financial Crisis, Korean securities firms became risk-averse and avoided securities lending, making short-selling in Korea practically impossible in our data period. As a result, it was impossible to place a short spoofing-sell order, and thus impossible to alternate spoofing-sell and spoofing-buy orders to increase volatility and generate an ongoing profit stream. Thus, in practice, most spoofing-buy orders were used to raise the price of an intended sale, and a smaller number of spoofing-sell orders were used to lower the cost of increasing a trader's holding of a given security.

[5]See footnote 5 of Eom, Ok, and Park (2007) for a press release by the KRX on November 10, 2001.

results indicate conclusively that traders *could* use this strategy to obtain extra profits at the expense of other traders,[6] and thus regulators should seek to prevent it.

- It is possible that some of the spoofing orders we have identified may not have been intended to mislead other investors, but were rather submitted as part of normal trading behavior, or with other intentions. However, in Section 6, we lay out strong circumstantial evidence supporting the conclusion that the majority of the spoofing orders represented intentional manipulation. In the following bullets, we summarize a portion of that evidence.
- Prior to the change in the disclosure rule, the shares covered by the spoofing-buy orders represented 0.81% of the total shares covered by all buy orders, and almost all of the spoofing orders were placed by individual investors. Following the change in the order-disclosure rule (January 2, 2002), the frequency of spoofing orders decreased drastically; this strongly supports the inference that spoofing orders were intended to exploit the KRX order-disclosure rule.
- The average spoofing-buy order is 5.6 times larger than a typical buy order, and almost 90% of spoofing orders are priced more than 10 ticks away from the current best bid price, rendering the probability of execution extremely low. The combination of large size and low probability of execution strongly supports the inference that spoofing orders were intended to exploit the KRX order-disclosure rule.
- To address a concern that the spoofing order might be an attempt to elicit information as part of a day-trading strategy, we defined a spoofing day-trade strategy as buy at the market price, place a spoofing-buy order, sell at the market price (as influenced by the spoofing order), and finally cancel the spoofing-buy order. We found that 57.8% of the spoofing-buy orders were not placed as part of a day-trading strategy.[7] The remaining 42.2% of the spoofing-buy orders were placed as part of a day-trading strategy. The average spoofing-buy order among spoofing day-traders was 5,202 shares, 4.1 times as large as their average executed buy order (1,283 shares). The vast majority of spoofing-buy orders submitted by day traders were more than 10 ticks away from the current best bid, whereas 94.8% of the actual executed buy orders by spoofing day-traders were submitted within 5 ticks from the current best bid. The spoofing-buy orders' much larger size and much greater distance from the market price strongly supports the inference that these orders were not intended to be executed.
- The durations between the sequences of the spoofing trading strategy were short, but longer than we would have guessed. The average duration between the submission of a spoofing-buy order and the initial following sell order is 43.27 minutes, with an additional duration of 35.73 minutes before the cancellation of the initial spoofing-buy order. However, we argue that the low probability of execution and a desire to minimize potential regulatory penalties lead to the delayed cancellation of the spoofing orders.

[6]While transaction costs would reduce the profitability of the spoofing strategy to some extent, it remains very profitable net of transaction costs. The costs imposed on other traders are equal to the gross profits of the spoofing strategy and are not reduced by the spoofers' transaction costs.

[7]During our data period, it was effectively impossible for traders to short stocks on the KRX; thus, sales were not short sales, and the trader must have held the stock at least since the previous day, and possibly for much longer. The day traders incurred transaction costs from the executed buy and sell orders, but not from the spoofing-buy order. The remaining traders had bought the stock previously and presumably intended to sell it on the given day, regardless of whether they placed a spoofing order, so they incurred no additional transaction costs by placing the spoofing-buy order.

- The intraday pattern of spoofing orders is U-shaped similar to, but flatter than, that of total orders; the rate is highest at market opening, decreases over time during the trading day, and increases again at market closing. Firms with higher return volatility, lower market capitalization, lower price level, and lower managerial transparency tend to be targets of spoofing orders. Trading volume is not a significant determinant of targeting by spoofing traders.

This paper is organized as follows. In Section 2, we review the literature regarding stock market manipulation. In Section 3, we provide a precise definition of spoofing. Section 4 reports the data and basic descriptive statistics of spoofing orders. In Section 5, we report the empirical results; first, we report the diurnal pattern, size, and price of spoofing orders, the durations between the sequences of the spoofing trading strategy, and the distribution of the number of spoofing trades per spoofer. Next, we analyze the spoofing-order strategy employed by day traders. Then, we analyze the characteristics of firms targeted by spoofing traders and the profitability of spoofing trading strategies. Finally, we compare the prevalence of the order pattern characteristics of spoofing before and after the change in the order-disclosure rule. Section 6 discusses alternative explanations for traders' behavior and argues that in the vast majority of cases, the traders must have intended to manipulate the market. Section 7 provides a summary of our results.

2. Review of related literature

There is comparatively little empirical research regarding manipulative stock trading. There is, however, an extensive theoretical literature. Manipulators are generally categorized as either engaging in the actual trading of stocks to affect prices (*trade-based manipulation*), or having (or pretending to have) private information regarding the value of the stocks they trade (*information-based manipulation*).[8]

Allen and Gale (1992) develop a model of transaction-based manipulation. They show that when the market does not know whether manipulative investors have private information or not, even those who do not have private information can profit from price manipulation. Allen and Gorton (1992) derive an equilibrium model where the existence of noise traders makes it possible to manipulate prices, but no profit is expected. Jarrow (1992) examines a case where a large trader affects prices by significantly changing the order flow to the market-maker and makes a profit with no risk.

Mei, Wu, and Zhou (2004) and Aggarwal and Wu (2006) adapt the Allen and Gale (1992) model and present empirical evidence of stock price manipulation.[9] They find that

[8]Some research focuses on markets other than stock markets. Kyle (1984), Kumar and Seppi (1992), and Jarrow (1994) examine price manipulation in the derivatives markets. Vitale (2000) examines manipulation in the foreign exchange market. Jordan and Jordan (1996) examine manipulation in a Treasury auction. Merrick, Naik, and Yadav (2005) examine manipulation in the bond futures market. For more references, see Bagnoli and Lipman (1996), Mei, Wu, and Zhou (2004), and Aggarwal and Wu (2006).

[9]Mei, Wu, and Zhou (2004) analyze the pump-and-dump strategy, and add the Allen and Gale (1992) model to behavioral bias and limit of arbitrage. Aggarwal and Wu (2006) is not a purely trade-based manipulation case since a manipulator of their theoretical model is informed and the cases for their empirical analysis involve the use of rumors, wash sales, and attempts to corner the market. Both papers also show empirical evidence in the stock markets from data on stock market manipulation cases pursued by the Securities and Exchange Commission (SEC).

manipulation increases volatility, liquidity, and returns. Prices rise during the manipulation period and fall after the manipulation period. In Aggarwal and Wu (2006), manipulators can be profitable, and smart money, contrary to conventional wisdom, may actually create market inefficiency when manipulators are present. Jianga, Mahoney, and Mei (2005) study stock pools, through which groups of investors actively traded specific stocks in the 1920s. Although these stock pools were the main reason for the adoption of current U.S. anti-manipulation laws, the paper finds no empirical evidence that the stock pools' trades drove prices to artificially high levels, or that public investors were harmed by the pools.

Fishman and Haggerty (1995) derive a one-period equilibrium model of information-based manipulation, where uninformed insiders can make a profit by pretending they are informed and disclosing their trading. John and Narayanan (1997) show that the regulatory trade-disclosure rule on corporate insiders may create incentives for the latter to trade in the wrong direction from their information to confuse other investors. Van Bommel (2003) presents a rumor game model in which imprecise information is shared in a way that manipulates an audience of followers, changing the market price to benefit the originators of the rumor. Chakraborty and Yilmaz (2004) "show that when the market faces uncertainty about the existence of the insider in the market and when there is a large number of trading periods before all private information is revealed, long-lived informed traders will manipulate in every equilibrium."

Boehme and Holz (2006), Frieder and Zittrain (2007), and Hanke and Hauser (2008) present empirical evidence of the efficacy of spam email in pump-and-dump schemes involving stocks traded on Pink Sheets—small and illiquid stocks.

In this paper, we empirically investigate the potential for price manipulation by agents without private information. Manipulators in our paper mislead other investors by placing orders that are neither intended to be executed nor are in fact executed. In this sense, our paper is close to Jarrow (1992). However, the manipulators in that paper intend to execute their initial orders, while ours do not.

3. Formal definition of spoofing trading

In empirical analysis, it is impossible to know with certainty a trader's intent in placing any given order. We define a spoofing order as a bid/ask with a size at least twice the previous day's average order size[10] and with an order price at least 6 ticks away from the market price, followed by an order on the opposite side of the market, and subsequently followed by the withdrawal of the first order.

From the regulator's perspective, spoofing orders are malicious because they can manipulate prices and increase volatility while adding no useful information.[11] They are not even subject to the short-swing-profit rule, which requires corporate insiders to return any profits made from a round-trip transaction within a certain period to the firm.

Spoofing-sell orders are rarely observed, due to the technical difficulty of short selling in the Korean stock market. Accordingly, we focus on "spoofing-buy strategies," limit-buy

[10]A similar analysis without the size restriction shows qualitatively the same results, and is not reported here.

[11]It has been debated whether price manipulation needs to be regulated first, especially when it is informed or includes actual trading. See Fischel and Ross (1991) for a discussion.

orders that are followed by a sell order for the same stock and the subsequent cancellation of the initial limit-buy order.[12]

4. Data and basic description of spoofing orders

We use the intraday transaction data for firms listed on the KRX from November 1, 2001 through February 28, 2002 (78 trading days). We exclude firms with fewer than 30 orders per day on average during 55 trading days, that is, 70% of the total 78 trading days. Our selected sample consists of 549 firms out of the 884 total listed firms for the analysis. In analyzing spoofing trading strategies, we use data from November 1, 2001 to December 31, 2001 (hereafter the first period, 41 trading days), prior to the change in the order-disclosure rule. To analyze the effect of the change in the order-disclosure rule, we compare the data from January 2, 2002 to February 28, 2002 (hereafter the second period, 37 trading days) to the data from the first period.

The data used in this study includes trading records for all investors who traded on the KRX during the sample period, and covers both order and trade information. A special feature of the data is that it allows us to trace an investor's trading activity throughout a trading day. Since the account number of the trader submitting each order is included, it is possible to track the size and price of the order; the order arrival time; the best buy and the best sell price at the time of the order arrival; the cancellation, amendment, or withdrawal of the order and their times, and the time and price of the execution (if applicable). For those orders filled in several segments, the data also contains information for each of the fills.

Panel A in Table 1 summarizes the orders and trades data on daily transactions for the first period of our sample period. The average daily order amount and the ratio of execution for a stock listed on the KRX are 3,165,387 shares and 69.78% respectively. The average daily spoofing-buy order amount for a stock is 13,666 shares, and 0.81% of the daily total buy order. Panel B in Table 1 shows that most (96.12%) spoofing orders are submitted by individual investors. The proportions of spoofing orders for the individual and institutional investors do not differ substantially, whereas that of foreign investors is very small.

5. Results of empirical analyses

5.1. The diurnal pattern of spoofing orders

Since the spoofing trading strategy is employed by traders who mislead other investors and distort their perceptions, we anticipate that several factors might affect when and how traders use spoofing trading strategies. The first question concerns the diurnal pattern of spoofing orders. We expect that spoofing orders will be more effective and therefore more frequently used when there is greater uncertainty about the value of a firm. Since the principal purpose of spoofing orders is to mislead other investors, uncertainty regarding the value of a stock is a necessary condition for the success of such a strategy. On a trading

[12]In a typical case of trade-based manipulation, manipulators usually attempt to affect the price of the stock they wish to sell. In their empirical analysis, Aggarwal and Wu (2006) also used only buy-trades for the same reason.

Table 1
Descriptive statistics.

Panel A: Ratio of execution for daily buy- and sell-order and the proportion of spoofing orders

	Daily total orders	Daily buy orders	Daily sell orders	Daily spoofing orders
Amounts (shares, A)	3,165,387	1,680,761	1,484,626	13,666
Execution (shares, B)	2,208,866	1,104,433	1,104,433	–
Ratio (%, B/A)	69.78	65.71	74.39	–
Proportion of spoofing orders (%)				0.81[a]

Panel B: Proportion of spoofing orders by investor type

Investor type	Daily spoofing orders (shares, A)	Daily buy orders (shares, B)	A/B (%)	A/C (%)
Institutional investors	416	52,278	0.80	3.04
Individual investors	13,135	1,579,170	0.83	96.12
Foreign investors	54	32,667	0.17	0.40
Others	60	16,646	0.36	0.44
Total	13,666 (C)	1,680,761	–	100

The sample includes 549 firms listed on the KRX between November 1, 2001 and December 31, 2001. The statistics are the daily averages *per firm* and are measured only during the continuous trading hours. a: daily spoofing order divided by daily buy order.

day, the existing literature generally confirms that the volatility and spreads are highest shortly after market opening and shortly before market close (McInish and Wood, 1991). Naturally, we expect to see more spoofing orders during these periods, since their impact will be larger.

To confirm this conjecture, we divide a trading day into six one-hour intervals and compare the shares and proportions of spoofing orders for each interval. Fig. 1 confirms our expectations; the shares of spoofing orders are the highest at market opening, decrease over time during a trading day, and increase again at market closing. The U-shape of the spoofing orders by hour during a trading day is similar to that of ordinary orders. However, their patterns differ in their details. First, the diurnal pattern of the proportion of spoofing orders (bold line in Fig. 1) is flatter than that of the ordinary orders, particularly at market closing. Second, the proportion of spoofing orders during each interval (dotted line in Fig. 1) decreases monotonically as it nears market closing. These two characteristics suggest that the spoofing orders are quite short-lived.

5.2. The size and price of spoofing orders

Because the primary purpose of spoofing-buy orders is to affect other investors' perceptions, while bearing minimal risk of execution, we expect spoofing orders to be larger than ordinary orders. We also expect the spoofing-buy order prices to be lower than ordinary buy-order prices, since the price must be substantially below the current bid price to avoid risking execution. Panel A in Table 2 compares the average sizes of total orders and spoofing orders. The average size of a buy order by all traders is 864 shares, while the average size of a spoofing-buy order is 4,809 shares, almost 5.6 times larger, as would be expected if the trader intended to influence the price and did not intend the trade to be

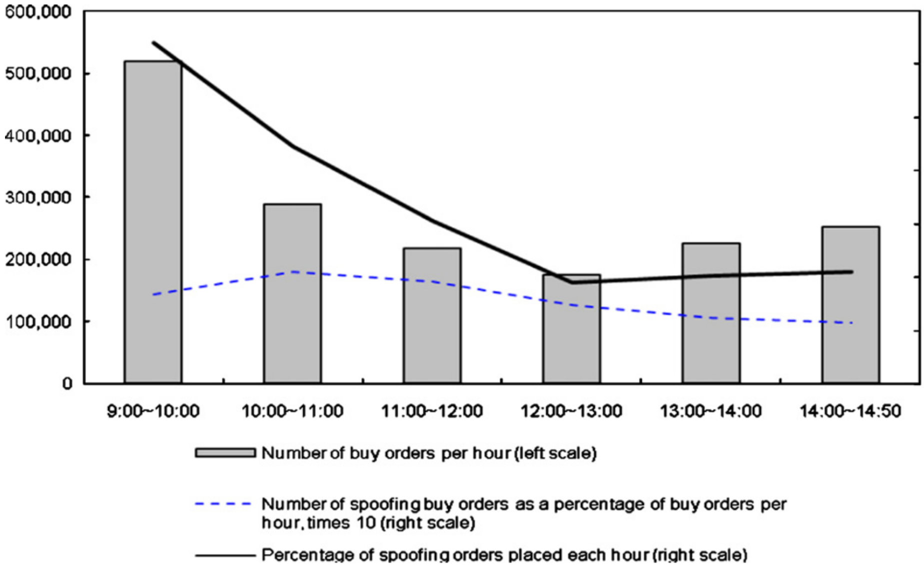

Fig. 1. The diurnal pattern of spoofing orders. We divide a trading day into six one-hour intervals. The sample includes 549 firms listed on the KRX between November 1, 2001 and December 31, 2001. The numbers are the daily averages *per firm*, and the units for orders are in shares. The number of spoofing orders submitted during each interval is as follows: 4,377 (9:00–10:00), 3,052 (10:00–11:00), 2,099 (11:00–12:00), 1,305 (12:00–13:00), 1,395 (13:00–14:00), and 1,437 (14:00–14:50), respectively.

executed.[13] The executed sell orders of spoofers are slightly larger than those of the average trader, but their spoofing-buy orders are *much* larger than the average buy orders of all traders, or the average executed sell order of the spoofers.[14] The results also suggest that our definition of spoofing trading is reasonable, since such asymmetric order sizes would not be observed if they were placed by day traders.

The tendency toward a larger order size is stronger for firms with a higher proportion of spoofing orders. For the 30 firms with the highest proportions of spoofing orders, the average size of spoofing orders was 14,514 shares, or about 11.1 times larger than the average buy order size for those firms. In contrast, the average size of spoofing-buy orders for the 30 firms with the smallest proportions of spoofing orders is 908 shares, or approximately 2.4 times larger than the average size of buy orders for those firms. The dramatic increase in the order size of spoofing orders, along with the increase in the proportion of spoofing orders, suggests that investors in general possess some information regarding the existence and frequency of spoofing orders. Investors, therefore, are to be misled only by larger spoofing orders.

Panel B in Table 2 shows the proportion of total orders and spoofing orders by their order prices in terms of ticks. Spoofing-buy orders are generally submitted well below

[13]Even when we do not restrict the minimum size of spoofing orders, the difference in order sizes is significant.

[14]The average size of a sell order is 828 shares, while that of spoofing traders is 1,337 shares, or about 1.5 times larger than the former. We cannot distinguish between two competing explanations of the discrepancy in the size of sell orders. The first explanation is that spoofing traders are different from other traders, and have larger holdings to sell. The other explanation is that individual traders sometimes spoof and sometimes do not, and tend to choose a spoofing strategy when they have a larger holding to sell.

Table 2
Order size, price, and duration of spoofing order strategy.

Panel A: Comparison of average order size (shares)

	Buy order size (A)	Sell order size (B)	Spoofing-buy order size (C)	Spoofing-sell order size (D)	p-value of the difference between A and C	p-value of the difference between B and D
All firms	864	828	4,809	1,337 (1,395)[a]	0.0001***	0.0001***
All firms (Day trading)	864	828	819	741		
Top 30 firms	1,304	1,120	14,514	2,102	0.0001***	0.0001***
Lowest 30 firms	389	369	908	336	0.0001***	0.0001***

Panel B: Price of spoofing order

	Buy order (%)	Spoofing order (%)
0 tick~5 tick	84.78	–
6 tick~10 tick	4.30	10.47
Over 10 tick	10.92	89.53
Daily volatility (measured in ticks)	Mean (9.11)	t-value (49.59)

Panel C: Duration of spoofing order strategy (minutes)

	Time interval between spoofing-buy order and real sell order	Time interval between real sell order and cancellation of initial buy order
Mean duration	43.27	35.73
Standard deviation	59.54	62.91

Panel D: Distribution of the number of spoofing trades per spoofer

No. of spoofing trades	1	2	3	4	5	6	7	8	9
No. of spoofers	13,083	2,568	973	505	285	168	108	81	65
No. of spoofing trades	10	11~15	16~20	21~30	31~40	41~50	51~100	101~	
No. of spoofers	37	124	52	40	20	7	10	7	

	Mean	Max	Min	Std. Dev.
No. of spoofing trades per spoofer	1.9	332	1	4.95

The sample includes 549 firms listed on the KRX between November 1, 2001 and December 31, 2001. The statistics are the daily averages *per firm* and are measured only during the continuous trading hours. Panel A shows the average order sizes (in shares) for all firms, the top 30 firms, the lowest 30 firms, and their comparisons. The "Top 30 firms" include those firms with the highest proportion of spoofing orders, while the "Lowest 30 firms" include those firms with the lowest proportions. [a] denotes the executed sell orders of spoofers. *** denotes significance at the 1% level. The numbers in Panel B denote the proportion (%) of orders submitted at each range of quotes out of total orders or spoofing orders. The number of ticks away from the market for a buy order is measured from the prevailing bid. Daily return volatility is measured by daily high minus low trade price in ticks. Panel C shows the durations (in minutes) between the stages of the spoofing trading strategy. Panel D presents the distribution of the number of spoofing trades per spoofer. If a spoofer executes a spoofing trading strategy for two different stocks, this is counted as two spoofing trades.

current prices, while ordinary orders are submitted nearer the current prices. The proportion of the spoofing orders priced outside 10 ticks of the current bid price is 89.53%. The fact that orders outside the 10th tick are quite unlikely to be executed during a trading day and are still cancelled after a sell order suggests that most of those buy orders are submitted principally for the purpose of misleading other investors without the intention of actual purchase.[15]

5.3. Spoofing trading strategy duration and the number of spoofing trades per spoofer

A spoofing trader also strategically determines the time interval between his orders. Since the effect of spoofing-buy orders is short-lived, as will be demonstrated later, we expect that a spoofing trader would submit sell orders within a short interval period after the submission of spoofing-buy orders.

Panel C in Table 2 shows the time intervals between the actions of spoofing traders. The average duration between the submission of spoofing-buy orders and the following sell orders is 43.27 minutes. The average duration between the submission of sell orders and the cancellation of the initial buy orders is 35.73 minutes.

The duration from the placement of the spoofing-buy order to the execution of the sell order is longer than might have been anticipated. Note, however, that even today, Korea is categorized as an emerging market, albeit an advanced emerging market. The efficiency of the price discovery mechanism may be approaching that of advanced markets, but it has yet to attain that status. In 2001, the market was significantly less advanced, and price discovery was considerably slower. Moreover, as noted below in Section 5.5, firms with higher return volatility, lower market capitalization, lower price level, and lower managerial transparency tend to be targets of spoofing orders. Under these circumstances, the very rapid price discovery that we find in, say, index futures in the U.S., is not to be expected. Simply put, it takes some time for the effect of the spoofing-buy order to be incorporated into the price, and thus the spoofing traders must wait a certain amount of time before executing the sell order.

The duration from the execution of the sell order to the cancellation of the spoofing-buy order was longer than one might have anticipated, even though the standard deviations of the durations are much larger than the means (see Fig. 2). This is discussed in Section 6 below, where we argue that it is evidence of manipulative intent.

Panel D shows the distribution of the number of spoofing trades per spoofer. 18,133 traders submitted a total of 34,459 spoofing orders, while 13,083 individuals submitted only one spoofing order each, for a total of 13,083 orders. Thus, the remaining 21,376 spoofing orders (62.0% of all spoofing orders) were submitted by the remaining 5,050 individuals, for an average of 4.2 spoofing orders per individual in this group: the majority of spoofing orders were submitted by an individual who spoofed more than once.

[15]The mean value of daily return volatility (daily high trade minus daily low trade) is 9.11 ticks. The average spoofing-buy order in the first period is 9.02 ticks away from the bid price. Considering that the spoofing-buy order is cancelled on average 35.73 minutes after execution of the sell order (and could be cancelled earlier if the price were falling, creating a risk that the spoofing order would be executed), the risk of undesired execution is small.

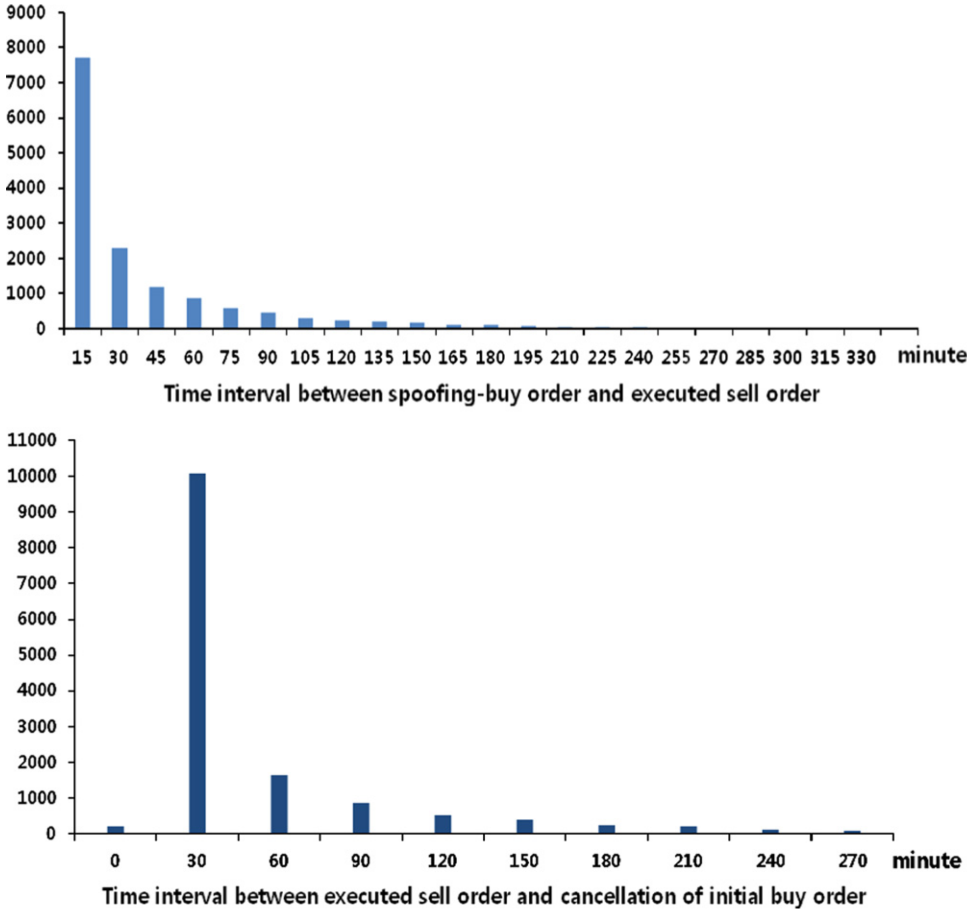

Fig. 2. Time intervals among spoofing-buy order, executed sell order, and cancellation of initial buy order.

5.4. Day trading and spoofing

We found that 42.2% of the spoofing-buy orders were preceded by an actual executed buy order of the same stock on the same day; of course, by the definition of a spoofing order, all were followed by an actual executed sell order on the same day. The average executed buy and sell orders were of similar magnitude (see Table 3). In *no* case was there an executed buy order between the spoofing-buy order and the executed sell order. Thus, 42.2% of the spoofing-buy orders were placed as part of a day-trading strategy: buy at the market price, place a spoofing-buy order, sell at the market price (as influenced by the spoofing order), and finally cancel the spoofing-buy order.

For the remaining 57.8% of the spoofing-buy orders, there was no executed buy of the same stock on the same day as the spoofing-buy order and subsequent executed sale. During our data period, it was effectively impossible for traders to short stocks on the KRX; thus, none of the sales were short sales and the trader must have held the stock at least since the previous day, and possibly for considerably longer.

Table 3
Trade and order size, price, and duration of spoofing-order strategy employed by *day traders*.

Panel A: Traders' average trade or order size

	Actual-buy prior to spoofing-buy order (Avg. trade size)	Spoofing-buy order (Avg. order size)	Actual-sell (Avg. trade size)
All firms	1,283	5,202	1,395

Panel B: Price of actual-buy (%)

0 tick~5 tick	94.76		72.43
6 tick~10 tick	2.17	20.30	10.54
Over 10 tick	3.06	79.70	17.03

Panel C: Duration of spoofing order strategy (minutes)

	Time interval between actual buy order and spoofing-buy order	Time interval between spoofing-buy order and real sell order	Time interval between real sell order and cancellation of initial buy order
Mean duration	31.82	32.76	31.11
Standard deviation	50.27	45.03	51.98

The sample includes 549 firms listed on the KRX between November 1, 2001 and December 31, 2001. Statistics are the daily averages *per firm* and are measured only during the continuous trading hours. 42.2% of the spoofing-buy orders were placed as part of a *day-trading* strategy: buy at the market price, place a spoofing-buy order, sell at the market price (as influenced by the spoofing order), and finally cancel the spoofing-buy order. Panel A, Panel B, and Panel C show trade and order size, price of actual-buy, and the durations (in minutes) among the stages in the spoofing trading strategy for the subgroup of spoofing day-traders. The number of ticks away from the market for a buy order is measured from the prevailing bid.

5.5. *Determinants of target firms by spoofing traders*

As we have shown, spoofing traders are very strategic in their trading behavior, and we may thus expect that their choice of stocks for spoofing trading will be strategic as well. In this section, we investigate the characteristics spoofing traders identify to select target firms.

Since spoofing orders are more effective when there is greater uncertainty about the value of a firm, we expect that firms with a higher "*return volatility*" would have more spoofing orders.[16] "*Firm size*" would also be related to information. Large firms would have better managerial transparency and the marginal effect of a spoofing order on large firms would be lower, thereby decreasing the proportion of spoofing orders. "*Daily trading volume*" would have two opposite effects on the proportion of spoofing orders. Larger trading volumes make it difficult to spoof. Any spoofing attempts should quickly affect the price of a stock, but spoofing stocks that already have large transaction volumes is difficult, since the spoofing order must be very large to alter the balance of supply and

[16]Additionally, stocks that are easily spoofed may exhibit higher volatility due to the effects of spoofing.

demand. On the other hand, larger trading volumes allow spoofing traders to better disguise their spoofing orders, and thus attract more spoofing investors. "*Price level*" also should influence the decision. As small investors who are not well-informed tend to prefer low-price shares, we would expect to observe more spoofing orders for low-price stocks, where they would be more effective. The score on corporate disclosure policy,[17] measured by the KRX as part of the annual corporate governance scoring, is considered to reflect the level of informational asymmetry and uncertainty. We also include "*inside ownership,*" which is defined as the sum of the ownerships by a controlling family and affiliated firms, and the effect of inside ownership is expected to be negative since it would reduce the number of stocks traded.

We use the following empirical model for the regression analysis:

$$prop = \alpha + \beta_1 Vol + \beta_2 MV + \beta_3 VM + \beta_4 P + \beta_5 Disclosure + \beta_6 Inside + \varepsilon \tag{1}$$

where *prop*: Proportion of spoofing orders, *Vol*: Return volatility measured by average daily high-low ratio, *MV*: Market value of equity capital, *VM*: Daily trading volume, *P*: ln(*Price*), *Disclosure*: Score on corporate disclosure policy measured by the KRX, *Inside*: Inside ownership as the sum of the ownerships by controlling shareholder, his family members and affiliated firms.

Table 4 shows the results of the empirical analysis. Since some of the independent variables are significantly correlated,[18] we implement both simple and multiple regressions designed to minimize the multicollinearity problem. In the simple regressions (regressions (1) through (6)), firms with higher return volatility, lower market capitalization, lower price levels, and lower scores on corporate disclosure policy tend to have a higher proportion of spoofing orders, as we expected. In multiple regressions (7) and (8), which control for multicollinearity, the significance of the coefficients is still maintained, again confirming the preceding results.

5.6. *The profitability of spoofing trading strategies*

In this section, we measure the profitability of a spoofing trading strategy, which is of great concern both practically and academically.

If spoofing trading is statistically profitable, it will provide another piece of empirical evidence contradicting the weak-form efficient markets hypothesis. We measure the

[17]Since 2001, the Korea Corporate Governance Service (KCGS) in collaboration with the KRX has annually evaluated the governance structure for the firms listed on the KRX and has announced their scores as a component of a corporate disclosure policy. The score consists of 4 categories: appropriateness of governance structure (60 score), extent of firm's provision of information (25 score), appropriateness of firm's distribution of returns (5 score), and managerial efficiency (10 score). In this paper, we use the extent of a firm's provision of information as data for transparency. This score, which consists of industrial relationship, speed of disclosure, and untruthful disclosure, reflects whether the firm provides its information to the investors with transparency and speed.

[18]Trading volume, stock price, and disclosure are statistically significantly positively correlated with market capitalization, and thus we did not use trading volume, stock price, and disclosure for the multiple regression shown in Eq. (5) of Table 4. Stock price is statistically significantly positively correlated with market capitalization, but is negatively correlated with trading volume. Inside ownership is statistically significantly negatively correlated with volatility. Hence, we did not use volatility, market capitalization, and trading volume for the multiple regression shown in Eq. (8) of Table 4.

Table 4
Determinants of the proportion of spoofing orders.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.0035***	0.0663***	0.0158***	0.0345***	0.0176***	0.0123***	0.0623***	0.0393***
	(3.01)	(12.07)	(4.65)	(10.92)	(10.80)	(12.61)	(11.49)	(11.45)
Volatility	0.1449***						0.1479***	
	(7.19)						(8.10)	
Market capitalization		−0.0022***					−0.0023***	
		(−10.05)					(-11.15)	
Trading volume			−0.0003					
			(−1.35)					
Stock price				−0.0027***				−0.0025***
				(−7.43)				(−6.85)
Disclosure					−0.0005***			−0.0004***
					(-4.05)			(−3.26)
Inside ownership						−0.0031	−0.0038	−0.0040
						(−1.23)	(−1.73)	(−1.68)
F-value	51.63	101.04	1.83	55.21	16.39	1.52	62.82	22.83
Adj. R^2	0.0905	0.1643	0.0016	0.0962	0.0293	0.0010	0.2671	0.1140

The dependent variable is the proportion of spoofing orders. Daily high-low ratios are used for stock return volatilities, and stock price and trading volume are the averages for November 1, 2001 through December 31, 2001. Market capitalization is measured for the end of 2001. Inside ownership is the sum of the ownerships by controlling family and affiliated firms. Disclosure, which proxies the managerial transparency, is obtained from the score on corporate disclosure policy evaluated annually by the Korea Corporate Governance Service (KCGS). Numbers in parentheses are *t*-values. *** denotes significance at the 1% level.

profitability of the spoofing trading strategy in three different ways:

Definition A. Extra profit from a spoofing order = (Market-sell price at time of a sell order − Market-sell price at time a spoofing-buy order is submitted) × (Shares of sell order)

Definition B. Extra profit from a spoofing order = (Actual sell price − Market sell price at time a spoofing-buy order is submitted) × (Shares sold)

Definition C. (applicable only to day traders, whether or not spoofing)
Extra profit = (Actual sell price − Actual buy price earlier that day) × (Shares sold)

We adjust the profits to take into account transaction costs. Korea imposes a tax of 30 basis points on the sale of securities paid by the seller. Trading fees during our data period consisted of a fee of approximately one basis point to the exchange, and about seven basis points to online brokers on executed buy and sell orders. There were no fees or taxes on unexecuted orders.

For day traders (spoofers or non-spoofers) who executed a buy and a subsequent sell on the same day, we estimate transaction costs of 46 basis points, based on the transfer tax on the sale and the fees on both the buy and the sale. For the spoofers who were not day traders (i.e., they sold a stock that they held in inventory from some previous day), it seems reasonable to suppose that the trader had decided to sell the stock on the given day or soon thereafter, and the transaction costs should be attributed to the decision to sell rather than the decision to spoof; thus, we do not adjust these returns to take the additional transaction costs into account.

During the first data period, the KOSPI index rose rapidly, with a mean daily return of 69 basis points. We computed the per-trade return of three groups of agents, which are provided in Table 5.[19]

Spoofing traders who were not day traders earned an extra profit of 79 basis points by Definition A. Spoofing traders who were day traders earned an extra profit of 67 basis points gross and 21 basis points net of transaction costs by Definition A; by Definition C, the figures were 83 basis points gross and 37 basis points net. In contrast, all day traders earned an extra profit of 15 basis points gross and lost 31 basis points net, by Definition C. Returns computed using Definition B were similar to and somewhat higher than those computed using Definition A.[20]

The mean daily returns of 69 basis points of the KOSPI index during our sample period cannot be directly compared to the other returns, which are computed over substantially shorter periods.

- Spoofing is profitable, both gross and net of transaction costs. It is particularly attractive to an agent who has already decided to sell, since the price enhancement achieved by spoofing is gained without incurring additional transaction costs.
- The extra profits by Definition A are earned over a mean period of 43.3 minutes. The return volatility over such short periods would be much lower than the daily return volatility, which includes six hours of trading plus 18 hours overnight. Thus, even though the gross per-trade returns (79, 67, and 83 basis points) are of roughly the same magnitude as the daily returns, the Sharpe ratios of the spoofing trade returns would be much higher.
- Since all the spoofing returns are computed over short periods, the 15 basis point per-trade gross return of all day traders provides a proxy for what the spoofing gross returns would have been, if spoofing had been ineffective. Note that the per-trade returns to spoofing are far higher than the per-trade returns of all day traders. Consider a 69 basis

[19]In the return and profit measures, there could be cross-sectional correlations in contemporaneous returns due to a common marketwide factor. To address this issue, we also use the Fama and MacBeth (1973) method: average all the observations on a given day, and then assume independence across days (see "Part 2" of Table 5). However, the Fama and MacBeth (1973) approach reduces the number of observations from tens of thousands to 40, making it unreasonable to hope for statistical significance in an event-study like this one, which uses two months on either side of the change in order reporting. We found that the median, max, min, std. error of mean, skewness, and kurtosis of profits changed greatly using Fama and MacBeth (1973), indicating that the profits on each day are quite heterogeneous. We believe the heterogeneity of profits on each day supports the belief that distinct observations on a single day are at least roughly independent. Another potential concern is within-investor correlations in trading strategies. To address that issue, we computed the profitability of the spoofing trades using clustering by investor; the t-statistics are somewhat reduced but remain very high.

[20]Since our definition of spoofing orders is based on two characteristics (order size twice as large as the average, and order price at least 6 ticks away from the market price), one might be concerned that the substantial extra profit from a spoofing order might arise from sample selection bias. As a robustness check, we conducted three VAR (vector autoregression) tests for individual stocks. In the first test, we examined whether the proportion of orders at least 6 ticks away from the market price affects the returns of individual stocks. In the second test, we investigated whether the proportion of orders with order sizes twice as large as the average affected the returns of individual stocks. Neither characteristic was determined to have a significant impact on the returns of individual stocks. In the third test, we examined whether the proportion of orders at least 11 ticks away from the market price (the definition of spoofing order in the second period) affected the returns of individual stocks in the second period differently from the proportion of orders at least 6 ticks away from the market price (the definition of spoofing order in the first period); see Section 5.7. Our test found no significant difference. In sum, all three tests confirmed that the substantial extra profit from a spoofing order did not arise from sample selection bias.

Table 5
The profitability of spoofing orders.

	Panel A: Extra profit by spoofing traders				*Panel B: Extra profit for spoofing trading strategy*		*Panel C: Extra profit for day-trading strategy*	
	Extra profit (won) (Definition A)	Extra profit (won) (Definition B)	Extra return (%) (Definition A)	Extra return (%) (Definition B)	Extra return (%) (Definition A): Spoofing traders, but not day traders	Extra return (%) (Definition A): Spoofing day traders	Extra return (%) (Definition C): Spoofing day traders	Extra return (%) (Definition C): Day traders
Part 1: Without using Fama-MacBeth daily clustering								
Mean	87,974*	101,786*	0.74*	0.83*	0.79*	0.67*	0.83*	0.15*
Median	4,500†	6,000†	0.35†	0.43†	0.34†	0.35†	0.65†	0.26†
Max	162,500,000	162,500,000	19.15	18.96	17.74	19.15	21.30	50.60
Min	−65,032,800	−65,032,800	−13.52	−9.13	−13.52	−9.30	−17.38	−88.44
Std. dev.	1,408,378	1,581,562	1.97	2.01	2.10	1.77	2.71	3.51
t-value	11.6	9.77	69.45	62.62	52.96	45.34	37.01	73.88
Std. error of mean	7,587	10,414	0.01	0.01	0.015	0.014	0.02	0.002
Skewness	57.76	54.79	1.60	1.59	1.49	1.74	0.40	−1.25
Kurtosis	6,188	5,481	7.87	7.11	6.53	10.38	5.33	12.02
	Proportion of orders (%)							
extra profit > 0	58.25	61.27	58.25	61.27	57.51	59.27	63.67	52.97
extra profit = 0	13.44	11.71	13.44	11.71	13.61	13.21	4.80	2.46
extra profit < 0	28.30	27.02	28.30	27.02	28.87	27.52	31.53	44.57
No. of Obs.	34,459	23,065	34,459	23,065	19,910	14,549	14,549	2,921,263
Part 2: Fama-MacBeth approach								
Mean	85,346*	97,200*	0.72*	0.81*	0.77*	0.65*	0.82*	0.14
Median	80,879†	93,663†	0.73†	0.82†	0.75†	0.64†	0.88†	0.15

Table 5 (*continued*)

	Panel A: Extra profit by spoofing traders				*Panel B: Extra profit for spoofing trading strategy*		*Panel C: Extra profit for day-trading strategy*	
	Extra profit (won) (Definition A)	Extra profit (won) (Definition B)	Extra return (%) (Definition A)	Extra return (%) (Definition B)	Extra return (%) (Definition A): Spoofing traders, but not day traders	Extra return (%) (Definition A): Spoofing day traders	Extra return (%) (Definition C): Spoofing day traders	Extra return (%) (Definition C): Day traders
Max	283,121	387,601	1.20	1.27	1.44	0.97	1.61	1.58
Min	−18,861	−30,331	0.23	0.37	0.31	0.13	−0.26	−1.34
t-value	9.01	8.2	20.00	23.29	17.42	22.25	11.04	1.36
Std. error of mean	9,471	11,404	0.04	0.03	0.04	0.03	0.07	0.11
Skewness	1.56	1.87	0.11	0.09	0.32	−0.45	−0.36	−0.22
Kurtosis	3.54	6.26	−0.67	−0.60	−0.61	0.28	−0.06	−0.14
No. of Obs.	40	40	40	40	40	40	40	40
Daily average returns of KOSPI index (November 1, 2001 to December 31, 2001): 0.687%								

The sample includes 549 firms listed on the KRX between November 1, 2001 and December 31, 2001. Extra profits are measured by three definitions:
Definition A {(Market sell price at time of a sell order−Market sell price at time a spoofing-buy order is submitted) × Shares of sell order}.
Definition B {(Actual sell price−Market sell price at time a spoofing-buy order is submitted) × Shares sold}.
Definition C {(Actual sell price−Actual buy price earlier that day) × Shares sold}, which is only applicable to day traders, whether or not spoofing.
Panel A presents descriptive statistics on extra profit by all the spoofing traders as defined in our paper. Our spoofing traders can be classified into two groups: (1) Spoofing traders who were not day traders (57.8%) and (2) Spoofing traders who were day traders (42.2%). Panel B shows descriptive statistics on extra profit for these two groups. Panel C shows descriptive statistics on extra profit for day traders; the left column represents the day traders who were also spoofers, whereas the right column represents all day traders, regardless of whether they were spoofers. Day trading is defined as the purchase and sale of the same stock by the same investor on the same day. Korea imposes a tax of 30 basis points on the sale of securities paid by the seller. Trading fees during our data period consisted of a fee of approximately one basis point to the exchange, and about seven basis points to online brokers on executed buy and sell orders. Thus, for example, each day-trading strategy costs 46 basis points. All statistics in Part 1 are measured without clustering by day. All statistics in Part 2 are measured by the Fama and MacBeth (1973) approach: average all the observations on a given day, then assume independence across days; because this produces only 40 observations, it is unrealistic to hope for statistical significance.
* and † denote statistical significance at the 1% level using the *t*-test and the binomial test.

point daily drift spread uniformly over a six-hour trading day; this generates a 15 basis point return in a holding period of slightly under 90 minutes. As expected, day traders lose money net of transaction costs, despite the rapid rise in the market during our data period. In this context, Definition C is particularly important, as it compares profitability of the spoofing day traders to the profitability of simultaneous non-spoofing day traders on the same side of the market.

- If the spoofing-buy order is not causing the per-trade returns, the only possible other explanation for the high returns is that the spoofing traders are day-trading geniuses, who are able to consistently pick precisely the right 45-minute period to capture the day's overall market return. This seems entirely implausible to us. Moreover, if this were true, why would these genius day-traders bother to place the spoofing orders?
- From a regulatory standpoint, the key consideration is not the profitability of the strategy, but the loss inflicted on other market participants as a result of the manipulation. Thus, while transaction costs reduce the profitability of spoofing, they do not diminish the harm inflicted on other traders by this manipulation.

We also consider the median extra profit. Measured in percentage terms, the median extra profit (0.35% under Definition A, 0.43% under Definition B) is *much* larger than the standard error (0.01%), which supports the notion that spoofing is profitable. The median extra profit in monetary terms is comparatively small, simply because there is enormous variation in the size of the trades, and many of them are quite small. Thus, we conduct a formal test to determine whether the median extra profit is statistically significantly positive.

Since we do not know that the distribution of extra profits is symmetric around its median, we elect not to use the Wilcoxon signed-rank test (which assumes symmetry) and instead use the appropriate binomial test, which is less powerful but valid without any assumptions on the distribution. Let q denote the proportion of positive results in a population. The number of positive observations among N independent observations from the population is distributed as binomial $B(N,q)$. Under the null hypothesis that the median of the population is less than or equal to zero, $q \leq 1/2$. In our setting, where the proportion of zero results in the population is positive, we have $q < 1/2$. We nonetheless use a binomial test with $q = 1/2$, since this minimizes the probability of erroneously rejecting the null hypothesis.

Using Definition A, 58.3% of the extra profits were positive, 13.4% were zero, and 28.3% were negative. The excess number of positive results is 30.6 times the binomial standard deviation, and the hypothesis that the median extra profit from spoofing is less than or equal to zero is overwhelmingly rejected.[21] Thus, the results are not driven by outliers; the median spoofing trade clearly makes a positive profit.

We also test the hypothesis that the median extra profit is less than or equal to zero in the two subgroups: spoofing non-day traders and spoofing day traders. Of the spoofing non-day traders, using Definition A, 57.5% of the trades earned positive extra profit, 28.9% earned negative extra profit, and 13.6% earned zero extra profit; the number of positive extra profits exceeds the expected number by 21.2 binomial standard deviations. Of the spoofing day traders, 59.3% earned positive extra profit, 27.5% earned negative

[21] Using Definition B, the excess number of positive results is 34.2 times the binomial standard deviation.

extra profit, and 13.2% earned zero extra profit; the number of positive extra profits exceeds the expected number by 22.4 binomial standard deviations. Thus, there is little difference between the day traders and the non-day traders, and the median is positive and overwhelmingly statistically significant in both groups.

Additionally, Table 5 shows that all of the skewnesses for spoofing traders are highly positive (see Panel A and Panel B), providing further evidence that spoofing is profitable. In contrast, the skewness for day traders is negative (see Panel C), providing further evidence that day trading is unprofitable.

5.7. The effects of the change in the order-disclosure rule on spoofing trading strategies

On January 2, 2002, the KRX changed the order-disclosure rule. The new order-disclosure rule increased the number of publicly disclosed quotes on each side of the market from 5 to 10, and stopped disclosing the total quantity of buy/sell orders, in order to prevent the public posting of misleading information. Table 6 shows the results regarding the efficacy of this rule change, focusing only on spoofing trading.[22]

First, the average daily spoofing order for a firm is 4,104 shares (0.26% of total orders) for our second period, a sharp decrease from the 0.81% in the first period. Hence, the spoofing traders are not simply tracing out a simple demand curve; if they had been, then the proportion of spoofing orders should be the same in the second period. Moreover, the daily order execution ratio in the second period increased from 69.78% to 72.72% in the first period. Both differences are significant at the 1% level. The results indicate that the change in the order-disclosure rule brought about the intended positive result. The increase in the order execution ratio is partly the result of the change in the buy order prices, whereby more orders were submitted near the best bids and asks, as well as the fact that fewer spoofing orders were being submitted.

Second, the proportion of spoofing-buy orders priced at 11 ticks and below decreased sharply, from 89.53% to 40.80%.[23] Under the new order-disclosure rule, traders who intend to mislead other traders by their orders must submit their orders within 10 ticks of the current bid. Our results indicate that the disclosure of the total amounts of orders by the KRX induced spoofing behavior. The new order-disclosure rule succeeded in reducing the number of spoofing orders by forcing traders who wished to spoof to submit their spoofing orders nearer the current bids, increasing the risk that a spoofing order would be executed.

The average duration between the submission of spoofing-buy orders and the following sell orders increased slightly to 44.28 minutes after the change; this increase is not statistically significant, though. On the other hand, the average duration between the submission of sell orders and the cancellation of the initial buy orders in the second period increased to 43.28 minutes, which was statistically significant.

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[22]The proportion of spoofing orders by investor type, the diurnal pattern of spoofing orders, and determinants of the proportion of spoofing orders are qualitatively same for both periods. Thus, we do not report them. The detailed results are available from the authors on request.

[23]40.80% of the 0.26% of orders are placed more than 10 ticks away from the current bid, and thus would not be conveyed to the market. Perhaps these are legitimate, non-manipulative orders, but if so, the total number is very small. Perhaps those placing these orders were unaware that the order-disclosure rule had recently changed, and thus hoped to influence the market.

Table 6
Descriptive statistics, price, and duration of spoofing order strategy for the second period: January 2, 2002–February 28, 2002.

Panel A: Ratio of execution for daily buy- and sell-order and the proportion of spoofing orders

	Daily total orders	Daily buy orders	Daily sell orders	Daily spoofing orders
Amounts	3,059,903	1,579,638	1,480,265	4,104
(shares, A)	(0.3525)	(0.0849)	(0.8767)	(0.0001)***
Execution	2,225,154	1,112,577	1,112,577	
(shares, B)	(0.8248)	(0.8099)	(0.8864)	
Ratio (%, B/A)	72.72	70.43	75.16	
Proportion of spoofing orders (%)				0.26[a]
				(0.0001)***

Panel B: Price of spoofing order

	Total order (%)	Spoofing order (%)
0 tick~5 tick	87.31	–
	(0.0001)***	
6 tick~10 tick	6.03	59.20
	(0.0001)***	(0.0001)***
Over 10 tick	6.66	40.80
	(0.0001)***	(0.0001)***

Panel C: Duration of spoofing order strategy (minutes)

	Time interval between spoofing-buy order and real sell order	Time interval between real sell order and cancellation of initial buy order
Mean duration	44.28	43.28
Standard deviation	59.02	65.89
Daily average returns of KOSPI index (January 2, 2002 to February 28, 2002): 0.45%		

The sample includes 549 firms listed on the KRX between January 2, 2002 and February 28, 2002. The statistics are the daily averages *per firm* and are measured only for the continuous trading hours. [a]: daily spoofing order divided by daily buy order. Panel A shows the ratio of execution for daily buy- and sell-order and the proportion of spoofing orders. The numbers in Panel B denote the proportion (%) of orders submitted at each range of quotes out of total orders or spoofing orders. The number of ticks away from the market for a buy order is measured from the prevailing bid. Panel C shows the duration (in minutes) between the stages of the spoofing trading strategy. ( ) and *** denote the p-values and significance at the 1% level using the paired t-test.

6. Discussion of traders' intent

It is possible that some of the spoofing-buy orders represented error or confusion on the part of the trader. However, it is simply implausible that 0.81% of all buy orders placed on the KRX would contain the exact same mistake, and we conclude that most of them must have been placed deliberately.

The most natural interpretation of a spoofing-buy order—a buy order with much larger size, submitted at a price well below the current market price, and followed by a sell order on the same stock—is an attempt to mislead other investors. In this section, we discuss other possible interpretations and argue that they are implausible.

6.1. Day trading

Do our results simply reflect normal day-trading behavior? As noted above, 42.2% of the spoofing orders we identified were placed as part of a day-trading strategy: a sequence of executed buy order, spoofing-buy order, executed sell order, and cancellation of the spoofing-buy order, all over the course of a single day.

However, the average size of spoofing-buy orders of day traders is approximately 4.1 times larger than that of non-spoofing buy orders by day traders in general. The vast majority (79.70%) of spoofing-buy orders submitted by day traders were more than 10 ticks away from the current best bid, whereas 94.8% of the actual executed buy orders by spoofing day-traders were submitted within 5 ticks from the current best bid (see Table 3).

Could a spoofing-buy order have been submitted to acquire information regarding the profitability of day trading, perhaps by assessing market liquidity or the reactions of other investors? Since the spoofing-buy order was submitted after the executed buy order, the day trader was already committed to day trading in that stock. Market liquidity is generally defined in terms of the price impact of an *executed* order; since the spoofing-buy order is not executed, it cannot have been intended to gauge liquidity. Placing the spoofing-buy order does allow the trader to observe the reactions of other traders. However, the consistent reaction is that the stock price rises, which is exactly the point of the manipulation inherent in spoofing. Especially in the case of day traders, who already have inventories of stocks prior to the spoofing, their main focus would be to close out the position by a sale executed by the end of the day, at the highest possible price.[24]

The higher returns of the spoofing day traders also confirm they are not typical day traders. According to Barber, Lee, Liu, and Odean (2008, p. 10), 99% of day traders on the Taiwan Stock Exchange (TWSE) consistently lose money[25]; the TWSE is a neighboring stock market in which investors' trading behaviors are reportedly similar to those in the Korean stock market. Moreover, we find that non-spoofing day traders in our sample lose money, net of transaction costs. In contrast, our results demonstrate that spoofing day-trading is very profitable. While nearly half of the spoofing orders involve day trading, the spoofing traders are decidedly not typical day traders. These results demonstrate that spoofing strategies need to be differentiated from typical day-trading strategies.

Finally, note that in 57.8% of the spoofing-buy orders, the stock had been purchased on a previous day (possibly long ago) and was sold following the placing of a spoofing-buy order. These traders were *not* day traders.[26]

[24]See the case of the Taiwan Stock Exchange (TWSE) by Barber, Lee, Liu, and Odean (2008, p. 7). "Most day trading (about 2/3) involves the purchase and sale of the same number of shares in a stock over the course of one day (i.e., most day trades yield no net change in ownership at the close of the day.") See also Garvey and Murphy (2005).

[25]"In aggregate, day trading is a losing proposition. In other words, day trading is an industry that consistently and reliably loses money. From an industrial organization perspective, it is difficult to understand how such an industry survives."

[26]Perhaps the trader had decided to sell the stock that day, and wanted to influence the price. Perhaps the trader had adopted a price target and was trying to move the price upward to meet that target. Both these motivations are manipulative in intent.

6.2. Liquidity provision

Some traders might seek to benefit from the bid-ask spreads, providing liquidity to the market by simultaneously placing buy orders below the current market price and sell orders above the current market price. This type of strategy would involve placing buy and sell orders of similar size, at similar variation from the current market price. However, in our sample, the average spoofing-buy order is roughly four times the size of the executed buy and sell orders, and the executed buy and sell orders are very close to the market price, while the spoofing-buy order is far from the market price. Moreover, the results of Barber, Lee, Liu, and Odean (2008, p.15) suggest that "the gross returns earned by day traders do not appear to be compensation for the provision of liquidity."

6.3. Day traders' expectation of lower stock prices

Could the day traders' spoofing-buy order have been placed in the expectation that prices would drop, and hence the order would be executed after all?

Recall that a day trader's spoofing-buy order is placed shortly after the trader executes a buy order at the market price; if the day trader expected prices to drop, why would he hurriedly execute a buy order at the market price?

Moreover, following the placement of the spoofing-buy order, prices rise rather than fall, as confirmed by the extra return to spoofing; if the spoofing day traders are expecting prices to fall, they are consistently wrong. How can day traders who are consistently wrong about short-term movements nonetheless earn extra profits? The only plausible answer is that their expectations are reflected in their executed buy order, rather than in their unexecuted spoofing-buy order: they expect prices to rise, not fall. The statistical significance of the extra profit confirms their profit does not arise simply by chance. It seems implausible that the traders could repeatedly accurately intuit the moments at which the prices would increase. We are left to conclude that the observed extra profit arise from the effects of spoofing.

6.4. Duration of the spoofing-buy order

As noted above, the time duration between the execution of the sell order and the cancellation of the spoofing-buy order is longer than might have been expected. In waiting to cancel the spoofing-buy order, the trader faces the risk that the order will be executed, for example if bad news is released. Even if the probability of execution is low, why take the risk? The legal question surrounding the spoofing trading strategy provides a motivation. Executing a sale, followed a minute later by the cancellation of the spoofing-buy order, would be much more likely to attract regulatory attention. Moreover, if the transaction did come to the attention of regulators, it would be much harder to deny the intent behind these rapidly placed orders than if they were spread out in time. An individual trader could simply say that s/he had a change of sentiment, and decided to sell, but forgot to cancel the spoofing-buy order until later in the day. However, most traders will not "forget" the fact that they wait some time before cancelling the order strongly suggests their goal is to camouflage a transaction they know is legally dubious.

6.5. Many occasional spoofers and some regular spoofers

We see a large number of traders engaged in occasional spoofing, and a small number spoofing regularly. During our full sample period of 40 trading days, 18,133 traders submitted one or more spoofing orders, averaging 1.9 spoofing orders per person (see Panel D in Table 2). Seventy-two percent of spoofers submitted just one spoofing order; on the other hand, 62% of spoofing *orders* were submitted by individuals who spoofed more than once, with an average of 4.2 spoofing orders per individual in this group. Some of those who submitted just one spoofing order may have done so by mistake, but it is hard to believe that 0.81% of *all* buy orders placed in this period (see Panel A in Table 1) contained this particular error.[27] It is even harder to believe that those who placed multiple spoofing orders did so in error. Seven individuals submitted more than 100 spoofing orders, and one trader submitted a total of 332 spoofing orders in 10 different stocks, almost one spoofing order per stock per day. It is inconceivable that the few regular spoofers, even if they had started spoofing for some benign reason, had not discovered that spoofing was a very profitable way to manipulate the market.

6.6. Limited participation by institutional investors

As reported in Table 1, 96.12% of the spoofing-buy orders are placed by individuals, and 3.04% by institutional investors. Normally, we think of institutions as being quicker than individuals to exploit elaborate but profitable trading strategies. If the strategy had a benign motivation, one would have expected institutions to jump in, ready to provide that benign explanation in case of regulatory scrutiny. The absence of a benign explanation predicts the exact pattern we see, in which spoofing is overwhelming done by individuals:

First, in order to have a material effect on their overall returns, institutions would need to make either large spoofing trades, or many small spoofing trades. This would expose them to a much higher risk of detection than a small individual investor, who could spoof occasionally with little risk.

Second, the consequences of regulatory sanctions are much higher for an institutional investor, since these could subject their other trading actions to more stringent oversight or result in serious damage to their reputations.

Third, the compliance departments of institutional investors are likely to object to the use of strategies that could potentially be illegal. Small individual investors rely on their own consciences.

Fourth, in light of the above, we might have expected 100% of the spoofing orders to be placed by individuals. In Korea, freelance financial advisers with individual clients maintain offices in the branches of financial firms but are not employed by the securities firms and are not subject to the same compliance oversight as traders employed by the

[27] This is supported by additional robustness checks. We redid all the analyses with the one-time spoofers excluded. The results excluding the one-time spoofers are qualitatively similar, with the following exceptions. First, the proportion of spoofing orders by individual investors increases a bit, and that increase is offset by the decrease by institutional investors (Table 1). Second, the time interval between the real sell order and cancellation of the initial buy order is considerably reduced from 35.73 minutes to 7.92 minutes (Table 2). Third, the *t*-values of the determinants of the proportion of spoofing orders decrease somewhat as a result of the reduction in the number of observations, but are qualitatively similar (Table 4). Fourth, the mean profitability of spoofing orders is slightly but not significantly reduced (Table 5). The detailed results are available on request.

firms to manage mutual funds or trade for the firms' own accounts. The trades carried out by these financial advisers are reported in our data as institutional trades, and we believe this explains the fact that a small fraction of the spoofing trades are characterized as institutional.

6.7. *Effect of change in the order-disclosure rule*

Starting in January 2002, the size of the total order book was no longer disclosed. Thus, a spoofing-buy order that was not among the ten best buy prices would no longer be disclosed at all, and thus would have no effect on the market unless executed. If a spoofing order was among the ten best buy prices, then both the size and price of the order would be disclosed, so that other traders could conclude that the order was unlikely to be executed and discount the order in their evaluation of market conditions. Thus, the effectiveness of the spoofing strategy in manipulating other traders' beliefs was greatly diminished by the change in order-disclosure rule, while the change would have no obvious effect on any other reason for placing a large buy order far from the current market price. Spoofing-buy orders constituted 0.81% of all buy orders before the rule change (see Table 1), but only 0.26% (see Table 6) immediately after the rule change.

There was a general consensus of the securities industry and regulators that various forms of market manipulation were hurting bona fide investors in the Korean stock markets around 2001 (our sample period is from November 1, 2001 to February 28, 2002).

7. Concluding remarks

This paper analyzes a microstructure-based manipulation, spoofing-order strategy, and its determinants and performance in the KRX. We find that approximately 0.81% of the total orders fit our definition of a spoofing order, and that they were more frequently observed in stocks with higher return volatility, lower market capitalization, lower price, and lower managerial transparency. During a trading day, more spoofing orders were observed shortly after the opening of the market and shortly before the close of the market. Investors who use the spoofing-order strategy obtain extra profits of 67 to 83 basis points in slightly less than 45 minutes. After the change in the order-disclosure rule, the number of spoofing orders decreased significantly, indicating that the market design facilitated this type of manipulation.

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