Do Foreign Short-Sellers Predict Stock Returns? Evidence from Daily Short-Selling in Korean Stock Market

Kuan-Hui Lee*
Seoul National University Business School

Shu-Feng Wang
Seoul National University Business School

April 15, 2014

Abstract

We investigate the daily short-selling by foreign investors and their impact on stock price, liquidity, and volatility in the Korean stock market. From January 1, 2006 to May 31, 2010, we find that the majority of short-selling is performed by foreign, rather than by domestic, investors and that foreign short-sellers are contrarians, whose large short-selling predicts short-run future return. We also find that foreign investors' short-selling is performed when buying-pressure is high, but does not improve stock liquidity. Furthermore, we find that foreign investors' short-selling does not increase volatility, providing evidence against the foreign investors' destabilizing role in emerging markets.

Keywords: short-selling; foreign investor; emerging market; Korean stock market

JEL Classification: G12, G14, G15

* Corresponding author. 703 LG Building, Business School, Seoul National University, 1 Gwanak-Ro, Gwanak-Gu, 151-916, Seoul, S. Korea; telephone +82 2 880-6924; fax +82 2 878-3154; e-mail kuanlee@snu.ac.kr. We thank seminar participants at the Korean Academic Society of Business Administration Annual Meeting in 2011, the Korea Advanced Institute of Science and Technology (KAIST), the Korea Institutue of Finance, Seoul National University (SNU) Business School, SNU Institute for Research in Finance and Economics, and Sungkyunkwan (SKK) Graudate School of Business. We also thank Paul M. S. Choi for helpful comments. We greatly appreciate support from the Institute of Management Research at Seoul National University and financial support from the Institute for Research in Finance and Economics of Seoul National University. This paper was formerly circulated under the title of "Are foreign investors to blame? Evidence from daily short-selling in Korean stock market." All errors are our own.

Do Foreign Short-Sellers Predict Stock Returns? Evidence from Daily Short-Selling in Korean Stock Market

April 15, 2014

Abstract

We investigate the daily short-selling by foreign investors and their impact on stock price, liquidity, and volatility in the Korean stock market. From January 1, 2006 to May 31, 2010, we find that the majority of short-selling is performed by foreign, rather than by domestic, investors and that foreign short-sellers are contrarians, whose large short-selling predicts short-run future return. We also find that foreign investors' short-selling is performed when buying-pressure is high, but does not improve stock liquidity. Furthermore, we find that foreign investors' short-selling does not increase volatility, providing evidence against the foreign investors' destabilizing role in emerging markets.

Keywords: short-selling; foreign investor; emerging market; Korean stock market

JEL Classification: G12, G14, G15

I. Introduction

In this paper, we investigate short-selling activities by foreign investors and their impact on stock price, liquidity, and volatility in the Korean stock market. Despite the vast amount of studies on short-selling in the US market, only a few studies examine short-selling activity in the global financial markets other than in the US (Beber and Pagano, 2013; Bris, Goetzmann, and Zhu, 2007; Chang, Cheng, and Yu, 2007; Jain, Jain, McInish and McKenzie, 2013; Saffi and Sigurdsson, 2011). Hence, general features of foreign investors' short-selling trading and its impact on stock characteristics have not been given much attention. Filling this gap, we contribute to the literature by investigating the following wide range of research questions: How much daily short-selling is carried out in emerging markets? Are foreign investors bigger players in short-selling markets than domestic investors, or vice versa? What short-selling trading strategies, on average, are used by foreign investors in emerging markets? Can we find evidence that foreign investors are informed or naïve, uninformed trend- chasers through their short-selling activity? Do foreign short-sellers provide liquidity? Do foreign investors destabilize stock prices through their short-selling activity?

We focus on the Korean stock market for the following reasons. First, Korea has the most developed financial market among emerging markets in which many foreign investors can actively trade under less binding regulations on foreign investors. For example, the legal limitation on share ownership by foreign investors was abolished in the Korean market before our sample period begins. Second, the Korea Exchange (KRX) provides high-frequency data with good quality for a relatively long period of time; Our sample period covers five and a half years, while Diether, Lee, and Werner (2009a) use only a one-year sample period. In addition, the presence of high-frequency data enables us to study *daily* short-selling activity and its relation with other variables of interests. Another benefit of our dataset is that it distinguishes each trade by traders' type. That is, each trade is flagged to denote whether it was initiated by domestic individual investors, domestic institutional investors, or foreign institutional investors. Hence, our data provides a good opportunity to examine different trading behaviors according

to different investor types.[1] The most prominent and unique feature of our dataset may be that each trade is flagged with order sequence number and the direction of trade, which shows whether it was buyer- or seller-initiated, rendering Lee and Ready's (1991) algorithm for obtaining order imbalance data unnecessary for our sample stocks. This provides benefit of constructing buy-order imbalance data without being engaged in the argument about the validity of Lee and Ready algorithm (Ellis, Michaely, and O'Hara, 2000; Odders-White 2000).

In Korean stock market, short-selling is not so frequent compared to that in the US market. According to Diether, Lee, and Werner (2009a), 24% and 31% of daily trading volume is generated from short-selling trading in New York Stock Exchange and in Nasdaq, respectively, in 2005. However, for 761 stocks in Korean stock market, before any screening, we find that the cross-sectional mean of average daily short-selling is only 0.53% of daily trading volume over the sample period from January 1, 2006 to May 31, 2010, excluding October 1, 2008, to May 31, 2009, when short-selling was banned in Korea by regulation. Moreover, for 24 percent of stocks, average short-selling is zero and 92% of stocks have an average short-selling of less than 2% of trading volume. Legal restrictions during our sample period on hedge funds, which often use short sales to carry out long–short strategies, may contribute to this small percentage of short-selling relative to trading volume in the Korean stock market.[2] Given the rarity of short-selling in the Korean stock market, we restrict our sample to fifty stocks that are mostly actively engaged in short-selling over the sample period, in order to perform meaningful analyses for short-sale trading activity.[3] The average market capitalization of the fifty sample stocks is 380,920 billion Korean won (roughly USD 346

[1] Boehmer, Jones, and Zhang (2008) investigate short-selling activity by investor types, separating individuals and institutions in the US market. Diether, Lee, and Werner (2009a), lacking investor type data, used trade size as a proxy for investor type to distinguish trades by individual investors from trades by institutional investors in an earlier version of their paper.

[2] The 12 hedge funds with over 150 billion Korean won came into operation, for the first time in Korea, in December 23, 2011. These hedge funds were operated by nine major Korean financial institutions.

[3] In a robustness section, we discuss empirical results based on the extended sample that consists of 104 stocks. Instead of selecting fifty stocks with the highest average short-selling record over the sample period, we construct sample year-by-year. Empirical results are similar.

billion)[4], reflecting 47.8% of total market capitalization of all stocks listed in Korean stock market. In our sample, the mean short-selling volume in the Korean market is 3.16% of the daily trading volume.

Interestingly, we find that the major portion of short sales is performed by foreign investors, whereas domestic investors, both individuals and institutions, are rarely engaged in short-selling trading in Korean stock market. Short-selling by individual and institutional domestic investors constitutes 0.05% and 0.24%, respectively, of daily trading volume while that by foreign investors is 2.87%, which is roughly ten to sixty times larger than the numbers for domestic investors. More strikingly, we find that about 88% of shorted shares are carried out by foreign investors, showing sharp contrasts with only 5% and 7% of short-selling by individual and institutional domestic investors, respectively. Considering that foreign investors are institutional investors, this pattern is consistent with Boehmer, Jones, and Zhang (2008), who find that about 75% of all short sales in the US market are executed by institutions, while less than 2% are performed by individual investors. Since the largest portion of short sales is executed by foreign investors, who have been shown to prefer large stocks in foreign markets (Kang and Stulz, 1997), it is not surprising to see that the short-selling activity in Korean stock market mostly involves large stocks rather than small stocks. Specifically, relative short-selling, which is defined as the number of shorted shares divided by the number of traded shares, is 1.22% for large stocks, while the number is only 0.02% and 0.19% for small stocks and for medium-cap stocks, respectively, in Korean stock market (before any screening). By examining the cross-sectional variation in relative short-selling in our sample, we find that short-selling is more concentrated for large-cap stocks, growth (i.e., low book-to-market) stocks, high-priced stocks, and stocks with low institutional ownership.

During our sample period, relative short-selling by foreign investors has been growing over time from 1.18% in January 2006 to 4.00% in May 2010 (except for short-selling ban period). The relative short-selling by foreign investors is highest, 6.42%, in August, 2008,

[4] One USD is approximately to 1,100 Korea won.

possibly reflecting increased pessimism among investors before the 2008 subprime mortgage crisis. The dominance of short-selling by foreign investors over short-selling by domestic investors is persistent over time in the Korean stock market. Specifically, about 80–90% of shorted shares are coming from foreign investors consistently over time. This finding may justify our exclusive focus on short sales by foreign investors throughout the paper to draw meaningful conclusions about short-selling in emerging markets.

By examining short-selling activity of foreign investors, our paper also contributes to the literature on trading behavior and the informational (dis)advantage of foreign investors in emerging markets. It is interesting to see that previous research shows that the trading behavior of foreign investors and that of short-sellers are not similar to each other. The recent study on short-selling in the US market by Diether, Lee, and Werner (2009a) shows that short-sellers are negative feedback (i.e., contrarian) traders, whereas Brennan and Cao (1997), Grinblatt and Keloharju (2000), and Griffin, Nardari, and Stulz (2007) show that foreign investors use positive feedback (i.e., momentum) trading strategy due to their informational disadvantage relative to domestic investors. Unlike previous studies on foreign investors' trading activity, which are mostly based on changes in foreign investors' equity holdings, this paper is the first one to investigate the issue through foreign investors' daily short-selling. Specifically, we investigate whether foreign short-sellers are momentum traders or contrarian traders in this paper.

There has been much debate on the informational advantage of foreign investors over domestic investors in overseas markets, with some arguing that foreign investors are informed (Froot, O'Connell, and Seasholes, 2001; Froot and Ramadorai, 2008) and with others arguing that they are not (Brennan and Cao, 1997; Kang and Stulz, 1997; Choe, Kho, and Stulz, 2005; Dvorak, 2005). If foreign short-sellers are good at timing the short-term trends of stock prices (i.e., if foreign short-sellers are informed), their increased short-selling should be negatively related to future stock prices. The availability of *daily* short-selling data in the Korean stock market allows us to examine whether the short-selling activity of foreign investors is related to

the future decline of the return of stocks sold short. According to Avramov, Chordia, and Goyal (2006), trading by contrarian traders is informed and thus related to lower future volatility. Hence, investigation of a trend-chasing short-selling strategy can be naturally extended to the on-going argument of whether foreign investors destabilize financial markets in emerging market countries. This paper contributes to the literature by adding evidence on the destabilization issue in terms of short-selling.

One of the perceived benefits of allowing cross-border investments by foreign investors is on their liquidity-providing role. Short-selling provides liquidity to the market if it is performed to absorb excessive buying pressure. That is, foreign investors provide liquidity through short-selling when they bet on short-run price reversals, considering that the past days' positive returns are due to temporary buying pressure. Hence, if short-sellers provide liquidity, then an increase in short-selling should coincide with contemporaneous buy–order imbalance and will be related to future decreases in bid-ask spread. Diether, Lee, and Werner (2009a) find that short-sellers in the US market provide liquidity by shorting shares when the buy–order imbalance is high. On the other hand, according to Kyle (1986), increased presence of informed traders is linked to decrease in stock liquidity due to market maker's request of larger compensation for potential losses that may arise from trading against informed traders. Hence, it is possible that foreign investors' short-selling, if informed, may adversely affect stock liquidity. We test whether the liquidity providing role is empirically supported by daily short-selling data in the Korean stock market. This paper is also the first to investigate the liquidity-providing role of foreign investors in terms of their short-selling trading in emerging markets.

We report some interesting findings about foreigners' short-selling in this paper. Consistent with evidence for the US market as in Diether, Lee, and Werner (2009a), we find that foreign short-sellers in the Korean stock market are contrarian investors (e.g. negative feedback traders). Specifically, we find that foreign short-sellers increase short-selling when a stock's past performance is positive. The finding of negative feedback trading strategy by foreign short-sellers provides us deeper and comprehensive understanding of trading strategy

employed by foreign investors since previous studies, which focus on foreign investors' long-side trading, show that foreign investors are mostly engaged in a positive feedback trading (Brennan and Cao, 1997; Grinblatt and Keloharju, 2000; Griffin, Nardari, and Stulz, 2007). Our subsequent analysis to examine whether foreign investors' short-selling helps destabilize stock prices shows that foreign investors' short-selling is not significantly related to future volatility, consistent with Choe, Kho, and Stulz (1999), who find no evidence of a destabilizing role of foreign investors in the Korean stock market.

Regressions of daily stock returns on lagged foreign investors' short-selling show that foreign investors' short-selling activity predicts future returns. This return predictability, however, holds only for stocks with high short-selling, implying that the relation between short-selling activities and future stock returns are nonlinear. The evidence of informedness of short-selling by foreign traders is also supported by additional empirical analysis in this paper, which investigates the potential profits of a long–short trading strategy based on the level of foreign investors' short-selling. We find that a long–short trading strategy based on short-selling generates both statistically and economically significant daily abnormal returns of 0.13% (about 38% annually) after adjusting for size and book-to-market. These findings are consistent with the literature that argues that short-sellers are informed (Boehmer, Jones, and Zhang, 2008; Diether, Lee, and Werner, 2009a), and that foreign investors have informational advantage over domestic investors (Froot, O'Connell, and Seasholes, 2001; Froot and Ramadorai, 2008).

Turning to liquidity, we find that foreign short-sellers increase short-selling when a stock is under large contemporaneous buy–order imbalance. However, regressions of stock's daily bid-ask spread on the lag of foreign investors' short-selling show that the lagged short-selling is not significantly related to stock spread, implying that the amount of increase in short-selling may not be sufficient to significantly resolve the buying pressure of a given stock.

The rest of paper is organized as follows. In Section II, we illustrate the general features of Korean short-selling markets. Section III describes the data together with the sample

screening procedure. Section IV investigates the short-selling behavior of foreign investors in the Korean stock market, focusing on whether they are contrarian or momentum traders. Section V examines whether foreigners predict future returns and whether they have an opportunity to obtain profits based on their short-selling strategy. Section VI investigates whether foreign investors' short-selling has a destabilizing role and whether it provides liquidity. In Section VII, we discuss empirical results based on the extended sample. Section VIII concludes the paper.

II. Short-sales in Korean stock market

In 1969, margin transaction was allowed in the Korean stock market, which made short-selling possible. Initially, only individual investors were allowed to perform short-selling, but the restriction for short-selling was removed for institutional investors in September, 1996, and for foreign investors in July 1998. The up-tick rule was first introduced in 1996 in Korean stock market. The institutional (individual) short-sellers were required to cover their short position within six (three) months, but the security lenders had a right to recall the shares five days after lending. The collateral values were required to be 90% to 110% of the market value of borrowed stocks and the loan fee, which is a direct cost of short-selling, was about 2.5% to 6%, on average. In Korea, the main security lenders are pension fund, banks, insurance companies and asset management companies.

The Financial Supervisory Service (FSS) in Korea began to strengthen the regulation for short-selling after the so-called WooPung credit union event in March 2000.[5] Since then, FSS prohibits naked short-selling, a short-selling without borrowing of stocks, and requests all short-selling orders and executions to be tagged as 'margin sell.' The Korea Exchange (KRX) was launched in January 2005 by consolidating KOSPI (Korea Composite Stock Price Index) market, KOSDAQ (Korea Securities Dealers Automated Quotation) market, and derivative market together. Due to the financial crisis of 2008, the FSS prohibited short-selling for all

[5] In March 29, 2000, WooPung credit union sold short 350,000 shares of SUNGDO ENG stocks. On settlement date, however, it failed to deliver the stocks to buyers.

stocks that were listed on KOSPI and KOSDAQ for October 1, 2008 to May 31, 2009. In this period, the FSS also built up rules on short-selling regarding intensively shorted stocks, the collateral requirement, and disclosure. FSS adapted the "cooling period system" that prohibits a stock from being sold short for ten days when the shorted amount for a given stock exceeds 5% (3%) of total trading amount in the KOSPI (KOSDAQ) during the most recent 20 days; The collateral requirement increases to 140% of market value of borrowed stocks; From June 23, 2008, the KRX is required to disclose on a daily basis the list of shares sold short together with the amount sold short.

III. Data and sample construction

We collect intra-daily short-selling data for common stocks listed in the KOSPI market, which is a part of the Korea Exchange (KRX), for January 1, 2006 to May 31, 2010. We obtain daily return, market capitalization, book-to-market ratio, and institutional ownership data from FnGuide. At the initial stage, we have a total of 761 firms with 746,692 stock–day observations. To avoid any potential confounding effects on the empirical results, we exclude the period from October 1, 2008 to May 31, 2009, during which short-selling was banned by regulation.[6] We exclude financial firms from the sample and drop a stock-day observation if return data is missing. We drop stock-year observations if market capitalization or book-to-market ratio data are not available that year, or the previous year-end stock price falls below 1,000 Korean won (roughly one USD). For our measure of daily short-selling activity, we define relative short-selling (*relss*) as a ratio of the number of shorted shares to the daily share trading volume, as in Diether, Lee, and Werner (2009a):

$$relss_{i,t} = \frac{N \quad of \quad shorted \quad share_{i,t}}{N \quad of \quad traded \quad share_{i,t}} \tag{1}$$

[INSERT TABLE 1 HERE]

[6] In the ban period, however, a small amount of short-selling was made if the purpose of the trade is to provide liquidity or to hedge underlying positions.

Table 1 shows the distribution of stock-day observations of *relss* for 761 stocks in KOSPI market. We see that 78% of stock-day observations have zero *relss* and 20% has *relss* that is positive but less than 10%. Panel B shows that average short-selling is zero for 24% of stocks (182 firms) and that 92% of stocks (621 firms) have an average short-selling of less than 2% of trading volume. The average market capitalization for stocks whose *relss* is larger than 2% is 7,598 billion Korean won (roughly, USD 6.9 billion) or bigger, while that for stocks whose *relss* is smaller than 1% is 471 billion Korean won (USD 0.4 billion) or smaller. Hence, it is clear that the short-selling activity is performed much more for large stocks than for small stocks in Korean stock market. In an unreported exercise, we find that *relss* is 1.22% for large stocks, while the number is only 0.02% and 0.19% for small stocks and for medium-cap stocks, respectively, for 761 stocks in KOSPI universe.

Given the rarity of short-selling in the Korean stock market, we restrict our sample to fifty stocks that are mostly actively engaged in short-selling over the sample period, in order to perform meaningful analyses for short-sale trading activity. Specifically, we sort stocks by the average *relss* over the sample period and select the fifty stocks with the highest average *relss*. Our final sample consists of fifty stocks and 42,981 stock-day observations among which 26% of stock-day observations have zero short-selling. To examine the potential sampling bias issue, we build a sample by selecting fifty stocks *every year* based on *annual* average of *relss* and repeat the empirical analyses based on this extended sample, which consists of 104 stocks. As we mention in the robustness section, empirical results based on the extended sample are similar.

[INSERT TABLE 2 HERE]

Table 2 shows the list of fifty sample stocks together with other relevant firm characteristics such as market capitalization, book-to-market ratio, share turnover, institutional

ownership, and foreign ownership, in descending order by the average *relss*. Our sample covers stocks with large capitalization and active trading volume such as Samsung Electronics, POSCO, Korea Electric Power, LG Electronics, KT, and Hyundai Motor. Average daily relative short-selling varies from 2.09% to 6.98% in our sample stocks. The aggregate average market capitalization of sample stocks is 380,920 billion Korean won, reflecting 47.8% of total market capitalization of all stocks listed in the KOSPI market.

Table 3 shows descriptive statistics of short-selling by different subperiods (panel A) and by investor types and subperiods (panel B). For the overall sample period of 2006:01–2010:05, the mean number of shorted shares is 29,564.50. Overall short-selling relative to the daily trading volume in the Korean market is small compared to that in the US market - The mean *relss* comprises 3.16% in our sample, while it is 24% and 31% for NYSE and Nasdaq, respectively, in Diether, Lee, and Werner (2009a). We conjecture that legal restrictions on hedge funds during our sample period, which often use short sales to carry out long–short strategies, may be responsible for this relatively small amount of short sales in the Korean stock market.

[INSERT TABLE 3 HERE.]

It is notable to see that a major portion of short-selling is carried out by foreign investors rather than by domestic investors in the Korean stock market. While *relss* by individual and institutional domestic investors comprises 0.05% and 0.24%, respectively, that by foreign investors is 2.87%, which is roughly ten to sixty times larger. Out of a 29,565 average shorted shares, 25,984 shares are from short-selling by foreign investors. That is, about 88% of short-sold shares are from foreign investors, while only 5% and 7% are from individuals and institutional domestic investors, respectively. This shows that, in Korea, institutional traders with large short-selling bets tend to be foreign investors, while domestic institutions are minor players in short-selling at best. Considering that foreign investors are

institutional investors, this pattern may be consistent with Boehmer, Jones, and Zhang (2008), who find in the US market that about 75% of all short sales are executed by institutions, with less than 2% carried out by individual investors. Given this finding, we focus exclusively on short sales by foreign investors to draw meaningful conclusions about short-selling in Korean stock market.

$$relss^{F}_{i,t} = \frac{N \ of \ shorted \ share \ by \ foreign \ investors_{i,t}}{N \ of \ traded \ share_{i,t}} \qquad (2)$$

Relative short-selling also shows time variation across different subperiods in our sample. We divide our sample period into two subperiods using short-selling ban period as cutoff. The average relative short-selling is 3.24% for the earlier subperiod (2006:01–2008:09), but smaller, 2.98%, in the later subperiod (2009:06–2010:05). This may be due to increased pessimism before and during the 2008 subprime mortgage crisis.

[INSERT FIGURE 1 HERE.]

Panel A of Figure 1 shows short-selling activity relative to trading volume in the Korean stock market. During our sample period, *relss* by foreign investors, $relss^{F}$, is growing over time from 1.25% to 4.13% (except for short-selling ban period, the shaded area) and is much larger than that by domestic investor groups. The relative short-selling is at the highest, 6.33%, in August, 2008, possibly reflecting increased pessimism among investors before the 2008 subprime mortgage crisis. Panel B of Figure 1 shows that the dominance of short-selling by foreign investors over short-selling by domestic investors is persistent over time in the Korean stock market. It shows that about 80–90% of shorted shares are coming from foreign investors consistently over time, except for the short-selling ban period. Figure 1 also may justify our exclusive focus on short sales by foreign investors.

To examine cross-sectional variations in short-selling, we report a short-selling statistic (*relss*) for different groups of stocks in Panel C of Table 3.[7] Based on market capitalization at the end of June of each year, we sort stocks into small, medium, and large stock groups, with the 33rd and 67th percentiles of all 761 stocks in the KOSPI market as cutoffs. We also group stocks based on book-to-market ratio (*B/M*), which is defined following Fama and French (1993). Like market cap, low and high *B/M* values are associated with the 33rd and 67th percentile of all KOSPI stocks, respectively. A stock is considered a low- or high-priced stock based on its closing price at the end of each day, again, using the 33% and 67% cutoffs. Lastly, we group stocks based on institutional ownership at the end of each year. No institutional ownership denotes stocks with zero institutional ownership, while high institutional ownership refers to stocks with institutional ownership above the median (we compute the median institutional ownership after excluding stocks with zero institutional ownership).

Panel C of Table 3 shows that all of shorted shares are large stocks with no shorted shares in small stock-tercile. Since a large portion of short-selling is executed by foreign investors, who prefer large stocks in foreign markets (Kang and Stulz, 1997), it is not surprising to see that average relative short-selling is mostly done for large stocks in the Korean market. This preference for large stocks in short-selling is also consistent with the previous literature (D'Avolio, 2002; Jones and Lamont, 2002; Diether, Lee, and Werner, 2009a). We find evidence of more short-selling for stocks with low book-to-market ratio than for those with high book-to-market ratio, as for the NYSE in Diether, Lee, and Werner (2009a). Consistent with Cohen, Diether, and Malloy (2007), where less short-selling is expected for low-priced stocks due to their high collateral costs, we see *relss* is 3.23% for high-priced stocks and 2.07% for low-priced stocks. Contrary to D'Avolio (2002), who shows that stocks with high institutional ownership are easier to be engaged in short-selling because of heightened

[7] The availability of put options may provide alternative trades to short-selling. However, we do not report relative short-selling by groups of stocks with or without put options in the table, since availability and activity in the trading of put options for individual stocks are very low in the Korean stock market. The average cumulative trading volume and trading value of put options are only 23.92 contracts and 3.7 million won (approximately US$3,400) in our sample period, respectively.

willingness of lending stocks by institutions, we find that short-selling is more concentrated for stocks with no institutional ownership than for those with high institutional ownership in Korean stock market. We conjecture that under-developed short-selling infrastructure in Korea does not provide institutions with sufficient incentive to lend shares. More importantly, given that large portion of institutional ownership is de facto controlling shares in Korea, lack of institutional ownership may contribute to increased short-selling by increasing the number of floating shares available for trades. The next section investigates the short-selling trading behavior of foreign investors in a regression framework.

IV. Are foreign short-sellers contrarian or momentum traders?

The key research questions in this section are whether foreign investors' short-selling strategies are based on short-run price trends and whether they could earn positive abnormal returns based on such a trading strategy. Brennan and Cao (1997) provide a theoretical model together with empirical evidence that foreign investors act as momentum traders due to their informational disadvantage compared to domestic investors. Grinblatt and Keloharju (2000) and Griffin, Nardari, and Stulz (2007) provide supporting evidence of this positive feedback trading of foreign investors. On the other hand, Diether, Lee, and Werner (2009a) provide evidence that short-sellers are contrarian traders in the US market. Since contrarian traders trade against past stock performance, while momentum traders trade following past stock returns, we regress the foreign investors' relative short-selling on past cumulative stock returns along with other control variables to find a specific trend-chasing pattern. The regression is performed with stock and day fixed effects, and standard errors are clustered by both stock and date (Thompson, 2011). If foreign short-sellers are contrarian (momentum) traders, *relss* by foreign investors, $relss^F$, may be significantly and positively (negatively) related to past cumulative stock returns.

According to Diether, Lee, and Werner (2009a), short-selling may arise from opportunistic risk-bearing motivation during periods of high uncertainty – i.e., periods with

high intraday volatility. If high uncertainty comes from high level of asymmetric information, short-selling activity may coincide with wide spread (Kyle, 1985). On the contrary, if high uncertainty comes from high level of differences of opinion, short-selling activity may coincide with low spread. Hence, we include in the regression intraday volatility, which is defined as the difference between daily highest price and lowest price, divided by the daily highest price, as well as daily proportional spread, which is defined as a bid-ask spread scaled by bid-ask midpoint, averaged across quotes for a given stock on that date.

It is possible that high past cumulative returns are actually caused by temporary buying pressures, hence following Diether, Lee, and Werner (2009a), we control buy-order imbalance in the regression. Focusing on buy-side price pressure, we specifically define positive buy-order imbalance, oib_t^+, as equal to oib_t if $oib_t > 0$, and zero otherwise, where oib_t is a stock's daily buy–order imbalance, computed as the daily price-setting buy volume minus the daily price-setting sell volume, divided by the daily trading volume. Similarly, $oib^+_{-5,-1}$ is defined as equal to $oib_{-5,-1}$ if $oib_{-5,-1} > 0$, and zero otherwise, where $oib_{-5,-1}$ is the average of oib_t from days t-5 to t-1.

[INSERT TABLE 4 HERE.]

Table 4 shows the results of the regression of daily foreign investors' relative short-selling, $relss^F$, on a stock's past cumulative returns, $r_{-5,-1}$, which is computed based on returns from days t-5 to t-1, for the full sample period as well as for the two subperiods, as denoted in the column headings. In the first specification, we include contemporaneous returns, r_t, in the regressions to control for positive return autocorrelation. We also include the past five days of relative short-selling by foreign investors, $relss^F_{-5,-1}$, and turnover, $tv_{-5,-1}$, which is computed as the sum of traded shares for days t-5 to t-1 divided by the number of shares outstanding at the end of the previous year in the regressions because it is possible that each of short-selling and trading volume is positively autocorrelated. We see that the coefficient of past cumulative

returns is 0.0155 with a *t*-value of 2.26, which is significant at the 5% level. This is evidence that foreign short-sellers are contrarian traders, a finding consistent with Diether, Lee, and Werner (2009a). The significant result for $r_{-5,-1}$ is, however, present only to the most recent subperiod; The coefficient of $r_{-5,-1}$ is 0.0279 with a *t*-value of 2.29 in 2009:06-2010:05, but are not statistically significant (*t*-value of 1.63) though positive in 2006:01-2008:09.

Contrarian trading behavior in short-selling may not necessarily be symmetric. That is, the short-selling strategy can be different when the trading is based on positive or negative past cumulative returns. To observe this nonlinearity in short-selling for winner/loser stocks, we define a dummy variable for losers (winners), *Loser* (*Winner*), that equals one if a stock is in the lowest (highest) quartile based on $r_{-5,-1}$, and zero otherwise.[8] We see that the contrarian short-selling strategy is present only for the winner dummy. The coefficient of the winner dummy variable is 0.2065, with a *t*-value of 2.20, while the coefficient of the loser dummy is not significant. Consistent with the results in the first specification, the coefficient of the winner dummy is significant in the more recent subperiod, while it is not in the earlier subperiod.

Previous research shows that order imbalance is significantly related to stock returns through price pressure caused by the serial correlation of order imbalance (Chordia and Subrahmanyam, 2004). In our analysis, order imbalance may therefore be related to $r_{-5,-1}$. By including order imbalance into the regressions, we can also test whether foreign short-sellers act as liquidity providers in the Korean stock market. Foreign investors provide liquidity through short-selling when they bet on short-run price reversals, where the past days' positive returns are considered to be due to temporary buying pressure. In addition, because short-selling activity in the KOSPI market is under the uptick rule during our sample period, short-sellers may tend to act as passive liquidity providers (Diether, Lee, and Werner, 2009b). Consistent with Diether, Lee, and Werner (2009a), we find a positive and significant (at 1% level) coefficient of contemporaneous buy–order imbalance in the overall sample period as well as in two different subperiods. For the full sample period, oib_t^+ has a coefficient of 1.2667,

[8] The results are similar when we define Winner/Loser based on either tercile or quintile.

which is highly significant with a *t*-value of 11.46. This finding implies the liquidity provision by foreign short-sellers in that they increase short-selling when the buying pressure is high.

Interestingly, we find that contemporaneous spread and volatility are all negative and significant, suggesting that foreign short-sellers increase short-selling when the liquidity is high (low spread) and the volatility is low. This result contrasts with Diether, Lee, and Werner (2009a), who find positive and significant results for both variables, implying that short-sellers are opportunistic risk bearers in periods of elevated uncertainty caused by information asymmetry. Our finding provides evidence of new aspect of foreign short-sellers' trading strategy in that foreign short-sellers are not opportunistic risk bearers in Korean stock market.

Overall, our findings so far show that foreign short-sellers time their short-sale trades based on short-term price trends, provide evidence on liquidity-providing, but do not provide evidence in support of risk-bearing role of foreign short-sellers in the Korean stock market.

V. Are foreign short-sellers informed?

In the previous section, we have established that foreign short sellers are contrarian. In this section we investigate whether foreign investors' contrarian short-selling can predict the future returns. Table 5 shows the results of regressing $t + 2$ day returns on the relative short-selling by foreign investors on day t, $relss^F_t$, to see whether their short-selling predicts future stock returns.

[INSERT TABLE 5 HERE.]

In the first specification, we regress future returns on relative short-selling and past cumulative returns, including stock and day fixed effects. In the second specification, we add more control variables such as spread, order-imbalance, volatility and turnover. The coefficients of relative short-selling by foreign investors are not significant in any subperiod. The sign of $relss^F_t$ is negative but is not statistically significant. However, there is no reason to believe that returns and $relss^F_t$ are linearly related. Hence, in the third specification, we

explore *asymmetric* and *nonlinear* relationship of relative short-selling with future returns. In doing so, we define dummy variables, $relss^F\_Low$ and $relss^F\_High$, based on $relss^F_t$; $relss^F\_Low$ ($relss^F\_High$) has a value of one if a stock is in the lowest (highest) quartile based on $relss^F_t$. Similarly, we define a *Winner* (*Loser*) to have a value of one if a stock is in the highest (lowest) quartile based on $r_{-5,-1}$. The results in specification (3) show that large short-selling activity of foreign investors is a significant predictor of future returns in the overall sample period and in the earlier subperiod, implying that foreign investors' *heavy* short-selling activities are based on information. We conjecture that the insignificant coefficient on $relss^F\_High$ in the later subperiod may come from the possibility that short-selling after the subprime mortgage crisis might be more engaged in index arbitrage rather than information-based trading. The predictability of short-selling trades by foreign investors is consistent with the US market findings of Diether, Lee, and Werner (2009a).

Profitability based on this nonlinear relationship between $relss^F_t$ and future returns is also confirmed in Table 6, in which we investigate whether foreign investors can materialize abnormal profits based on their contrarian short-selling strategy. On day t, based on $relss^F$ on a previous day, we divide the sample into three groups: small, medium, and large $relss^F$ groups. Then, we compute the daily returns of each equally weighted portfolio for days t+2, t+3, t+4, and t+5 (we skip a day to avoid bid–ask bounce). Abnormal returns are computed from characteristic-adjusted returns using 25 value-weighted size–*B/M* portfolios as in Fama and French (1993). Although we report the results based on equally-weighted portfolios, but the results are qualitatively similar in the case of a market value-weighted portfolio. Table 6 shows the results over full sample period and the subperiods before and after the short-selling ban in different panels.

[INSERT TABLE 6 HERE.]

The column 'Small-Large' shows abnormal returns from long–short portfolios formed by taking a long position on portfolios with small short-selling and by simultaneously taking a short position on portfolios with large short-selling. We see that in the full period the long-short portfolio generates a significant abnormal return of 0.127 and 0.076 (*t*-value of 4.05 and 2.47) at day t+2 and t+3, respectively. Moreover, the numbers in the full sample period at day t+2 and t+3 are monotonically distributed across short-selling portfolios. Profitability of long-short portfolio is also persistent in different subperiods. Contrasting the previous research that shows informational disadvantage of foreign investors relative to domestic investors (Dvorak, 2005; Choe, Kho, and Stulz, 2005), our findings in this section provide new, supporting evidence through foreign investors' short-selling of their informational advantage in overseas markets.

VI. Does foreign short-selling destabilize the stock price and liquidity?

It is widely accepted among stock market participants in emerging market countries, though rarely supported in academic literature, that foreign investors could destabilize the stock market through a swift repackaging of their large portfolios across borders. However, it might be paradoxical to see that many countries have actually tried to reduce the restriction on cross-border capital flows, largely to exploit the benefit of the abundance of liquidity provided by foreign capital. If cross-border investment flows are to blame, it might be more so for short-selling. This section investigates the effect of foreign investors' short-selling on stock volatility and liquidity and provides new evidence on the argument on destabilization through short-selling activity.

[INSERT TABLE 7 HERE.]

We regress daily volatility of the stock returns on days t+1 and t+2, σ_{t+1} and σ_{t+2}, respectively, on a short sale by foreign investors on day t. The variable σ_t is computed as the daily highest price minus the lowest price, scaled by the highest price on day t. If short-selling

trades by foreign investors destabilize stock prices, short-selling on day *t* should be positively and significantly related to future volatility. Table 7 shows, however, that this is not the case. The variable $relss^F_t$ is not significant in any specification or in any subperiod in the table. The coefficient of relative short-selling is sometimes even negative, though insignificant. The result is consistent with Choe, Kho, and Stulz (1999), who show that the destabilizing role of foreign investors is not supported in the Korean stock market.

Table 8 revisits the issue of liquidity-providing role of foreign short-sellers. Recall that, in Table 4, we find evidence of liquidity providing role of foreign short sellers in that foreign investors increase short-selling when the buy-order imbalance is high. Then, the remaining issue will be whether such an increase in short-selling actually relieves liquidity constraint of a given stock. In Table 8, we examine the effect of foreign short-selling on stock liquidity, proxied by bid-ask spread. We regress the proportional spread on days $t + 1$ and $t + 2$ on foreign investors' short-selling on day *t* with other control variables. To control for serial correlation of dependent variables, we include own lagged variables in the regressions in both panels.

[INSERT TABLE 8 HERE.]

If short-selling by foreign investors provides liquidity, then we should be able to observe significant and negative coefficients for $relss^F_t$ on future stock spreads. However, Table 8 shows that the coefficient of $relss^F_t$ is not significant. This is not surprising given small amount of short-selling in Korean stock market shown in Table 3. That is, though foreign short-sellers increase their short-selling when buy-order imbalance is high (Table 4), the amount of short-selling seems not sufficient to fully resolve buying pressure of a given stock or to increase liquidity.

VII. Robustness

So far, our analyses are based on fifty sample stocks with most active short-selling in Korean stock market during the sample period. Specifically, we calculate average daily *relss* over the sample period and select fifty stocks with the highest average relative short-selling value. However, it is possible that screening based on average *relss* over the sample period may drop some stocks whose short-selling is concentrated on a certain period. To cope with potential issues arising from this sampling bias, we perform all analyses based on extended sample. That is, instead of selecting fifty stocks with high average short-selling record over the sample period, we construct sample year-by-year. Specifically, we select fifty stocks with high short-selling activity *each year* based on average daily *relss* in a given year. As a result, we could double the sample size – we now have a total of 104 stocks in our extended sample. Average relative short-selling in our extended sample is 3.46%, slightly above 3.16% based on our current sample based on fifty stocks. Foreign investors' average $relss^F$ increases to 3.11% in the extended sample from 2.87% in our current sample, while average *relss*'s for individuals and domestic institutions in the extended sample, which are 0.06% and 0.29%, respectively, are similar to the numbers shown in Table 3. Similar to the case of our current sample, we see the highest *relss* in 2008 and 2010, 5.08% and 4.21%, respectively, which may be due to increased pessimism before and during the 2008 subprime mortgage crisis and 2010 European sovereign debt crisis. All other empirical results based on this extended sample are similar to those based on our current sample.

VIII. Conclusion

This paper investigates the daily short-selling activities of foreign investors in the Korean stock market from January 1, 2006, to May 31, 2010. Our research questions are extensive, covering the average amount of short-selling by different investor types, their short-selling strategy, its informedness, the role of liquidity provision, and the potential destabilizing effect of short-selling by foreign investors in the Korean stock market. We find that about 88% of

short-selling, in terms of short-selling volume, are performed by foreign investors, while short-selling by domestic investors, both individuals and institutional, comprise only a negligible portion of the total amount of short-selling. In extensive empirical tests on the trading behavior of foreign investors through short-selling, we find that foreign investors use a contrarian trading strategy and such a (negative) trend-chasing short-selling strategy is generally significantly related to short-run return predictability in nonlinear fashion. This informational advantage of foreign short-selling activity is also shown by the profitability of long-short portfolios formed based on daily relative short-selling by foreigners. In terms of liquidity provision, we find that foreign short-sellers increase their short-selling when there is a contemporaneous buying pressure for a given stock. However, it seems that such short-selling by foreign investors are not sufficient to fully resolve the buying pressure. Furthermore, we find that foreign investors' short-selling is not significantly related to future return volatility, providing evidence against the alleged destabilizing role of trading by foreign investors in emerging markets.

The findings in this paper help understand broad aspects of foreign investors' trading behavior and its impact on stock prices in an emerging market through short-selling. The overall findings show that foreign short-sellers are not to blame in the Korean stock market.

References

Avramov, D., T. Chordia, and A. Goyal. 2006. The Impact of Trades on Daily Volatility. *Review of Financial Studies* 19: 1241–77.

Beber, A., Pagano, M., 2013. Short-Selling Bans Around the World: Evidence from the 2007-09 Crisis. *Journal of Finance* 68, 343-381

Boehmer, Ekkehart, Charles M. Jones, and Xiaoyan Zhang. 2008. Which Shorts Are Informed? *Journal of Finance* 63(2): 491–527.

Brennan, M. J., and H. H. Cao. 1997. International Portfolio Investment Flows. *Journal of Finance* 52: 1851–80.

Bris, A., W. N. Goetzmann, and N. Zhu. 2007. Efficiency and the Bear: Short Sales and Markets Around the World. *Journal of Finance* 62: 1029–1079.

Chang, E. C., J. W. Cheng, and Y. Yu. 2007. Short-Sales Constraints and Price Discovery: Evidence from the Hong Kong Market. *Journal of Finance* 62: 2097–2121.

Choe, H., B.-C. Kho, and R. M. Stulz. 1999. Do Foreign Investors Destabilize Stock Markets? The Korean Experience in 1997. *Journal of Financial Economics* 54: 227–64.

Choe, H., B.-C. Kho, and R. M. Stulz. 2005. Do Domestic Investors Have an Edge? The Trading Experience of Foreign Investors in Korea. *Review of Financial Studies* 18: 795–829.

Chordia, T., and A. Subrahmanyam. 2004. Order Imbalance and Individual Stock Returns: Theory and Evidence. *Journal of Financial Economics* 72: 485–518.

Christophe, S.,M. Ferri, and J. Angel. 2004. Short-Selling Prior to Earnings Announcements. *Journal of Finance* 59: 1845–75.

Cohen, L., K. Diether, and C. Malloy. 2007. Supply and Demand Shifts in the Shorting Market. *Journal of Finance* 62: 2061–96.

D'Avolio, G. 2002. The Market for Borrowing Stock. *Journal of Financial Economics* 66: 271–306.

Diether, K. B., K.-H. Lee, and I. M. Werner. 2009a. Short-Sale Strategies and Return Predictability. *Review of Financial Studies* 22: 575–607.

Diether, K. B., K.-H. Lee, and I. M. Werner. 2009b. It's SHO Time! Short-Sale Price Tests and Market Quality. *Journal of Finance* 64: 37–73.

Dvorak, T. 2005. Do Domestic Investors Have an Information Advantage? Evidence from Indonesia. *Journal of Finance* 60: 817–39.

Ellis, K., R. Michaely, and M. O'Hara, 2000, "The Accuracy of Trade Classification Rules: Evidence from Nasdaq," *Journal of Financial and Quantitative Analysis* 35, 529.

Fama, E. F., and K. R. French, 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* 33, 3-56.

Froot, K. A., P. G. J. O'Connell, and M. S. Seasholes. 2001. The Portfolio Flows of International Investors. *Journal of Financial Economics* 59: 151–93.

Froot, K. A., and T. Ramadorai. 2008. Institutional Portfolio Flows and International Investments. *Review of Financial Studies* 21: 937–71.

Geczy, C., D. Musto, and A. Reed. 2002. Stocks Are Special Too: An Analysis of the Equity Lending Market. *Journal of Financial Economics* 66: 241–69.

Griffin, J., F. Nardari, and R. M. Stulz. 2007. Do Investors Trade More When Stocks Have Performed Well? Evidence from 46 Countries. *Review of Financial Studies* 20: 905–51.

Grinblatt, M., and M. Keloharju. 2000. The Investment Behavior and Performance of Various Investor Types: A Study of Finland's Unique Data Set. *Journal of Financial Economics* 55: 43–67.

Jain, A., Jain, P.K., McInish, T.H., McKenzie, M., 2013. Worldwide reach of short selling regulations. *Journal of Financial Economics* 109, 177-197

Jones, C., and O. Lamont. 2002. Short Sales Constraints and Stock Returns. *Journal of Financial Economics* 66: 207–39.

Kang, J.-K., and R. M. Stulz, 1997. Why is there a home bias? An analysis of foreign portfolio equity ownership in Japan. *Journal of Financial Economics* 46, 3-28.

Kyle, A. S., 1985. Continuous Auctions and Insider Trading. *Econometrica* 53, 1315-1335.

Lamont, O. 2012. Go Down Fighting: Short Sellers vs. Firms. *Review of Asset Pricing Studies* 2:1-30.

Lee, C., and M. Ready. 1991. Inferring Trade Direction from Intraday Data. *Journal of Finance* 46: 733–46.

Miller, E. 1977. Risk, Uncertainty, and Divergence of Opinion. *Journal of Finance* 32: 1151–68.

Nagel, S. 2005. Short Sales, Institutional Investors, and the Cross-Section of Stock Returns. *Journal of Financial Economics* 78: 277–309.

Newey, W., and K. West. 1987. A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. *Econometrica* 55: 703–8.

Odders-White, E. R., 2000. On the occurrence and consequences of inaccurate trade classification. *Journal of Financial Markets* 3, 259-286.

Saffi, P. A. C., and K. Sigurdsson, 2011, Price Efficiency and Short Selling. *Review of Financial Studies* 24, 821-852.

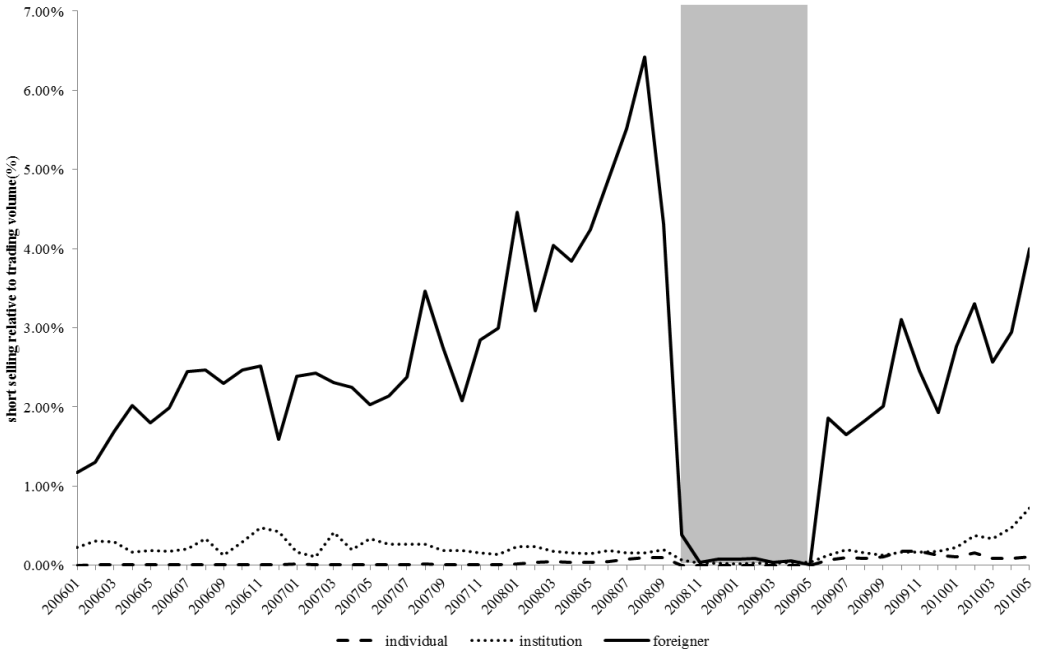
Thompson, S. B. 2011. Simple Formulas for Standard Errors that Cluster by Both Firm and Time. *Journal of Financial Economics* 99: 1–10.

White, Halbert, 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48 (4): 817–838

Figure 1. Short-selling activity in the KOSPI market over time.

Panel A shows the cross-sectional average across fifty sample stocks of monthly relative short-selling (*relss*) by different types of investors, which is obtained from the average of daily *relss* in month *t*. *Relss*(%) is the number of shorted shares divided by the number of traded shares for a stock in a given day. Panel B shows the sum of daily shares shorted by different types of investors in month *t* as a fraction of the sum of daily shorted shares in the same month. The sample covers fifty stocks in the KOSPI market and the sample period is from January 1, 2006 to May 31, 2010. The shaded area denotes the short-selling ban period (October 1, 2008 to May 31, 2009), during which the short-selling is prohibited by law.

Panel A. Short-selling activity relative to trading volume by investor type in the KOSPI market



Panel B. Proportion of short-selling activity by investor type in the KOSPI market

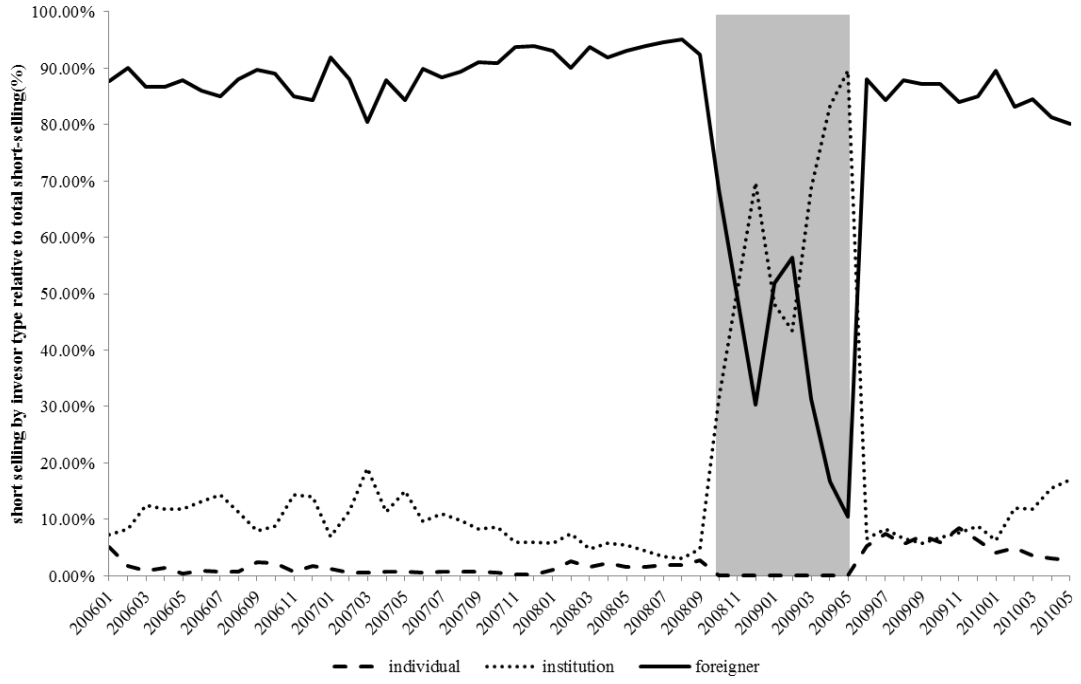


Table 1 Distribution of average relative short-selling

Panel A shows the number of stock-day observations with the daily *relss* that belongs to the range that is specified in the first column. *relss*(%) is the number of shorted shares divided by the number of traded shares for a stock each day. Panel B shows the number of stocks with the average over the sample period of daily *relss* that belongs to the range that is specified in the first column. Market cap.(in billions of won) shows the cross-sectional average for firms in the given range of time-series means of market capitalization over the sample period. There are 761 firms in the sample and the sample period is from January 1, 2006, to May 31, 2010, excluding the short-selling ban period, in which a short-selling is prohibited by law. (October 1, 2008, to May 31, 2009).

Panel A: distribution of stock-day observations		
range	N of stock-day obs.	%
relss =0%	495,514	78.46
0%< *relss* <=10%	128,071	20.28
0%< *relss* <=1%	70,247	11.12
1%< *relss* <=2%	20,543	3.25
2%< *relss* <=3%	11,814	1.87
3%< *relss* <=4%	7,734	1.22
4%< *relss* <=5%	5,542	0.88
5%< *relss* <=6%	3,925	0.62
6%< *relss* <=7%	3,002	0.48
7%< *relss* <=8%	2,235	0.35
8%< *relss* <=9%	1,685	0.27
9%< *relss* <=10%	1,344	0.21
10%< *relss* <=20%	6,065	0.96
20%< *relss* <=30%	1,492	0.24
relss >30%	415	0.07
Total	631,557	100.00

Panel B : Distribution of firm observations			
range	N of stocks	%	Market cap.
relss =0%	182	23.91	56.10
0%< *relss* <=1%	439	57.69	470.55
1%< *relss* <=2%	76	9.99	2,202.58
2%< *relss* <=3%	40	5.26	7,598.37
3%< *relss* <=4%	18	2.36	7,654.08
relss >4%	6	0.79	6,435.68
Total	761	100.00	

Table 2. Sample stocks and the stock characteristics

The table shows the list of fifty sample stocks (sorted by the average over the sample period of relative short-selling) together with the averages of short-selling activity and other characteristics over the sample period. Shorted shares show the number of shorted shares for a stock, and the short amount shows the average amount of shorted stocks in millions of Korean won. *relss*(%) is the number of shorted shares divided by the number of traded shares for a stock each day. Market cap. (in billions of won) is the average of market capitalization of a given firm at the end of June of each year and *B/M* is an average book-to-market ratio at the end of previous year that is defined similarly as in Fama and French (1993). *tv*(%) is average daily trading volume, measured as the daily traded shares divided by the number of shares outstanding at the end of the previous year. Foreign ownership (%) is the average of daily foreign ownership as a fraction of the number of shares outstanding. The sample period is from January 1, 2006, to May 31, 2010, excluding October 1, 2008–May 31, 2009, when short-selling was prohibited by law.

Company Name	shorted shares	short amount	*relss*(%)	Market cap.	B/M	*tv*(%)	Foreign ownership(%)
LG Household&Healthcare., LTD	3,343.14	550.43	6.98	2,671.20	0.05	0.31	46.75
HITE Brewery	1,032.19	162.27	5.05	1,461.05	0.03	0.19	42.92
LOTTE Chemical CORPORATION	6,920.41	636.50	4.57	2,548.38	0.08	0.53	37.21
Amore Pacific CORPORATION	775.10	543.48	4.57	4,352.48	0.01	0.29	35.17
Hyundai Motor	64,779.03	5,334.29	4.22	18,154.28	0.08	0.66	37.47
LG Electronics	49,598.72	4,973.13	4.00	12,767.29	0.06	0.80	32.44
Kia Motors	119,478.90	1,870.98	3.92	5,741.74	0.42	0.92	20.87
LG Display	91,688.86	3,615.58	3.90	13,476.89	0.15	0.71	41.52
LOTTE Shopping CO., LTD.	2,366.59	799.61	3.89	9,411.65	0.02	0.22	19.73
Hyundai Development CO.Engineering & Const	16,640.43	955.92	3.84	3,645.05	0.10	0.54	63.31
Nongshim	787.82	189.26	3.83	1,454.17	0.02	0.34	31.77
Hanjin Shipping Holdings	35,160.90	1,104.77	3.82	2,204.51	0.22	1.34	31.69
S-Oil Corporation	11,002.45	714.35	3.81	7,325.23	0.04	0.25	48.29
Hyundai Heavy Industries	15,527.99	4,245.99	3.72	18,273.55	0.04	0.49	19.33
Hanjin Heavy Industries & Construction	17,120.35	589.67	3.71	1,737.00	0.14	1.15	16.67
SAMSUNG SDI CO.,LTD.	17,305.71	1,477.57	3.71	3,895.45	0.07	1.08	21.43
Hankook Tire	32,266.46	575.60	3.53	2,434.79	0.03	0.59	41.19
S1	2,755.99	130.63	3.40	1,955.55	0.01	0.24	53.68
POSCO	10,724.57	4,768.13	3.35	35,973.61	0.02	0.37	54.50
CJ CheilJedang Corp	1,490.63	337.46	3.25	2,560.59	0.02	0.58	26.56
HITE Holdings	2,640.94	269.99	3.17	1,747.27	0.10	0.54	22.02
NCsoft Corporation	6,493.33	592.87	3.14	2,091.86	0.01	1.11	35.76
Doosan Heavy Industries & Construction	17,755.18	1,548.22	3.09	7,387.04	0.09	0.57	13.78
Hynix Semiconductor	191,247.15	5,036.92	3.06	12,910.17	0.26	1.42	22.63
LotteChilsung Beverage	73.30	80.07	2.95	1,292.77	0.00	0.23	32.95
Yuhan	1,059.67	193.64	2.90	1,650.63	0.03	0.45	26.04
Lotte Confectionery	56.74	72.33	2.83	1,700.12	0.00	0.17	39.68
GS Engineering & Construction Corp	11,759.76	1,330.71	2.81	4,511.41	0.07	0.69	45.08
Shinsegae CO., LTD	1,880.92	1,053.44	2.77	10,128.94	0.01	0.35	44.89
Daeduck Electronics	5,548.25	36.38	2.66	,314.50	0.08	0.53	31.94
Doosan Infracore	37,165.79	930.73	2.66	3,830.40	0.26	0.87	12.59
KT Corporation	25,861.78	1,162.15	2.65	11,445.72	0.13	0.37	46.05
Hyundai Merchant Marine	8,264.65	281.22	2.61	3,851.08	0.23	0.72	17.15
Daewoo Engineering & Construction	33,111.97	557.46	2.51	5,591.42	0.34	0.47	9.59
Samsung Electro Mechanics	23,544.34	1,423.85	2.49	4,225.89	0.11	1.31	10.63
Hyundai Departments Store CO., LTD	2,987.13	287.48	2.46	2,097.84	0.06	0.55	44.19
Hyundai Steel	23,250.73	1,495.24	2.43	4,900.01	0.14	1.07	22.49
Kumho Tire CO.,INC	8,748.73	89.39	2.39	706.18	0.59	0.71	23.15
STX Pan Ocean	406,172.95	1,219.04	2.38	3,580.17	0.05	1.84	7.42
Korea Electric Power	45,332.59	1,660.53	2.37	22,160.03	0.13	0.29	27.93
Cheil Worldwide	529.45	120.07	2.36	1,136.61	0.02	0.45	39.95
Daewoo Ship buliding & Marine Engineering	32,137.00	945.70	2.35	6,631.06	0.20	0.65	28.27
Samsung Heavy Industries	51,489.93	1,602.10	2.31	7,480.25	0.22	1.00	28.40
Korea Zinc	3,599.65	524.77	2.31	2,566.06	0.06	0.92	17.00
Samsung Engineering	6,293.57	543.12	2.27	3,154.11	0.11	0.66	37.23
Orion Corp.	763.52	188.33	2.25	1,553.67	0.02	0.62	29.74
NHN	5,713.72	1,019.88	2.22	8,630.36	0.00	0.57	51.11
Handsome Corporation	3,654.55	56.05	2.15	408.90	0.04	0.59	22.47
LG CHEM,LTD	10,967.80	1,223.38	2.09	7,135.23	0.08	0.76	26.99
Samsung Electronics	9,353.66	6,148.89	2.09	90,522.17	0.01	0.32	48.39

Table 3. Summary statistics of short-selling activity

Panel A reports the summary statistics of short-selling activity for sample stocks by different subperiods. Shorted share is the number of shorted shares for a stock and the short amount is the amount of shorted stocks in millions of Korean won. *relss*(%) is the number of shorted shares divided by the number of traded shares for a stock each day. Panel B shows the summary statistics of short-selling activity by investor type and subperiods. We classify investors into three types: domestic individual investors (individual), domestic institutional investors (institution), and foreign investors (foreigner). Panel C shows the average *relss* (%) for different groups of stocks. The small/large and low/high groupings are determined by the 33- and 67-percentile of all 761 stocks in the KOSPI market. Market capitalization (market cap) is measured at the end of June of each year for each stock. *B/M* is a book-to-market ratio at the end of previous year that is defined similarly as in Fama and French (1993). Price denotes a closing price at the end of each day. No institutional ownership denotes stocks with zero institutional ownership at the end of each year, while High institutional ownership refers to stocks whose institutional ownership is above the median in a given year, which is obtained after excluding stocks with zero institutional ownership. The sample period is from January 1, 2006, to May 31, 2010 (excluding October 1, 2008–May 31, 2009, when short-selling was prohibited by law). The sample covers fifty stocks and 42,981 stock–day observations.

		Mean			Median			std.dev		
		short shares	short amount	*relss* (%)	short shares	short amount	*relss* (%)	short shares	short amount	*relss* (%)
Panel A: short-selling summary statistic										
2006:01-2010:05		29,564.50	1,305.39	3.16	11,424.10	524.52	1.14	47,631.04	2,131.42	4.99
2006:01-2008:09		33,160.38	1,266.57	3.24	12,882.24	434.28	1.03	50,048.87	2,142.12	5.24
2009:06-2010:05		26,259.13	1,500.07	2.98	14,629.15	826.40	1.56	37,104.73	2,027.62	3.96
Panel B: short-selling summary statistic by investors type										
individual	2006:01-2010:05	1,377.23	30.09	0.05	54.28	2.74	0.00	3,095.73	75.21	0.13
	2006:01-2008:09	1,495.09	14.64	0.03	575.01	2.40	0.00	2,529.14	35.21	0.08
	2009:06-2010:05	1,583.78	72.13	0.11	839.76	34.46	0.05	2,408.38	109.50	0.18
institution	2006:01-2010:05	2,203.76	130.11	0.24	280.30	13.75	0.02	5,996.72	327.90	0.90
	2006:01-2008:09	1,886.89	98.67	0.22	356.35	14.49	0.03	5,351.67	270.95	0.81
	2009:06-2010:05	3,212.66	218.85	0.28	1,117.88	90.22	0.06	5,957.60	368.98	0.81
foreigner	2006:01-2010:05	25,983.52	1,145.19	2.87	8,116.63	385.87	0.86	45,631.32	2,033.33	4.82
	2006:01-2008:09	29,778.40	1,153.26	2.99	9,802.81	341.99	0.83	48,296.56	2,060.83	5.06
	2009:06-2010:05	21,462.69	1,209.09	2.58	10,192.23	559.35	1.17	34,914.25	1,909.31	3.82

Panel C: Mean of relss(%) across stock characteristics

Market Cap.		B/M	price		Institutional ownership
Small		Low	3.20	2.07	No	3.28
Large	3.14	High	2.52	3.23	High	2.72

Table 4. Regression of daily foreign investors' relative short-selling ($relss^F$) on past returns

The table shows the results of the regressions of daily foreign investors' relative short-selling, $relss^F$, which is defined as the number of shares shorted by foreign investors divided by the number of traded shares, on a stock's past cumulative returns and various other control variables. The regressions are performed with stock- and day-fixed effects. $r_{-5,-1}$ is the cumulative stock return from day t-5 to t-1. r_t is the stock return on day t. $spread_t$ (%) is the daily proportional spread at day t, which is defined as the quote number-weighted average of intra-daily bid–ask spreads, scaled by the bid–ask midpoint. oib_t^+ equals oib_t if $oib_t > 0$, and zero otherwise, where oib_t is a stock's daily buy–order imbalance, computed as the daily price-setting buy volume minus the daily price-setting sell volume, divided by the daily trading volume. Similarly, $oib^+_{-5,-1}$ is defined as $oib_{-5,-1}$ if $oib_{-5,-1} > 0$, and zero otherwise, where $oib_{-5,-1}$ is the average of oib_t from day t-5 to t-1. $relss^F_{-5,-1}$ is the average of $relss^F$ from days t-5 to t-1. σ_t is computed as the daily highest price minus the daily lowest price, scaled by the highest price on day t. $\sigma_{-5,-1}$ is the average of daily σ values from day t-5 to t-1. $tv_{-5,-1}$ is average trading volume, measured as average daily traded shares for days t-5 to t-1, divided by the number of shares outstanding at the end of the previous year. *Loser* (*winner*) is a dummy variable that equals one if a stock is in the lowest (highest) quartile in a sample of fifty stocks based on $r_{-5,-1}$, and zero otherwise. The sample period is from January 1, 2006, to May 31, 2010, excluding October 1, 2008–May 31, 2009, when short-selling was prohibited by law. The sample covers fifty stocks and 42,981 stock–day observations. An intercept is estimated in the regression but is not reported. The t-statistics are in parentheses and are based on standard errors adjusted for clustering by calendar date and by stock, as in Thompson (2011). The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	2006:01-2010:05		2006:01-2008:09		2009:06-2010-05	
	(1)	(2)	(1)	(2)	(1)	(2)
$r_{-5,-1}$	0.0155**		0.0116		0.0279**	
	(2.26)		(1.63)		(2.29)	
r_t	-0.1875***		-0.1856***		-0.1917***	
	(-10.76)		(-9.04)		(-7.05)	
$spread_t$	-0.4542**		-0.4975**		0.0116	
	(-2.15)		(-2.18)		(0.02)	
oib_t^+	1.2667***		1.3900***		0.9830***	
	(11.46)		(10.71)		(6.55)	
$oib^+_{-5,-1}$	-0.0591		-0.11022		0.1069	
	(-1.06)		(-1.60)		(1.10)	
$relss^F_{-5,-1}$	0.5257***		0.5312***		0.4103***	
	(27.95)		(23.51)		(16.49)	
σ_t	-0.0744***		-0.0684***		-0.0704***	
	(-4.01)		(-3.18)		(-2.73)	
$\sigma_{-5,-1}$	0.1308***		0.1160***		0.2460***	
	(3.56)		(2.88)		(4.47)	
$tv_{-5,-1}$	-0.2838***		-0.1256		-0.4631***	
	(-3.98)		(-1.48)		(-4.20)	
Winner		0.2065**		0.1206		0.6000***
		(2.20)		(1.15)		(3.48)
Loser		0.0045		0.0521		-0.0765
		(0.05)		(0.46)		(-0.56)
R^2	23.8%	12.3%	25.5%	13.9%	18.6%	11.7%
Stock fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Day fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 5. Regressions of daily future returns on foreign investors' short-selling activity

The table reports the results of regressions of the stock return on day t+2 on past short-selling activity and various control variables together with stock- and day-fixed effects. $relss^F_t$ is the number of shares shorted by foreign investors divided by the number of traded shares on day t. $relss^F_t\_Low$ ($relss^F_t\_High$) is a dummy variable that equals one if a stock is in the lowest (highest) tercile based on $relss^F_t$. $r_{-5,-1}$ is a cumulative stock return from day t-5 to t-1. r_t is the stock return on day t. $spread_t$ (%) is the daily proportional spread at day t, which is the quote number-weighted average of intra-daily bid–ask spreads, scaled by the bid–ask midpoint. oib_t is a stock's daily buy–order imbalance, computed as the daily price-setting buy volume minus the daily price-setting sell volume, divided by the daily trading volume. oib_t^+ equals oib_t if $oib_t > 0$, and zero otherwise. $oib_{-5,-1}$ is the average of oib_t from day t-5 to t-1, and $oib^+_{-5,-1}$ equals $oib_{-5,-1}$ if $oib_{-5,-1} > 0$ and zero otherwise. σ_t is computed as the daily highest price minus the daily lowest price, scaled by the highest price on day t. $\sigma_{-5,-1}$ is the average daily σ from day t-5 to t-1. $tv_{-5,-1}$ is a trading volume measured as average daily traded shares for days t-5 to t-1, divided by the number of shares outstanding at the end of the previous year. *Loser* (*winner*) is a dummy variable that equals one if a stock is in the lowest (highest) quartile based on $r_{-5,-1}$. The sample period is from January 1, 2006, to May 31, 2010, excluding October 1, 2008–May 31, 2009, when short-selling was prohibited by law. The sample consists of fifty stocks and 42,981 stock–day observations. An intercept is estimated in the regression but not reported. The t-statistics are in parentheses and are based on standard errors adjusted for clustering by calendar date and by stock, as in Thompson (2011). The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	2006:01-2010:05			2006:01-2008:09			2009:06-2010:05		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
$relss^F_t$	-0.0050			-0.0042			-0.0067		
	(-1.27)			(-0.93)			(-1.12)		
$relss^F_t\_Low$		0.0457	0.0441		0.0078	0.0079		0.1302*	0.1242*
		(1.06)	(1.03)		(0.36)	(0.39)		(1.73)	(1.91)
$relss^F_t\_High$		-0.0710**	-0.0632*		-0.1079**	-0.1052**		0.0173	0.0250
		(-2.05)	(-1.84)		(-2.46)	(-2.42)		(0.29)	(0.42)
$r_{-5,-1}$	-0.0262***			-0.0313***			-0.0148*		
	(-4.44)			(-4.34)			(-1.65)		
$spread_t$			-0.0140			-0.0522			0.2792
			(-0.15)			(-0.54)			(1.36)
oib_t^+			-0.0725*			-0.0286			-0.1953***
			(-1.74)			(-0.52)			(-3.43)
σ_t			0.0097			0.0050			0.0078
			(0.50)			(0.21)			(0.32)
$tv_{-5,-1}$			0.0962**			0.0845*			0.0989*
			(2.45)			(1.68)			(1.66)
Loser		0.1600***	0.14588***		0.1867***	0.1758***		0.0981	0.0794
		(5.17)	(4.87)		(5.07)	(4.94)		(1.55)	(1.25)
Winner		-0.1302***	-0.1462***		-0.1787***	-0.1903***		-0.0677	-0.0793
		(-4.04)	(-4.34)		(-4.77)	(-4.67)		(-1.03)	(-1.27)
R^2	26.1%	26.0%	26.1%	28.1%	28.0%	28.0%	20.3%	20.3%	20.6%
Stock fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6. Daily abnormal returns of equally weighted portfolios based on foreign investors' short-selling activity
The table reports daily abnormal returns (in percentage) from foreign investors' short-selling activity. $relss^F_t$ denotes the number of shares shorted by foreign investors divided by the number of traded shares on day *t*. On day *t*, based on relative short-selling by foreign investors on a previous day, $relss^F_{t-1}$, we divide the sample stocks into terciles. The abnormal returns of equally weighted portfolios for days *t*+2, *t*+3, *t*+4, and *t*+5 are computed from characteristic-adjusted returns using 25 value-weighted size–B/M portfolios. The sample period is from January 1, 2006, to May 31, 2010 (excluding October 1, 2008–May 31, 2009, when short-selling was prohibited by law). The sample covers fifty stocks and 42,981 stock–day observations. The *t*-statistics are adjusted for autocorrelation using the Newey–West (1987) procedure with a lag of five days. The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Small $relss^F$	Medium $relss^F$	Large $relss^F$	Small-Large
		2006:01-2010:05		
		Abnormal ret : Holding period = *t*+2		
Mean	0.042	-0.042	-0.085*	0.127***
t-Stat	1.05	-0.89	-1.94	4.05
		Abnormal ret : Holding period = *t*+3		
Mean	0.021	0.009	-0.055	0.076**
t-Stat	0.42	0.17	-1.12	2.47
		Abnormal ret : Holding period = *t*+4		
Mean	0.007	-0.023	-0.015	0.022
t-Stat	0.13	-0.39	-0.27	0.73
		Abnormal ret : Holding period = *t*+5		
Mean	0.009	-0.063	-0.037	0.046
t-Stat	0.15	-0.93	-0.60	1.39
		2006:01-2008:09		
		Abnormal ret : Holding period = *t*+2		
Mean	0.026	-0.049	-0.100*	0.126***
t-Stat	0.52	-0.81	-1.91	3.35
		Abnormal ret : Holding period = *t*+3		
Mean	0.006	0.005	-0.067	0.073*
t-Stat	0.09	0.07	-1.13	1.94
		Abnormal ret : Holding period = *t*+4		
Mean	-0.010	-0.035	-0.034	0.024
t-Stat	-0.15	-0.48	-0.53	0.67
		Abnormal ret : Holding period = *t*+5		
Mean	-0.004	-0.089	-0.042	0.038
t-Stat	-0.06	-1.07	-0.54	0.93
		2009:06-2010:05		
		Abnormal ret : Holding period = *t*+2		
Mean	0.086	-0.026	-0.043	0.130**
t-Stat	1.28	-0.37	-0.57	2.35
		Abnormal ret : Holding period = *t*+3		
Mean	0.062	0.018	-0.023	0.086*
t-Stat	0.78	0.23	-0.28	1.65
		Abnormal ret : Holding period = *t*+4		
Mean	0.055	0.009	0.039	0.016
t-Stat	0.58	0.09	0.43	0.29
		Abnormal ret : Holding period = *t*+5		
Mean	0.043	0.005	-0.025	0.069
t-Stat	0.49	0.04	-0.25	1.26

Table 7. Regression of abnormal daily volatility on short-selling

The table reports the results of the regression of abnormal stock volatility on day t+1 ($Ab(\sigma_{t+1})$) and day t+2 ($Ab(\sigma_{t+2})$) on foreign investors' short-selling activity with various control variables together with stock- and day-fixed effects. The abnormal volatility is defined as daily stock volatility minus market volatility. The variable σ_t is computed as the daily highest price minus the daily lowest price, scaled by the highest price on day t. Market volatility is computed as the daily highest Kospi200 index minus the daily lowest Kospi200 index, scaled by highest index on day t. The variable $relss^F_t$ is the number of shares shorted by foreign investors divided by the number of traded shares on day t. $r_{-5,-1}$ is a cumulative stock return from day t-5 to t-1. r_t is the stock return on day t. $spread_t$ (%) is the daily proportional spread at day t, which is the quote number-weighted average of intra-daily bid–ask spreads, scaled by the bid–ask midpoint. $tv_{-5,-1}$ is a trading volume measured as average daily traded shares from day t-5 to t-1, divided by the number of shares outstanding at the end of the previous year. The sample period is from January 1, 2006, to May 31, 2010, excluding October 1, 2008–May 31, 2009, when short-selling was prohibited by law. The sample consists of fifty stocks and 42,981 stock–day observations. An intercept is estimated in the regression but not reported. The t-statistics are in parentheses and are based on standard errors adjusted for clustering by calendar date and by stock, as in Thompson (2011). The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	2006:01-2010:05		2006:01-2008:09		2009:06-2010:05	
	$Ab(\sigma_{t+1})$	$Ab(\sigma_{t+2})$	$Ab(\sigma_{t+1})$	$Ab(\sigma_{t+2})$	$Ab(\sigma_{t+1})$	$Ab(\sigma_{t+2})$
$relss^F_t$	0.0004	-0.0010	0.0000	-0.0010	0.0047	0.0017
	(0.14)	(-0.30)	(0.01)	(-0.27)	(0.98)	(0.43)
r_t	0.0009	0.0096	-0.0012	0.0093	0.0074	0.0110
	(0.13)	(1.49)	(-0.15)	(1.17)	(0.72)	(1.27)
$r_{-5,-1}$	0.0100***	0.0110***	0.0081**	0.0075**	0.0121***	0.0181***
	(3.43)	(3.99)	(2.50)	(2.36)	(2.54)	(3.77)
$spread_t$	0.3175***	0.3859***	0.1877*	0.2556**	1.0698***	1.1530***
	(2.75)	(3.21)	(1.70)	(2.17)	(3.65)	(3.74)
$tv_{-5,-1}$	0.4585***	0.4500***	0.4291	0.4246	0.4455***	0.4049***
	(7.65)	(6.70)	(0.11)	(0.08)	(7.58)	(6.86)
σ_t	0.2601***	0.2041***	0.2530***	0.1878***	0.1833***	0.1479***
	(18.45)	(12.89)	(14.47)	(9.63)	(9.99)	(7.63)
R^2	29.8%	27.6%	30.9%	38.6%	32.0%	30.8%
Stock fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Day fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 8. Regression of daily spread on short-selling

The table reports the results of regressions of abnormal daily proportional spread on day t+1 or t+2 on foreign investors' short-selling activity with various other control variables together with stock- and day-fixed effects. The abnormal spread, *Ab(spread)*, is defined as a difference between the log of stock spread and the log of market spread. $spread_t$ (%) is the daily proportional spread at day t, which is the quote number-weighted average of intra-daily bid–ask spreads, scaled by the bid–ask midpoint. Market spread (%) is the daily average of proportional spread over all stocks listed on KOSPI market. $relss^F_t$ is the number of shares shorted by foreign investors divided by the number of traded shares on day t. r_t is stock return on day t; $r_{-5,-1}$ is a cumulative stock return from day t-5 to t-1; σ_t is computed as the highest price minus the lowest price, scaled by the highest price on day t; $tv_{-5,-1}$ is a trading volume measured as average daily traded shares from day t-5 to t-1, divided by the number of shares outstanding at the end of the previous year. The sample period is from January 1, 2006, to May 31, 2010, excluding October 1, 2008–May 31, 2009, when short-selling was prohibited by law. The sample consists of fifty stocks and 42,981 stock–day observations. An intercept is estimated in the regression but not reported. The t-statistics are in parentheses and are based on standard errors adjusted for clustering by calendar date and by stock, as in Thompson (2011). The superscripts *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	2006:01–2010:05		2006:01–2009:08		2009:06–2010:05	
	$Ab(spread_{t+1})$	$Ab(spread_{t+2})$	$Ab(spread_{t+1})$	$Ab(spread_{t+2})$	$Ab(spread_{t+1})$	$Ab(spread_{t+2})$
$relss^F_t$	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001
	(0.25)	(0.27)	(0.13)	(0.14)	(0.23)	(0.24)
r_t	0.0019	0.0017	0.0025	0.0022	0.0002	0.0003
	(1.13)	(1.01)	(1.26)	(1.10)	(0.14)	(0.23)
$r_{-5,-1}$	0.0008	0.0008	0.0011	0.0011	0.0001	0.0001
	(1.27)	(1.29)	(1.46)	(1.49)	(0.17)	(0.20)
σ_t	0.0035	0.0044	0.0028	0.0036	0.0016	0.0023
	(1.33)	(1.66)	(0.93)	(1.17)	(0.79)	(1.13)
$tv_{-5,-1}$	-0.0081	-0.0088	-0.0182*	-0.0194*	-0.0023	-0.0029
	(-0.75)	(-0.78)	(-1.77)	(-1.71)	(-0.41)	(-0.52)
$spread_t$	0.4433***	0.3716***	0.3900***	0.3121***	0.5890***	0.5475***
	(13.96)	(12.03)	(12.28)	(10.58)	(12.55)	(11.44)
R^2	65.3%	63.5%	63.0%	61.2%	82.0%	81.0%
Stock fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Day fixed effects	Yes	Yes	Yes	Yes	Yes	Yes