Thirty-two years of foreign investors in Korea

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Abstract

This study tests the informed cash-flow hypothesis as an explanation for the outperformance of foreign investors in Korea using high-frequency (daily) data spanning 32 years. This hypothesis requires three conditions: foreign investors show herd behavior between countries (or investor types); their net buys have a positive relationship with local market returns; and foreign investors outperform domestic investors. We also investigate foreign investors' characteristics and behaviors according to nationality and institutional type. Using Blanchard and Quah's (1989) decomposition, we test whether foreign net buys have a temporary effect on local market returns, and fail to find any price pressure effect.

We are grateful to the officials of the Korea Exchange and the Financial Supervisory Service for providing the data and information used in this study. However, the views expressed herein are ours own and do not necessarily reflect those of the Korea Exchange and the Financial Supervisory Service.

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1. Introduction

Calvo et al. (1993) and Fernandez-Arias (1996) first study foreign capital flows, with their core focus being on identifying the determinants of foreign investment. They introduce the concepts of push and pull factors as a basis for their empirical research. Push factors refer to external factors that influence global investors' decisions, whereas pull factors denote internal factors within emerging markets that attract foreign capital. Research from the perspectives of push and pull factors can be divided into foreign direct and indirect investments through portfolios. Since the late 1990s, many academics extensively analyze cash flows through portfolio investment, mostly targeting the investments of advanced-country investors in emerging markets.

Many studies investigate the impact of foreign investor-based volatility on local market stability and examine the information advantages between foreign and domestic investors. By the early 2000s, the research has focused on whether foreign investment in emerging markets benefits or harms the recipient countries. [e.g., Choe et al. (1999) and Hamao and Mei (2001).] Some studies question whether domestic investors have an information advantage and exhibit better performance than foreign investors. Brennan and Cao (1997) develop a model of international portfolio cash flows, arguing that domestic investors trade with superior information compared with foreign investors. Several studies support this model with empirical results. [e.g., Hau (2001), Choe et al. (2005), Dvorak (2005), and Bae et al. (2008).] Nonetheless, many other studies strongly contest these findings by pointing out the weaknesses of prior research's methodologies, suggesting that foreign investors' information efficiency results in higher performance than that of domestic investors. [e.g., Grinblatt and Keloharju (2000), Froot et al. (2001), Baily et al. (2007), Froot and Ramadorai (2008), Ko et al. (2007), Baily et al. (2007), and He and Shen (2014).] Currently, evidence on the performance of foreign and local investors is mixed. Albuquerque et al. (2009) develop a model suggesting dynamic relationships between foreign equity trading and returns to show that global private information helps explain U.S. investors' trading behavior and performance. They also show that global private information generates return chasing that reflects superior performance of U.S. investors in local markets.

A lot of empirical studies analyze low-frequency (i.e., quarterly or monthly) returns and cash flows because of data limitations. Although some studies, including Griffin et al. (2004) and Richards (2005), use daily data to analyze various emerging markets, the short duration (4-5 years) limits the validity of the results. This may be attributed to the lack of sufficiently long-term data on foreign investors' cash flows. Furthermore, most studies analyze foreign investors' aggregate cash flows

without investigating how different countries or types of foreign institutions invest.[1] Additionally, considering emerging markets collectively, regardless of their degree of economic development or market size, makes it difficult to interpret the results coherently. To address these issues, this study analyzes the cash flows of foreign investors in the Korean stock market, which has evolved into an advanced market among emerging markets.[2] Using high- and low-frequency (daily and monthly, respectively) data spanning 32 years, this study seeks to elucidate the characteristics and performance of foreign investors. In particular, country-specific and type-of-investor analyses will provide invaluable insights into foreign investors' behavior. Dividing the aggregate performance of foreign investors by country will make it possible to estimate the investment efficiency of each country's investors.

For a comprehensive understanding, this study proposes the "*informed cash-flow hypothesis*," which posits that international institutional investors engage in herd behavior by sharing valuable information with each other during crucial periods to invest collectively. Ultimately, as a result of this herd behavior, stock prices in local markets rise, leading foreign investors to achieve favorable performance. To validate this hypothesis, foreign investors should demonstrate herd behavior following the exchange of valuable information across countries and institutions. Consequently, significant positive correlations in net buys must be observed on a daily or monthly basis. Along with these positive correlations, foreign investors' net buys should exhibit at least a positive contemporaneous impact on daily and monthly market returns. More importantly, this positive effect on local market returns should not lead to a price pressure effect. Finally, foreign investors' aggregate returns should exceed those of domestic investors, and the returns of major countries also surpass those of domestic investors. If this hypothesis is empirically validated, one can argue that foreign investors exhibit herd behavior while sharing information, resulting in superior performance relative to domestic investors. This is the essence of the informed cash-flow hypothesis, the core concept of this study.

The findings of this study are summarized as follows. First, foreign net buys exhibit significant positive inter-country and inter-institutional correlations, indicating herd behavior. Second, foreign net buys demonstrate a strong positive contemporaneous relationship at both daily and monthly frequencies, with local returns Granger-causing foreign net buys at the daily frequency—the results indicate

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[1] From the investment returns perspective, Albuquerque et al. (2009) suggest that the investment performance of foreign investors in specific periods or countries may vary depending on how investors reflect local or global private information.

[2] The Korean stock market begun to experience significant growth in the 1990s as an important emerging market. In September 2004, it was added to the watch list of FTSE's developed markets; in September 2009, it was added to the FTSE developed market category. Owing to the foreign investor's registration system, as of December 2023, it was not included in the MSCI developed market index. However, this system was abolished on December 14, 2023; thus, it could be included in the MSCI's developed market category in the near future.

"return chasing." However, they have no price pressure effect on local market returns, suggesting that their effect is not temporary, but permanent. Third, foreign net buys exhibit one-day return predictability. Fourth, foreign net buys display a strong positive contemporaneous relationship with S&P 500 returns at both daily and monthly frequencies, with S&P 500 lagged returns positively Granger-causing foreign net buys at the daily frequency—the results indicate "global return chasing." Fifth, foreign investors with such characteristics outperform domestic investors. These findings support the *informed cash-flow hypothesis* proposed by this study. Finally, foreigners' trading characteristics show high turnover ratios in countries such as the U.K., the Cayman Islands, Switzerland, and Hong Kong, which are de facto tax havens.

This study contributes to the extant literature in four ways: First, we propose and test the informed cash-flow hypothesis to address the outperformance of foreign over domestic investors. Second, this study examines the characteristics and behavior of foreign investors using sufficiently long periods of high frequency (daily) trading data spanning 32 years. This approach ensures highly robust empirical results. Third, foreign investors are divided by nationality and investor type. To the best of our knowledge, this is the first study to investigate foreign investors' behavior based on these characteristics.[3] Fourth, using Bernanke and Sims's structural vector autoregressive regression (henceforth, SVAR) model, we test the concurrent impact of each economic shock on foreign net buys and domestic market returns. The price pressure effect of foreign net buys is also easily tested using Blanchard and Quah's (1989; henceforth, BQ) decomposition.

This paper is structured as follows: Section 2 discusses the existing literature leading up to this study and proposes the informed cash-flow hypothesis, and Section 3 explains the data and research methodologies. Subsequently, Section 4 describes the capital liberalization process in the Korean stock market and examines foreign investors' characteristics by nationality and investor type. Section 5 presents the empirical analysis and results, and Section 6 reports the foreign investors' performance. The final section concludes the paper.

2. Related research and informed cash-flow hypothesis

2.1 Related research

Regulators in emerging markets monitor foreign investors' activities to protect domestic investors and ensure stable domestic markets. Allowing foreign investors to participate primarily aims

[3] Albuquerque et al. (2009) develop a dynamic model of equity trading where U.S. investors possess global private information and invest in multiple countries. They empirically test their model for the eight advanced countries. Conversely, this study empirically investigates into the characteristics and performance of major countries investing in Korea.

to facilitate smooth capital inflows to domestic firms and prevent the negative behavior of foreign investors. Hamao and Mei (2001) refute the notion that foreign investors negatively affect domestic markets in the Japanese stock market. Karolyi (2002) states that foreign trading behavior did not exacerbate market volatility during the 1997 Asian financial crisis in Japan. Based on an analysis of the Korean stock market, Choe et al. (1999) also argue that foreign investors do not increase volatility in the domestic stock market during a crisis. He and Shen (2014) show that foreign ownership improves the price efficiency of local stock markets. Bena et al. (2017) suggest that foreign institutions play a disciplinary role in entrenched corporate insiders worldwide. Based on various empirical studies, we infer that foreign investors have a positive impact on local stock markets.

Although there are some theoretical and empirical studies on the investment performance of foreign and domestic investors, they reach no convincing conclusions. Early studies highlight domestic investors' information advantages over foreign investors. Brennan and Cao (1997) present a theoretical study supporting this claim, followed by empirical studies by Hau (2001), Choe et al. (2005), Dvorak (2005), Bae et al. (2008), and Baik et al. (2010) corroborating their theoretical model. However, Choe et al. (2005) have a drawback in that they compute the time-series average of the cross-sectional volume-weighted average price (VWAP), overlooking time-series volume changes.[4] Furthermore, Dvorak (2005) has two main shortcomings. First, he calculates only trading gains without considering position gains. Second, he normalizes per-transaction gains by the number of transactions, which might not accurately reflect real trading gains.[5] These criticisms suggest that his conclusions may not be sufficiently robust to support the argument of an information disadvantage for foreign investors. Other studies argue that analysts working closer to the headquarters of the firms produce more accurate predictions, thus implying a disadvantage for foreign investors, which is called "home bias at home." [See Coval and Moskowitz (1999).] Nevertheless, this concept cannot be applied to foreign investors' information disadvantage because they also deploy analysts in local markets to obtain investment information. Therefore, there is no reason for foreign investors to be disadvantaged in terms of information.

Contrary to these studies, numerous others argue that foreign investors have an information advantage over domestic investors. [See Grinblatt and Keloharju (2000), Froot et al. (2001), Ghysels

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[4] During their sample period, a similar pattern emerged with KOSPI 200 futures in Korea, where it appeared that foreign investors traded at unfavorable prices. However, foreign investor trading volumes were low on days with unfavorable VWAP, but significantly higher on days with favorable VWAP. [See Ko et al. (2012), Lee (2015), and Jang et al. (2023).] Based on Ko's (2007) empirical findings, a similar phenomenon could occur in the Korean stock market as well.

[5] Daily trading gain is the profit/loss generated from daily trading, while daily position gain is the profit/loss from the portfolio position or ownership at the end of the previous trading day.

and Seon (2005), Baily et al. (2007), Ko et al. (2007), Baily et al. (2007), Froot and Ramadorai (2008), Kamesaka et al. (2008), Ko (2012), Lee (2015), and Jang et al. (2023).] Baily et al. (2007) examine market response to earnings announcements in Singapore and Thailand, and conclude that their evidence is consistent with foreigners having superior information processing ability, rather than locals having pre-announcement private information. In this context, Seasholes and Zhu (2010) state that individual investors do not help incorporate information into stock prices. As Barber et al. (2009) demonstrate, individual investors are likely to incur losses from their trading activities. As many emerging markets are predominantly composed of individual investors, it is very difficult to argue that domestic investors hold an information advantage over foreign investors. Kim and Wei (2002) mention that foreign investors could obtain more information because of their establishment of local branches or offices in the region even before the 1997 Asian financial crisis. Therefore, the argument that foreign investors have informational disadvantages is not persuasive. Ghysels and Seon (2005) contend that futures markets and foreign investor trading played significant roles during the 1997 turbulence in the Korean stock market. Recently, Kacperzyk et al. (2021) suggest that foreign institutional investors increase price efficiency and bring new information from less-informed domestic individual investors. Thus, in stock markets with a high proportion of individual investors, foreign investors possessing an information advantage can be expected to achieve better performance.

Other studies analyze foreign investors' investment behavior. Bohn and Tesar (1996) suggest that foreign investors employ a return-chasing investment strategy, investing in stock markets in which high returns are expected and selling in markets in which low returns are anticipated. Their argument implies that, within the neo-classical economic paradigm, capital flows to markets with higher marginal productivity. In this sense, Griffin et al. (2004) develop a simple model of equity flows within the context of neo-classical economics to study the determinants of foreign investors' cash flows. Using daily data from emerging stock markets over 4-5 years, they analyze the dynamic relationships between global market returns, foreign net-buy ratios, and domestic market returns. They show that, when barriers to international investment exist and foreign investors' expectations are more extrapolative than those of domestic investors, unexpectedly high worldwide or local stock returns lead to net equity inflows in small countries. Richards (2005) studies these issues around the same time and coincidently obtains similar empirical results.

Amid the empirical studies oscillating between arguments for and against foreign investors' information advantage, Albuquerque et al. (2009) set up a meaningful theoretical model regarding the relationship between foreign investors' cash flows and returns. According to their theoretical framework, U.S. investors possess an advantage in global private information despite being relatively weak in local private information, leading to superior investment performance. They argue that the return-chasing behavior of U.S. investors is not due to inferior knowledge, nor naïve trend following, but stems from

their superior performance. However, there is no reason for investors in other major developed countries to gain access to this purported global private information later than U.S. investors. It would be reasonable to assume that institutional investors from Europe and elsewhere establish branches or offices in the U.S., dispatching experts to obtain global private information similarly to that of U.S. institutional investors. Thus, institutional investors in major advanced countries are expected to achieve superior performance, similar to US investors. Therefore, along with return-chasing behavior, superior performance should be observed among foreign investors in emerging markets or even all advanced markets.

2.2 Informed cash-flow hypothesis

The informed cash-flow hypothesis proposed in this study can be tested as follows. Institutional investors must exhibit herd behavior when investing in a local market. Several studies have shown that connections between stock holdings (or ownership) and investment banking facilitate information exchange and communications among institutional investors. [e.g., Massa and Rehman (2008), Bodnaruk, Massa, and Simonov (2009), and Ivashina and Sun (2011).] While some disagreements on this issue exist, a few studies also point out the connection between institutional investors and trading profits. [e.g., Acharya and Johnson (2010), Cohen, Frazzini, and Malloy (2008, 2010).] Therefore, it would be extremely difficult to deny that institutional investors share information while investing. This phenomenon is likely to apply to foreign institutional investors when investing in local markets. Typically, foreign institutional investors, including investment banks and mutual funds, establish branches or offices in local markets to obtain investment information. Informally, they have close relationships with each other and share important information, even when communicating with local regulatory agencies or governments. Reporting all the investment information to their parent companies and sharing it are common practices. Ultimately, the net buys of foreign investors in any local market are likely to exhibit herd behavior between countries or institutional types during significant periods. Ghysels and Seon (2005) note that foreign investors exhibited herd behavior when trading KOSPI 200 futures in Korea during the 1997 Asian financial crisis.

In this context, such herd behavior is likely to be based on the global or local private information as proposed by Albuquerque et al. (2009). As they suggest, in high-frequency (i.e., daily) data, foreign investors' net buys would exhibit a positive response to lagged local or global market returns, whereas, in low- and high-frequency (daily and monthly, respectively) data, they would have a positive contemporaneous relationship with local returns. The positive impact of foreign investors' net buys on local returns should not be due to price pressure for them to be profitable. In other words, this effect should be permanent rather than temporary. Through this process, foreign investors should outperform domestic investors. The following conditions should be satisfied to validate the informed cash-flow hypothesis:

Condition A:	Positive cross-correlation of net-buy ratios between countries and institutional types
Condition B:	Positive relationships between foreign net-buy ratios and local market returns
Condition B-1:	A positive contemporaneous effect of foreign net-buy ratios on local market returns.
Condition B-2:	Preferably return predictability of the foreign net-buy ratio in the high-frequency (daily) data.
Condition B-3:	No price pressure effect of foreign net-buy ratios on local market returns
Condition C:	Foreign investors outperform domestic investors.

This literature review demonstrates the development of the informed cash-flow hypothesis from empirical and theoretical perspectives. This constitutes the core concept of this study, and its validation process shapes the overall contents.

3. Data and the research methodologies

3.1 Data description

All our data are from public sources and a semi-governmental institution, the Financial Supervisory Service. Table 1 summarizes the contents, sample periods, and data sources. Panel A presents data at the overall market level. Daily trading data are provided by the Korea Exchange for the 32 years from 1992 to December 2023. These data are readily downloadable through the Korea Exchange's Information Data System. Monthly foreign ownership data from 1992 to September 2005 can be downloaded from the Financial Supervisory Service website, whereas data from October 2005 onward can be easily obtained from the Korea Exchange's Information Data System. Additionally, the estimation of market returns requires knowledge of capital changes, which can be readily obtained from the Korea Exchange's Firm-Disclosure Channel.[6]

Panels B and C display the sources of foreign trading volumes in dollars and ownerships by foreign country and institutional type, respectively. Foreign trading volumes by country are obtained through subscriptions from the Korea Exchange. Moreover, ownership by country can be acquired monthly from the Financial Supervisory Service website. These figures represent the combined foreign ownership by country invested in Korea. These ownership data are essential for calculating foreign investors' performance by country, serving as a unique feature that distinguishes this study from the existing research. Panel D illustrates the sources of the various stock indices and other required data. Most of the data presented in Panel D are obtained from DataStream.

[6] Firm-Disclosure Channel is a website for providing disclosed data of firms operated by the Korea Exchange.

*** Insert Table 1 here! ***

3.2 Research methodologies

3.2.1 Sims's (1972) two-sided regressions

This study employs 2-variate and 3-variate vector autoregressive (henceforth, VAR) analyses. For the 2-variate case, we assume a dynamic relationship between foreign net buys and domestic market returns, which is considered as a pull factor. We start with the two-sided regression using 2 variables. Griffin et al. (2004) include contemporaneous foreign net buys in the return equation as an independent variable, considering the price pressure between the endogenous variables, to show the return predictability of foreign net buys. Instead, Sims (1972) uses a two-sided regression to test the Granger causality between U.S. money (i.e., M1) and income (i.e., GNP). This approach naturally considers contemporaneous relationships when testing the Granger causality. The following two-sided regression is used to test the Granger causality of foreign net buys on market returns, and vice versa.

$$fnbr_t = \alpha + \sum_{k=-l}^{m} \beta_k R_{M,t-k} + e_t, \quad (1)$$

where $fnbr_t$: foreign net-buy ratio (foreign net buys divided by market capitalization) on day t,

R_t^M: market return on day t,

e_t: error term on day t,

$E\left(e_t, R_{t-k}^M\right) = 0 \; for \; all \; k \; (= -l, \cdots, -1, 0, 1, \cdots, m)$.

According to Theorem 2 of Sims (1972), if the null hypothesis that all the coefficients of future returns are zero (i.e., $\beta_k = 0 \; for \; all \; k < 0$) is rejected, then past foreign net buys Granger-cause market returns. Conversely, if the null hypothesis that all the coefficients of past market returns are 0 (i.e., $\beta_k = 0 \; for \; all \; k > 0$) is rejected, then past market returns Granger-cause foreign net buys. In other words, we can use a two-sided regression to test the predictability of foreign net buys for market returns, which can be interpreted based on information asymmetry (i.e., global private information), and vice versa.

3.2.2 Bernanke (1986) and Sims's (1986) structural vector autoregressions

Using three endogenous variables, as in Richards (2005), we employ U.S. returns as a push factor to explain foreign net buys. He also accounts for the time difference between the United States and emerging markets by using the previous day's U.S. returns. Here, U.S. returns refer to the S&P 500 returns. In this case, we use a 3-variate structural vector autoregressive (henceforth, SVAR) model to account for contemporaneous relationships, as follows:

$FY_t = \sum_{k=1}^{K} \Gamma_k Y_{t-k} + \varepsilon_t$: structural form of VAR (2)

where $Y_t = \begin{bmatrix} R_{t-1}^{S\&P} \\ fnbr_t \\ R_t^M \end{bmatrix}$, $F = \begin{bmatrix} 1 & f_{12} & f_{13} \\ f_{21} & 1 & f_{23} \\ f_{31} & f_{32} & 1 \end{bmatrix}$, $\Gamma_k = \begin{bmatrix} \gamma_{11}^k & \gamma_{12}^k & \gamma_{13}^k \\ \gamma_{21}^k & \gamma_{22}^k & \gamma_{13}^k \\ \gamma_{31}^k & \gamma_{32}^k & \gamma_{33}^k \end{bmatrix}$, $\varepsilon_t = \begin{bmatrix} \varepsilon_{t-1}^{S\&P} \\ \varepsilon_t^{fnbr} \\ \varepsilon_t^M \end{bmatrix}$,

Y_t: vector of endogenous variables on day t,

F: coefficient matrix for contemporaneous relationships between endogenous variables,

Γ_k: coefficient matrix for k-lagged variables,

$R_{t-1}^{S\&P}$: return of S&P 500 on day t-1,

$fnbr_t$: foreign net-buy ratio on day t,

R_t^M: market return on day t,

ε_t: random-shock vector on day t.

Multiplying both sides of the above equations by the inverse of the coefficient matrix, F^{-1}, yields the following reduced-form vector autoregressive model. When using daily data, the previous day's S&P 500 returns affect today's foreign net buys and market returns, consistent with the approach used by Richards (2005). Hence, we consider the relationships between $R_{t-1}^{S\&P}$, $fnbr_t$, and R_t^M. However, we use the S&P 500 returns for the same month when using monthly data.

$Y_t = A(L)Y_{t-1} + e_t$: Reduced form of VAR; (3)

i.e., $\begin{bmatrix} R_{t-1}^{S\&P} \\ fnbr_t \\ R_t^M \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} + \begin{bmatrix} A_{11}(L) & A_{12}(L) & A_{13}(L) \\ A_{21}(L) & A_{22}(L) & A_{23}(L) \\ A_{31}(L) & A_{32}(L) & A_{33}(L) \end{bmatrix} \begin{bmatrix} R_{t-1}^{S\&P} \\ fnbr_{t-1} \\ R_{M,t-1} \end{bmatrix} + \begin{bmatrix} e_{t-1}^{S\&P} \\ e_t^{fnbr} \\ e_t^M \end{bmatrix}$;

where $A(L) = [A_{ij}(L)] = [\Sigma_k a_{ij}^k L^{k-1}]$, i, j=1,2,3,

$\begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix}$: coefficient vector of constant terms,

$$e_t = \begin{bmatrix} e_{t-1}^{S\&P} \\ e_t^{fnbr} \\ e_t^M \end{bmatrix} = F^{-1}\varepsilon_t = C^0\varepsilon_t = \begin{bmatrix} c_{11}^0 & c_{12}^0 & c_{13}^0 \\ c_{21}^0 & c_{22}^0 & c_{23}^0 \\ c_{31}^0 & c_{32}^0 & c_{33}^0 \end{bmatrix} \begin{bmatrix} \varepsilon_{t-1}^{S\&P} \\ \varepsilon_t^{fnbr} \\ \varepsilon_t^M \end{bmatrix} \quad (4)$$

where $Var(e_t) = \Omega$.

The C^0 matrix mentioned above contains nine elements; however, for identification, three elements must be predetermined using economic theory or the relationships between variables. Following Richards (2005) and Hasbrouck (1991), we employ the Cholesky decomposition (i.e.,

identification by ordering). When using daily data, this identification subsumes that S&P 500 returns in the U.S. market on day t-1 can affect both foreign net buys and domestic market returns on day t, with no inverse impact.

The residual term in the above reduced model is represented as follows:

$$e_t = Y_t - E(Y_t|Y_{t-s}, s \geq 1) \text{ and } Var(e_t) = \Omega. \quad (5)$$

Converting the reduced-form VAR model into a moving average representation yields the following.

$$Y_t = [I - A(L)L]^{-1} e_t \quad (6)$$

$$= [I - A(L)L]^{-1} C^0 \varepsilon_t$$

$$= C(L)\varepsilon_t$$

that is, $\begin{bmatrix} R_{t-1}^{S\&P} \\ fnbr_t \\ R_t^M \end{bmatrix} = \begin{bmatrix} C_{11}(L) & C_{12}(L) & C_{13}(L) \\ C_{21}(L) & C_{22}(L) & C_{23}(L) \\ C_{31}(L) & C_{32}(L) & C_{33}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_{t-1}^{S\&P} \\ \varepsilon_t^{fnbr} \\ \varepsilon_t^M \end{bmatrix}$.

As A(L) can already be estimated from the reduced form model, estimating C(L) requires estimating C^0. Normalizing the variance of ε_t results in $Var(\varepsilon_t) = I$. When we decompose $Var(e_t) = \Omega$ using Equation (4), we have

$$C^0 C^{0^T} = \Omega, \quad (7)$$

that is, $\begin{bmatrix} c_{11}^0 & c_{12}^0 & c_{13}^0 \\ c_{21}^0 & c_{22}^0 & c_{23}^0 \\ c_{31}^0 & c_{32}^0 & c_{33}^0 \end{bmatrix} \begin{bmatrix} c_{11}^0 & c_{21}^0 & c_{31}^0 \\ c_{12}^0 & c_{22}^0 & c_{32}^0 \\ c_{13}^0 & c_{23}^0 & c_{33}^0 \end{bmatrix} = \begin{bmatrix} \sigma_{11} & \cdot & \cdot \\ \sigma_{21} & \sigma_{22} & \cdot \\ \sigma_{31} & \sigma_{32} & \sigma_{32} \end{bmatrix}$.

The Cholesky decomposition based on Richards (2005) and Hasbrouck (1991) produces the following.

$$\begin{bmatrix} e_{t-1}^{S\&P} \\ e_t^{fnbr} \\ e_t^M \end{bmatrix} = \begin{bmatrix} c_{11}^0 & 0 & 0 \\ c_{21}^0 & c_{22}^0 & 0 \\ c_{31}^0 & c_{32}^0 & c_{33}^0 \end{bmatrix} \begin{bmatrix} \varepsilon_{t-1}^{S\&P} \\ \varepsilon_t^{fnbr} \\ \varepsilon_t^M \end{bmatrix} \quad (8)$$

On the other hand, the price pressure effect is that the impact of foreign net buys on market returns is temporary, but not permanent. We can test this easily using BQ's (1989) decomposition. The notion that the effect of a shock on a variable is temporary implies that the cumulative sum of the impact on the variable is 0 from the onset of the effect until its complete disappearance. If the jth shock has a temporary effect on the ith variable, it can be represented by a moving average representation as follows.

$$C_{ij}(L)|_{L=1} = C_{ij}(1) = \sum_{k=0}^{\infty} c_{ij}(k) = 0 \text{ (i,j=1,2,3)} \quad (9)$$

$$C_{ij}(1) = [I - A(1)]_{i1}^{-1} c_{1j}^0 + [I - A(1)]_{i2}^{-1} c_{2j}^0 + [I - A(1)]_{i3}^{-1} c_{3j}^0 = 0 \quad (10)$$

We apply the Cholesky decomposition method, following Richards (2005) and Hasbrouck (1991), with S&P 500 returns, foreign net-buy ratios, and (domestic) market returns in a sequential order. The test of the price pressure effect entails examining whether the impact of the foreign net-buy ratios on domestic market returns is temporary. In this case, we have i=3 and j=2.

$$C_{32}(1) = [I - A(1)]_{31}^{-1} c_{12}^{0} + [I - A(1)]_{32}^{-1} c_{22}^{0} + [I - A(1)]_{33}^{-1} c_{32}^{0} = 0 \quad (11)$$

The Cholesky decomposition method indicates that c_{12}^{0} equals 0, allowing c_{32}^{0} to be estimated as follows.

$$c_{32}^{0} = \frac{[I-A(1)]_{32}^{-1} c_{22}^{0}}{[I-A(1)]_{33}^{-1}} \quad (12)$$

Under the null hypothesis of no price pressure effect, the following null hypothesis can be tested using the likelihood ratio test.

$$\mathrm{H}_0: c_{32}^{0} = \frac{[I-A(1)]_{32}^{-1} c_{22}^{0}}{[I-A(1)]_{33}^{-1}} \quad (13)$$

To test whether the effect of each shock on a variable is temporary, we use the likelihood ratio test.

$$\chi^2(1) = -2(lnLH^{o} - lnLH^{J}) \quad (14)$$

where $\chi^2(1)$: Chi-square statistic with one degree of freedom,

LH^{o}: Likelihood of over-identified model with BQ effect,

LH^{J}: Likelihood of just-identified model.

4. Landscape of foreign investors

4.1 Liberalization of the Korean stock market

Stock market liberalization refers to the process by which the Korean government eased restrictions and opened up its stock market to foreign investors, allowing greater participation and investment from foreign investors. This liberalization occurred over several stages and involved various reforms and policy changes. Before the 1990s, the Korean government maintained strict controls over its financial markets, including the stock markets. Foreign investment was heavily regulated, with limitations to the foreign ownerships of Korean companies.

In the early 1990s, Korea began to liberalize its financial markets as part of its broader economic reforms. The government started to relax restrictions on foreign investment, allowing foreign investors greater access to the Korean stock market. This included raising or removing caps on the foreign ownerships of Korean companies and easing regulations on foreign capital flows. The Korean government opened the stock market by allowing foreign portfolio investment for the first time on

January 3, 1992. The limit on foreign ownerships of stocks started at 10% and increased gradually each year, reaching 20% by October 1996. The 1997 Asian financial crisis prompted Korea to accelerate its financial market liberalization efforts. In response to the crisis and pressure from international organizations such as the International Monetary Fund, the Korean government implemented additional reforms to further open up its financial markets further. These reforms aimed to increase transparency, enhance regulatory frameworks, and attract foreign investment to stabilize the economy. Owing to the crisis, the limit on foreign ownership increased significantly to 50% on December 11, 1997. Subsequently, on May 25, 1998, the limit was completely abolished except for certain industries that were designated as sensitive to national security concerns.[7] This allowed foreign investors to invest freely in Korean stocks, with a few exceptions. As early as the end of 1997, the bond market became completely open to foreign investment, even before the stock market.

By the early 2000s, Korea had fully liberalized its capital account, allowing for unrestricted capital flows in and out of the country. This included removing remaining restrictions on foreign investment in the Korean financial markets and abolishing barriers to foreign exchange transactions. Consequently, foreign investors have a more access to Korean stocks and other financial assets. As Korean financial markets became more open and transparent, the stock markets gained recognition from international index providers, such as the FTSE and MSCI. The inclusion in these indices increased Korea's visibility to global investors and facilitated foreign investments in the Korean stock market. As noted in Footnote 2, the Korean stock market was included in the FTSE-developed market category in September 2009. It is expected to be included in the MSCI-developed market category in the near future. Regardless, it goes without saying that the Korean stock market has now effectively joined the category of advanced countries. At this stage, Korea is a small, but perfectly open economy.

4.2 A brief look at the Korean stock market and foreign investors

The Korean stock market is divided into two main segments: the KOSPI and KOSDAQ markets.[8] The KOSPI market comprises relatively larger, well-established firms and is considered the representative stock market of Korea. In contrast, the KOSDAQ market, which commenced trading on July 1, 1996, was established with the U.S. NASDAQ market as its prototype. It primarily comprises start-up and small to middle-sized firms with technological expertise. Figure 1 illustrates the historical capitalizations and trading volumes in dollars for the KOSPI and KOSDAQ markets. In Panel A, the market capitalization of the KOSPI market, measured on the right vertical axis, was relatively small

[7] Ghysels and Seon (2005) provides detailed information on changes in foreign investors' ownership limits in Table 1 on page 614.

[8] In fact, in addition to the KOSPI and KOSDAQ markets, a highly experimental market called KONEX began trading in July 2013. However, foreign ownership in this market is negligible; thus, we need not consider it.

before the 2000s. However, it has grown rapidly since then. Although there were significant decreases in market capitalizations in 2008 due to the global financial crisis and in 2022 due to the COVID-19 pandemic, overall growth trends are evident. Foreign investor ownership also has steadily increased throughout the 21st century, reaching $536B by the end of 2023, accounting for approximately 33% of the market capitalization.[9] Both the market and foreign investors' trading volumes, measured on the left vertical axis, have steadily increased since 2000, although market trading volumes appear relatively volatile compared to the steadily increasing trading volumes of foreign investors.

Panel B of Figure 1 shows that the KOSDAQ's market capitalization has grown steadily since the 2008 global financial crisis. Nonetheless, foreign investors' ownership has not kept pace with the market capitalization growth, accounting for only 9.04% of the market capitalization at the end of 2023. Market trading volumes significantly increased since 2008, but foreign investors' trading volume in 2023 will account for only 12.82% of the KOSDAQ market. Although the KOSDAQ market capitalization was only 20.29% of the KOSPI market capitalization in 2023, the trading volume was nearly at a similar level, indicating a higher turnover ratio and the likelihood of speculative trading activities in the KOSDAQ market.

*** Insert Figure 1 here! ***

Table 2 presents the descriptive statistics of the data used in this study, divided into three subperiods to reflect the rapid development of the Korean stock market. The first subperiod spans eight years, from 1992, when indirect foreign portfolio investment was allowed, to 1999.[10] The second subperiod covers 12 years, from the beginning of the 21st century until the end of the global financial crisis in 2011. The third subperiod extends from then until December 2023, totaling 12 years. Panel A displays statistics for the KOSPI market, while Panel B shows statistics for the KOSDAQ market. However, since the KOSDAQ market commenced trading in July 1996, no statistics are available for the first subperiod.

In Panel A, the KOSPI market shows that over time, the monthly average market return decreases from 1.06% to 0.36%, while volatility decreases from 10.51% to 4.51%. The decrease in market returns is attributed to the slowdown in Korea's economic growth, and the decrease in volatility is seen as a result of increased market stability and a decline in market returns. As Karolyi (2002) suggests, foreign investors largely influence market stability. As the market size grows, the trading

[9] The foreign investors' ownership ratio relative to the market reached record high in July 2004, standing at 43.87% based on month-end data. Since then, foreign ownership has steadily declined.

[10] Before foreign portfolio investment was permitted through portfolios, foreign direct investment and closed-end fund investments occurred through the establishment of the Korea fund (in 1984), Korea Euro fund (in 1987), and Korea Asia fund (in 1990), but the amounts were considerably small and therefore insignificant.

volume also increases gradually. An interesting observation is the change in turnover ratios. While domestic investors' turnover ratios start at 163.66% and decrease to 83.81%, foreign investors' turnover ratios have shown a stable trend between 50% and 90%.[11] This seems to be due to foreign investors' stabilizing effect on the market. Moreover, among domestic investors, individual investors show very similar buy and sell volumes, exhibiting a correlation coefficient close to 100%. This indicates that individual investors are highly heterogeneous as Albuquerque et al. (2007) emphasize.

Conversely, foreign investors' trading volumes depend on buys during the first subperiod, resulting in significantly larger buy volumes than sell volumes. Nonetheless, the correlation coefficients between buy and sell volumes for the three subperiods are relatively smaller than those of individual investors, suggesting that foreign investors exhibit less heterogeneous trading behavior than individual investors. As individual and foreign investors are the largest and most important participants in the Korean stock market, their net buys show the opposite trends. Although not reported here to save space, institutional investors in Korea show a similar trading volume to foreign investors, but their influence is relatively insignificant compared to that of foreign investors, as Richard (2005) demonstrates. Finally, the ownership ratio of foreign investors peaked during the second subperiod, reaching a record high of 43.87% in July 2004, and remained at around 32-33% by the end of 2023.

In Panel B, the KOSDAQ market presents a markedly different picture from the KOSPI market. Market volatility decreased significantly from 11.42% to 5.94% in the third subperiod, and market returns dropped significantly because of the 2000 tech bubble in Korea. In terms of trading volume, the market shows a growing trend; however, the relatively high turnover ratio suggests that the market is highly speculative. Foreign investors show a turnover ratio of 148.91% in the second subperiod, indicating relatively restrained speculative trading; however, in the third subperiod, it increased dramatically to 435.30%, similar to the turnover ratio of domestic investors. This increase appears to be due to hedge funds or aggressive capital engaging in speculative trading in the KOSDAQ market.[12] Individual investors exhibit a correlation coefficient of 99.99% between buy and sell volumes, indicating high heterogeneity. However, it is interesting to note that the correlation coefficient for foreign investors increased from 89.99% to 99.87%. This finding suggests that foreign investors became highly heterogeneous and implies that foreign investors in the KOSDAQ market are more actively involved in speculative trading. Finally, foreign investors' ownership ratios show a slight decrease in the third subperiod.

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[11] The calculation method for turnover ratio can vary, but here, it is calculated by dividing the smaller of the buy and sell volumes by the average market capitalization at the beginning and end of the year. This is the lowest turnover ratio among various turnover ratio calculation methods.

[12] We examine which foreign investors participate in such speculative trading in the KOSDAQ market later.

*** Insert Table 2 here! *

4.3 Anatomy of foreign investors by country

Analyzing the trading volume of foreign investors by country and investor type can provide a comprehensive understanding of their behaviors and characteristics. The countries and types of investors depicted here are determined by the information reported to the Financial Supervisory Service by foreign investors themselves, and it is difficult for this agency to accurately audit the countries and types of investors. This implies that the identities, especially for types of investors, may be inaccurate. Table 3 presents the country-wise trading volumes of the KOSPI and KOSDAQ markets during the second and third subperiods. Here, the country-wise trading volumes represent the monthly average buy and sell volumes for each country. While country-wise trading volume data spans 12 years for the second subperiod, such data for the last six months are not available for the third subperiod, resulting in monthly statistics for the 11.5-year period. Additionally, data for the second subperiod are not available for the KOSDAQ market. The country order is arranged in descending order based on the trading volume for the third subperiod.

Panel A shows that trading volumes decrease in the order of the United Kingdom, the United States, Singapore, the Cayman Islands, and Switzerland, and so on in the KOSPI market. There are three notable characteristics, here. First, regardless of the period, the U.K. has the highest trading volume, followed by the U.S. While the trading volume of the U.S. is not significantly different from that of the U.K. during the second subperiod, it is only about one-fifth of that of the U.K. during the third subperiod. In Table 14, in terms of stock ownership, the U.K.'s ownership is only about one-fourth of that of the U.S.; nonetheless, it far surpasses in trading volume. This excessive U.K. trading volume indicates a high likelihood of proprietary trading by investment banks and speculative trading by hedge funds seeking short-term high returns, as mutual funds pursuing long-term returns are likely to trade, for a year, far below their holdings. Second, the trading volumes of Singapore and the Cayman Islands rank 3rd and 4th, respectively, significantly higher than those of other countries. These countries are noteworthy because they are both well-known tax havens. Consequently, investments from Singapore and the Cayman Islands may be attributed to the trading volumes of hedge funds established on behalf of investors in other countries. Third, most countries that invest in Korea are advanced countries. While this may seem obvious, it is important to demonstrate the behavior of advanced-country investors in emerging markets or early-stage advanced countries, as shown in this study.

Table A1 in Appendix A presents the monthly trading volumes by institutional type from April 2009 to May 2014 for the U.K., the U.S., and the Cayman Islands, which are not reported here because of space limitations. This table provides a more detailed breakdown of their monthly average trading

volumes by institutional type. Therefore, it is easy to discern the institutions responsible for each country's trading volume.

Panel B shows the country-wise trading volumes in the KOSDAQ market. Again, a notable observation is that the U.K. and the Cayman Islands rank first and second, respectively, by trading volume. Conversely, the U.S. drops to eighth place. What could be the reason for the relatively low trading volume of the U.S. in the KOSDAQ market, considering that the U.S. holds the largest ownership of stocks in the Korean stock market? As Table 2 shows, the KOSDAQ market can be considered a speculative market. Therefore, it is natural to expect that the trading volume of US investors focusing on mutual funds investing in Korea to be relatively small in the KOSDAQ market. In the same context, it is also natural to observe a considerably high KOSDAQ trading volume by hedge funds and investment banks centered in the U.K. and the Cayman Islands, which seek short-term high returns.

*** Insert Table 3 here! ***

4.4 Anatomy of foreign investors by investor type

Table 4 presents trading volumes by investor type for the KOSPI and KOSDAQ markets in Panels A and B, respectively. Looking at Panel A for the KOSPI market, we see a division between non-resident and resident foreigners. Resident foreigners are predominantly investment banks established in Korea, accounting for an absolute majority of 97.03%, with 2.59% being individuals, most of whom can be considered Americans.[13] The remaining resident foreigners' trading is almost negligible. Among non-resident foreign investors, investment banks are the most prevalent at 47.63%, followed by mutual funds at 18.46%. Importantly, the proportion of private funds, which hedge funds should belong to, is extremely low at 0.05%. Does this mean that few hedge funds invest in the KOSPI market? No: generally, few hedge funds that invest in the Korean stock market clearly report their identity. Hedge funds typically do not invest in the Korean stock market while explicitly identifying themselves as hedge funds. For example, in the case of the Cayman Islands, funds commonly referred to as hedge funds fall under the category of mutual funds and are thus regulated by its own Mutual Funds Act. Hedge funds can also be established as other types of institutions; hence, they can be reported under the types of other companies or other financials. Consequently, many hedge funds are reported by other companies or other financials, and significant hedge fund participation within types of mutual funds may also exist. The trading volume in the KOSPI market by institutions, such as pension funds, state/local governments, and so forth, is not significant. In conclusion, foreign investors largely

[13] From Panel A of Table A1 in Appendix A, foreign individuals in the KOSPI market are predominantly Americans.

investing in the KOSPI market include investment banks, mutual funds, other financials, commercial banks, and other companies. According to Table A1 in Appendix A, most investment banks are British-owned, mutual funds are predominantly American-owned, and the Cayman Islands has many hedge funds investing in the KOSPI market under mutual funds and other companies.[14]

Panel B of Table 4 displays foreign investors' trading volumes in the KOSDAQ market. Among non-resident foreign investors, investment banks account for the majority (61.60%). However, unlike in the KOSPI market, we find no individual investors, and the proportion of state/local governments is 38.60%. While detailed information regarding state/local governments is not available, given the relatively very small proportion of resident foreign investors' trading volume compared with that of non-resident foreign investors, their trading volume is insignificant. Among non-resident foreign investors, investment banks dominate, with a proportion of 56.44%, followed by mutual funds, other financials, commercial banks, and other companies in decreasing order of trading volume. Similar to the KOSPI market, the trading volume diminishes substantially after pension funds, rendering it less meaningful. As the KOSDAQ market is much more speculative than the KOSPI market, hedge funds are more likely to trade actively.

*** Insert Table 4 here! ***

5. Empirical evidence

5.1 Co-movement (herd behavior) of foreign investors

To verify the informed cash-flow hypothesis proposed in this study, foreign investors' trading behaviors must satisfy the three conditions outlined earlier. The first condition is that there should be positive cross-correlations of net-buy ratios between countries and between types of investors. Thus, foreign investors exhibit herd behavior across countries or investor types. To demonstrate this, previous studies have gathered deviations in buy or net-buy ratios from the mean during specific periods to test herd behavior indirectly, as the buy or net-buy ratios of various investor groups are not often available. However, if the buy or net-buy ratios of multiple groups are available, their correlations can be tested directly to examine herd behavior among investor groups. This study, utilizing net-buy ratios by country and investor types, allows for the direct verification of herd behavior among foreign investors using correlation coefficients.

[14] In Panel A of Table A1 in Appendix A, regarding the trading volume in the KOSPI market, it can be observed that in the Cayman Islands, the majority of trading is conducted by hedge funds registered as mutual funds and other companies. Panel B shows the trading volume of KOSPI 200 futures for the U.K., U.S., and the Cayman Islands. In this case, it is evident that other companies and mutual funds from the Cayman Islands contribute significantly to the futures market trading volume. Given that mutual funds generally do not engage in futures trading extensively, it is easy to infer that other companies and mutual funds are likely hedge funds.

Table 5 presents the cross-correlations of foreign net-buy ratios ($fnbr_t$) between countries and between types of investors. $Fnbr_t$ is defined as foreign net buys divided by market capitalization at time t (on day t or in month t). Panel A presents the daily correlations of foreign net-buy ratios between the U.K. (the U.S. or Cayman Islands) and several other countries. Panel B shows the monthly correlations between the U.K. (the U.S. or Cayman Islands) and other countries, while Panel C displays the monthly correlations between investment banks (mutual funds) and other types of institutional investors. In Panel A, for the KOSPI market, the foreign net-buy ratios of the U.K. and U.S. show significantly positive correlations with those of other countries. This suggests a tendency for net buys from the sample countries to move together, indicating herd behavior among them. In the KOSDAQ market, the U.K. exhibits significantly positive correlations only with the U.S., contrary to the KOSPI market. The Cayman Islands show significantly positive correlations with Singapore, Hong Kong, and Canada, which is noteworthy because Singapore and Hong Kong are tax havens where many hedge funds are established on behalf of investors in other countries.

Panel B presents the monthly correlations, which allow for more data availability than daily data, resulting in correlation coefficients among the 15 countries. In the KOSPI market, the U.K. exhibits significantly positive correlations with all the countries in Panel A, except for Canada. While the U.S. shows somewhat different results from those in Panel A, it still maintains significant positive correlations with the seven countries. There aren't as many clear positive correlations in the KOSDAQ market, as in the KOSPI market. However, the U.K. and the Cayman Islands still exhibit significantly positive correlations with a few countries.

Panel C shows that a few correlations between investment banks (mutual funds) and other types of investors have negative values, although with more significant positive correlations. Particularly, noteworthy is that investment banks have significantly positive correlations with mutual funds, other companies, commercial banks, and other financials in the KOSPI market. In the KOSDAQ market, investment banks and mutual funds exhibit significantly positive correlations with a few investor types. Nevertheless, investment banks have no correlation with mutual funds, which implies that they may have a different trading pattern in a speculative market.

Indeed, these kinds of significantly positive correlations strongly indicate the presence of herd behavior between countries and between types of investors. Although not reported here, it's common to observe a substantial increase in the monthly correlation coefficients during periods of high returns (i.e., in the highest 20% quintile). In particular, the correlation coefficients of the U.K. with the U.S., Canada, Singapore, and Hong Kong experience a sharp increase, indicating that they tend to move together more closely when extremely positive information is present. We observe a similar phenomenon among foreign institutional investor types, in which the correlations of investment banks with mutual funds, commercial banks, and other companies show a substantial increase. This evidence satisfies *Condition*

A of the informed cash-flow hypothesis. Such herd behavior among foreign investors forms the cornerstone of our hypothesis.

*** Insert Table 5 here! ***

5.2 Review of the stylized facts on foreign investors

Various theoretical and empirical studies on foreign investors' cash flows show divergent results depending on their assumptions they employ, sample countries, and sample periods. However, several stylized facts, most of which are widely agreed upon by researchers, exist, as follows.

Fact A. *Flow momentum*: The net buys of foreign investors exhibit persistence, showing a positive correlation with their lagged variables.

Fact B: *Return chasing* or *momentum investing*: The net buys of foreign investors are positively correlated with contemporaneous or lagged local market returns.

Fact C: *Global return chasing*: The net buys of foreign investors show positive contemporaneous or lagged relationships with the U.S. or world market returns.

Many studies using daily data find that the cash flows of foreign investors are autocorrelated, indicating the persistence of foreign flows or flow momentum. Froot and Donohue (2004) use daily data to ascertain that the informed trading hypothesis accounts for approximately 75% of the total persistence of aggregate foreign flows. Using short-term (4-5 years) daily data, Griffin et al. (2004) and Richards (2005) demonstrate the persistence of net buys when foreigners invest in emerging markets

Brennan and Cao (1997) suggest that foreign investors perceive a lack of information about a local market, which leads them to interpret the local market returns as good news and invest accordingly. They note a positive correlation between foreign net buys and local returns, called "return chasing." In this case, foreign net buys have a positive relationship with contemporaneous local returns in low-frequency (quarterly or monthly) data, and with lagged local returns in high-frequency (daily) data. Griffin et al. (2004) develop a simple intertemporal equilibrium model to argue for positive correlations between foreign net buys and local returns. They empirically support this assertion using daily data from emerging markets. Richards (2005) presents similar empirical results. Choe et al. (2005) demonstrate return-chasing behavior among foreign investors for individual stocks. Unlike Brennan and Cao (1997), Albuquerque et al. (2009) develop a dynamic model of equity trading in which U.S. investors have global private information, leading to better performance than local investors. They also note that these investors engage in return chasing, which is a co-movement between foreign (i.e., U.S.) net buys and local returns.

Regarding Fact C, Griffin et al. (2004) state that in their intertemporal model, foreign net buys exhibit a positive relationship with the U.S. market returns. Albuquerque et al. (2009) empirically show

that because U.S. investors utilize global private information to invest abroad, net buys by U.S. investors exhibit a positive relationship with U.S. market returns (i.e., global return chasing). They argue, "The key assumption is that the fraction of investors who receive global signals is larger in the U.S. than in the rest of the world. ⋯ At the same time, global private information generates return chasing that reflects superior performance of U.S. investors. This is because local investors abroad underreact to movements in global factors, about which they know less than U.S. investors." In their argument, global factors could be the U.S. or world index returns. For the daily frequency, Griffin et al. (2004) and Richards (2005) test Fact C and also find global return chasing.

Here, return chasing is thoroughly reviewed using high- and low-frequency (daily and monthly, respectively) data spanning 32 years. Fact C is addressed in a subsequent structural analysis. Table 6 presents the correlations between the foreign net-buy ratios and market returns across the different periods. In Panel A, which focuses on the daily data of the KOSPI market, the foreign net-buy ratios show a significantly positive correlations with market returns. Considering the correlation coefficient of 0.2797 for the entire 32-year period in the last column, we can conclude that foreign net-buy ratios and market returns have a very strong contemporaneous positive relationship, given the daily data. Thus, stock prices tend to rise on days when foreign investors make positive net buys.

Conversely, the individuals' net-buy ratios have the opposite signs to foreign net-buy ratios, indicating that trading between foreign and individual investors trade in opposite directions. When foreigners buy, individuals sell, and vice versa. As institutional investors play an insignificant role in Korea, the trading behavior of foreigners and individuals is naturally the opposite. Given this structure, if one side possesses superior information, they are likely to show superior performance. As evidenced by the negative correlation coefficient of -0.3664 for individuals' net-buy ratios with market returns for the entire period displayed in the last column, they move in the opposite direction of market returns. Therefore, while it may be argued that foreign investors' net buys are a factor in moving the market with their information on a daily basis, examining the monthly correlations would provide further insights.

Panel B shows the monthly results for the KOSPI market. Foreign net-buy ratios exhibit a similar correlation pattern with market returns, as shown in Panel A, but with a considerably high correlation coefficient of 0.5123 over the entire 32-year period. Naturally, individuals' net-buy ratios have a strong negative correlation with market returns. A more sophisticated econometric methodology is necessary for a scientific assessment; however, this can be seen as evidence that foreign investors' net buys in the KOSPI market are indicative of return chasing. Panels C and D present the daily and monthly results for the KOSDAQ market. There are no major differences compared to the KOSPI market, but the absolute values of the correlation coefficients between foreign investors (individuals) and market returns are relatively smaller in absolute value.

*** Insert Table 6 here! ***

Now, we graphically examine the relationship between net buys and market returns. Figures 2 and 3 depict the trends of KOSPI (during the period of 1992/01-2023/12) and KOSDAQ (during the period of 2000/01-2023/12) returns, respectively, according to the deciles of the net-buy ratios. The first has the lowest 10% bin of foreign net-buy ratios, and the 10th, the highest 10%. The two right-hand bars next to the foreign net-buy ratio in each bin represent the net-buy ratios of individuals and domestic institutions, respectively. Regardless of the daily and monthly relationships in Panels A and B of Figure 2, respectively, market returns exhibit a strong positive relationship with foreign net-buy ratios, showing a monotonically increasing trend.[15] Conversely, the net-buy ratios of individuals and domestic institutions show strongly negative relationships with market returns. This pattern of foreign net buys is similarly observed in the daily relationships of the KOSDAQ market in Panel A of Figure 3, although we see some distortion in the 7th and 8th deciles of the monthly relationships in Panel B of Figure 3. Overall, foreign net-buy ratios show a positive relationship with market returns, while the net-buy ratios of individuals and domestic institutions show negative relationships with market returns.

*** Insert Figure 2 here! ***

*** Insert Figure 3 here! ***

Thus far, we've examined the relationship between the foreign net-buy ratios and market returns by constructing 10 decile portfolios. Now, let's look at the returns of days (or months) with the highest and lowest 10% foreign net-buy ratios, as well as the returns of days (or months) around them. This finding provides a fundamental picture of the dynamic relationship between foreign net-buy ratios and market returns. Figures 4 depicts the surrounding market returns centered on the dates with the highest and lowest 10% foreign net-buy ratios in the KOSPI market. Panel A shows that the highest case exhibits the highest market return on day -1, with very high market returns from days -2 to +1, while Panel B shows the lowest case displays the lowest market return on day -1, with consistently low market returns from days -2 to 0. Such patterns can help us understand the dynamic relationships between foreign net-buy ratios and market returns. In particular, previous day's market returns are very important for foreign net buys. Figure 5 shows the market returns in the months with the highest and lowest 10% foreign net-buy ratios in the KOSPI market. For the highest 10%, the market return is close to 9%, and it is just over 3% in month -1 and 1% in month +1. For the lowest 10%, the market return is less than -3.5%, but it is close to 0% in months -1 and +1, revealing that when foreign net buys are the weakest, they strongly affect the market return on the concurrent month. In other words, the

[15] However, in the 3rd and 7th deciles of the monthly relationships, KOSPI returns show slightly less values than those of 2nd and 6th deciles, respectively.

relationships between foreign net-buy ratios and market returns observed daily disappear at the low-frequency (monthly) level.

*** Insert Figure 4 here! ***

*** Insert Figure 5 here! ***

Figures 6 and 7 depict the market returns around the days and months with the highest and lowest 10% foreign net-buy ratios in the KOSDAQ market, respectively. These figures show patterns very similar to those observed in the KOSPI market. Therefore, we can conclude that there exists a strong positive contemporaneous relationship between foreign net buys and market returns (or lagged ones at the daily frequency) for the KOSPI and KOSDAQ markets.

*** Insert Figure 6 here! ***

*** Insert Figure 7 here! ***

5.3 Bi-variate analysis between foreign net buys and local returns

We use the VAR model to estimate the relationship between foreign net buys and local returns. Local market returns act as a pull factor. However, as Griffin et al. (2004) note, failing to consider the contemporaneous relationship between foreign net-buy ratios and local returns can complicate the explanation of a correct Granger-causality relationship. To control for this effect, we employ Sims's (1972) two-sided regression model, as in Equation (1). The preliminary analysis confirms that the asymmetric lagged relationships between the two variables are appropriate.[16] Setting the market returns with a lag of 6 days and foreign net-buy ratios with a lag of 1 day produces the most parsimonious modeling. Thus, l=1 and m=6.

Table 7 presents the daily estimation results of the two-sided regressions. The adjusted R^2 in the rightmost column ranges from 9.82% to 30.08%, indicating a significantly high level of explanatory power. This result suggests a strong dynamic relationship between these two variables. The statistical significance of whether foreign net-buy ratios predict or Granger-cause one-day market returns can be tested by the t-value of β_{-1} or the F-value (F1, in the third to the last column), where the squared t-value becomes the F-value. Meanwhile, whether lagged market returns Granger-cause today's foreign net-buy ratio is determined by t-values of β_1 to β_6, with the overall impact tested by F-value—F2 in the second to the last column.

[16] In fact, Sims (1972) use asymmetric lagged relationships to analyze the relationships between U.S. money and GNP.

Looking at β_0, all coefficients have highly significant positive t-values, indicating that foreign net buys have a considerably strong positive relationship with local market returns. This result implies that Condition B-1 for the informed cash-flow hypothesis is satisfied by the sign and statistical significance of β_0 on a daily basis. On the other hand, the Granger causality test is modeled appropriately, considering the contemporaneous relationship between the two variables. Examining β_{-1}, we see significantly positive coefficient values for all periods except for the third subperiod from January 2012 to December 2023. In particular, the t-value of 2.98 for the entire period is highly significant, suggesting that foreign net-buy ratios have return predictability in the KOSPI market. The F-value for the entire period ($F1=t^2=2.98^2 = 8.90$), also indicates their return predictability. This finding satisfies Condition B-2 that foreign net-buy ratios have return predictability on a daily basis. Additionally, β_1 to β_6 are significantly positive across all periods, indicating that lagged market returns Granger-cause today's foreign net buys. The F-value, F2, is also highly significant, confirming the accuracy of the previously mentioned return-chasing behavior exhibited by daily foreign net buys.

The results in Panel B for the KOSDAQ market show a slightly different pattern from those in Panel A for the KOSPI market. β_0 still holds a highly significant positive t-value across all periods, indicating that foreign net buys maintain a strongly positive contemporaneous relationship with market returns. Furthermore, as all β_{-1} coefficients also hold significantly positive values, foreign net-buy ratios exhibit predictability for the next day's market returns in the KOSDAQ market as well. Such contemporaneous positive relationships and one-day return predictability are likely the driving forces behind foreign investors' superior performance. However, due to a mixture of positive and negative values in β_1 to β_6, it is challenging to argue for the existence of return chasing or foreign investors' momentum investing in the KOSDAQ market. In particular, during the recent entire period from January 2000 to December 2023, the third lagged coefficient is negatively significant, while the sixth lagged coefficient is positively significant, indicating that return chasing with lagged market returns may not exist in the KOSDAQ market despite the statistically significant F2 value. This result holds an important implication for foreign investment behavior. In stable and mature stock markets, foreign investors engage in return chasing using daily lagged local returns. Nevertheless, in relatively small and turbulent emerging markets such as the KOSDAQ market, return chasing with daily lagged local returns may not manifest.

*** Insert Table 7 here! ***

Table 8 presents the monthly results of the two-sided regressions estimating the dynamic relationships between foreign net-buy ratios and market returns. Panel A displays the results for the KOSPI market, and Panel B, for the KOSDAQ market, divided by periods. For monthly relationships, the lag of both variables is set to 1 based on the Schwarz Bayesian Criteria (henceforth SBC). In Panel

A, the adjusted R^2 is notably higher, ranging from 22 to 32%, compared with the daily data. An intriguing observation is the lack of statistical significance in β_{-1} indicating the absence of return predictability of foreign net buys on a monthly basis. While daily data reveals return predictability and contemporaneous effects potentially benefiting foreign investors' performance, such effects disappear when using monthly (low frequency) data. Nevertheless, $\beta_0$still shows strongly significant positive values, indicating that the contemporaneous relationship between foreign net-buy ratios and market returns indeed persists in the monthly data. As one month is a sufficiently long period for investors to capitalize on information, foreign investors may reap significant gains from information-based trading for a month even if there is no return predictability from foreign net buys. Figure 5 illustrates that months with the highest 10% foreign net-buy ratios exhibit market returns close to 9%, whereas months with the lowest 10% see market returns dip near -4%. Figure 7 depicts the KOSDAQ market returns and shows similar patterns. Based on these findings, we can infer that foreign investors' net buys, driven by information, contribute to boosting market returns, resulting in favorable performance for foreign investors. This evidence satisfies Condition B-1 of the informed cash-flow hypothesis.

On the other hand, β_1 exhibits a significant positive value during the first subperiod from January 1992 to December 1999, revealing a significant positive relationship throughout the entire period. Nevertheless, after 2000, no statistically significance differences are observed at all. This suggests that foreign investors do not engage in return chasing based on lagged market returns, but on concurrent market returns at a monthly level after 2000. Why not? This is because chasing lagged returns relies on the market's inefficiency, suggesting that lagged returns serve as informational signals. Before 2000, foreign investors have capitalized on this market characteristic to make monthly profits. Nonetheless, it can be inferred that this inefficiency has diminished after 2000, making it difficult to engage in return chasing based on monthly lagged market returns.

The estimation results for the KOSDAQ market in Panel B also exhibit a similar pattern to those of the KOSPI market. While the market's explanatory power, as indicated by the adjusted R^2, is considerably lower than that of the KOSPI market, there is still neither return predictability from foreign net buys, nor observed return chasing based on lagged market returns. Nonetheless, the coefficient β_0, still representing the contemporaneous relationship with market returns, remains significantly positive. This result implies that even in the KOSDAQ market, foreign investors may achieve better performance using information than domestic investors, and return chasing with concurrent market returns is observed.

*** Insert Table 8 here! ***

5.4. Tri-variate analysis: Structural relationships

5.4.1 Daily analysis

We estimate the SVARs presented in Equation (2) by incorporating the S&P 500 returns as a push factor in the above two endogenous variables. The estimation procedure involves Equation (8) and hypothesis testing for the coefficients c_{21}^0, c_{31}^0, and c_{32}^0 as presented therein. Here, c_{ij}^0represents the contemporaneous effect of the j^{th} shock on the i^{th} variable. Specifically, c_{21}^0 denotes the effect of the U.S. return shocks on foreign net-buy ratios, c_{31}^0represents the effect of the U.S. return shocks on local returns, and c_{32}^0 signifies the effect of foreign net-buy shocks on local returns. Using the likelihood ratio test, we test the following two effects for each coefficient:

$H_0: c_{ij}^0 = 0$: No contemporaneous effect of the j^{th} shock on the i^{th} variable,

$H_0: C_{ij}(1) = 0$: Temporary effect of the j^{th} shock on the i^{th} variable.

Specifically, when i=3 and j=2, c_{32}^0 represents the effect of foreign net-buy shocks on local returns. Moreover, $C_{32}(1) = 0$ implies that foreign net buys have a price pressure effect on local returns because it is temporary; consequently, stock prices will revert back to their original levels.

Table 9 presents the SVAR estimation results across different periods. Panel A presents the results of the KOSPI market. Across all periods, all coefficients, except for c_{32}^0, exhibit significantly positive values at the 1% level, indicating a considerably strong contemporaneous effect. Examining the last column, which represents the results for the entire period, we observe that the effect of S&P 500 return shocks on foreign net-buy ratios (c_{21}^0) is notably large and permanent. This finding supports the assertion of Albuquerque et al. (2009) that foreign net buys utilize global private information, which is consistent with the findings of Griffin et al. (2004) and Richards (2005).[17]

c_{31}^0 represents the contemporaneous effect of S&P 500 return shocks on KOSPI returns. Across all periods, all coefficients exhibit significantly positive values at the 1% level, indicating a strong contemporaneous effect. Over the entire period, c_{31}^0 indicates that the shock has a strong positive effect on KOSPI returns, which is permanent rather than temporary. This finding suggests that the KOSPI market is heavily influenced by the U.S. stock market which aligns with the inferences of Griffin et al. (2004) and Richards (2005). It also serves as evidence that stock markets are influenced by global economic environments because the Korean economy moves in conjunction with the U.S. (or world) economy.

c_{32}^0 represents the effect of foreign net-buy shocks on the KOSPI returns. Except for the first subperiod, it consistently exhibits highly significant positive values. This finding suggests that foreign

[17] Our results differ from those of Griffin et al. (2005) and Richards (2004) in that they report the regression coefficients of reduced-form VAR while this study provides the coefficients of the SVAR explaining the contemporaneous effects of S&P 500 return and foreign net-buy shocks.

net buys have a significantly positive effect on KOSPI returns, revealing that the KOSPI market moves in response to the foreign net-buy shocks that rely on global private information. The fact that foreign net-buy shocks positively affect KOSPI returns, even after being influenced by S&P 500 return shocks, aligns clearly with the theoretical model and empirical results of Albuquerque et al. (2009). However, if these effects were temporary, it would be challenging to support their argument. If the effect is the result of price pressure and not based on global private information, it is ultimately not significant. The likelihood ratio test results of the BQ decomposition strongly negate the hypothesis that foreign net-buy shocks temporarily affect KOSPI returns. Therefore, it can be argued that foreign investors in the KOSPI market should achieve better performance compared to domestic investors because they depend on global private information.

Panel B, which represents the result for the KOSDAQ market, also shows a tendency for the coefficients to decrease in magnitude compared to those in Panel A. However, as the signs and statistical significance of the coefficients are almost similar, the overall conclusion remains the same: S&P 500 return shocks positively influence foreign net buys, and foreign net-buy shocks positively affect KOSPI returns, supporting Albuquerque et al.'s (2009) contention that foreign investors trade with global private information. Specifically, the contemporaneous effect of foreign net-buy shocks on KOSPI returns is not temporary but permanent, indicating the absence of a price pressure effect.

*** Insert Table 9 here! ***

Table 10 displays the variance decomposition results of foreign net-buy ratios and market returns during the period of 1991/01-2023/12 for the KOSPI market and during the period of 2000/01-2023/12 for the KOSDAQ market. In Panel A, the variance decomposition results of the foreign net-buy ratios indicate that they are significantly influenced by their own shocks, accounting for 86.76% of the variance. Additionally, they receive 9.05% influence from S&P 500 shocks, while the impact of KOSPI return shocks is minimal. However, in the KOSDAQ market, foreign net-buy ratios almost exclusively reflect their own shocks and are little influenced by S&P 500 and KOSDAQ return shocks. This result suggests that the KOSDAQ market can be characterized as a speculative market with abnormally high turnover ratios.

In Panel B, the variance decomposition of the KOSPI returns also indicates the significant influence of its own shocks, accounting for 85.65% of the variance. Nevertheless, it is influenced more by S&P 500 return shocks than from foreign net-buy shocks. Similar patterns are observed in the KOSDAQ market. These phenomena can be interpreted as the variances in the KOSPI and KOSDAQ market returns being fundamentally influenced by the U.S. (or world) stock market rather than foreign net buys.

*** Insert Table 10 here! ***

Figures 8 and 9 confirm the earlier empirical results. They graphically depict the values of the impulse response function (IRF) of the daily KOSPI and KOSDAQ SVARs.[18] The solid line at the center represents the impact of each shock, whereas the two outer solid lines represent the 95% confidence band. The confidence band is estimated using bootstrapping methods. When the confidence band touches the X- axis, which represents 0, the impact of the shock vanishes on that day..

Turning first to Figure 8, the impact of S&P 500 return shock on foreign net buy is most significant on the same day (i.e., day 0), and gradually diminishes until it nearly disappears on the ninth day (i.e., day 9). The fact that this effect does not easily dissipate within a few days indicates that it has a relatively long-lasting impact, which is also consistent with global return chasing. Similarly, S&P 500 return shocks also significantly influence KOSPI returns on the same day, sharply decreasing the next day, and completely disappearing on the third day. In other words, the impact of the S&P 500 return shock lasts for up to three days, including on the same day as the shock. Foreign net-buy shocks also significantly influence KOSPI returns on the same day, sharply decreasing the next day, and disappearing on the fourth day. However, the persistence of this shock's positive values for four days implies that foreign net-buy shocks have a highly positive impact on foreign investors' performance, suggesting that they are informed traders.

*** Insert Figure 8 here! ***

The daily IRF graphs for KOSDAQ SVARs in Figure 9 are similar to those in Figure 8. Nonetheless, a prominent feature is the impact of S&P 500 return shocks on foreign net buys and KOSDAQ returns. The impact of the S&P 500 return shocks on foreign net buys switches to a considerably small negative value two days later, then changes to an extremely small positive value three days later, and completely disappears on the fourth day. The influence on KOSDAQ returns almost dissipates on the first day (day 1), rebounds slightly, and disappears again on the third day. These effects suggest that while the Korean stock market heavily influenced by the U.S. (or world) stock market, the impact does not gradually decrease in the KOSDAQ market because it is a highly speculative market with a high turnover ratio. The impact of foreign net-buy shocks on the KOSDAQ returns is similar to that on the KOSPI market, sharply decreasing one day later and completely disappearing on the fourth day.

*** Insert Figure 9 here! ***

[18] Each shock could generate IRF graphs for each variable, resulting in 9 graphs. However, the IRF graphs for their own variables and those on the upper diagonal are omitted as they hold little significance. All IRF graphs are available upon request to the authors.

From the empirical evidence presented above, the positive and significant value of c_{32}^0 satisfies Condition B-1, as stated earlier. This result implies that the foreign net-buy ratios have a contemporary effect on the local market returns. The fact that this effect persists for four days, including the same day, before disappearing on the fourth day, serves as evidence for satisfying Condition B-2. Furthermore, the non-temporary or permanent nature of the c_{32}^0 effect indicates that the impact of foreign net-buy shocks on the KOSPI and KOSDAQ returns is not due to the price pressure effect, but due to information-based trading. Therefore, it can be concluded that Condition B for the informed cash-flow hypothesis is fulfilled by the above findings at the daily data level.

5.4.2 Monthly analysis

Table 11 presents the monthly estimation results of the SVAR for various periods. Panel A shows the monthly estimation results for the KOSPI market. Similar to the daily estimation, except for c_{31}^0 in the first subperiod, all coefficients for all periods exhibit significantly positive values at the 1% level. As with the daily estimation, the following results are obtained.

a. S&P 500 return shocks have a contemporaneous positive effect on foreign net buys. This effect is not temporary, but permanent. (Global return chasing)
b. S&P 500 return shocks have a contemporaneous positive effect on KOSPI returns. This effect is not temporary, but permanent. (Coupling of the Korean stock market with the U.S. one)
c. Foreign net-buy shocks have a contemporaneous positive effect on KOSPI returns. This effect is not temporary, but permanent, which implies no price pressure effect of foreign net-buy shocks.

The estimation results for the KOSDAQ market in Panel B also exhibit coefficient signs and statistical significance, similar to those in Panel B of Table 9. Therefore, the same conclusions as the above (i.e., a, b, and c) hold true for the KOSPI and KOSDAQ markets.

*** Insert Table 11 here! ***

Table 12 shows the results of the variance decomposition during 1991/01-2023/12 for the KOSPI market and 2000/01-2023/12 for the KOSDAQ market. In Panel A, regarding the foreign net-buy ratios in the KOSPI market, its variance is primarily explained by its own shock (85.53%), with S&P 500 return shocks explaining 13.07%, and KOSPI return shocks explaining a negligible amount. Similarly, in the KOSDAQ market, the explanatory power of its own shock is the highest. Nevertheless, here, the explanatory powers of the S&P 500 return and KOSDAQ return shocks are very similar (6.29% and 7.02%, respectively), which indicates that the S&P 500 return shocks have a similar effect on the variance of foreign net-buy ratios to that of KOSDAQ returns. This is because foreign investors in the KOSDAQ market tend to use more information on market returns than those in the KOSPI market. This is likely because the KOSDAQ market is a speculative market with a high volatility and turnover ratio.

The variance decomposition results for the market returns in Panel B are considerably different

from the daily estimation results. In both the KOSPI and KOSDAQ markets, the impact of market return shocks decreases significantly, whereas the explanatory power of S&P 500 return shocks and foreign net-buy shocks increases significantly. This is likely because of the transition from daily to monthly data, which reduces the irregularities present in the daily data.

*** Insert Table 12 here! ***

Figure 10 shows the IRFs of the monthly KOSPI SVARs. The impact of S&P 500 return shocks on foreign net-buy ratios starts with a significantly positive effect in the concurrent month (month 0), gradually decreases, and disappears in the 5th month. However, the impact on KOSPI returns begin in the same month, sharply decreases in the first month, and disappears in the second month. Conversely, the impact of foreign net-buy shocks on KOSPI returns is significant only in the concurrent month, with a positive effect, and completely disappears in the first month. This finding implies that the effect of foreign net-buy shocks is limited to the concurrent months.

*** Insert Figure 10 here! ***

The IRF of the KOSDAQ market SVAR shown in Figure 11 exhibits a particularly distinctive pattern. The impact of the S&P 500 return shocks on foreign net buys gradually diminishes and disappears in the fifth month, whereas its effect on KOSDAQ return is only significant only in the concurrent month and vanishes in the first month. This finding suggests that the influence of the US market is not prominently reflected in the KOSDAQ market, except in the concurrent month. Finally, while the impact of foreign net-buy shocks on KOSDAQ returns is positive in the concurrent month, it becomes significantly negative in the first month—its effect on KOSDAQ returns is not substantial. This pattern can be inferred from the fact that the KOSDAQ market is known for its high turnover ratio and speculative nature. These characteristics lead to a swift reflection of external shocks, which last for only a relatively short period.

*** Insert Figure 11 here! ***

Summarizing the monthly analysis of the KOSPI and KOSDAQ markets, the S&P 500 return shocks have a contemporaneous positive effect on foreign net buys just in the concurrent month. This satisfies the previously mentioned Condition B-1. Additionally, the foreign net-buy shocks have a contemporaneous positive effect on KOSPI returns. This effect is not temporary but permanent—foreign net-buy shocks have no price pressure effect. This evidence satisfies Condition B-3. Nevertheless, as one month is a sufficient period for information to be reflected, there is neither return chasing nor predictability beyond the concurrent month.

6. Foreign investor performance

We demonstrate that Conditions A and B (B-1, B-2, and B3) are satisfied in order to validate

the informed cash-flow hypothesis in the previous section. Now, we must prove Condition C, which states that foreign investors' performance is superior to that of domestic investors. To achieve this, we aim to compare the performance of aggregate foreign investors with that of domestic investors over different periods from 1992 to 2023. Additionally, we estimate foreign investors' performance by country from January 2012 to June 2023, and compare it with that of domestic investors. Furthermore, we intend to analyze foreign investors' profitability by dividing them into the timing ability and selectivity components.

6.1 Aggregate foreign investors

Table 13 compares the estimated monthly returns of foreign and domestic investors along with the actual returns of the MSCI, KOSPI, and KOSDAQ indices. The estimation process of monthly returns is detailed in Appendix B. Panel A displays the returns of the MSCI PI, KOSPI, and KOSDAQ indices for different periods. Notably, the returns of the MSCI PI index generally outperform those of the KOSPI and KOSDAQ indices across all periods.[19] The MSCI PI index primarily focuses on highly liquid large-cap stocks, indicating that the returns on blue-chip stocks have been favorable in the Korean stock market from 1992 to 2023.

Panel B compares the monthly average returns of foreign and domestic investors with the estimated returns on the KOSPI market. While the estimated returns of the KOSPI market might differ slightly from the actual returns, the actual and estimated returns for the entire period from 1992 to 2023 are almost identical at 0.66% and 0.67%, respectively. This result implies that the return estimation is reasonably reliable. Notably, foreign investors' returns consistently exceed those of domestic investors. During the first subperiod (1992 to 1999), the average excess return of foreign over domestic investors averages 0.95% per month, but this declines to 0.19% during the third subperiod from 2012 to 2023. However, with the statistical significance of this difference being maintained, foreign investors outperform domestic investors. Over the entire period (1992-2023), the monthly average returns of foreign and domestic investors are 1.05% and 0.57%, respectively, resulting in a difference of 0.45%. On an annualized basis, this translates to a difference of 5.76% between them.[20] Therefore, the fact that foreign investors have achieved an average excess return of 5.76% per year over domestic investors in the KOSPI market over the past 32 years is sufficient to satisfy Condition C of the informed cash-flow hypothesis.

Panel C shows the estimated returns on the KOSDAQ market. Foreign investors' returns significantly outweigh those of domestic investors in both subperiods and the 24-year recent entire

[19] The MSCI PI is a price index that does not include cash dividends.

[20] The annualized return is calculated by the monthly multiplied by 12.

period. The estimated difference in returns averages 0.7% in the recent entire period, which translates into an annual average of 8.4%—foreign investors achieve an annual excess return of 8.40% compared with domestic investors. This is also sufficient to satisfy Condition C of the informed cash-flow hypothesis.

Panel D compares the returns of foreign and domestic investors in the combined market of the KOSPI and KOSDAQ markets. In the first subperiod, we consider only the returns of the KOSPI market, while in the two remaining subperiods, the returns of both markets are weighted by their respective previous end-of-month market capitalizations to estimate the combined market returns. Over the 32-year entire period, foreign and domestic investors have average returns of 1.02% and 0.48%, respectively. Foreign investors have earned an excess return of 0.59% per month and an annual excess return of 7.08% compared with domestic investors. This clearly indicates that Condition C of the informed cash-flow hypothesis is satisfied. Thus, this study demonstrates the validity of the informed cash-flow hypothesis in the Korean stock market that includes the KOSPI and KOSDAQ markets.

*** Insert Table 13 here! ***

6.2 Country analysis

We also estimate the monthly average returns for 15 countries. To estimate country-level monthly returns, we require country-specific data on trading volumes and ownerships for the KOSPI and KOSDAQ markets. The Korea Exchange provides country-specific trading volume data separately for each market (KOSPI or KOSDAQ), but not country-specific ownership data. Fortunately, the Financial Supervisory Service provides country-specific ownership data, but only for the combined market (KOSPI+KOSDAQ). These data are available since around 2012, limiting us to an estimation of country-level returns during the third subperiod (January 2012 to June 2023) for the combined market.

Table 14 presents country-wise ownerships as of June 2023, annual turnover ratios, monthly average returns, estimated monthly volatility measured by standard deviation, and yearly returns. The monthly average returns provided here do not include cash dividends, while the annual average returns include a 1.5% annual average cash dividend. The U.S. holds the largest share of foreign ownership at 41.01%, significantly higher than the next highest, the U.K., at 9.21%. Nevertheless, the turnover ratio in the U.S. is modest at 13.10%, whereas that of the U.K. is significantly higher at 381.69%—the U.K. dominates market trading activity in Korea.[21] Despite being small countries, Luxembourg and

[21] The turnover ratio of 13.10% in the U.S. is notably lower than the 50-100% range typically seen in U.S. mutual funds. In addition to the Korea Exchange, the Financial Supervisory Service also provides monthly trading volume data. According to their data, the turnover ratios for the U. S. and the U.K. are 33.20% and 394.99%, respectively. The discrepancy in country-specific trading volumes between these two institutions arises from slight differences in the definition of investor's nationality. As the Korea Exchange provides most of the data used in this study, we

Singapore rank third and fourth, respectively, in foreign ownerships. While the U.K. stands out with exceptionally high turnover, the Cayman Islands and Switzerland also demonstrate turnover ratios well exceeding 200%, indicating substantial trading activity. In terms of monthly average returns, foreign investors' overall returns stand at 0.52%, significantly surpassing domestic investors' 0.35%. Among the 15 countries listed in Table 14, all except for Norway, China, and Saudi Arabia show returns higher than 0.52%. Interestingly, the monthly average return for the other countries is remarkably low at -0.37%. Notably, Hong Kong, a tax haven, exhibits the highest monthly average return at 2.27%. The U.K.'s monthly average return of 0.98%, despite its exceptionally high turnover ratio, suggests that its investment strategy aimed at short-term high returns has been successful. In terms of volatility, Hong Kong, which shows the highest monthly average return, also exhibits excessively high volatility at 16.42%.

In essence, Saudi Arabia's monthly average return of 0.34% falls slightly below the domestic investors' return of 0.35%. However, the returns on the other 14 countries are all estimated to be higher than the domestic investors' return of 0.35%. This result means that the monthly average returns of most major investment countries surpass those of domestic investors—Condition C of the informed cash-flow hypothesis holds not only for aggregate foreign investors but also for major investment countries.

*** Insert Table 14 here! ***

6.3 How do foreign investors make more profits than domestic investors?

If we divide the returns of informed foreign investors into timing ability and selectivity, it may be possible to do so under the assumption that their investments mirror the MSCI Korea portfolio as a benchmark. As it is almost impossible to accurately estimate these components of investment returns without knowing foreign investors' benchmark portfolio, we call their timing ability "quasi-timing" and their selectivity "quasi-selectivity." Under this assumption in mind, the returns of foreign investors in the KOSPI market, the KOSDAQ market, and the combined market can be decomposed as follow.

$$R_{F,t}^{KOSPI} = \left(R_{F,t}^{KOSPI} - R_{MSCI,t}^{Korea}\right) + \left(R_{MSCI,t}^{Korea} - R_{M,t}^{KOSPI}\right) + \left(R_{M,t}^{KOSPI} - r_{f,t}\right) + r_{f,t} \quad (15)$$

$$= \text{Quasi-timing ability} + \text{Quasi-selectivity} + \text{Equity over risk-free} + \text{Risk free}$$

where $R_{F,t}^{KOSPI}$: Foreign investors' return in month t;

$R_{MSCI,t}^{Korea}$: MSCI index return for Korea in month t;

$R_{M,t}^{KOSPI}$: KOSPI market return in month t;

$r_{f,t}$: Risk-free rate in month t.

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rely solely on the Korea Exchange's data, except for country-specific ownership data.

The returns on the KOSDAQ and combined markets can also be decomposed in the same manner.

Panel A of Table 15 displays the decomposition of foreign investors' returns on the KOSPI market by period. As better foreign investor performance has already been observed, the null hypothesis here is that their quasi-timing ability and quasi-selectivity are either zero or negative, whereas the alternative hypothesis is that these components have significantly positive values. Therefore, we test the null hypothesis using one-tailed t-tests. Quasi-timing ability shows consistently positive and significant values, except in the second subperiod. Over the 32-year entire period, quasi-timing ability stands at 0.22% with a significant t-value of 2.19, suggesting that foreign investors have quasi-timing ability in the KOSPI market. While quasi-selectivity seems weak in the second subperiod, its consistently significant positive values in both the recent entire period (2000/01-2023/12) and the entire period (1992/01-2023/12) suggest that quasi-selectivity is also present. Thus, foreign investors possess quasi-timing ability and quasi-selectivity in the KOSPI market.

In Panel B, regarding the results for the KOSDAQ market, quasi-timing ability shows significantly positive values in the third subperiod, whereas quasi-selectivity exhibits significantly positive values in the second subperiod. Consequently, reaching a concrete conclusion is not straightforward; however, quasi-selectivity appears to be weakly significant over the recent entire period. As the MSCI index does not include many KOSDAQ stocks, considering it a benchmark portfolio for foreign investors in the KOSDAQ market is challenging. Thus, we are not able to conclude about the foreign investors' quasi-timing ability and quasi-selectivity in the KOSDAQ market.

Panel C presents the results for the combined market, which includes both the KOSPI and KOSDAQ markets. As the results for the KOSDAQ market are included, it is challenging to obtain consistent results regardless of the period. Consider the results for the entire period shown in the last column. Both quasi-timing ability and quasi-selectivity have significantly positive values at 0.20% and 0.23%, respectively. This finding indicates that foreign investors exhibit quasi-timing ability and quasi-selectivity. This, along with the results in Panel A of the KOSPI market, make it difficult to refute the presence of quasi-timing ability and quasi-selectivity among foreign investors.

Panel D displays the quasi-timing ability of the 15 countries in the combined market. Among these 15 countries, 10 (the U.S., the U.K., Luxembourg, Singapore, Canada, Australia, Japan, the Cayman Islands, Switzerland, and Hong Kong) exhibit quasi-timing ability. This finding implies that a sufficient number of countries demonstrate quasi-timing ability in the Korean stock market

7. Concluding remarks

This study presents three conditions for the informed cash-flow hypothesis to hold. Sub-section 5.1 confirms the satisfaction of Condition A by demonstrating that foreign inter-country and inter-institutional net buys exhibit significantly positive correlation coefficients. Using daily data in

Subsections 5.2 through 5.4, we show that foreign net buys engage in return chasing using both concurrent and lagged local returns, demonstrating one-day return predictability. Further, in the monthly data, a strongly positive contemporaneous relationship between foreign net buys and local returns is observed, indicating return chasing in the low-frequency data. This evidence satisfies Conditions B-1 and B-2. Moreover, the SVAR estimation reveals that the impact of foreign net buys on local returns is not temporary, but permanent, implying the absence of price pressure effect and satisfying Condition B-3. Finally, Section 6 shows that foreign investors significantly outperform domestic investors, satisfying Condition C. This evidence collectively validates the informed cash-flow hypothesis.

The empirical evidence of this study can be summarized as follows. First, foreign net buys exhibit significant positive inter-country and inter-institutional correlations, indicating the herd behavior among foreign investors. We observe this herd behavior in daily and monthly data, with a greater degree at the monthly frequency than at the daily frequency. Second, foreign net buys demonstrate a strongly positive contemporaneous relationship at daily and monthly frequencies with local returns Granger-causing foreign net buys at the daily frequency, indicating local return chasing. However, they have no price pressure effect on local market returns, suggesting that their effect is not temporary, but permanent. Third, foreign net buys exhibit one-day return predictability. Fourth, foreign net buys display a strongly positive contemporaneous relationship with S&P 500 returns at daily and monthly frequencies. S&P 500 lagged returns also Granger-cause foreign net buys at the daily frequency. These findings indicate global return chasing. This is consistent with Albuquerque et al. (2009), who suggest that foreign net buys (in their study, U.S. net buys) utilize global private information. Fifth, foreign investors with such characteristics outperform domestic investors. Such superior performance has also been observed in the major advanced countries. These findings support the proposed informed cash-flow hypothesis. Finally, foreigners' trading characteristics show high turnover ratios in countries such as the U.K, Cayman Islands, Switzerland, and Hong Kong. These countries are de facto tax havens. In particular, despite holding 41.01% of total foreign ownership as of June 2023, the U.S. exhibits an extremely low turnover ratio of 13.10%, while the U.K., with ownership less than a quarter of that of the U.S., shows a trading volume approximately six times that of the U.S. since 2012.

This study examines the characteristics and behavior of foreign investors in the Korean stock market from its opening to foreign investors in 1992 to the present, 2023, using long-term daily data spanning 32 years. During this period, the Korean stock market has transitioned from a representative emerging market to an advanced market. The informed cash-flow hypothesis is proposed as a concept that distinctly characterizes foreign investors' investment behavior. Building on this foundation, this study suggests directions for future research. First, given that foreign investors have information advantage over domestic investors, it is necessary to verify how global or local return chasing would manifest when their investments are divided into portfolios by foreign ownership or trading volume.

Second, a study should test whether the characteristics of foreign investors found in this study are evident in the Japanese stock market, which is older than that in Korea. Although Japan is located in Far East Asia alongside Korea, it has long been classified as an advanced market, raising cconcerns about the characteristics and investment behavior of foreign investors.

References

Acharya, V. and T. Johnson (2010), More insiders, more insider trading: Evidence from private equity buyouts, *Journal of Financial Economics* 98, 500-523.

Albuquerque, R., G. Bauer, and M. Schneider (2007), International equity flows and returns: A quantitative equilibrium approach, *Review of Economic Studies* 74, 1-30.

Albuquerque, R., G. Bauer, and M. Schneider (2009), Global private information in international equity markets, *Journal of Financial Economics* 94, 18-46.

Bae, K.-H., R. Stulz, and H. Tan (2008), Do local analysts know more? A cross-country study of the performance of local analysts and foreign analysts, *Journal of Financial Economics* 88, 581-606.

Baik, B., J.-K. Kang, J.-M. Kim (2010), Local institutional investors, information asymmetries, and equity returns, *Journal of Financial Economics* 97, 81-106.

Baily, W., C. Mao, and K. Sirodom (2007), Investment restrictions and the cross-border flow of information: Some empirical evidence, *Journal of International Money and Finance* 26, 1-25.

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

Bena, J., M. Ferreia, P. Matos, and P. Pires (2017) Are foreign investors locusts? The long-term effect of foreign institutional ownership, *Journal of Financial Economics* 126, 122-146.

Bodnaruk, A., M. Massa, and A. Simonov (2009), Investment banks as insiders and the market for corporate control, *Review of Financial Studies* 22, 4989-5026.

Bohn, H. and L. Tesar (1996), U.S. equity investment in foreign markets: Portfolio rebalancing or return chasing?, *Amercan Economic Review* 86, 77-81.

Bernanke, B. (1986), Alternative explanations of the money-income correlations, *Carnegie-Rochester Conference Series on Public Policy* 15, 49-99.

Brennan, M. and H. Cao (1997), International portfolio investment flows, *Journal of Finance* 52, 1851-1880.

Calvo, G., L. Leiderman, and C. Reinhart. (1993), Capital inflows and real exchange rate appreciation in Latin America: The role of external factors, IMF Staff Papers: 108-151.

Choe, H., B.-C. Kho, and R. Stulz (1999), Do foreign investors destabilize stock markets? The Korean experience in 1997, *Journal of Financial Economics* 54, 227-264.

Choe, H., B.-C. Kho, and R. Stulz (2005), Do domestic investors have an edge? The trading experience of foreign investors in Korea, *Review of Financial Studies* 18, 795-829.

Cohen, L., A. Frazzini, and C. Malloy (2008), The small world of investing: Board connections and mutual fund returns, *Journal of Political Economy* 116, 951-979.

Cohen, L., A. Frazzini, and C. Malloy (2010), Sell-side school ties, *Journal of Finance* 65, 1409-1437.

Coval and Moskowitz (1999), Home bias at home: Local equity preference in domestic portfolios, *Journal of Finance* 54, 2045-2073.

Dvorak, T. (2005), Do domestic investors have an information advantage? Evidence from Indonesia, *Journal of Finance* 60, 817-839.

Fernandez-Arias, E. (1996), The new wave of private capital inflows: Push or pull?, *Journal of Development Economics* 48, 389-418.

Froot, K. and J. Donohue (2004), Decomposing the persistence of international equity flows, *Finance Research Letters* 1, 154-170.

Froot, K., P. O'connell, and M. Seasholes (2001), The portfolio flows of international investments, *Journal of Financial Economics* 59, 151-194.

Froot, K. and T. Ramadorai (2008), Institutional portfolios flows and international investments, The portfolio flows of international investments, *Review of Financial Studies* 21, 937-971.

Ghysels, E. and J. Seon (2005), The Asian financial crisis: The role of derivative securities trading and foreign investors in Korea, *Journal of International Money and Finance* 24, 607-630.

Griffin, J., F. Nardari, and R. Stulz (2004), Are daily cross-border equity flows pushed or pulled?, *Review of Economics and Statistics* 86, 641-657.

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.

Hamao, Y. and J. Mei (2001), Living with the "enemy": an analysis of foreign investment in the Japanese equity market, *Journal of International Money and Finance* 20, 715-735.

Hasbrouck, J. (1991), Measuring the information content of stock trades, *Journal of Finance* 46, 179-207.

Hau, H. (2001), Location matters: An examination of trading profits, *Journal of Finance* 56, 1959-1983.

He, W. and J. Shen (2014), Do foreign investors improve informational efficiency of stock prices? Evidence from Japan, *Pacific-Basin Finance Journal* 27, 32-48.

Hendershott, T., D. Livdan, N. Schurhoff (2015), Are institutions informed about news?, *Journal of Financial Economics* 117, 249-287.

Ivashina, V. and S. Sun (2011), Institutional stock trading on loans market information, *Journal of Financial Economics* 100, 284-303.

Jang, J., J. Kang, and J. Lee (2023), Who has an edge in trading index derivatives?, *Journal of Futures Markets* 43(3), 325-348.

Kacperczyk, M., S. Sundaresan, and T. Wang (2021), Do foreign institutional investors improve price efficiency?, *Review of Financial Studies* 34, 1317-1367.

Kamesaka, A., J. Nofsinger, H. Kawakita (2003), Investment patters and performance of investor groups in Japan, *Pacific-Basin Finance Journal* 11, 1-22.

Karolyi, G. (2002), Did the Asian financial crisis scare foreign investors out of Japan?, *Pacific-Basin Finance Journal* 10, 411-442.

Kim, W. and S.-J. Wei (2002), Foreign portfolio investors before and during a crisis, *Journal of International Economics* 56, 77-96.

Ko, K. (2012), Who wins in the money game? The case of KOSPI 200 futures, *Pacific-Basin Finance Journal* 20, 843-856.

Ko, K. (2007), Characteristics and performance of institutional and foreign investors in Japanese and Korean stock markets, *Journal of the Japanese and International Economies* 21, 195-213.

Lee, E. (2015), High frequency trading in the Korean index futures market, *Journal of Futures Markets* 35, 31-51.

Massa, M. and Z. Rehman (2008), Information flows within financial conglomerates: Evidence from the banks-mutual fund relation, *Journal of Financial Economics* 89, 288-306.

Richards, A. (2005), Big fish in small ponds: The trading behavior and price impact of foreign investors in Asian emerging equity markets, *Journal of Financial and Quantitative Analysis* 40, 1-27.

Seasholes, M. and N. Zhu (2010), Individual investors and local bias, *Journal of Finance* 65, 1987-2011.

Sims, C. (1972), Money, income, and causality, *American Economic Review* 62, 540-552.

Sims, C. (1986), Macroeconmics and reality, *Econometrica* 48, 1-48.

Appendix A. More on the monthly trading volumes for the U.K., the U.S., and the Cayman Islands

Table A1. Monthly trading volumes of 10 types of foreign investors for the U.K., the U.S., and the Cayman Islands [2009/04-2014/05] (Unit: Million)

This table shows the trading volumes of various investor types for the U.K., U.S., and the Cayman Islands in descending order of the U.K. institutions' trading volume for 2009/04-2014/05 (62 months). Trading volume is the average of buy and sell volumes. All values are converted into US dollars by the exchange rate of Korean won 1,300/US dollar. [% sum] is the proportion of each type's average to the sum. There are round-off errors in summing all the figures.

Panel A. Equity trading: KOSPI market

	United Kingdom (1)[a]		United States (2)		Cayman Islands (3)	
	Trading vol.	[% sum]	Trading vol.	[%sum]	Trading vol.	[% sum]
1. Investment banks	$2,760	[57.13%]	$452	[19.55%]	$1	[0.20%]
2. Mutual funds	$972	[20.13%]	$1,222	[52.85%]	$394	[52.27%]
3. Other companies	$829	[17.15%]	$374	[16.15%]	$339	[45.01%]
4. Commercial banks	$151	[3.12%]	$10	[0.45%]	$2	[0.28%]
5. Pension funds	$64	[1.32%]	$141	[6.12%]	$0	[0.02%]
6. Insurance companies	$44	[0.92%]	$21	[0.92%]	$0	[0.00%]
7. State/Local governments	$6	[0.13%]	$5	[0.21%]	$1	[0.16%]
8. Other financials	$4	[0.07%]	$19	[0.82%]	$13	[1.79%]
9. Individuals	$1	[0.03%]	$68	[2.92%]	$0	[0.02%]
10. Private funds	$0	[0.00%]	$0	[0.01%]	$2	[0.26%]
Sum	$4,832		$2,313		$753	

Panel B. Equity futures trading: KOSPI 200 futures

	United Kingdom (1)[b]		United States (7)		Cayman Islands (2)	
	Trading volume	[% sum]	Trading volume	[% sum]	Trading volume	[% sum]
1. Other companies	$17,078	[47.93%]	$420	[6.41%]	$27,025	[83.53%]
2. Investment banks	$10,139	[28.46%]	$4,653	[71.09%]	$139	[0.43%]
3. Commercial banks	$5,519	[15.49%]	$0	[0.00%]	$0	[0.00%]
4. Mutual funds	$2,739	[7.69%]	$1,135	[17.34%]	$5,187	[16.02%]
5. Other financials	$128	[0.36%]	$279	[4.26%]	$7	[0.02%]
6. Insurance companies	$26	[0.07%]	$0	[0.00%]	$0	[0.00%]
7. Pension funds	$0	[0.00%]	$1	[0.01%]	$0	[0.00%]
8. Individuals	$0	[0.00%]	$58	[0.89%]	$0	[0.00%]
Sum	$35,628		$6,546		$32,375	

a. Ranks of equity trading volumes among all foreign countries

b. Rank of equity futures trading volumes among all foreign countries

Sources: Korea Exchange

Appendix B. Estimation of monthly returns

Monthly market returns are estimated as follows:

$$R_{M,t}^{\text{KOSPI or KOSDAQ}} = (\text{MarketCap}_t - \text{Listing}_t - \text{Seasoned}_t - \text{MarketCap}_{t-1})/\text{MarketCap}_{t-1} \quad \text{(B-1)}$$

where $\text{MarketCap}_t =$ Market capitalization at the end of month t;

$\text{Listing}_t =$ New listing amount including re-listed and transfered firms from other markets in month t;

$\text{Seasoned}_t =$ Seasoned equity offerings (in value) in month t.

The KOSPI market is estimated using Equation (B-1). Information on listings and seasoned equity offerings are downloaded from Firm-Disclosure Channel of the Korea Exchange. The KOSDAQ market return is also estimated using Equation (B-1), but this results in an excessively overestimated return on the KOSDAQ market, possibly due to missing observations in the listed amounts, leading to an overly reduced listed amount. We correct for this outcome by multiplying the listing amount by 2.05 to make it closest to the actual returns of the KOSDAQ market. As this correction affects both domestic and foreign returns, it does not influence the comparison of the returns of domestic and foreign investors.

The monthly returns of foreign investors are estimated as follow:

$$R_t^{\text{Foreign}} = \frac{\text{F\_Ownership}_t - r1_t^F \times \text{Listing}_t - r2_{t-1}^F \times \text{Seasoned}_t - \text{F\_netbuy}_t - \text{F\_Ownership}_{t-1}}{\text{F\_Ownership}_{t-1}} \quad \text{(B-2)}$$

where $\text{F\_Ownership}_t =$ Foreign ownership at the end of month t;

$r1_t^F = \begin{cases} 0 & , \quad t \leq 199912 \\ 0.1 & , \quad t \geq 200001 \end{cases}$: Adjustment ratio for foreign investors;

$r2_{t-1}^F = \frac{Foreign\ ownership_{t-1}}{MarketCap_{t-1}}$: Foreign ownership ratio at the end of previous month;

F_net_buy_t: Foreign net buy volume (in value) in month t.

Until 1999, firms listing in the KOSPI market were irrelevant to foreign investors' returns. However, starting from 2000, the listing became relevant to the returns of foreign investors in the following cases: (a) Foreign Direct Investment (henceforth FDI) firms are listed; (b) when firms partially invested in by foreign investors move their listing from the KOSDAQ market to the KOSPI market; (c) when firms are relisted in which foreign investors are partially invested. In these three cases, the listing is related to foreign investors' returns. The listing of FDI firms is exceedingly rare; few firms in the KOSDAQ market had foreign ownership exceeding 10% when they moved their listings from the KOSDAQ market to the KOSPI market; it is rare for a delisted firm with more than 10% foreign ownership to be listed on the KOSPI market. Assuming that foreign investors are allocated 10% of the value of the firms listed since 2000, their monthly returns are underestimated. The monthly returns of foreign investors in each country are also estimated using Equation (B-2); however, $r1_t^F$ and $r2_{t-1}^F$ are allocated according to each country's ownership proportion in the aggregate foreign ownership. For example, if

U.S. ownership in the previous end of month accounts for 40% of the aggregate foreign ownership, then $r1_t^{U.S.} = 0.4 \times r1_{t-1}^{F},\ r2_{t-1}^{U.S.} = 0.4 \times r2_{t-1}^{F}$.

In the case of the KOSDAQ market, foreign investors have little opportunity to participate in initial public offerings. This is also inconsequential even with regard to relisting. Moreover, no foreign ownership is involved in stocks moving from the KONEX to the KOSDAQ, and FDI firms are rarely listed on the KOSDAQ market. Nevertheless, exceptional cases may exist; therefore, 3% of the total listing is considered as allocated to foreign investors in the KOSDAQ listing. This adjustment is also a factor in underestimating returns for foreign investors in the KOSDAQ market.

Table 1. Data sources and sample periods

	Sample period	Data Sources
Panel A. Aggregate market level		
Investors' trading volume	1992/01-1999/12 (D)[a]	Subscription from Korea Exchange
	2000/01-2023/12 (D)	Information Data System of Korea Exchange[b]
Foreign ownership	1992/01-2005/09 (M)	Financial Supervisory Service website[c]
	2005/10-2023/12 (D)	Information Data System of Korea Exchange
Capital changes	1994/01-2023/12 (M)	Firm-Disclosure Channel of Korea Exchange[d]
Market capitalizations	1992/01-2023/12 (M)	Information Data System of Korea Exchange and Datastream
Panel B. Country level[e]		
Foreign trading volume (15 countries)	1999/01-2023/06 (M)	Subscription from Korea Exchange
Foreign trading volume (8 countries)	1999/01-2023/06 (D)	Subscription from Korea Exchange
Foreign ownership	2012/01-2023/12 (M)	Financial Supervisory Service
Panel C. Type-of-investors level[e]		
Foreigners' trading volume (10 types of investors)	1999/01-2023/06 (M)	Subscription from Korea Exchange
Panel D. Market returns		
KOSPI and KOSDAQ index	1992/01-1998/12 (D)	Information Data System of Korea Exchange
MSCI PI index	1992/01-2023/12 (D)	DataStream
Individual-country index	1992/01-2023/12 (D)	DataStream
The other required data	1992/01-2023/12 (D)	DataStream

a. Data frequency: D (daily), M (monthly)
b. Information Data System of Korea Exchange (http://www.fss.or.kr)
c. Financial Supervisory Service website (http://www.fss.or.kr
d. Firm-Disclosure Channel of Korea Exchange (https://kind.krx.co.kr)
e. For the KOSDAQ market, there exist a reliable data set from April 2009.

Table 2. Descriptive statistics (Unit: Million)

This table shows the average monthly trading volumes (in dollars) of foreign and individual investors, and other related statistics for the KOSPI and KOSDAQ markets. (Yearly) turnover ratio is calculated by dividing the lesser of buy or sell volumes (in dollars) in a year by average equity ownership for each investor type. Average equity ownership is calculated by the arithmetic average of the beginning- and end-of-year equity ownerships. Trading volume is an average of buying and selling values. All values are converted into US dollars by the exchange rate of Korean won 1,300/US dollar. [% sum] is the ratio of foreign or individual investors' trading volume to that of the market. Foreign ownership ratio is calculated by dividing the end-of-month foreign ownership by market capitalization. Nobs is the number of observations.

	1992-1999 (8 yrs.) First sub-period [Nobs=96]	2000-2011 (12 yrs.) Second sub-period [Nobs=144]	2012-2023 (12 yrs.) Third sub-period [Nobs=144]
Panel A. KOSPI market			
Market return / Volatility	1.06% / 10.51%	0.68% / 7.51%	0.36% / 4.51%
Market trading volume	$16,013	$63,182	$112,915
(Yearly) turnover ratio			
Domestic investors	163.66%	148.09%	83.81%
Foreign investors	50.83%	87.32%	79.28%
Individual investors' trading			
Buy [% sum]: (C)	$11,796 [73.69%]	$36,603 [57.93%]	$62,413 [55.27%]
Sell [% sum]: (D)	$11,863 [74.11%]	$37,767 [58.19%]	$62,064 [54.95%]
Net buy [% sum]	-$67 [-0.42%]	-$164 [-0.26%]	$36 [0.33%]
Corr. btw. (C) and (D)	99.96%	99.85%	99.89%
Foreign investors' trading			
Buy [% sum]: (A)	$851 [5.32%]	$12,341 [19.53%]	$27,292 [24.17%]
Sell [% sum]: (B)	$701 [4.38%]	$12,308 [19.48%]	$27,364 [24.23%]
Net buy [% sum]	$150 [0.94%]	$33 [0.05%]	-$72 [-0.06%]
Corr. btw. (A) and (B)	87.95%	96.98%	97.62%
Foreign ownership ratio			
Average	12.25%	34.98%	34.63%
Minimum	3.64%	23.38%	30.64%
Maximum	22.04%	43.87%	38.95%
Panel B. KOSDAQ market			
Market return / Volatility		-0.50% / 11.42%	0.56% / 5.94%
Market trading volume		$26,579	$86,033
(Yearly) turnover ratio			
Domestic investors		659.21%	466.89%
Foreign investors		148.91%	435.30%
Individual investors' trading			
Buy [% sum]: (G)		$24,721 [93.01%]	$73,839 [85.83%]
Sell [% sum]: (H)		$24,643 [92.72%]	$73,499 [85.43%]
Net buy [% of sum]		$79 [0.30%]	$340 [0.40%]
Corr. btw. (G) and (H)		99.99%	99.99%
Foreign investors' trading			
Buy [% sum]: (A)		$737 [2.77%]	$8,336 [9.69%]
Sell [% sum]: (B)		$729 [2.74%]	$8,325 [9.68%]
Net buy [% sum]		$8 [0.03%]	$11 [0.01%]
Corr. btw. (A) and (B)		89.99%	99.87%
Foreign ownership ratio			
Average		11.75%	9.97%
Minimum		6.40%	7.77%
Maximum		20.94%	13.69%

Table 3. Monthly trading volumes of 15 foreign countries (Unit: Million)

This table presents monthly average trading volumes (in dollars) of 15 major foreign countries in descending order based on their sizes for the third sub-period. Trading volume by country is an average of its buy and sell volumes. The data for the last six months (from July 2023 to December 2023) could not be used due to the data unavailability. Hence, the sum of all net buys could be slightly different from those in Table 2. All values are converted into US dollars by the exchange rate of Korean won 1,300/US dollar. [% sum] is the ratio of each average to the sum. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively, in two tailed t-tests. (Critical values for two tailed t-tests are 1.66, 1,98, and 2.62 at 10%, 5%, and 1% with the degree of freedom of 120, respectively.) Nobs is the number of observations.

	2000-2011 (12 yrs.) Second sub-period [Nobs=144]			2012-2023/06 (11.5 yrs.) Third sub-period [Nobs=138]		
	Trading volume	[% sum]	Net buy	Trading volume	[% sum]	Net buy
Panel A. KOSPI market						
1. United Kingdom	$2,988	[24.24%]	-$94 **	$9,210	[34.27%]	-$145 **
2. United States	$2,142	[17.38%]	$158 ***	$1,600	[5.97%]	-$60
3. Singapore	$403	[3.27%]	-$17	$1,377	[5.14%]	-$34
4. Cayman Islands	$783	[6.35%]	-$21	$1,198	[4.47%]	-$8
5. Switzerland	$391	[3.17%]	-$12	$1,051	[3.92%]	-$4
6. Ireland	$327	[2.65%]	$18 **	$770	[2.87%]	$22 **
7. Hong Kong	$408	[3.31%]	-$15	$603	[2.25%]	-$28 **
8. Luxembourg	$483	[3.92%]	$10	$563	[2.10%]	-$24 **
9. Australia	$146	[1.19%]	-$2	$442	[1.65%]	-$29
10. Japan	$111	[0.90%]	$9	$255	[0.95%]	-$12
11. Norway	$92	[0.75%]	$20 ***	$207	[0.77%]	$31 **
12. Canada	$137	[1.11%]	$16 ***	$198	[0.74%]	-$20
13. Netherlands	$273	[2.22%]	-$11	$143	[0.53%]	-$34
14. China	$32	[0.26%]	$14 ***	$139	[0.52%]	$32 ***
15. Saudi Arabia	$101	[0.82%]	$32 ***	$88	[0.33%]	-$45 ***
The others	$3,507	[28.46%]	-$70	$8,954	[33.41%]	$288 **
Sum	$12,324		$33	$26,798		-$70
Panel B. KOSDAQ market						
1. United Kingdom				$3,877	[50.47%]	-$51 ***
2. Cayman Islands				$844	[10.98%]	-$17 ***
3. Australia				$474	[6.17%]	-$3 **
4. Singapore				$454	[5.91%]	-$7
5. Switzerland				$428	[5.57%]	-$4
6. Ireland				$404	[5.26%]	-$2
7. Hong Kong				$195	[2.54%]	-$6 ***
8. United States				$139	[1.81%]	$5 *
9. Luxembourg				$73	[0.95%]	-$2
10. China				$72	[0.93%]	$1
11. Canada				$35	[0.45%]	-$1
12. Norway				$33	[0.43%]	$6 ***
13. Japan				$19	[0.25%]	-$1
14. Netherlands				$10	[0.43%]	-$7 **
15. Saudi Arabia				$2	[0.03%]	-$1 ***
The others				$623	[8.11%]	$82 ***
Sum				$7,682		-$8

Table 4. Monthly trading volumes of 10 types of foreign investors for the period of 2012/01-2023/06 (Unit: Million)

This table presents monthly average trading volumes (in dollars) of various types of investors in descending order based on those of non-resident foreign investors for the third sub-period (from January 2012 to June 2023). Trading volume is an average of buy and sell volumes. The data for the last six months (from July 2023 to December 2023) could not be used due to the data unavailability. Hence, the sum of all net buys is slightly different from those in Table 2. All values are converted into US dollars by the exchange rate of Korean won 1,300/US dollar. [% sum] is the ratio of each average to the sum. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively, in two tailed t-tests. (Critical values for two tailed t-tests are 1.66, 1,98, and 2.62 at 10%, 5%, and 1% with the degree of freedom of 120, respectively.) The number of observations is 138 for all types of investors.

	Non-resident foreign investors			Resident foreign investors		
	Trading vol.	[%sum]	Net buy	Trading vol.	[% sum]	Net buy
Panel A. KOSPI market						
1. Investment banks	$9,942	[47.63%]	-$40	$5,747	[97.03%]	$211 **
2. Mutual funds	$3,854	[18.46%]	-$1	$4	[0.06%]	$1 **
3. Other financials	$2,270	[10.88%]	-$56 **	$0	[0.00%]	$0 **
4. Commercial banks	$2,122	[10.16%]	-$5	$1	[0.00%]	$0
5. Other companies	$2,031	[9.73%]	-$116	$8	[0.13%]	-$3 **
6. Pension funds	$435	[2.09%]	-$31 *	$1	[0.01%]	$0
7. State/Local governments	$111	[0.53%]	-$9	$0	[0.00%]	$0
8. Insurance companies	$76	[0.36%]	-$13 ***	$9	[0.16%]	-$1
9. Individuals	$24	[0.11%]	-$6 ***	$154	[2.59%]	-$1
10. Private funds	$10	[0.05%]	-$1	$0	[0.00%]	$0
Sum	$20,874		-$277 *	$5,924		$207 **
Panel B. KOSDAQ market						
1. Investment banks	$4,088	[56.44%]	-$40 **	$270	[61.60%]	$67 ***
2. Mutual funds	$1,026	[14.17%]	-$11 **	$0	[0.00%]	$0
3. Other financials	$981	[13.55%]	-$16 ***	$0	[0.11%]	$0 *
4. Commercial banks	$583	[8.05%]	$2	$0	[0.02%]	$0
5. Other companies	$521	[7.19%]	-$4	$0	[0.06%]	$0
6. Pension funds	$20	[0.28%]	$2 *	$0	[0.01%]	$0
7. State/Local governments	$14	[0.20%]	-$7 ***	$167	[38.60%]	-$1 *
8. Insurance companies	$4	[0.06%]	-$16	$0	[0.00%]	$0
9. Individuals	$3	[0.04%]	$0	$0	[0.00%]	$0
10. Private funds	$2	[0.03%]	-$4	$1	[0.21%]	$0
Sum	$7,243		-$74 ***	$438		$66 ***

Table 5. Cross-correlations of foreign net-buy ratios between investment groups

This table shows the cross-correlations of foreign net-buy ratios between countries and between various types of investors. Panel A presents daily cross-correlations of foreign net-buy ratios between the U.K. (the U.S. and Cayman Islands) and other countries. Panel B presents monthly cross-correlations of foreign net-buy ratios between the U.K. (the U.S. and Cayman Islands) and other countries. Panel C. presents monthly cross-correlations of foreign net-buy ratios between investment banks (mutual funds) and other types of investors. The sample period is 2000/01-2023/06 for the KOSPI market and 2011/01-2023/06 for the KOSDAQ market.

	KOSPI market		KOSDAQ market	
Panel A. Daily correlations between countries				
	U.K.	U.S.	U.K.	Cayman Islands
1. United States	0.1425 ***		0.0658 ***	-0.0534 ***
2. Cayman Islands	0.1243 ***	0.2275 ***	-0.0283 **	-
3. Singapore	0.0870 ***	0.0489 ***	-0.0014	0.1325 ***
4. Ireland	0.0685 ***	0.0495 ***	0.0001	0.0155
5. Hong Kong	0.0765 ***	0.0737 ***	-0.0079	0.3188 ***
6. Luxembourg	0.1393 ***	0.2480 ***	0.0002	0.0096
7. Canada	0.0424 ***	0.1848 ***	-0.0101	0.2138 ***
The others	0.0558 ***	0.2068 ***	0.0700 ***	0.0071
Panel B. Monthly correlations between countries				
	U.K.	U.S.	U.K.	Cayman Islands
1. United States	0.3068 ***		-0.0286	0.0992 *
2. Cayman Island	0.2249 ***	0.2820 ***	-0.2562 ***	-
3. Singapore	0.2159 ***	0.0495	-0.0583	0.2318 ***
4. Switzerland	0.2212 ***	-0.0074	0.2454 ***	0.1164 *
5. Ireland	0.1588 ***	0.0367	0.1207 **	-0.1474 **
6. Hong Kong	0.1772 ***	0.2731 ***	0.0635	0.0384
7. Luxembourg	0.2937 ***	0.4057 ***	0.1127 *	0.0165
8. Australia	0.2212 ***	0.2385 ***	0.1034 *	0.1831 ***
9. Japan	-0.0257	0.0960	0.0317	0.0997 *
10. Norway	-0.0663	-0.0064	0.0064	0.1325 **
11. Canada	0.0936	0.3851 ***	-0.1121 *	-0.0540
12. Netherlands	0.2493 ***	0.2130 ***	-0.1178 **	0.0583
13. China	0.0090	-0.0205	-0.0149	-0.0897
14. Saudi Arabia	-0.0860	0.0725	0.0523	-0.0525
The others	0.2197 ***	0.3067 ***	0.1320 **	0.0272
Panel C. Monthly correlations between various types of foreign investors				
	Investment banks	Mutual funds	Investment banks	Mutual funds
1. Mutual funds	0.2276 ***		0.0349	
2. Other companies	0.3402 ***	0.3394 ***	-0.1288 **	0.1076 *
3. Commercial banks	0.2082 ***	0.2345 ***	0.1849 ***	0.0339
4. Pension funds	-0.0480	0.5737 ***	0.2877 ***	0.0796
5. Insurance companies	-0.0062	0.2741 ***	0.0481	-0.0653
6. State/Local governments	-0.1982 ***	-0.1571 ***	0.0749	0.0625
7. Other financials	0.2860 ***	0.0746	0.1670 ***	0.3547 ***
8. Private funds	0.1313 ***	0.0479	0.0669	-0.3612 ***
9. Individuals	-0.0450	0.0673	-0.2166 ***	0.0732

Table 6. KOSPI and KOSDAQ returns, foreign net-buy ratios, and their correlations

This table shows the average daily and monthly KOSPI and KOSDAQ returns, foreign (and individuals') net-buy ratios, and their correlations. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively, in two tailed t-tests.

	1992-1999 (8 yrs.) First sub-period		2000-2011 (12 yrs.) Second sub-period		2012-2023 (12 yrs.) Third sub-period		2000-2023 (24 yrs.) Recent entire period		1992-2023 (32 yrs.) Entire period	
Panel A: Daily KOSPI market										
KOSPI returns	0.0386%		0.0353%		0.0175%		0.0264%		0.0299%	*
Foreign net-buy ratios (fnbr)[a]	0.0077%	***	0.0032%		-0.0000%		0.0016%	***	0.0033%	***
Correlation with KOSPI returns	***0.1015***	***	***0.3479***	***	***0.4753***	***	***0.3741***	***	***0.2797***	***
Individuals' net-buy ratios (inbr)[b]	-0.0035%	***	-0.0031%	***	0.0008	*	-0.0012%	***	-0.0018%	***
Correlation with KOSPI returns	***-0.0595***	***	***-0.5149***	***	***-0.6294***	***	***-0.5425***	***	***-0.3664***	***
Panel B: Monthly KOSPI market										
KOSPI returns	1.0576%		0.6821%		0.3621%		0.5221%		0.6560%	*
Foreign net-buy ratios (fnbr)	0.1970%	***	0.0770%	**	0.0025%		0.0397%	**	0.0790%	***
Correlation with KOSPI returns	***0.5497***	***	***0.4883***	***	***0.5228***	***	***0.4936***	***	***0.5123***	***
Individuals' net-buy ratio (inbr)	-0.0885%	**	-0.0686%	***	0.0164%		-0.0261%	*	-0.0338%	***
Correlation with KOSPI returns	***-0.5051***	***	***-0.6452***	***	***-0.3690***	***	***-0.5407***	***	***-0.5239***	***
Panel C: Daily KOSDAQ market										
KOSPI returns			-0.0333%		0.0277%		-0.0029%			
Foreign net-buy ratios (fnbr)			0.0025%	***	0.0009%	*	0.0017%	***		
Correlation with KOSPI returns			***0.1739***	***	***0.4719***	***	***0.2660***	***		
Individuals' net-buy ratio (inbr)			0.0069%	***	0.0073%	***	0.0071%	***		
Correlation with KOSPI returns			***-0.1805***	***	***-0.5016***	***	***-0.3001***	***		
Panel D: Monthly KOSDAQ market										
KOSPI returns			-0.5027%		0.5621%		0.0297%			
Foreign net-buy ratios (fnbr)			0.0573%	*	0.0177%		0.0375%	**		
Correlation with KOSPI returns			***0.3320***	***	***0.4282***	***	***0.3429***	***		
Individuals' net-buy ratio (inbr)			0.0149%	***	0.1557%	***	0.1488%	***		
Correlation with KOSPI returns			***-0.2939***	***	***-0.1437***	*	***-0.2482***	***		

a. Fnbr is defined by foreign net buys divided by previous month's market capitalization, which is used by Griffin et al. (2004) and Richards (2005).

b. Inbr is defined by individual investors' net buys divided by previous month's market capitalization.

Table 7. Daily two-sided regressions of foreign investors' net-buy ratios on market returns

This table presents the results of Sims's two-sided regressions for the KOSPI and KOSDAQ markets. Coefficients of constants are not displayed due to space limitations. In parentheses are t-values. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively, in two tailed t-tests. F1 (net buy to returns) and F2 (returns to net buy) are F-statistics for Granger causality tests. Foreign net-buy ratio is defined by their net buys divided by previous month's market capitalization. Foreign net-buy ratios are multiplied by 100.

	β_{-1}	β_0	β_1	β_2	β_3	β_4	β_5	β_6	F1	F2	Adj. R^2
Panel A. KOSPI market											
1992/01-1999/12	0.0848	0.1377	0.4916	0.1754	0.1150	0.0774	0.1422	0.0843	4.71**	38.31***	9.82%
	(2.17) **	(3.49) ***	(12.46) ***	(4.45) ***	(2.91) ***	(1.96) **	(3.61) ***	2.16 **			
2000/01-2011/12	0.1132	0.7995	0.8321	0.2292	0.1497	0.1552	0.1200	0.1350	9.65***	101.67***	26.99%
	(3.11) ***	(21.94) ***	(22.82) ***	(6.29) ***	(4.11) ***	(4.26) ***	(3.30) ***	(3.71) ***			
2012/01-2023/12	0.0178	0.9686	0.4452	0.2306	0.1209	0.1129	0.1296	0.1319	0.31	54.05***	30.08%
	(0.56)	(30.48) ***	(13.98) ***	(7.24) ***	(3.80) ***	(3.54) ***	(4.08) ***	(4.15) ***			
2000/01-2023/12	0.0824	0.8420	0.7393	0.2346	0.1369	0.1436	0.1256	0.1294	10.72***	176.36***	27.01%
	(3.27) ***	(33.48) ***	(29.40) ***	(9.33) ***	(5.45) ***	(5.71) ***	(5.00) ***	(5.15) ***			
1992/01-2023/12	0.0642	0.5745	0.6260	0.2092	0.1224	0.1188	0.1345	0.1221	8.90***	183.99***	18.71%
	(2.98) ***	(26.65) ***	(29.4) ***	(9.71) ***	(5.68) ***	(5.51) ***	(6.24) ***	(5.68) ***			
Panel B. KOSDAQ market											
2000/01-2011/12	0.0866	0.2835	0.3428	-0.0070	-0.0340	0.0181	0.0178	0.0361	6.20**	16.63***	6.14%
	(2.49) **	(8.11) ***	(9.82) ***	(-0.20)	(-0.97)	(0.52)	(0.51)	(1.04)			
2012/01-2023/12	0.0981	1.0057	-0.6976	-0.0918	-0.0606	0.0276	0.0403	0.1195	10.19***	94.21***	34.72%
	(3.19) **	(32.71) ***	(-22.68) ***	(-2.99) ***	(-1.97) **	(0.90)	(1.31)	(3.89) ***			
2000/01-2023/12	0.0782	0.5193	0.0178	-0.0157	-0.0450	0.0123	0.0357	0.0662	9.90***	2.35**	7.30%
	(3.15) ***	(20.81) ***	(0.71)	(-0.63)	(-1.81) *	(0.49)	(1.43)	(2.67) ***			

Table 8. Monthly two-sided regressions of market returns on the net buys of foreign investors

This table presents the results of Sims's two-sided regressions for the KOSPI and KOSDAQ markets. For the KOSPI market, the sample period runs from 2000/01-2023/12 due to data unavailability. Coefficients of constants are not displayed due to space limitations. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively, in two tailed t-tests. Foreign net-buy ratio is defined by their net buys divided by previous month's market capitalization. Foreign net-buy ratios are multiplied by 100.

	β_{-1}	β_0	β_1	Adj. R^2
Panel A. KOSPI market				
1992/01-1999/12	0.2690	1.7417	1.2728	31.76%
	(0.76)	(4.85) ***	(3.62) ***	
2000/01-2011/12	-0.2045	2.7009	-0.0578	21.99%
	(-0.50)	(6.58) ***	(-0.14)	
2012/01/2023/12	-0.4324	2.4626	0.3815	28.41%
	(-1.31)	(7.44) ***	(1.13)	
2001/01-2023/12	-0.2447	2.6433	0.0811	23.87%
	(-0.89)	(9.59) ***	(0.29)	
1992/01-2023/12	-0.0465	2.2996	0.6346	24.82%
	(-0.22)	(10.61) ***	(2.94) ***	
Panel B. KOSDAQ market				
2000/01-2011/12	-0.2133	0.9857	-0.0837	7.94%
	(-0.78)	(3.78) ***	(-0.33)	
2012/01/2023/12	-0.1470	1.1842	-0.0228	19.01%
	(-0.73)	(5.90) ***	(-0.11)	
2001/01-2023/12	-0.2153	1.0169	-0.0843	10.41%
	(-1.19)	(5.81) ***	(-0.49)	

Table 9. Daily estimation of structural VAR

This table shows the test results of contemporaneous effects and temporary effects including price pressure effect of foreign net buys on the market return for the KOSPI and KOSDAQ markets. Based on the SBC criterion, the lag lengths are 5 for the KOSPI market and 2 for the KOSDAQ market. T-statistics are in parentheses, and χ^2-statistics are in brackets. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively. Foreign net-buy ratios are multiplied by 100.

	1992-1999 (8 yrs.) First sub-period	2000-2011 (12 yrs.) Second sub-period	2012-2023 (12 yrs.) Third sub-period	2000-2023 (24 yrs.) Recent entire period	1992-2023 (32 yrs.) Entire period
Panel A. KOSPI market					
1. S&P 500 return → Foreign net buy: c_{21}^0	0.2968	0.9857	0.5464	0.8002	0.7173
H_0: $c_{21}^0 = 0$ (t-statistics)	(3.52)***	(22.11)***	(17.51)***	(27.46)***	(25.69)***
H_0: $C_{21}(1) = 0$ [$\chi^2(1)$ statistics]	[36.21]***	[659.01]***	[295.68]***	[983.90]***	[894.69]***
2. S&P 500 return → KOSPI return: c_{31}^0	0.3062	0.5187	0.3648	0.4575	0.4191
H_0: $c_{31}^0 = 0$ (t-statistics)	(6.43)***	(23.01)***	(21.76)***	(29.34)***	(28.39)***
H_0: $C_{31}(1) = 0$ [$\chi^2(1)$ statistics]	[230.07]***	[777.53]***	[1089.47]***	[1670.32]***	[1645.41]***
3. Foreign net buy → KOSPI return: c_{32}^0	0.0246	0.1434	0.2622	0.1704	0.1219
H_0: $c_{32}^0 = 0$ (t-statistics)	(1.95)*	(16.04)***	(29.84)***	(26.10)***	(21.05)***
Test of price pressure effect					
H_0: $C_{32}(1) = 0$ [$\chi^2(1)$ statistics]	[214.51]***	[476.34]***	[855.38]***	[1141.48]***	[1245.99]***
Panel B. KOSDAQ market					
1. S&P 500 return → Foreign net buy: c_{21}^0		0.3896	0.2724	0.2977	
H_0: $c_{21}^0 = 0$ (t-statistics)		(7.79)***	(5.94)***	(8.21)***	
H_0: $C_{21}(1) = 0$ [$\chi^2(1)$ statistics]		[75.23]***	[53.49]***	[108.46]***	
2. S&P 500 return → KOSDAQ return: c_{31}^0		0.4272	0.3383	0.3888	
H_0: $c_{31}^0 = 0$ (t-statistics)		(16.00)***	(14.36)***	(21.40)***	
H_0: $C_{31}(1) = 0$ [$\chi^2(1)$ statistics]		[263.80]***	[1250.05]***	[846.57]***	
3. Foreign net buy → KOSDAQ return: c_{32}^0		0.0599	0.2653	0.1247	
H_0: $c_{32}^0 = 0$ (t-statistics)		(6.15)***	(32.22)***	(19.50)***	
Test of price pressure effect					
H_0: $C_{32}(1) = 0$ [$\chi^2(1)$ statistics]		[121.84]***	[1157.67]***	[607.74]***	

Table 10. Decomposition of variance from the daily SVAR estimation (Unit: %)
This table shows the results of variance decompositions for the KOSPI (1992/01-2023/12) and KOSDAQ (2000/01-2023/12) markets obtained from the daily SVAR estimation.

	KOSPI market			KOSDAQ market		
	S&P 500	Fnbr	KOSPI	S&P 500	Fnbr	KOSDAQ
Panel A. Decomposition of variance for foreign net-buy ratios (fnbr)						
1	7.70	92.30	0.00	1.15	98.85	0.00
2	8.31	87.01	4.67	1.86	98.02	0.12
3	8.89	86.57	4.54	1.83	97.95	0.23
4	9.10	86.45	4.43	1.83	97.92	0.25
5	9.13	86.50	4.37	1.83	97.91	0.26
6	9.03	86.70	4.27	1.83	97.91	0.26
7	9.03	86.74	4.24	1.83	97.91	0.26
8	9.04	86.75	4.22	1.83	97.91	0.26
9	9.05	86.75	4.20	1.83	97.91	0.26
10	9.05	86.76	4.19	1.83	97.91	0.26
Panel B. Decomposition of variance for market returns						
1	9.26	4.82	85.92	7.24	5.68	87.09
2	9.33	4.91	85.76	7.20	5.89	86.91
3	9.41	4.91	85.67	7.70	5.93	86.37
4	9.41	4.95	85.64	7.70	5.95	86.35
5	9.40	4.94	85.66	7.70	5.95	86.35
6	9.40	4.94	85.67	7.70	5.95	86.35
7	9.39	4.94	85.66	7.70	5.95	86.35
8	9.39	4.95	85.66	7.70	5.95	86.35
9	9.39	4.95	85.65	7.70	5.95	86.35
10	9.39	4.96	85.65	7.70	5.95	86.35

Table 11. Monthly estimation of structural VAR

This table shows the test results of contemporaneous effects and temporary effects including price pressure effect of foreign net buys on the market return for the KOSPI and KOSDAQ markets. Based on the SBC criterion, the lag lengths are 1 for both the KOSPI and KOSDAQ markets. T-statistics are in parentheses, and χ^2-statistics are in brackets. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively. Foreign net-buy ratios are multiplied by 100.

	1992-1999 (8 yrs.) First sub-period	2000-2011 (12 yrs.) Second sub-period	2012-2023 (12 yrs.) Third sub-period	2000-2023 (24 yrs.) Recent entire period	1992-2023 (32 yrs.) Entire period
Panel A. KOSPI market					
1. S&P 500 return → Foreign net buy: c_{21}^0	3.0527	3.7266	2.0011	2.8755	2.9473
H_0: $c_{21}^0 = 0$ (t-statistics)	(2.66)***	(6.54)***	(5.67)***	(8.33)***	(8.11)***
H_0: $C_{21}(1) = 0$ [$\chi^2(1)$ statistics]	[9.29]***	[26.12]***	[16.84]***	[37.20]***	[45.46]***
2. S&P 500 return → KOSPI return: c_{31}^0	0.6878	1.0472	0.8068	0.9230	0.8767
H_0: $c_{31}^0 = 0$ (t-statistics)	(2.30)**	(10.33)***	(13.26)***	(15.15)***	(11.34)***
H_0: $C_{31}(1) = 0$ [$\chi^2(1)$ statistics]	[40.92]***	[86.56]***	[115.83]***	[187.13]***	[182.51]***
3. Foreign net buy → KOSPI return: c_{31}^0	0.1432	0.0780	0.0821	0.0818	0.1055
H_0: $c_{31}^0 = 0$ (t-statistics)	(6.43)***	(5.75)***	(6.52)***	(8.61)***	(11.17)***
Test of price pressure effect					
H_0: $C_{31}(1) = 0$ [$\chi^2(1)$ statistics]	[37.21]***	[11.98]***	[9.49]***	[32.53]***	[88.82]***
Panel B. KOSDAQ market					
1. S&P 500 return → Foreign net buy: c_{21}^0		1.7542	1.0399	1.3468	
H_0: $c_{21}^0 = 0$ (t-statistics)		(3.01)***	(3.65)***	(4.04)***	
H_0: $C_{21}(1) = 0$ [$\chi^2(1)$ statistics]		[9.67]***	[33.81]***	[24.24]***	
2. S&P 500 return → KOSDAQ return: c_{31}^0		1.1019	0.9279	1.0079	
H_0: $c_{31}^0 = 0$ (t-statistics)		(6.14)***	(10.10)***	(9.69)***	
H_0: $C_{31}(1) = 0$ [$\chi^2(1)$ statistics]		[39.00]***	[80.74]***	[91.72]***	
3. Foreign net buy → KOSDAQ return: c_{32}^0		0.1037	0.1244	0.1064	
H_0: $c_{32}^0 = 0$ (t-statistics)		(4.19)***	(5.08)***	(0.1064)***	
Test of price pressure effect					
H_0: $C_{32}(1) = 0$ [$\chi^2(1)$ statistics]		[9.48]***	[13.82]***	[19.40]***	

Table 12. Decomposition of variance from the monthly SVAR estimation (Unit: %)
This table shows the results of variance decompositions for the KOSPI (1992/01-2023/12) and KOSDAQ (2000/01-2023/12) markets obtained from the monthly SVAR estimation.

	KOSPI market			KOSDAQ market		
	S&P 500	Fnbr	KOSPI	S&P 500	fnbr	KOSDAQ
Panel A. Decomposition of variance for foreign net-buy ratios (fnbr)						
1	14.58	85.42	0.00	5.41	94.59	0.00
2	13.52	85.55	0.93	6.15	87.62	6.24
3	13.20	85.54	1.26	6.26	86.89	6.85
4	13.11	85.53	1.36	6.29	86.73	6.99
5	13.08	85.53	1.39	6.29	86.70	7.01
6	13.07	85.53	1.40	6.29	86.69	7.02
7	13.07	85.53	1.41	6.29	86.69	7.02
8	13.07	85.53	1.41	6.29	86.69	7.02
9	13.07	85.53	1.41	6.29	86.69	7.02
10	13.07	85.53	1.41	6.29	86.69	7.02
Panel B. Decomposition of variance for market returns						
1	25.14	18.53	56.33	25.13	8.88	65.99
2	25.16	18.42	56.42	24.95	9.27	65.78
3	25.15	18.42	56.42	24.94	9.28	65.78
4	25.15	18.43	56.42	24.94	9.28	65.78
5	25.15	18.43	56.42	24.94	9.28	65.78
6	25.15	18.43	56.42	24.94	9.28	65.78
7	25.15	18.43	56.42	24.94	9.28	65.78
8	25.15	18.43	56.42	24.94	9.28	65.78
9	25.15	18.43	56.42	24.94	9.28	65.78
10	25.15	18.43	56.42	24.94	9.28	65.78

Table 13. Comparison of estimated monthly returns of foreign and domestic investors

This table shows the average monthly returns of foreign and domestic investors (excluding cash dividends) estimated from monthly foreign trading volumes and ownerships, capital changes by seasoned equity offerings and listings, and market capitalizations. MSCI PI is Morgan Stanly Capital International's (MSCI) price index. Except for those in Panel A, all monthly returns are estimated. All the (real and estimated) returns do not include dividend yields. (Dividend yield is usually 1.5% a year in Korea.) In parentheses are t-values. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively, in one tailed t-tests. (Critical values for one tailed t-tests are 1.29, 1,66, and 2.36 at 10%, 5%, and 1% with the degree of freedom of 120, respectively.) Nobs is the number of observations.

	1992-1999 (8 yrs.) First sub-period [Nobs=96]	2000-2011 (12 yrs.) Second sub-period [Nobs=144]	2012-2023 (12 yrs.) Third sub-period [Nobs=144]	2000-2023 (24 yrs.) Recent entire period [Nobs=288]	1992-2023 (32 yrs.) Entire period [Nobs=384]
Panel A: Real markets					
MSCI PI	1.32% (1.16)	0.88% (1.35)*	0.44% (1.13)	0.66% (1.73)**	0.80% (1.99)**
KOSPI	1.06% (0.99)	0.68% (1.09)	0.36% (0.96)	0.52% (1.43)*	0.66% (1.72)**
KOSDAQ		-0.50% (-0.53)	0.56% (1.13)	0.03% (0.06)	
KOSPI+KOSDAQ	1.06% (0.99)	0.48% (0.75)	0.38% (1.00)	0.43% (0.95)	0.59% (1.52)*
Panel B: Estimation of KOSPI market returns[a]					
KOSPI	1.03% (0.91)	0.70% (1.12)	0.41% (1.09)	0.55% (1.52)*	0.67% (1.71)**
Foreign investors (A)	1.86% (1.58)*	1.02% (1.64)*	0.53% (1.40)*	0.77% (2.13)**	1.05% (2.61)***
Domestic investors (B)	0.91% (0.80)	0.57% (0.89)	0.34% (0.90)	0.46% (1.23)	0.57% (1.43)*
Difference: (A) – (B)	0.95% (2.37)**	0.45% (1.78)**	0.19% (1.34)*	0.32% (2.21)**	0.45% (3.22)***
Panel C: Estimation of KOSDAQ market returns[b]					
KOSDAQ		-0.50% (-0.53)	0.56% (1.13)	0.03% (0.06)	
Foreign investors (C)		0.31% (0.29)	1.02% (2.06)**	0.66% (1.12)	
Domestic investors (D)		-0.55% (-0.58)	0.47% (0.93)	-0.04% (-0.07)	
Difference: (C) – (D)		0.86% (1.66)**	0.54% (2.48)***	0.70% (2.50)***	
Panel D: Estimation of KOSPI+KOSDAQ market returns					
KOSPI+KOSDAQ	1.03% (0.91)	0.48% (0.75)	0.41% (1.45)*	0.45% (0.99)	0.59% (1.49)*
Foreign investors (E)	1.86% (1.58)*	0.95% (1.52)*	0.55% (1.45)*	0.75% (1.69)**	1.02% (2.55)***
Domestic investors (F)	0.91% (0.80)	0.32% (0.48)	0.36% (0.90)	0.34% (0.72)	0.48% (1.18)
Difference: (E) - (F)	0.95% (2.37)***	0.63% (2.45)***	0.19% (1.24)	0.41% (2.26)**	0.59% (1.52)*

a. In the KOSPI market, the yearly returns of foreign investors are greater than those of the market and domestic investors for 23 years among 32 years.

b. In the KOSDAQ market, the yearly returns of foreign investors are greater than those of the market and domestic investors for 17 years among 24 years.

Table 14. Ownerships, estimated returns, and volatilities of 15 major foreign countries for the period of 2012/01-2023/06

This table shows ownerships, returns, and volatilities of 15 major foreign countries for the period of 2012/01-2023/06. Each country's ownership includes all stock holdings in the KOSPI and KOSDAQ markets. The unit of foreign ownership is $million (M). Turnover ratio is the average of annual turnover ratios for the period of 2012-2022 (11 years). All values are converted into US dollars by the exchange rate of Korean won 1,300/US dollar. [% sum] is the ratio of each type-of-investors' ownership to the sum of all foreign countries. In parentheses are t-values. Volatility (standard deviation) of each country's returns is represented in a percentage. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively, in two tailed t-tests. Yearly average returns are calculated by averaging annual returns for the period of 2012/01-2023/06 because of data unavailability. For the year of 2023, six months are deemed a year. Average dividend yield of 1.5% a year is added to the computed average annual returns.

	Foreign ownership		Turnover	Monthly return	Volatility	Yearly
	June 2023	[% sum]	ratio[a]		Std. Dev.	return
1. United States	$218,222	[41.01%]	13.10%	0.57% (1.39)*	4.77%	8.32%
2. United Kingdom	$49,004	[9.21%]	381.69%	0.98% (2.34)**	4.90%	12.40%
3. Luxembourg	$34,278	[6.44%]	29.73%	0.63% (1.50)*	4.95%	9.59%
4. Singapore	$33,255	[6.25%]	80.09%	0.81% (1.69)**	5.63%	10.62%
5. Ireland	$23,617	[4.44%]	97.45%	0.63% (1.42)*	5.23%	9.70%
6. Norway	$16,992	[3.19%]	23.93%	0.48% (1.14)	4.90%	7.31%
7. Canada	$14,649	[2.75%]	21.82%	0.74% (1.87)**	4.66%	10.55%
8. Netherlands	$13,273	[2.49%]	13.33%	0.86% (1.63)*	6.22%	11.55%
9. Australia	$12,207	[2.29%]	103.93%	1.17% (2.49)***	5.51%	16.01%
10. China	$11,556	[2.17%]	23.99%	0.42% (1.03)	4.83%	6.48%
11. Japan	$11,281	[2.12%]	37.68%	0.82% (1.88)**	5.11%	11.20%
12. Cayman Islands	$10,205	[1.92%]	249.95%	1.18% (2.41)***	5.75%	16.82%
13. Switzerland	$9,791	[1.84%]	234.27%	1.01% (2.05)**	5.82%	13.89%
14. Hong Kong	$7,087	[1.33%]	138.84%	2.27% (1.63)**	16.42%	29.91%
15. Saudi Arabia	$6,729	[1.26%]	7.37%	0.34% (0.76)	5.36%	6.92%
The others	$59,951	[11.27%]	205.28%	-0.37% (-0.88)	4.95%	-1.96%
Foreign investors	$532,096		91.76%	0.52% (1.36)*	4.51%	7.92%
Domestic investors	$1,355,799		196.19%	0.35% (0.89)[b]	4.58%	5.35%
Estimated				0.41% (1.08)	4.58%	6.44%
Real				0.37% (0.97)	4.46%	5.78%

a. The correlation coefficient between turnover ratios and monthly returns for foreign investors is 0.4473.

b. Domestic investors' returns are calculated as follow:

$$R_D = R_D^{KOSPI} \times \frac{Holding_D^{KOSPI}}{Holding_D^{KOSPI+KOSDAQ}} + R_D^{KOSDAQ} \times \frac{Holding_D^{KOSDAQ}}{Holding_D^{KOSPI+KOSDAQ}} .$$

Table 15. Decomposition of foreign investors' returns for estimating quasi-timing, quasi-selectivity, and excess market return over risk-free rate

This table shows the decomposed returns of foreign investors into various return measures. In parentheses are t-values. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively, in one tailed t-tests. (Critical values for one tailed t-tests are 1.29, 1,66, and 2.36 at 10%, 5%, and 1% with the degree of freedom of 120, respectively.) Nobs is the number of observations.

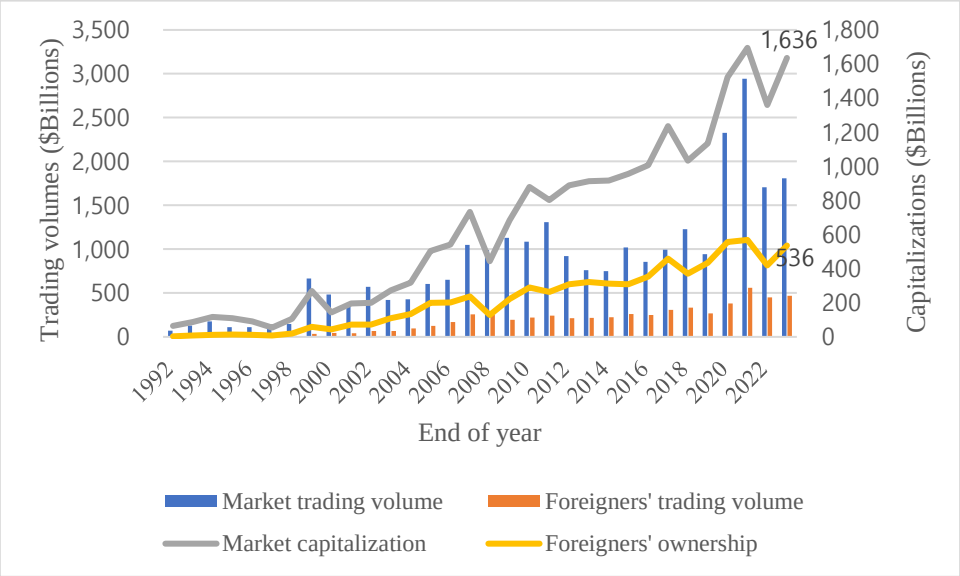
	1992-1999 (8 yrs.) First sub-period [Nobs=96]	2000-2011 (12 yrs.) Second sub-period [Nobs=144]	2012-2023 (12 yrs.) Third sub-period [Nobs=144]	2000-2023 (24 yrs.) Recent entire period [Nobs=288]	1992-2023 (32 yrs.) Entire period [Nobs=384]
Panel A: KOSPI market					
$R_F^{KOSPI} - R_{MSCI}^{Korea}$: Quasi-timing	0.54% (1.50)*	0.14% (1.24)	0.09% (1.87)**	0.12% (1.91)**	0.22% (2.19)**
$R_{MSCI}^{Korea} - R_M^{KOSPI}$: Quasi-selectivity	0.26% (0.92)	0.20% (1.55)*	0.07% (0.87)	0.14% (1.78)**	0.17% (1.84)**
$R_M^{KOSPI} - r_f$: Excess market	0.05% (0.05)	0.36% (0.58)	0.21% (0.55)	0.29% (0.78)	0.23% (0.59)
r_f: Risk-free rate[a]	1.00% (29.52)***	0.32% (45.08)***	0.15% (24.73)***	0.24% (34.95)***	0.43% (21.81)**
Panel B. KOSDAQ market					
$R_F^{KOSDAQ} - R_{MSCI}^{Korea}$: Quasi-timing		-0.57% (-0.71)	0.58% (1.49)*	0.00% (0.01)	
$R_{MSCI}^{Korea} - R_M^{KOSDAQ}$: Quasi-selectivity		1.38% (1.98)**	-0.13% (-0.35)	0.63% (1.59)*	
$R_M^{KOSDAQ} - r_f$: Excess market		-0.82% (-0.86)	0.41% (0.82)	-0.21% (-0.38)	
Panel C. KOSPI+KOSDAQ market					
$R_F^{KOSPI+KOSDAQ} - R_{MSCI}^{Korea}$: Quasi-timing	0.54% (1.50)*	0.06% (0.61)	0.11% (2.36)***	0.09% (1.16)	0.20% (2.00)**
$R_{MSCI}^{Korea} - R_M^{KOSPI+KOSDAQ}$: Quasi-selectivity	0.26% (0.92)	0.40% (2.13)**	0.06% (0.51)	0.23% (1.72)**	0.23% (2.18)**
$R_M^{KOSPI+KOSDAQ} - r_f$: Excess market	0.05% (0.05)	0.17% (0.26)	0.23% (0.59)	0.20% (0.43)	0.16% (0.41)

Panel D. Each country's quasi-timing ability (2012/01-2023/06: 11.5 years)

1. United States	0.15% (1.78)**	7. Canada	0.33% (3.40)***	13. Switzerland	0.60% (2.29)**
2. United Kingdom	0.56% (1.89)**	8. Netherlands	0.45% (1.18)	14. Hong Kong	1.86% (1.42)*
3. Luxembourg	0.22% (1.60)*	9. Australia	0.75% (3.19)***	15. Saudi Arabia	-0.07% (-0.32)
4. Singapore	0.39% (1.36)*	10. China	0.01% (0.08)	The others	-0.79% (-2.56)
5. Ireland	0.21% (1.20)	11. Japan	0.40% (1.85)**		
6. Norway	0.06% (0.49)	12. Cayman Islands	0.76% (2.62)***		

a. Risk-free rate is non-guaranteed 1-day call rate, which is very close to the policy interest rate of the Bank of Korea.

Panel A. The KOSPI market



Panel B. The KOSDAQ market

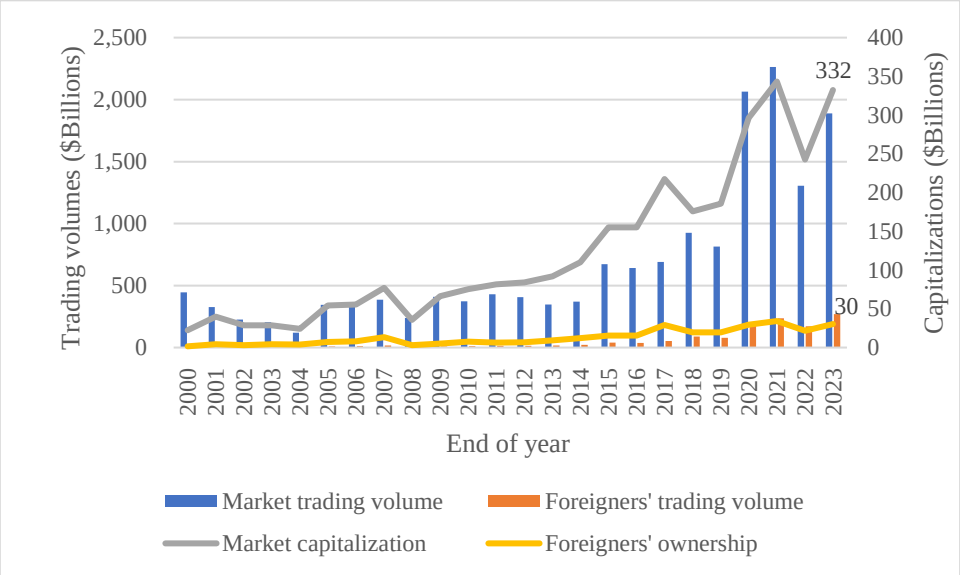
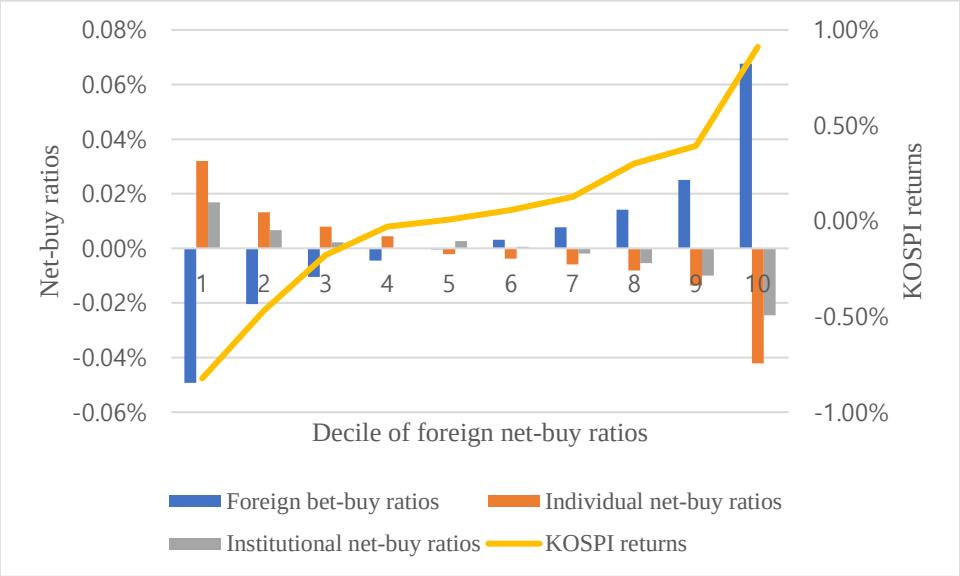


Figure 1. Market and foreign investors' capitalizations and trading volume (in values)

Panel A. Daily relationships



Panel B. Monthly relationships

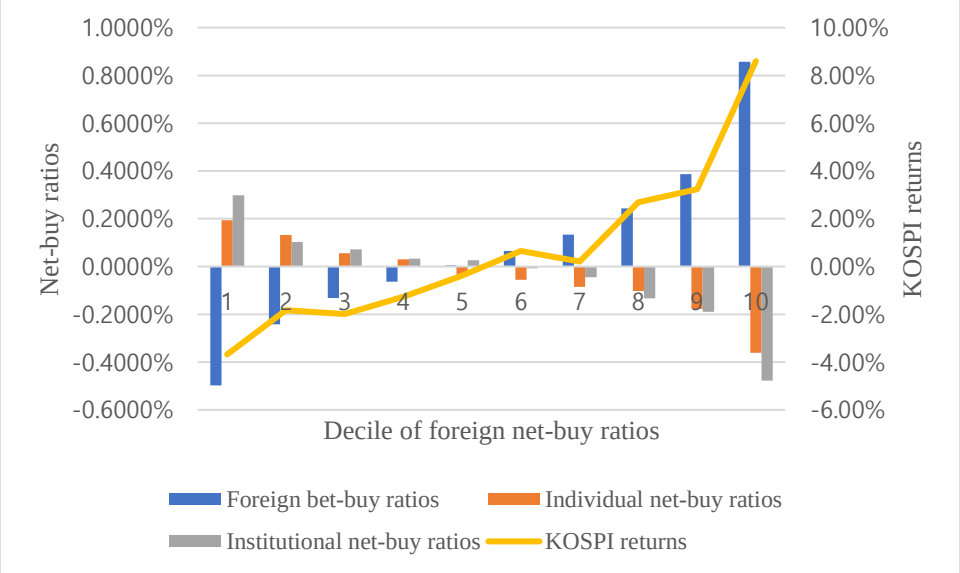
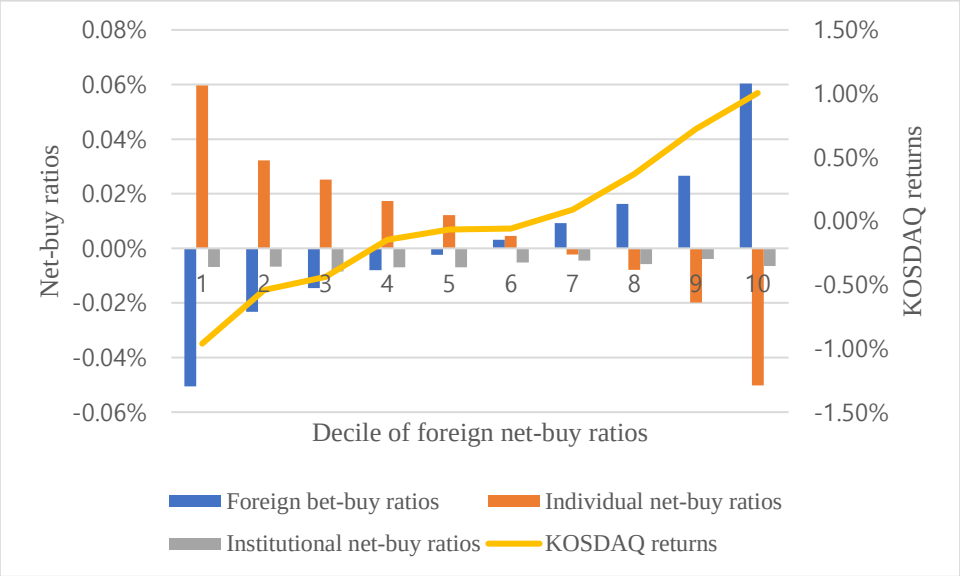


Figure 2. The cross-sectional relationships between net-buy ratios and KOSPI returns: 1992/01-2023/12

Panel A. Daily relationships



Panel B. Monthly relationships

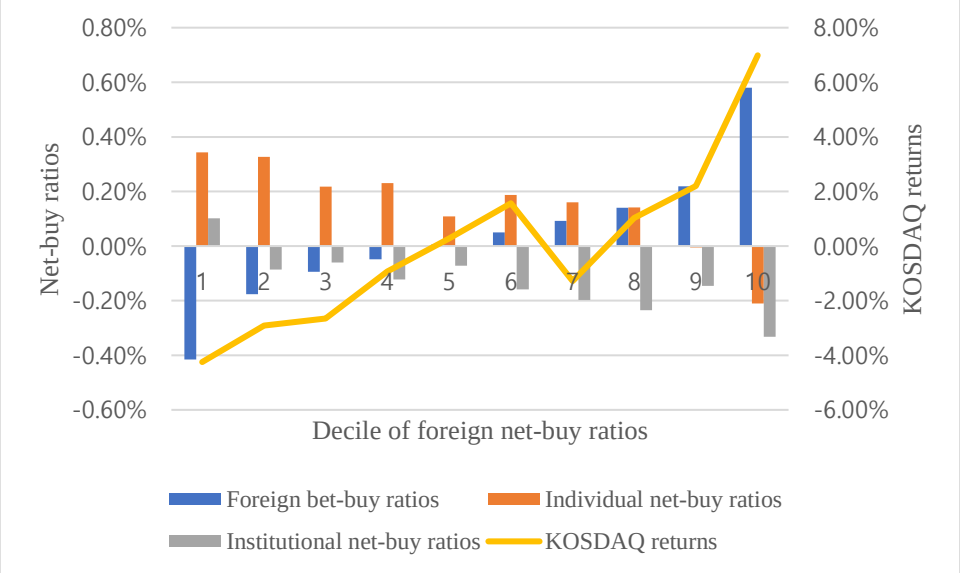
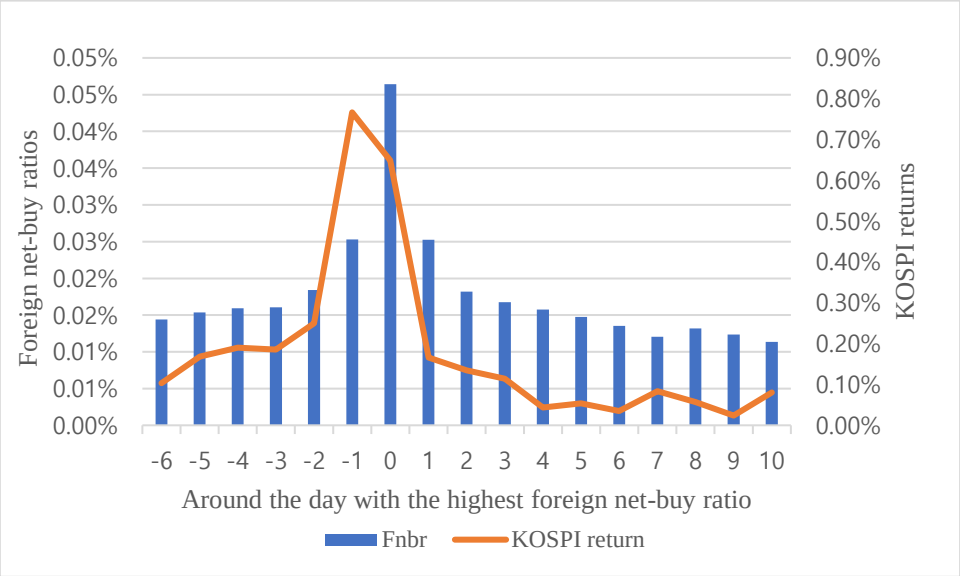


Figure 3. The cross-sectional relationships between net-buy ratios and KOSDAQ returns: 2000/01-2023/12

Panel A. Return behavior around the day with the highest 10% foreign net-buy ratio



Panel B. Return behavior around the day with the lowest 10% foreign net-buy ratio

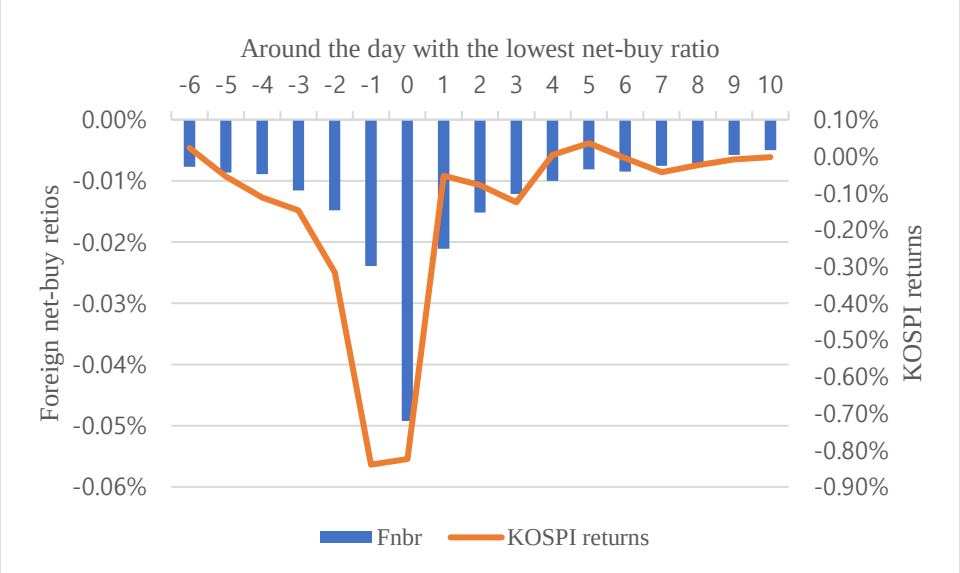
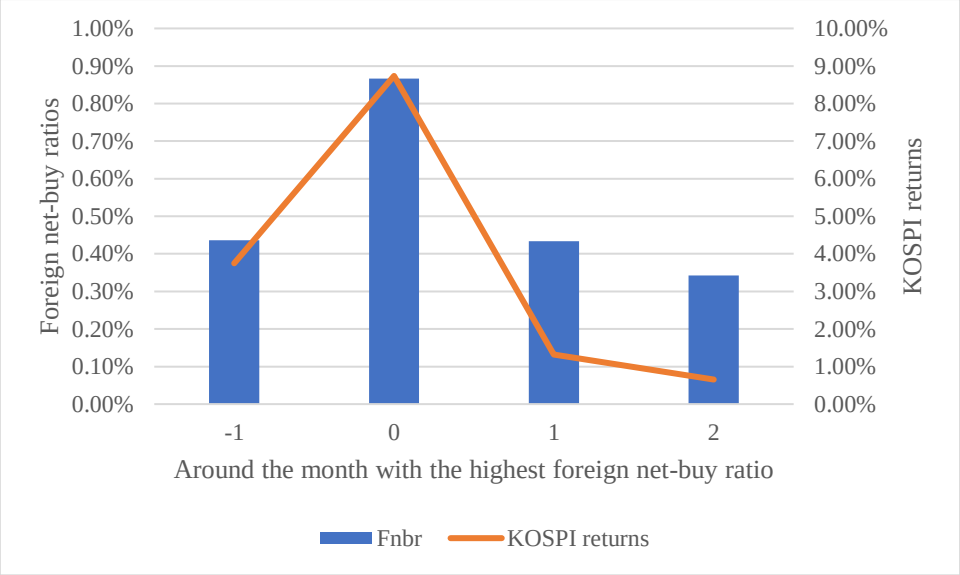


Figure 4. Daily KOSPI returns around the day with the extreme foreign net-buy ratios: 1992/01-2023/12

Panel A. Return behavior around the month with the highest 10% foreign net-buy ratio



Panel B. Return behavior around the month with the lowest 10% foreign net-buy ratio

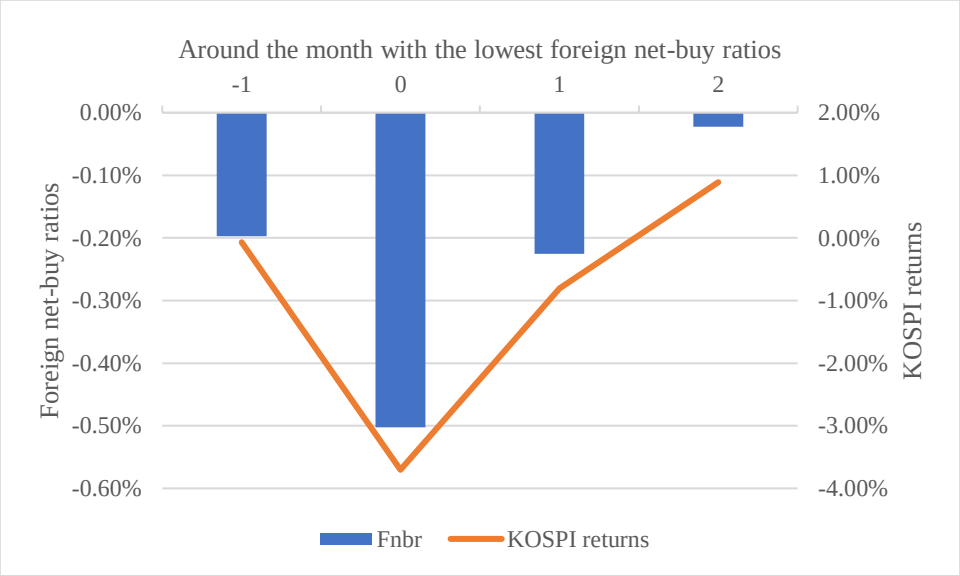
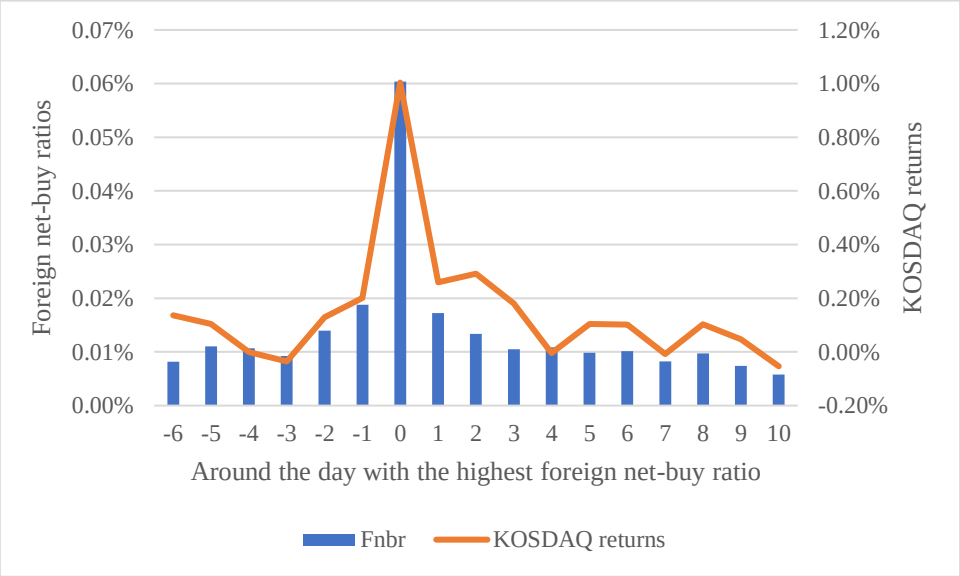


Figure 5. Monthly KOSPI returns around the month with the extreme foreign net-buy ratios: 1992/01-2023/12

Panel A. Return behavior around the day with the highest 10% foreign net-buy ratio



Panel B. Return behavior around the day with the lowest 10% foreign net-buy ratio

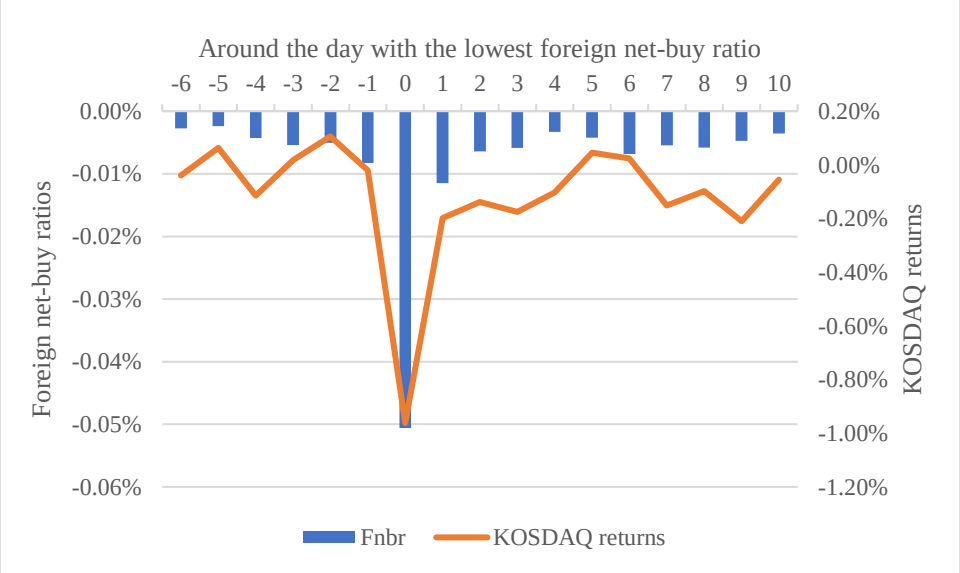
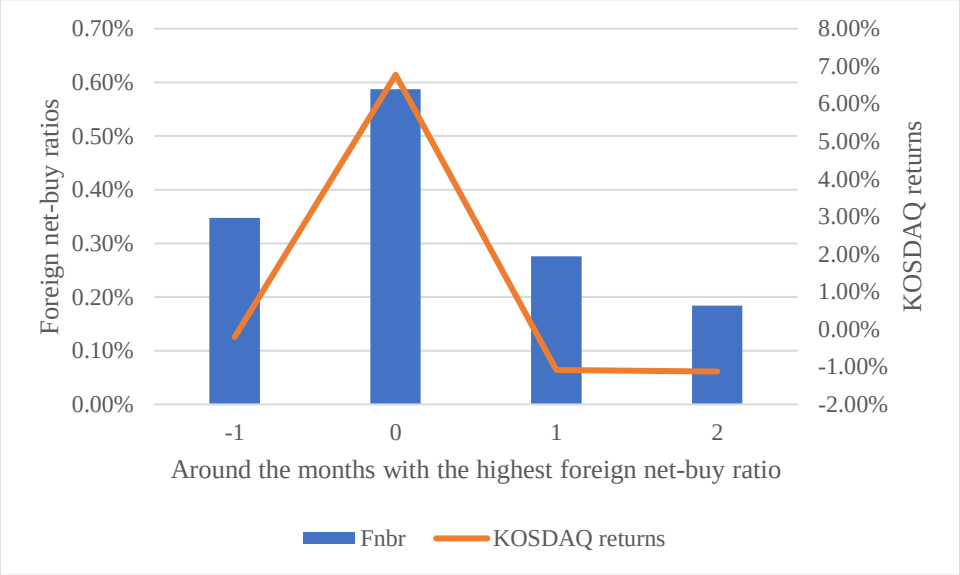


Figure 6. Daily KOSDAQ returns around the day with the extreme foreign net-buy ratios: 2000/01-2023/12

Panel A. Return behavior around the month with the highest 10% foreign net-buy ratio



Panel B. Return behavior around the month with the lowest 10% foreign net-buy ratio

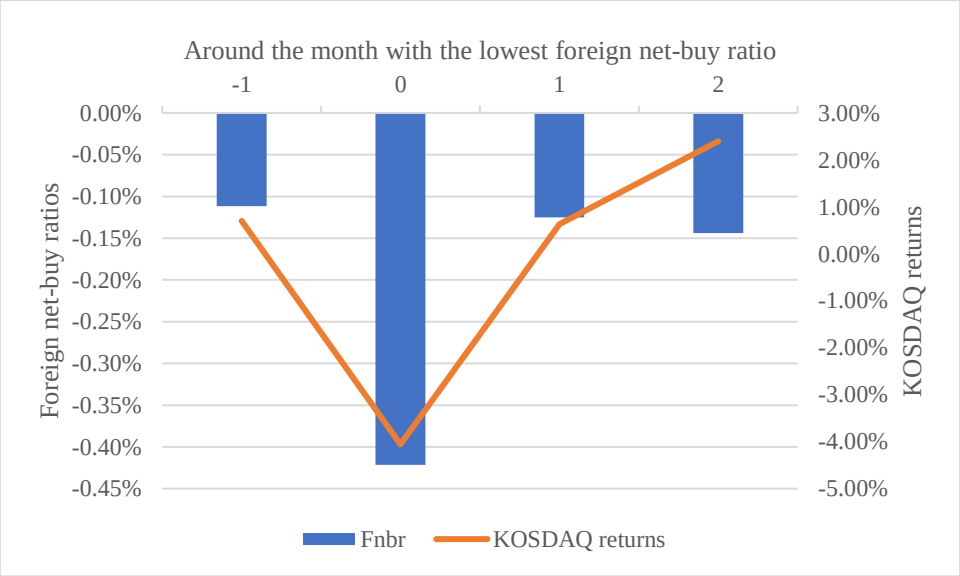
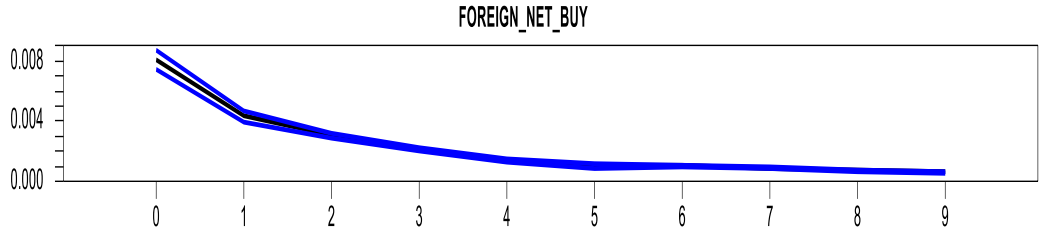
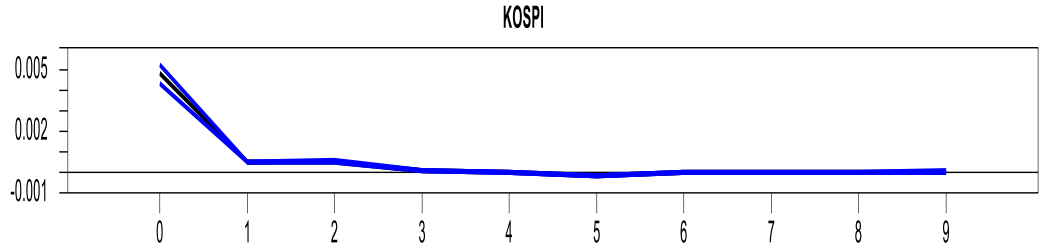


Figure 7. Monthly KOSDAQ returns around the day with the extreme foreign net-buy ratios: 2000/01-2023/12

Responses of foreign net buys to S&P 500 shocks



Responses of KOSPI returns to S&P 500 shocks



Responses of KOSPI returns to foreign net-buy shocks

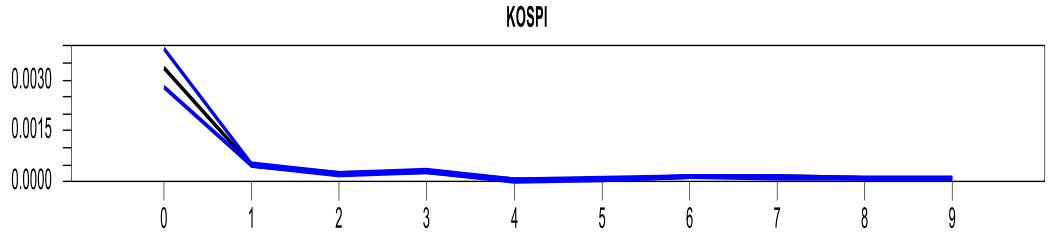
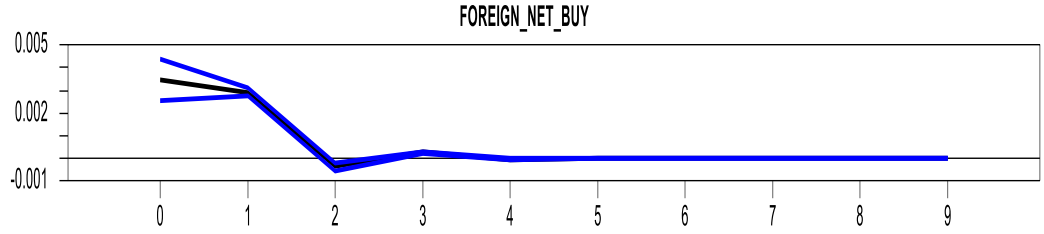
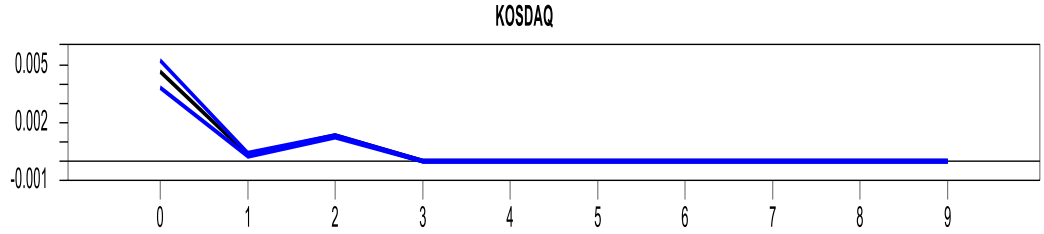


Figure 8. Responses of KOSPI returns and foreign net buys with confidence bands: Daily KOSPI SVAR (1992/01-2023/12)

Responses of foreign net buys to S&P 500 shocks



Responses of KOSDAQ returns to S&P 500 shocks



Responses of KOSDAQ returns to foreign net-buy shocks

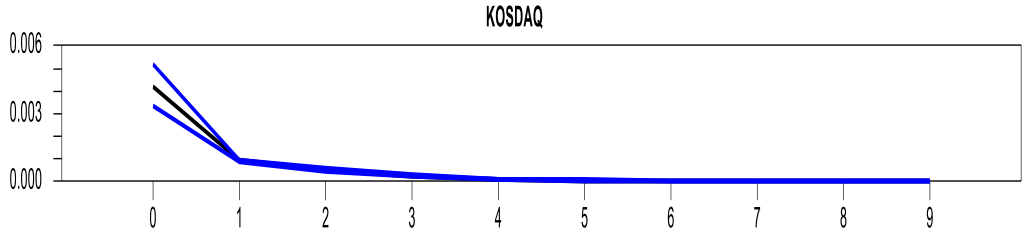
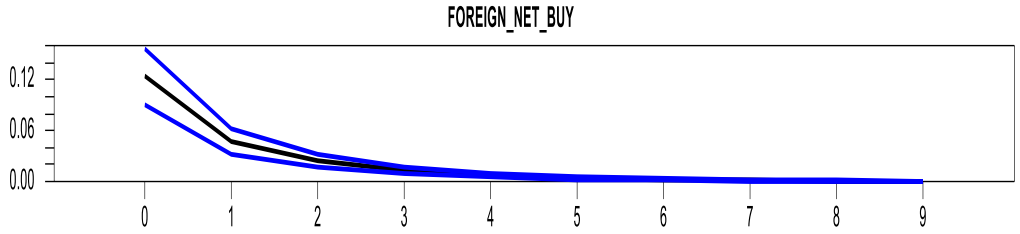
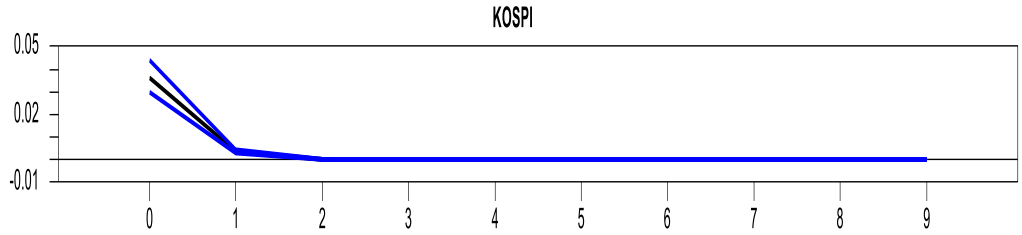


Figure 9. Responses of KOSDAQ returns and foreign net buys with confidence bands: Daily KODAQ SVAR (2000/01-2023/12)

Responses of foreign net buys to S&P 500 shocks



Responses of KOSPI returns to S$P 500 shocks



Responses of KOSPI returns to foreign net-buy shocks

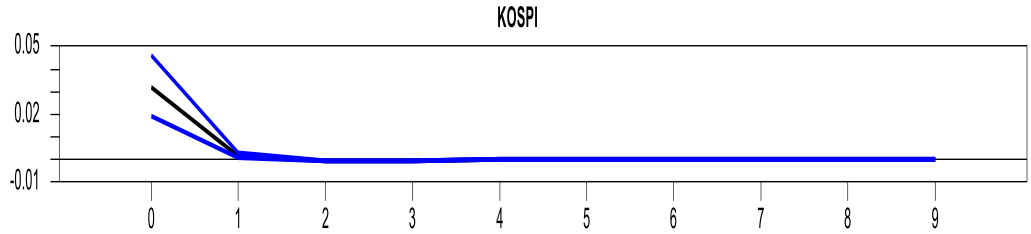
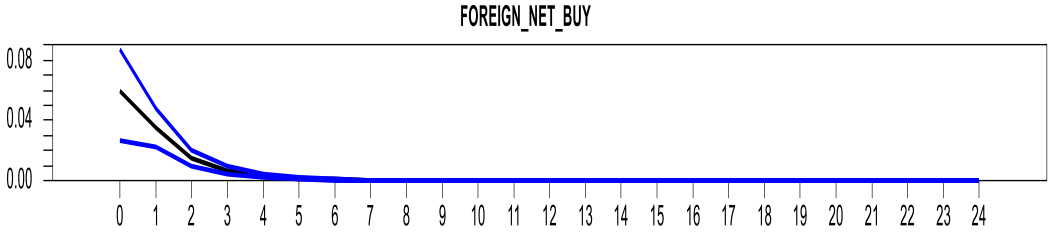
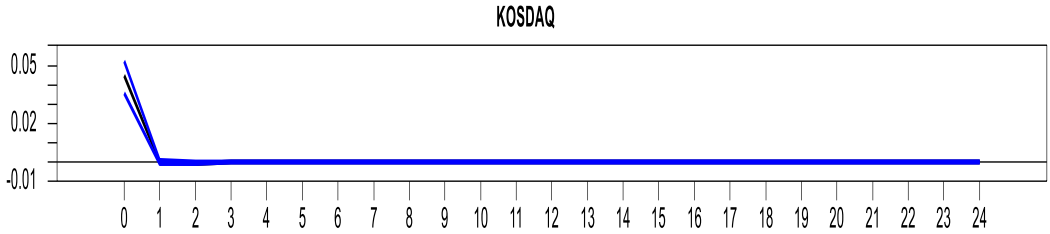


Figure 10. Responses of KOSPI returns and foreign net buys with confidence bands: Monthly KOSPI SVAR (1992/01-2023/12)

Responses of foreign net buys to S&P 500 shocks



Responses of KOSDAQ returns to S$P 500 shocks



Responses of KOSDAQ returns to foreign net-buy shocks

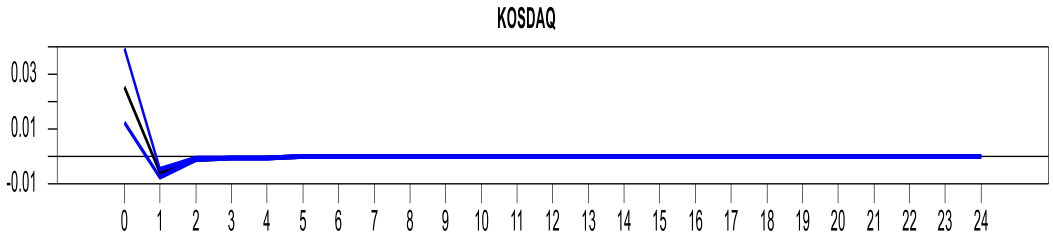


Figure 11. Responses of KOSDAQ returns and foreign net buys with confidence bands:

Monthly KODAQ SVAR (2000/01-2023/12)