The effect of foreign investors on market information efficiency in the Korean equity market

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<Abstract>

This study examines whether foreign investors increase informational efficiency in the Korean stock market from January 1999 to June 2013. Bae, Ozoguz, Tan, and Wirjanto (2012) document that the beneficial effect of foreigners facilitating information reflection on stock prices in other Asian markets is not observed in the Korean market even though the Korean market has a large amount of US equity holding. We reinvestigate the role of foreign investors in the Korean equity market by defining foreign investors' investibility as the normalized trading volume of foreign investors. We estimate how much faster the reflection of global or domestic information becomes when foreign investibility increases. In the results of our cross-sectional analysis, unlike Bae et al., foreigners' trades are shown to increase the informational efficiency for both global and local market information. In particular, in export-import companies that are expected to be more sensitive to the global market, the improvement in informational efficiency is significant when foreign investiblity increases. Our results prove that foreign investors play a beneficial role in the Korean equity market facilitating information transmission.

JEL classification: F36, G14, G15

Keywords: Korean stock market, foreign investors, information efficiency, price delay, information diffusion

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I. Introduction

In the late 1980s, as many developing countries in Asia opened their financial markets to foreign investors, they must have worried about a large loss from trades with foreigners and the market destabilization by foreigners. This is due to the belief that foreign investors, especially westerners, are more informed and more sophisticated. Indeed, at that time, given that the scale of the western financial markets was greater and not comparable to those of emerging Asian markets. Therefore, numerous researchers have investigated whether foreign investors make profits more than domestic investors and whether these investors raise the market volatilities in emerging markets. Many studies show that foreign investors do not have an edge over domestic investors and thus their trading is not strong enough to destabilize the emerging markets. In particular, Choe, Kho, and Stulz (1999) find out that foreign investors were not the factor that destabilizes the Korean market around the time of the East Asian financial crisis in 1997. Given that there are no harmful impacts of foreign investors on the Korean stock market, the question arises whether there are, on the other hand, any benefits from opening the market.

This study examines whether foreign investors increase informational efficiency in the Korean market. Bae, Ozoguz, Tan, and Wirjanto (2012) document that, as more foreign investors are allowed to trade on a stock, the stock price reflects global market information faster than others in 21 emerging financial markets. This result shows the positive role of foreign investors in emerging markets facilitating the reflection of global information into those market. They report, however, that the beneficial effect of foreigners in the Korean equity market is not observed even though that the Korean market is the market that has the largest amount of US equity holding among those 21 markets. Their results about the Korean market may be caused by investigating the Korean market as a whole. For example,

the informational impact of foreign investors on firms that mainly derive their earnings from domestic demand and that on export-import firms can be opposite. Therefore, we reinvestigate the role of foreign investors in the Korean equity market by applying Bae et al.'s methodology in a different way. Bae et al. use EMDB's degree open factor variable that indicates the "quantity of a company's market capitalization a foreign entity can legally own." According to the report of the Financial Supervisory Service in 2012, Korean financial markets regulate the participation of foreign investors uniformly across stocks with only few exceptions.[4] Thus, in this paper, we utilize a normalized trading volume rather than the legal limitation of foreigners' holding since there is only a small variation of limitation across stocks. In detail, we replace the investibility measure that Bae et al. use with foreigner's trading volume normalized by the market capitalization of the stock.

In our empirical results, we find that foreign investors' trading significantly decreases the delay of reflection of global and local market information on stock prices in the Korean market. In the examination of the extent of information delay among firms classified by the degree of foreign investors' trades and market capitalization, in general, firms with high foreign investors' trades show significantly lower delay than firms with low foreign investors' trades. In particular, because foreign investors' trades are concentrated on large firms, the difference in information delay between these two groups becomes more significant in large size firms. In addition, we conduct a cross-sectional analysis with filtered sample firms that are expected to be sensitive to global market information. With export-import firms, we find a more significant and negative relation between foreign investors' trading and the global information delay. Moreover, in the VAR examination, the

[4] According to 'Guidebook to foreign investment in the Korean Capital Market' in 2012, there are 12 exceptions in KOSPI market and 22 exceptions in KOSDAQ market.

returns on a portfolio with high foreign investors' trades are shown to lead the returns on a portfolio with low foreign investors' trades. From the adjusted VAR examination, which includes the current and lagged world market returns, this return predictability is also attributed to the superior information of foreign investors.

The paper is organized as follows. In Section 2, we document the data and methodology that we use and in Section 3, we present the results of the cross-sectional test and a comparison with previous research. Section 4 concludes this paper.

2. Data and Methodology

In this study, we use KRX market data provided by FnGuide from January 1999 to June 2013. The data include stock return, market capitalization, and trading volume for each investor group: domestic individual, domestic institution, and foreigners. We use the KOSPI return as a proxy for the local market return and the S&P 500 return as a proxy for the global market return. The S&P 500 data is provided by WRDS. In addition, we convert all returns to dollar returns with exchange rate data provided by the Bank of Korea. We exclude the stocks that have less than 20 weekly observations a year or stocks that have prices under 1,000 won.

2.1. Normalized trading volume

Bae et al. observe that a relation between foreigner's investibility and information delay in Korea is insignificant. We argue that the insignificant result may be attributed to their assumption that all firms in Korea have the instability.

<Insert Table 1>

Table 1 shows the change of the regulation on foreign investors holding in Korean markets provided by the Financial Supervisory Service of Korea. As shown in Table 1, in Korean markets, participation of foreign investors was regulated uniformly across stocks until 1997 and then the regulation was almost removed in 1998. Therefore, in order to solve the problem in Bae et al., we use a normalized trading volume instead of investibility measure. Every week, we aggregate foreign investors' buy and sell volume of each stock. This measure represents how actively foreign investors trade the stock *i* during week *t*. Moreover, to avoid a bias in our empirical results toward a particular firm size group, we normalize this trading volume with the firm's market capitalization as shown in equation (1). Indeed, Kang, Kwon, and Park (2013) report that the there is a great variation in the amount of foreign trades across firms with different market capitalizations. As a firm size increases, foreign trading is shown to be more active.

$$trading\ volume_{\mathrm{i,t}} = \frac{(BUY_{i,t}+SELL_{i,t})/2}{(market\ capitalization)_{i,t}} \quad (1)$$

Figure 1 shows the trend of the average foreign trades over our sample period. Unlike the great variation of the cross-sectional distribution of foreign holdings across firms, the time-series of foreign investors' trades do not change their average level over the period.

<Insert Figure 1>

2.2. Information delay Measures

Following Bae et al. (2012), every year, we regress weekly returns of each stock on the contemporaneous and three lagged world and local market returns in order to calculate two delay measures. The two delay measures are computed based on the following regression:

$$R_{i,t} = \alpha + \sum_{k=0}^{3} \delta_{i,k} R_{w,t-k} + \sum_{k=0}^{3} \gamma_{i,k} R_{l,t-k} + \varepsilon_{i,t} \quad (2)$$

where $R_{i,t}$ is the weekly return of stock *i* at week *t*, $R_{w,t-k}$ and $R_{l,t-k}$ are the weekly return on the world market portfolio and local market portfolio at week *t-k*, respectively. All returns are calculated as dollar returns.

In addition, we regress the weekly returns on the contemporaneous and one lagged world and local market returns that is closest to the contemporaneous return to compare a result from the three lagged returns with a result excluding insignificant lagged returns. Because the results from the regression with one lagged return is not significantly different from that from the three lagged returns, we only report the result from three lagged returns.

The first delay measure is constructed following Hou and Moskowitz (2005) as shown in equation (3)

$$delay1 = 1 - \frac{R_r^2}{R_{ur}^2} \tag{3}$$

In equation (3), R_r^2 is the R-squared statistic of the restricted regression model and R_{ur}^2 is that of the unrestricted regression model. In detail, the unrestricted regression model is equation (2) and the restricted regression model is equation (2) with assumption that the coefficients of the lagged world or local market returns are zero. The global (local) market delay is defined as the ratio of the explanatory power of the model excluding the lagged world (local) market returns to that of the model including all returns. If a delayed reflection of global (local) information exists, then the delay measure would be close to 1. Bae et al. argue that the value of delay1 will be greater as the lagged world or local returns better capture the variation of the current return. They also document that the greater the value of delay1, the greater the delay in the response of stock returns to global or local news.

The second delay measure is constructed following McQueen, Pinegar, and Thorley (1996). With the estimates of equation (2), the delay measures for global and local market information are computed as follows.

$$delay2 = \frac{1}{1+e^{-x}} \tag{4}$$

where

$$\text{x} = \sum_{k=1}^{3} \delta_{i,k} / (\sum_{k=0}^{3} \delta_{i,k} + \sum_{k=0}^{3} \gamma_{i,k})$$

for the delay of global market information and

$$\text{x} = \sum_{k=1}^{3} \gamma_{i,k} / (\sum_{k=0}^{3} \delta_{i,k} + \sum_{k=0}^{3} \gamma_{i,k})$$

for the delay of local market information.

To see the relation between the trading volume measure and the delay measures, we construct three portfolios sorted by foreigners' trading volume and compute each portfolio's delay measure for each year. Figure 2 shows the portfolios' delay 1 during the sample period.

<Insert Figure 2>

In Figure 2, portfolio 0 represents firms with the lowest foreign trading volume and portfolio 2 represent firms with the highest foreign trading volume. In Panel A of Figure 2, portfolio 2 has a lower global market information delay than other portfolios. This pattern is observed consistently during the sample period. However, in Panel B of Figure 2, a local market information delay does not show any pattern across portfolios during the sample period. Consequently, we can say that foreigners' trading seem to reduce the delay in the reflection of global information in stock prices in Korean stock market.

3. Results

3.1. Correlation between firm size and foreigner's trading volume

Before conducting cross-sectional regression tests, we examine whether the multicollinearity problem can be caused by substituting the investibility measure to our trading volume measure. We adopt three control variables: firm size, turnover, and volatility.

<Insert Table 2>

Table 2 shows the correlations among variables that are used in our cross-sectional regressions. Since the correlation between firm size and foreigner's trading is especially high, 0.507, if we include both variables in a regression, estimated coefficients can be biased.[5] Indeed, over 50% of foreign trades are concentrated in large firms (Kang, Kwon, and Park, 2013). Therefore, instead of utilizing firm size as an independent variable, we examine the relationship between information delay and foreign trades by classifying firms according to their market capitalizations.

<Insert Table 3>

Table 3 represents the delay of two-way sorted portfolio. First, we sort sample stocks by the foreigner's trading volume and then sort by firm size. In both Panel A and Panel B, the overall pattern shows that a foreigner's trading volume has a negative relation with market information delay. In particular, the negative relation is only significant in a large group, portfolio 2. Panel C and Panel D also show the delay of two-way sorted portfolios, but firms are sorted first by firm size and then by foreign investors' trading volume. Even

[5] More details are reported in APPENDIX.

though the significance of information delay in Panel C and D are weaker than that in Panel A and B, the implication does not change. As foreigners trade more, information is reflected more quickly and it is more significant in large size firms.

3.2 Cross-sectional regressions of delay measures

In this section, we conduct a cross-sectional analysis to examine the effect of foreigner's trading on information delay. With KOSPI stocks from January 1999 to June 2013, we conducted the following cross sectional regression model. We also conduct the regression without two control variables, turnover and volatility, to compare the effect of control variables on the coefficient of the foreigner's trading.

$$delay_{i,t+1} = \alpha_0 + \beta trading_{i,t} + \gamma_1 turnover_{i,t} + \gamma_2 volatility_{i,t} + \varepsilon_{i,t} \qquad (5)$$

where the dependent variable is the delay measure for stock i in year t+1 and the independent variables are foreigners' normalized trading volume($trading$), turnover, and volatility for stock i in year t.

<Insert Table 4>

Table 4 shows the results of our annual cross-sectional regression. On the third row, ew and vw stands for equal-weighted and value-weighted, respectively. They indicate how to calculate the global market return. In the left four columns of each panel the dependent variable is a delay measure with respect to global market information and in other columns the dependent variable is a delay measure with respect to local market information. For the global market delay, foreigner's trading shows significant negative relation with delay measure 1 regardless of control variables. Even though, in Panel B, the coefficient of

foreign investors' trading is not significant when value-weighted global market return is used, it shows significant when equal-weighted global market return is used. Thus, we may say that our results generally confirm our hypothesis that foreigner's trading facilitates the reflection of global market information on a stock price.

Interestingly, in the examination of the relation between foreigner's trading and local market information delay in both panels, foreign investors' trading is shown to have significant negative impact on information delay regardless of the way of calculating the global return and of how to calculate information delay. The coefficients are even negatively bigger in the right four models. It shows that the beneficial effect of foreign trading facilitating the information reflection is bigger for the local market information. However, Bae et al. report that the foreign investors contribute on increasing the speed of global market information's reflection, not the speed of local market information's reflection. Many literatures report that foreign investors are not better informed than domestic investors in emerging markets including the Korean market. Hau (2001) reports that the performance of foreign investors in the German equity market is significantly worse than that of domestic investors. Kang and Stulz (1997) analyze the trading behavior and performance of foreign investors in Japanese equity market and report that foreigners underperform domestic investors. Choe, Kho, and Stulz (2005) also report that domestic investors have an edge over foreign investors both buy and sell sides in the Korean equity market. Thus the result in Table 4 are inconsistent result with previous research. According to Kang, Kwon, and Park (2013), however, the result of Choe et al. is not consistent when the sample period is extended, which suggests that foreign investors are not informationally disadvantaged compared with domestic investors.

In summary, the results of the cross-sectional regression to examine the relation between foreign investors' trading and the information delay show that foreign investors not only

contribute to the reflection of global market information, but also to the reflection of local market information.

3.3. Cross-sectional regressions of delay measures with export-import firms

In the previous sections, according to a firm's market capitalization, the impact of foreign investors' trading on information delay is different. We interpret this as the result of the fact that foreign holding is concentrated on large size firms. However, given that large Korean companies are generally export-import companies, the results may be due to the fact that not all firms are sensitive to the global market information. Therefore, in this section, we examine the impact of foreign investors' trading on information delay by classigying firms according to the extent of exporting and importing. Intuitively, the export-import firms are expected to be more sensitive to the global market information than other firms because their profits are in tandem with exchange rates. We first conduct the same cross-sectional regression with only export-import firms and then, by using a dummy variable for the export-import firms, examine whether the export-import firms' coefficient on foreigners' trading is significantly different from others.

<Insert Table 5>

Table 5 shows the results of cross-sectional analysis with delay measure 1.[6] In Panel A, we report the result of the cross-sectional analysis with only export-import firms. Panel A shows that the export-import firm' global market information delay has a stronger and more significant relation with foreigners' trading than in Table 4. Thus, to examine whether this

[6] Since overall results of cross-sectional analysis with delay measure 2 are consistent, we report only the results with delay measure 1.

difference is statistically significant, we add another variable which is the product of the foreigner's trading and dummy variable for export-import firms and conduct the regression for all sample stocks. In Panel B, the estimates of the product variable show that export-import firms' sensitivity on the foreigner's trading is significantly higher than other sample firms. For the global information delay, value-weighted return model shows more significant results. In addition, not only for the global information delay, but also for the local information delay, the effect of the foreigner's trading of export-import firms is found to be greater than others, which means that for export-import firms, the foreign investors' role to facilitate the reflection of both global and local market information is more significant.

3.4. Lead-lag relations of foreign trading portfolios

In this section, focusing on the role of the foreigners' trades facilitating the reflection of global market information, we investigate whether there exists a lead-lag relation between returns of stocks highly traded by foreigners and returns of stock that are not.

Each year, we first sort stocks by their foreign trading volumes into three equal-size groups. Then we sort stocks by either firm size or by turnover. All classifications are performed independently to each other. Thus, we construct nine equal size-foreign trading portfolios or turnover-foreign trading portfolios. With these nine test portfolios, we examine whether foreign trading has a significant effect on the return dynamics across stocks even after controlled by firm size or turnover.

First, we test the existence of a lead-lag relation across portfolios following vector autoregression (VAR) model:

$$R_{LT,t} = a_0 + \sum_{k=1}^{3} b_k R_{LT,t-k} + \sum_{k=1}^{3} c_k R_{HT,t-k} + u_t \quad (6)$$

$$R_{HT,t} = a_1 + \sum_{k=1}^{3} d_k R_{LT,t-k} + \sum_{k=1}^{3} e_k R_{HT,t-k} + u_t \quad (7)$$

where $R_{HT,t-k}(R_{LT,t-k})$ indicates a lagged return on the portfolio highly (lowly) invested by foreigners and *k* stands how much returns are lagged.

In this test, we focus on the significance of lagged returns on highly invested portfolios in equation (6) since it can indicate whether a leading role of highly invested portfolios exists as we expect. Table 6 shows the results of the model.

<Insert Table 6>

In Panel A of Table 6, only the one period lagged return on the highly traded portfolios positively predicts the current returns on the lowly traded portfolios in the large size group. The coefficients of the lagged returns on the highly traded portfolios are monotonically increasing as firm size increases. Thus, in a small size group, the lagged returns on the highly traded portfolios affect negatively the current returns on the lowly traded portfolios. On the other hand, the lagged returns on the lowly traded portfolios also show significant impact on the current returns on the highly traded portfolios, but the directions of their impacts are opposite with hose of the lagged returns on the highly traded portfolios in small and large size groups. In Panel B, the relation between the lagged returns on the highly traded portfolios and the current returns on the lowly traded portfolios is only significant in the low turnover group. Intuitively, the low turnover group is constructed with relatively illiquid firms, thus the effect of foreign investors' trading can be more significant than that in high turnover group. In this illiquid group, we find that the lagged returns on the highly traded portfolios predict the current return on the lowly traded portfolios.

To confirm that the predictability observed in Table 6 is caused by the superiority of

foreign investors' trades in global market information, we conduct an additional test. The current and lagged world market returns are added to the VAR model (regression (6) and (7)) as follows:

$$R_{LT,t} = a_0 + \sum_{k=1}^{3} b_k R_{LT,t-k} + \sum_{k=1}^{3} c_k R_{HT,t-k} + \sum_{k=0}^{3} f_k R_{w,t-k} + u_t \quad (8)$$

$$R_{HT,t} = a_1 + \sum_{k=1}^{3} d_k R_{LT,t-k} + \sum_{k=1}^{3} e_k R_{HT,t-k} + \sum_{k=0}^{3} g_k R_{w,t-k} + u_t \quad (9)$$

where $R_{w,t-k}$ indicates a current or a lagged world market return for k = 0, 1, 2, 3.

If the results in Table 6 are mainly due to the global market information in foreign trades, which is closely related to the world market return, the coefficients of the lagged returns on the highly traded portfolios will become insignificant.

<Insert Table 7>

Table 7 shows the estimation results. In Panel A of Table 7, the coefficient of $R_{HT,t-1}$ is still significant, but the magnitude is reduced to 0.165 from 0.322, which is almost half of the results in Table 6. It suggests that the significant relation in Table 6 may be partially derived by the global market information. In addition, unlike in Panel B of Table 6, which shows that the lagged returns on the highly invested portfolios significantly predict the current returns on the lowly invested portfolios in the low turnover group, the coefficients of these lagged returns in Table 7 become insignificant. This implies that the lead-lag relation across stocks can be caused by global market information in foreign investors' trading. Moreover, we find that the sum of coefficients on the lagged world market returns is also significant. This is consistent with the results of Bae et al. that the lead-lag relation is partially driven by the slow diffusion of global market information into prices of lowly invested portfolios.

4. Conclusion

This study examines whether foreign investors increase informational efficiency in the Korean stock market from January 1999 to June 2013. Bae, Ozoguz, Tan, and Wirjanto (2012) document that the beneficial effect of foreigners facilitating information reflection on stock prices in other Asian markets is not observed in the Korean market even though the Korean market has a large amount of US equity holding. We reinvestigate the role of foreign investors in the Korean equity market by defining foreign investors' investibility as the normalized trading volume of foreign investors. We estimate how much faster the reflection of global or domestic information becomes when foreign investibility increases. In the results of our cross-sectional analysis, unlike Bae et al., foreigners' trades are shown to increase the informational efficiency for both global and local market information. In particular, in export-import companies that are expected to be more sensitive to the global market, the improvement in informational efficiency is significant when foreign investiblity increases. Our results prove that foreign investors play a beneficial role in the Korean equity market facilitating information transmission.

APPENDIX

1. Correlation with firm size

In this study, we use foreign investors' normalized trading volume instead of foreign investor's investibility that Bae et al. use. The problem caused from substituting the variable is the correlation with other variables, especially with firm size. Table 2 shows the correlation across independent variables of cross-sectional regression. In Table 2, the correlation between the foreigners' trading volume and firm size is 0.507. Because of this high correlation between those two variables, if we include both variables in a regression, estimated coefficients can be biased.

<Insert Table A1>

To see the effect of including size variable, the regression model with firm size is compared with the model without firm size. Table A1 shows the estimates of the regression model with firm size and Table 4 shows the estimates of the model without firm size. In Table A1, for each delay variable, the regression is conducted both with and without control variables, firm size, turnover, and volatility. The coefficient of foreigners' trading volume is insignificant when control variables are included in Table A1, but Table 4 shows that the coefficient of foreigners' trading volume is not affected significantly by including turnover and volatility as control variables. Thus the change of the coefficient in Table A1 can be mainly derived by firm size variable and the correlation in Table 2 also supports it. To avoid this multicollinearity problem, in Section 3.2, we exclude size variable in the cross-sectional regression.

Table A1. The cross-sectional regression with firm size

This table provides the results of cross-sectional regression. The left (right) eight columns present the results when delay measure 1 (2) is used for the dependent variable. And ew (vw) means that the global market return which is used for constructing the delay measure is equal-weighted (value-weighted) return. Turnover, volatility, firm size and trading variables are constructed with the previous year data in each year for each firm. The sample period is from 1999 to 2012 and numbers in parentheses are t-values.

	Delay 1								**Delay 2**							
	Delay measures w.r.t. global market information				**Delay measures w.r.t. local market information**				**Delay measures w.r.t. global market information**				**Delay measures w.r.t. local market information**			
	ew	**ew**	**vw**	**vw**	**ew**	**ew**	**vw**	**vw**	**ew**	**ew**	**vw**	**vw**	**ew**	**ew**	**vw**	**vw**
Constant	0.406	0.149	0.411	0.150	0.430	0.162	0.426	0.162	0.597	0.519	0.594	0.510	0.601	0.539	0.590	0.543
	(32.87)	(65.59)	(34.08)	(64.97)	(31.35)	(64.91)	(31.71)	(64.39)	(25.71)	(152.14)	(25.11)	(143.97)	(31.17)	(184.96)	(29.53)	(177.82)
Firm size	-0.022		-0.023		-0.023		-0.023		-0.008		-0.008		-0.005		-0.004	
	(-22.82)		(-23.61)		(-22.64)		(-22.60)		(-4.09)		(-4.06)		(-3.25)		(-2.36)	
Turnover	0.062		0.050		0.100		0.080		0.251		0.253		-0.239		-0.147	
	(1.22)		(1.09)		(1.67)		(1.40)		(3.19)		(3.65)		(-3.40)		(-2.41)	
Volatility	-0.037		-0.033		-0.074		-0.066		0.052		0.021		-0.053		-0.027	
	(-1.45)		(-1.41)		(-1.54)		(-1.45)		(0.74)		(0.30)		(-0.79)		(-0.42)	
Trading	0.150	-2.182	0.231	-2.137	-0.275	-2.723	-0.381	-2.791	-0.049	-0.635	1.046	0.391	-0.516	-1.201	-1.219	-1.713
	(0.78)	(-4.72)	(1.25)	(-4.39)	(-1.13)	(-4.77)	(-1.62)	(-4.83)	(-0.08)	(-1.35)	(1.34)	(0.62)	(-1.12)	(-2.41)	(-1.85)	(-2.85)

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Table 1. The allowance of foreign investors on Korean equities

The table shows the rule of each Korean market on the foreign investors. It shows the percentage of company's market capitalization a foreign investor can legally own. The rules for KOSPI and KOSDAQ market are reported separately.

	Date	JAN 1992 opened	DEC 1994	JUL 1995	APR 1996	OCT 1996	MAY 1997	NOV 1997	DEC 11th 1997	DEC 30th 1997	**MAY 25th 1998**	NOV 15th 2000
KOSPI	**Limits on the stock**											
	General corporation	10%	12%	15%	18%	20%	23%	26%	50%	55%	**abolished**	
	Public corporation	8%	⇒	10%	12%	15%	18%	21%	25%	⇒	**30%**	40%
	Limits on one person											
	General corporation	3%	⇒	⇒	4%	5%	6%	7%	50%	⇒	**abolished**	
	Public corporation	1%	⇒	⇒	⇒	⇒	⇒	⇒	⇒	⇒	**3%**	3%
KOSDAQ	**Limits on the stock**					10% (SEP 1996)	⇒	⇒	15% (DEC 1st 1997)	55% (APR 1st 1998)	**abolished**	
	Limits on one person					3% (SEP 1996)	⇒	⇒	5% (DEC 1st 1997)	50% (APR 1st 1998)	**abolished**	

Table 2. Correlation matrix

This table provides an average of annual correlation among independent and dependent variables. Each year, delay measures are computed for each stock for both global and local markets. Firm size, turnover, volatility, and the foreigners' trading, which is normalized by the market capitalization, are constructed for each stock in each year with the previous year's data. The correlations among the variables is computed every year, and then the time-series averages of the correlations are computed.

	Global market delay1(vw)	Local market delay1(vw)	Global market delay2(vw)	Local market delay2(vw)	Firm size	Turnover	Volatility
Global market delay1 (vw)	1						
Local market delay1 (vw)	0.416	1					
Global market delay2 (vw)	0.168	-0.026	1				
Local market delay2 (vw)	-0.064	0.087	-0.707	1			
Firm size	-0.275	-0.280	-0.031	-0.074	1		
Turnover	0.056	0.055	0.038	-0.023	-0.159	1	
Volatility	0.083	0.058	0.040	-0.024	-0.125	0.413	1
Foreigners' trading	-0.118	-0.140	0.009	-0.081	0.507	0.177	0.227

Table 3. Two-way sorted portfolios

This table presents the global and local market delay of portfolios that are constructed by firm size and foreigners' trading. Panel A (Panel C) and Panel B (Panel D) show the portfolios' delay measures when stocks are sorted by the foreigner's trading (firm size) first and then by firm size (the foreigner's trading).Since delay measure 2 shows consistent results with measure 1, we report only the results of delay measure 1. Portfolio 2 (portfolio 0) is constructed of the highest (lowest) one-third firms of sample stocks. The sample period is from 1999 to 2012 and numbers in parentheses are t-values.

Panel A: Global market delay (vw)									
		Firm size							
		0		1		2		2-0	
Foreign trading	0	0.0397	(3.28)	0.0250	(5.21)	0.0208	(3.57)	-0.0189	(-1.45)
	1	0.0328	(3.52)	0.0249	(2.46)	0.0177	(4.34)	-0.0152	(-1.83)
	2	0.0183	(3.91)	0.0148	(2.85)	0.0012	(3.68)	-0.0171	(-3.82)
	2-0	-0.0213	(-1.62)	-0.0102	(-1.66)	-0.0195	(-3.43)		
Panel B: Local market delay (vw)									
		Firm size							
		0		1		2		2-0	
Foreign trading	0	0.0540	(3.33)	0.0556	(3.21)	0.0422	(4.07)	-0.0118	(-0.95)
	1	0.0629	(2.99)	0.0497	(2.92)	0.0339	(3.64)	-0.0290	(-1.51)
	2	0.0416	(3.36)	0.0212	(2.69)	0.0024	(5.91)	-0.0392	(-3.23)
	2-0	-0.0124	(-0.67)	-0.0344	(-2.44)	-0.0398	(-3.88)		
Panel C: Global market delay (vw)									
		Foreign trading							
		0		1		2		2-0	
Firm size	0	0.0342	(5.19)	0.0281	(4.77)	0.0346	(3.34)	0.0004	(0.04)

	1	0.0152	(3.93)	0.0297	(2.49)	0.0214	(3.50)	0.0062	(1.51)
	2	0.0144	(3.77)	0.0100	(4.13)	0.0034	(4.08)	-0.0110	(-2.95)
	2-0	-0.0198	(-2.66)	-0.0181	(-2.73)	-0.0311	(-2.96)		
Panel D: Local market delay (vw)									
		Foreign trading							
		0		1		2		2-0	
Firm size	0	0.0555	(4.09)	0.0547	(2.75)	0.0683	(3.10)	0.0128	(0.86)
	1	0.0465	(2.93)	0.0564	(2.98)	0.0504	(3.17)	0.0039	(0.87)
	2	0.0207	(3.96)	0.0132	(2.38)	0.0049	(3.77)	-0.0158	(-3.12)
	2-0	-0.0348	(-2.19)	-0.0415	(-1.88)	-0.0634	(-2.86)		

Table 4. The cross-sectional regressions

This table provides the results of cross-sectional regression. Panel A (Panel B) presents the results when delay measure 1 (2) is used for the dependent variable. In each panel, the left (right) four columns are for delay measures with respect to global (local) market information. And ew (vw) means that the global market return which is used for constructing the delay measure is equal-weighted (value-weighted) return. Turnover, volatility, and trading variables are constructed with the previous year data in each year for each firm. The sample period is from 1999 to 2012 and numbers in parentheses are t-values.

	Panel A: Delay measure 1							
	Delay measures w.r.t. global market information				**Delay measures w.r.t. local market information**			
	ew	**ew**	**vw**	**vw**	**ew**	**ew**	**vw**	**vw**
Constant	0.1390	0.1493	0.1397	0.1504	0.1538	0.1622	0.1531	0.1617
	(30.40)	(65.59)	(28.82)	(64.97)	(46.83)	(64.91)	(45.40)	(64.39)
Turnover	0.2366		0.2262		0.2798		0.2577	
	(3.46)		(3.83)		(3.95)		(4.01)	
Volatility	0.0907		0.0966		0.0579		0.0641	
	(1.65)		(1.65)		(1.77)		(1.87)	
Trading	-2.4231	-2.1821	-2.3819	-2.1370	-2.9359	-2.7230	-3.0027	-2.7909
	(-4.83)	(-4.72)	(-4.52)	(-4.39)	(-4.83)	(-4.77)	(-4.88)	(-4.83)
	Panel B: Delay measure 2							
	Delay measures w.r.t. global market information				**Delay measures w.r.t. local market information**			
	ew	**ew**	**vw**	**vw**	**ew**	**ew**	**vw**	**vw**
Constant	0.5070	0.5187	0.5008	0.5102	0.5437	0.5388	0.5448	0.5428
	(69.06)	(152.14)	(69.00)	(143.97)	(110.55)	(184.96)	(112.53)	(177.82)
Turnover	0.3100		0.3131		-0.2018		-0.1181	
	(3.83)		(4.28)		(-2.96)		(-2.05)	
Volatility	0.0949		0.0652		-0.0259		-0.0052	
	(1.09)		(0.76)		(-0.47)		(-0.10)	

Trading	-0.9157	-0.6349	0.1525	0.3913	-1.0701	-1.2006	-1.6515	-1.7132
	(-1.97)	(-1.35)	(0.24)	(0.62)	(-2.18)	(-2.41)	(-2.73)	(-2.85)

Table 5. The cross-sectional regression with export-import firms

This table provides the results of cross-sectional regression with export-import information. In this analysis, we define export-import firm is the firm that has an amount of export higher than 50% of its sales. Panel A presents the results when only export-import firms are used for the sample firms and Panel B presents the results when all sample firms are used and the product of the foreign trading and a dummy variable for export-import firms are added to the model. In each panel, the left (right) four columns are for delay measures with respect to global (local) market information. And ew (vw) means that the global market return which is used for constructing the delay measure is equal-weighted (value-weighted) return. Turnover, volatility, and trading variables are constructed with the previous year data in each year for each firm and delay measure 1 is used for the dependent variable. The sample period is from 1999 to 2009 and numbers in parentheses are t-values.

	Panel A: With export-import firms							
	Delay measures w.r.t. global market information				**Delay measures w.r.t. local market information**			
	ew	**ew**	**vw**	**vw**	**ew**	**ew**	**vw**	**vw**
Constant	0.1493	0.1381	0.1490	0.1401	0.1614	0.1537	0.1618	0.1532
	(13.09)	(25.61)	(13.11)	(28.00)	(13.21)	(29.04)	(12.98)	(29.10)
Turnover	0.4894		0.4119		0.3022		0.2543	
	(2.83)		(2.52)		(3.28)		(2.77)	
Volatility	-0.2262		-0.1843		-0.1489		-0.1523	
	(-1.80)		(-1.40)		(-1.05)		(-1.04)	
Trading	-3.5928	-3.5701	-3.9465	-3.9223	-4.7092	-4.7026	-4.6862	-4.7025
	(-3.87)	(-3.88)	(-5.52)	(-5.54)	(-6.48)	(-6.49)	(-6.61)	(-6.65)
	Panel B: With all sample firms							
	Delay measures w.r.t. global market information				**Delay measures w.r.t. local market information**			
	ew	**ew**	**vw**	**vw**	**ew**	**ew**	**vw**	**vw**
Constant	0.1403	0.1506	0.1413	0.1518	0.1555	0.1639	0.1548	0.1634
	(30.61)	(66.63)	(29.11)	(67.46)	(48.02)	(67.59)	(46.61)	(67.05)
Turnover	0.2390		0.2289		0.2829		0.2609	

	(3.47)		(3.84)		(3.96)		(4.03)	
Volatility	0.0909		0.0965		0.0584		0.0649	
	(1.65)		(1.64)		(1.78)		(1.89)	
Trading	-2.4380	-2.1440	-2.3685	-2.0704	-2.9961	-2.7342	-3.0910	-2.8302
	(-4.52)	(-4.38)	(-4.26)	(-4.08)	(-4.55)	(-4.46)	(-4.61)	(-4.54)
Trading × export dummy	-2.2795	-2.3832	-2.6462	-2.7525	-2.6611	-2.7473	-2.5629	-2.6506
	(-2.53)	(-2.71)	(-3.45)	(-3.70)	(-3.24)	(-3.44)	(-3.14)	(-3.35)

Table 6. Lead-lag relations of foreign trading portfolios

This table presents the results of VAR model estimates to examine the lead-lag relations of foreign trading portfolios. To construct portfolios, se first sort stocks by their foreign trading volumes into three equal-size groups. Then we sort stocks by either firm size of turnover independently, thus construct nine size-foreign trading portfolios or turnover-foreign trading portfolios. In each size or turnover group, $R_{HT,t-k}(R_{LT,t-k})$ are returns portfolios that are highly (lowly) invested by foreigners. The estimates of following VAR model with these returns on portfolios are presented in this table.

$$R_{LT,t} = a_0 + \sum_{k=1}^{3} b_k R_{LT,t-k} + \sum_{k=1}^{3} c_k R_{HT,t-k} + u_t$$

$$\mathrm{R_{HT,t}} = \mathrm{a_1} + \sum_{\mathrm{k=1}}^{3} \mathrm{d_k R_{LT,t-k}} + \sum_{\mathrm{k=1}}^{3} \mathrm{e_k R_{HT,t-k}} + \mathrm{u_t}$$

The sample period is from 1999 to 2012 and numbers in parentheses are t-values.

Group	Dependent variable	Independent variables						Test (t-value)			
		$R_{LT,t-1}$	$R_{LT,t-2}$	$R_{LT,t-3}$	$R_{HT,t-1}$	$R_{HT,t-2}$	$R_{HT,t-3}$	$b_1 + b_2 = 0$ $(d_1 + d_2 = 0)$	$\sum_{k=1}^{3} b_k = 0$ $(\sum_{k=1}^{3} d_k = 0)$	$c_1 + c_2 = 0$ $(e_1 + e_2 = 0)$	$\sum_{k=1}^{3} c_k = 0$ $(\sum_{k=1}^{3} e_k = 0)$
Panel A: lead-lag relation controlling for size											
Small	$R_{LT,t}$	0.193	0.070	0.018	-0.117	-0.033	0.019	(2.84)	(2.58)	(-2.37)	(-2.21)
		(2.82)	(1.02)	(0.26)	(-2.64)	(-0.75)	(-0.44)				
	$R_{HT,t}$	0.217	0.010	-0.016	-0.162	0.004	-0.092	(1.58)	(1.25)	(-1.62)	(-2.12)
		(2.05)	(0.09)	(-0.15)	(-2.38)	(0.06)	(-1.35)				
Medium	$R_{LT,t}$	0.120	0.062	0.048	-0.076	0.001	-0.055	(1.22)	(1.26)	(-0.65)	(-0.91)
		(1.11)	(0.58)	(0.45)	(-0.92)	(0.01)	(-0.68)				
	$R_{HT,t}$	0.142	0.109	0.095	-0.092	-0.057	-0.102	(1.29)	(1.46)	(-0.99)	(-1.34)

		(1.01)	(0.78)	(0.68)	(-0.86)	(-0.53)	(-0.96)				
Large	$R_{LT,t}$	-0.317	-0.065	-0.017	0.322	0.118	-0.006	(-3.39)	(-2.87)	(3.94)	(3.15)
		(-4.11)	(-0.84)	(-0.23)	(4.21)	(1.52)	(-0.07)				
	$R_{HT,t}$	-0.323	-0.038	0.064	0.222	0.088	-0.111	(-3.20)	(-2.13)	(2.77)	(1.44)
		(-4.19)	(-0.48)	(0.84)	(2.89)	(1.14)	(-1.45)				
Panel B: lead-lag relation controlling for turnover											
Low	$R_{LT,t}$	-0.071	0.017	0.114	0.136	0.084	-0.116	(-0.48)	(0.46)	(2.08)	(0.84)
		(-0.83)	(0.19)	(1.36)	(1.79)	(1.11)	(-1.59)				
	$R_{HT,t}$	-0.259	-0.056	0.062	0.160	0.136	-0.101	(-2.45)	(-1.73)	(2.48)	(1.40)
		(-2.67)	(-0.57)	(0.65)	(1.87)	(1.59)	(-1.22)				
Medium	$R_{LT,t}$	-0.047	0.069	0.099	0.093	-0.038	-0.133	(0.20)	(0.87)	(0.50)	(-0.58)
		(-0.55)	(0.82)	(1.18)	(1.20)	(-0.50)	(-1.75)				
	$R_{HT,t}$	-0.133	0.070	0.058	0.068	-0.027	-0.122	(-0.49)	(-0.03)	(0.33)	(-0.56)
		(-1.43)	(0.76)	(0.64)	(0.80)	(-0.32)	(-1.47)				
High	$R_{LT,t}$	-0.093	0.083	0.084	0.085	-0.039	-0.080	(-0.08)	(0.48)	(0.40)	(-0.24)
		(-0.99)	(0.88)	(0.90)	(1.03)	(-0.47)	(-0.97)				
	$R_{HT,t}$	-0.168	0.047	0.076	0.102	-0.048	-0.102	(-0.82)	(-0.26)	(0.41)	(-0.30)
		(-1.58)	(0.45)	(0.72)	(1.08)	(-0.52)	(-1.09)				

Table 7. Lead-lag relations of foreign trading portfolios with world market returns

This table presents the results of VAR model estimates to examine the lead-lag relations of foreign trading portfolios. To construct portfolios, se first sort stocks by their foreign trading volumes into three equal-size groups. Then we sort stocks by either firm size of turnover independently, thus construct nine size-foreign trading portfolios or turnover-foreign trading portfolios. In each size or turnover group, $R_{HT,t-k}(R_{LT,t-k})$ are returns portfolios that are highly (lowly) invested by foreigners and $R_{w,t-k}$ indicates current and lagged world market return for *k* = 0, 1, 2, 3. The estimates of following VAR model with these returns on portfolios are presented in this table.

$$R_{LT,t} = a_0 + \sum_{k=1}^{3} b_k R_{LT,t-k} + \sum_{k=1}^{3} c_k R_{HT,t-k} + \sum_{k=0}^{3} f_k R_{w,t-k} + u_t$$

$$R_{HT,t} = a_1 + \sum_{k=1}^{3} d_k R_{LT,t-k} + \sum_{k=1}^{3} e_k R_{HT,t-k} + \sum_{k=0}^{3} g_k R_{w,t-k} + u_t$$

The sample period is from 1999 to 2012 and numbers in parentheses are t-values.

Group	Dependent variable	Independent variables										Test (t-value)					
		$R_{LT,t-1}$	$R_{LT,t-2}$	$R_{LT,t-3}$	$R_{HT,t-1}$	$R_{HT,t-2}$	$R_{HT,t-3}$	$R_{w,t}$	$R_{w,t-1}$	$R_{w,t-2}$	$R_{w,t-3}$	$b_1+b_2=0$ or $d_1+d_2=0$	$\sum_{k=1}^{3} b_k=0$ or $\sum_{k=1}^{3} d_k=0$	$c_1+c_2=0$ or $e_1+e_2=0$	$\sum_{k=1}^{3} c_k=0$ or $\sum_{k=1}^{3} e_k=0$	$f_1+f_2=0$ or $g_1+g_2=0$	$\sum_{k=1}^{3} f_k=0$ or $\sum_{k=1}^{3} g_k=0$
Panel A: lead-lag relation controlling for size																	
Small	$R_{LT,t}$	0.071	-0.008	0.059	-0.083	-0.012	-0.012	0.681	0.324	0.258	-0.023	(0.72)	(1.17)	(-1.71)	(-1.60)	(5.64)	(4.28)
		(1.10)	(-0.12)	(0.93)	(-2.14)	(-0.30)	(-0.32)	(11.17)	(4.76)	(3.71)	(-0.33)						
	$R_{HT,t}$	0.046	-0.107	0.038	-0.126	0.031	-0.084	0.707	0.450	0.406	-0.034	(-0.42)	(-0.14)	(-1.04)	(-1.62)	(5.02)	(3.81)
		(0.43)	(-1.01)	(0.36)	(-1.97)	(0.48)	(-1.31)	(7.02)	(4.00)	(3.54)	(-0.30)						
Medium	$R_{LT,t}$	0.066	-0.005	-0.054	-0.117	-0.002	0.038	0.679	0.341	0.258	0.026	(0.47)	(0.05)	(-1.12)	(-0.61)	(5.66)	(4.61)
		(0.70)	(-0.05)	(-0.57)	(-1.56)	(-0.03)	(0.52)	(11.17)	(4.98)	(3.64)	(0.36)						
	$R_{HT,t}$	0.065	0.009	-0.040	-0.157	-0.052	0.039	0.915	0.536	0.372	-0.033	(0.44)	(0.16)	(-1.56)	(-1.02)	(6.74)	(5.06)
		(0.53)	(0.08)	(-0.34)	(-1.66)	(-0.56)	(0.42)	(11.84)	(6.15)	(4.12)	(-0.37)						
Large	$R_{LT,t}$	-0.233	-0.117	-0.090	0.165	0.093	0.077	0.693	0.318	0.244	0.058	(-3.39)	(-3.45)	(2.25)	(2.36)	(4.25)	(3.66)

		(-3.29)	(-1.63)	(-1.29)	(2.15)	(1.21)	(1.03)	(9.34)	(3.71)	(2.76)	(0.65)						
	$R_{HT,t}$	-0.212	-0.103	-0.033	0.001	0.041	0.007	0.898	0.457	0.366	0.055	(-3.32)	(-2.98)	(0.42)	(0.39)	(6.79)	(5.65)
		(-3.25)	(-1.57)	(-0.53)	(0.02)	(0.62)	(0.10)	(13.16)	(5.80)	(4.51)	(0.68)						
Panel B: lead-lag relation controlling for turnover																	
Low	$R_{LT,t}$	-0.055	-0.006	0.096	0.029	0.027	-0.080	0.621	0.301	0.232	0.014	(-0.60)	(0.31)	(0.58)	(-0.20)	(5.39)	(4.32)
		(-0.73)	(-0.08)	(1.30)	(0.42)	(0.40)	(-1.19)	(11.25)	(4.67)	(3.51)	(0.21)						
	$R_{HT,t}$	-0.238	-0.086	0.038	0.028	0.064	-0.062	0.806	0.366	0.287	0.045	(-3.00)	(-2.31)	(0.88)	(0.24)	(6.13)	(5.12)
		(-2.93)	(-1.04)	(0.48)	(0.37)	(0.86)	(-0.87)	(13.56)	(5.28)	(4.03)	(0.63)						
Medium	$R_{LT,t}$	-0.101	-0.001	0.085	0.051	-0.029	-0.090	0.728	0.349	0.261	0.017	(-0.98)	(-0.14)	(0.22)	(-0.54)	(5.30)	(4.26)
		(-1.34)	(-0.02)	(1.15)	(0.72)	(-0.41)	(-1.30)	(11.06)	(4.65)	(3.39)	(0.22)						
	$R_{HT,t}$	-0.198	-0.024	0.031	-0.002	-0.034	-0.081	0.851	0.436	0.387	0.105	(-2.02)	(-1.45)	(-0.33)	(-0.89)	(6.75)	(5.96)
		(-2.49)	(-0.30)	(0.40)	(-0.02)	(-0.46)	(-1.11)	(12.22)	(5.49)	(4.73)	(1.29)						
High	$R_{LT,t}$	-0.042	0.009	0.045	-0.028	-0.025	-0.019	0.774	0.358	0.263	0.010	(-0.29)	(0.09)	(-0.47)	(-0.53)	(4.77)	(3.76)
		(-0.50)	(0.10)	(0.54)	(-0.36)	(-0.32)	(-0.25)	(10.37)	(4.25)	(3.00)	(0.12)						
	$R_{HT,t}$	-0.103	-0.048	0.021	-0.076	-0.044	-0.012	0.950	0.576	0.430	-0.014	(-1.20)	(-0.87)	(-0.99)	(-0.89)	(7.17)	(5.49)
		(-1.13)	(-0.53)	(0.24)	(-0.90)	(-0.53)	(-0.15)	(11.81)	(6.34)	(4.55)	(-0.14)						

Figure 1. The time-series of foreigner's trading volume

This figure shows the trend of foreigners' trading volume across stocks in each year. The upper (lower) dashed line shows the average trading volume + (-) 2σ and the middle solid line shows the average trading volume for each year. The sample period is from 1999 to 2012.

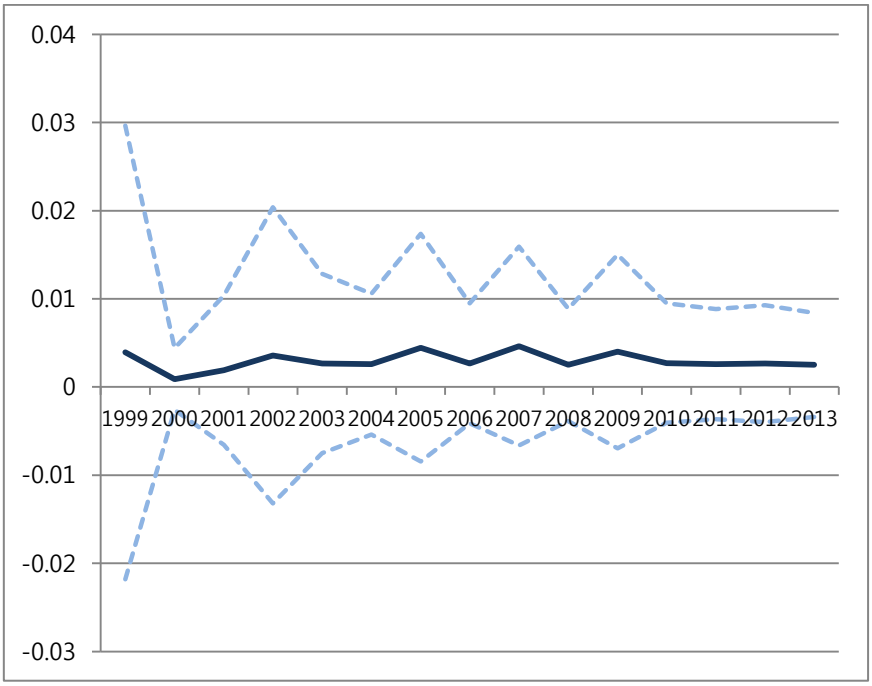
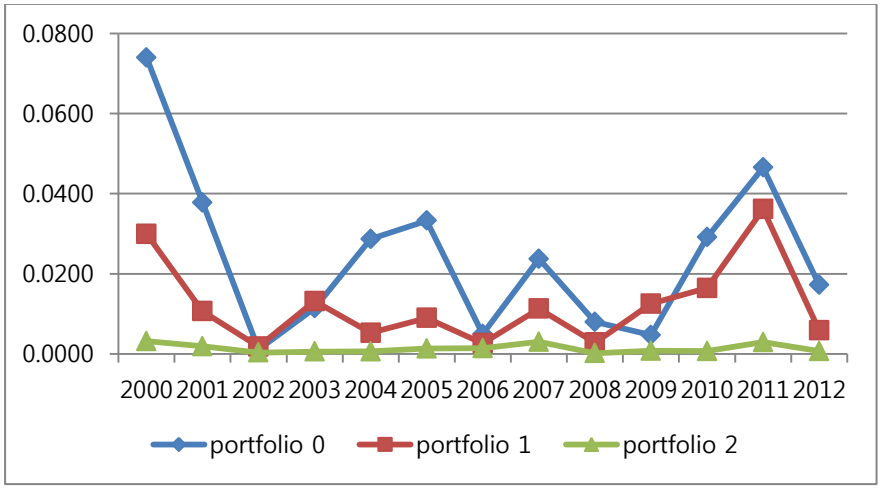
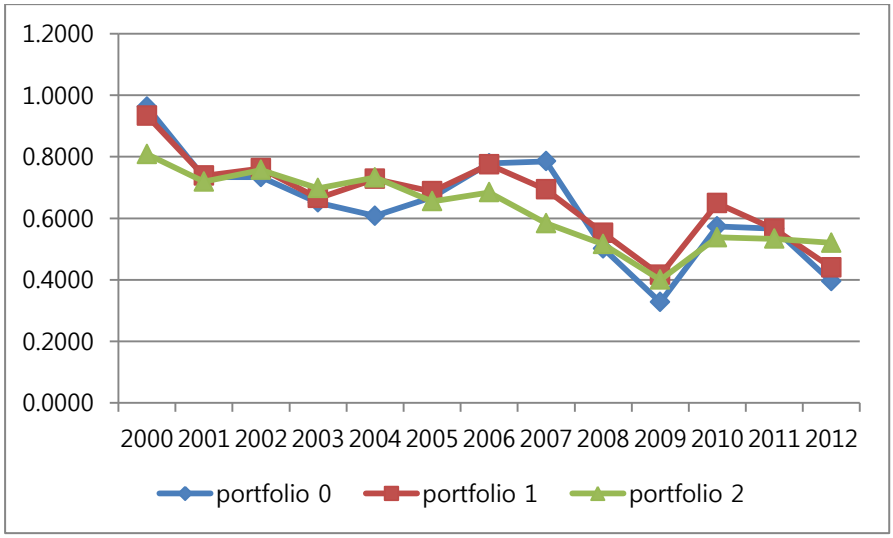


Figure 2. Time series of delay measures by foreigners' trading volume

The figure provides times series of delay measure 1 of three portfolios constructed by the foreign trading in the previous year. Portfolio 2 (portfolio 0) is constructed of the highest (lowest) one-third firms of sample stocks. Panel A (Panel B) shows the time series of delay measures with respect to global (local) market information.



Panel A. Delay measure with respect to global market information



Panel B. Delay measure with respect to local market information