

Foreign Ownership and Exchange Rate Risks: Evidence from Korean Stock Returns

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In this paper, we estimate several measures of a firm's 'exposure to exchange rate risks' —hereafter 'F/X exposure'—, and analyze how these exposures are affected by different firm characteristics including foreign ownership. By using the foreign ownership and stock return data of 571 Korean firms from 2000 to 2006, we find that foreign ownership is an important factor affecting the F/X exposures. In particular, during a month of home currency depreciation, the stock returns of firms with a higher ownership experience a greater negative shock, but during a month of increased exchange rate volatility, those firms with a lower ownership that experience a greater negative shock. Overall, various firm characteristics are found to affect F/X exposures in different directions, weakening the statistical significance of the exposure measures. This finding helps explain the previously documented weak association between exchange rates and stock returns.

JEL Classification: F31, G15, G32

Key words: Exchange rate exposure, foreign ownership, international finance

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1. Introduction

Suppose a firm's main source of income is exports. If the local currency is expected to depreciate, the firm's exports will gain price competitiveness, and the operating income is likely to increase. Would this seemingly good news automatically bring about a rise in the share price? The answer may not necessarily

be affirmative, especially from a foreign investor's perspective. This is because the expected depreciation of the local currency will result in a depreciation of the 'home' currency value of the foreign investor's stock holdings. Therefore, s/he may well sell off her/his shareholdings, and the share price may not respond positively to the depreciation of the local currency. The traditional research on F/X exposure has largely ignored the effects of foreign ow-

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nership, and this study attempts to fill the void.

Since Adler and Dumas (1984) defined a firm's F/X exposure as the correlation of the value of an asset or liability to the changes in exchange rates, empirical research on F/X exposure has largely focused on the measurement of the exposure itself and the contributing factors. The first such attempt is the work of Jorion (1990). He develops a model to measure F/X exposure by estimating the 'currency beta': a slope coefficient of stock returns against exchange rate changes. In essence, this model attempts to estimate the 'net' economic exposure on stock returns after all the effects of currency risks on the assets and liabilities, including the effects of hedging activities, have been taken into account. Jorion (1990) finds that even though the currency beta varies across U.S. multinational firms depending on their level of foreign activities, for most of the firms, it is statistically insignificant. The latter finding has been received as somewhat puzzling, thereby triggering a host of further investigations.¹⁾ For example, Bartov and Bodner (1994) corroborate this weak association between U.S. stock returns and exchange rates, and argue that the weak association may arise from mispricing. In addition, Chow, Lee, and Solt (1997) find that the weak association is mainly over short horizons, because interest

rate effects and cash-flow effects of F/X exposures offset over short horizons. Using Japanese data, He and Ng (1998) find that a slightly larger proportion²⁾ of sample firms experience a statistically significant F/X exposure. More recently, using proprietary internal data of a German corporation, Batram (2008) finds that various hedging activities taken by the managers cause the residual net exposure to be both economically and statistically small, even the company's operating cash flow is significantly exposed to exchange rate risk. In this study, we propose foreign ownership as another reason for this weak association. Especially, we aim at investigating whether foreign ownership further complicates the effects of exchange rates on stock returns, thereby rendering the relationship between the two obscure.

After Jorion (1990) suggested 'currency beta' as a measure of F/X exposure, subsequent empirical studies have expanded the concept of F/X exposure by including additional exchange rate-related variables in the measurement model. For example, Bartov and Bodner (1994) and He and Ng (1998) add lagged exchange rate movements as explanatory variables to explain stock returns. Analyzing U.S. firms, Bartov and Bodner (1994) report that stock returns have no relation with contemporaneous changes in exchange rates, but have

1) Batram and Bodner (2007) have an extensive survey on this puzzle.

2) Approximately 25 percent. In the work of Jorion (1990), only about 5 percent of firms exhibited a significant currency beta.

a significant relation with lagged ones. On the contrary, He and Ng (1998) find that in the case of Japanese MNCs, the stock returns are not affected by lagged exchange rate movements but by current movements. Koutmos and Martin (2003) further suggest volatility and asymmetric exposures. To estimate volatility exposure, they add exchange rate volatility in the measurement equation. For asymmetric exposure, they include a dummy variable to measure whether the stock returns respond differently to the appreciation of the local currency than to the depreciation. Unlike previous studies, however, they conduct the estimation only at the industry level, and do not perform cross-sectional analyses to investigate determinants of F/X exposure. In this paper, we include the variables that have been suggested by previous studies as measures of F/X exposure, and conduct cross-sectional analyses to investigate, among other things, how foreign ownership affects F/X exposure. In particular, we investigate how foreign ownership affects four measures of F/X exposure: appreciation exposure, depreciation exposure, volatility exposure, and lag exposure.³⁾

During the currency crises in 1997, Korea changed its exchange rate regime from a managed float to the free float. Bian and Cho (2006) find that even though the exchange

rate risk increased dramatically under the new regime, F/X exposures on equity returns generally decreased. We argue that this seemingly contradicting result is at least partly attributable to the increase in foreign ownership. During the currency crises, in addition to changing the exchange rate regimes, the Korean government lifted almost all restrictions on foreign ownership to help capital inflow from foreign investors. Since then foreign ownership has increased steadily to the extent that by 2006, about 5 percent of firms in our sample, 26 firms out of 571 to be exact, emerged with over 50 percent foreign ownership. Note that from foreign investors point of view, their total investment returns depend on both stock and currency returns. Heuristically speaking, the Korean economy is largely export driven, so the Korean Won's value and Korean firms' operating cash flows are negatively correlated. Therefore, in a period when foreign ownership is expanding, one may find that F/X exposures on equity returns are weaker than those in a period with little foreign ownership. Not only does the exchange rate affect foreign ownership, but changes in foreign ownership may also affect the exchange rates. When a large movement in exchange rates is observed, the news media typically posts an article suspecting large sales or purchases of

3) Batram (2004) also suggests nonlinear F/X exposure. Using a comprehensive sample of German nonfinancial firms, he finds that the nonlinear exposure is also an important aspect of F/X exposure. In our analysis, we use the asymmetric exposure as a proxy of nonlinear F/X exposure.

Korean stocks by foreign investors as one of the reasons for the movement. Therefore, foreign ownership seems to link the stock market and the market for foreign exchange, so understanding the link would definitely help in understanding the pricing mechanisms in both markets.

The literature on foreign ownership has been developed mainly along the line of its implication on corporate governance. For example, Rajan and Zingales (1998) argue that foreigners tend to demand better corporate governance. When the topic is applied to Korean firms, the discussion has been mainly on whether foreign investors destabilize Korean stock markets, or they earn higher returns compared to local investors. For example, Choe, Kho, and Stulz (1999) find no evidence that trades by foreign investors destabilize Korean stock market. In addition, Choe, Kho, and Stulz (2005) and Park, Bae and Cho (2007) investigate whether foreign investor outperform local investors. They all find evidence that foreign investors do not outperform local investors. Even though these lines of research are related to the current study, we steer away from them, and rather focus on the effects of the investment decisions

taken by foreign investors on the relationship between exchange rates and equity returns.⁴⁾

We find Korea as an ideal testing bed for our empirical study for a number of reasons. First, reliable foreign ownership data on Korea are readily available. There are not many countries, including the US, for which foreign ownership data are available.⁵⁾ Second, during the sample period from 2000 to 2006, Korea had few, if any, restrictions on trades as well as capital flows. On stock investments, there were even no capital gains taxes. In addition, its exchange rates were fully free float. Therefore, the empirical findings on F/X exposures are most likely to be driven by economic decisions of those agents free from government regulations. Lastly, owing to the wide variations in Korean corporate variables including foreign ownership, meaningful cross-sectional analyses can be conducted.

Like in previous studies, we also find that only about 8 percent of the sample firms exhibit statistically significant currency beta. If we include other aspects of F/X exposure, the number of firms that have at least one significant exposure parameter increases to about 27 percent of the sample. Overall, we find that stock returns are positively related to

4) The effect of foreign ownership on F/X exposure has never been studied before. However, the relationship between corporate governance and derivative use, which can affect F/X exposure, has been examined previously. For example, see the works of Whidbee and Wohar (1999), Easterbrook(2002), and Marsden and Pervost (2005).

5) To proxy foreign ownership, Bae, Chan and Ng (2004) and Bae, Ozoguz and Tan (2008) use the 'degree open factor' variable provided by Standard and Poor's Emerging Market database. This variable takes a value between 0 and 1, and measures the quantity of a company's market capitalization a foreign entity can legally own. This variable does not provide information on the exact holdings of foreign investors, but rather the amount that they are *allowed* to hold legally.

the currency value. This is somewhat surprising in that the Korean economy is largely export driven. From the cross-sectional analyses we find that different firm characteristics affect the exposure parameters in different directions, making F/X exposure less significant. With respect to foreign ownership, we first find that it has a strong relation to the depreciation beta. This implies that in a period when the Korean Won depreciates, the stock returns of firms with a higher ownership tend to be lower than those with a lower ownership. In addition, the volatility beta becomes larger for firms with a higher foreign ownership. This means that as the volatility of exchange rates increases, firms with a higher foreign ownership yield higher equity returns than those with a lower ownership. Another weak yet interesting finding is that foreign investors tend to decrease stock market efficiency. As Bartov and Bodner (1994) argue, a significant lag beta can be viewed as evidence that the stock market is inefficient. This is because with a significant lag beta, stock returns are predictable by observing the past exchange rates. In this paper, we find that the statistical significance of lag beta becomes stronger for firms with a higher foreign ownership.

These findings overall have implications for policy makers as well as on future research. First, during the global financial crises of 2007 and 2008, weak Korean Won policy mandated by Ministry of Finance triggered a sharp

depreciation of Korean Won. The policy makers seemed to believe that weak Korean Won would benefit most of the exporting companies. What the government officials overlooked was the fact that a lot of Korean exporting firms placed hedges against strong Korean Won including engaging in KIKO contracts. The sharp depreciation of Korean Won actually caused massive financial losses for these firms. The findings from this paper suggest that many factors including foreign ownership affect F/X exposure of Korean companies so that the changes of exchange rates have complicating effects on firm value. Therefore, policy makers should understand that firms adapt to the changing environments, and simple textbook-type policy measures may not bring out the desired impacts. Second, this paper examines the effects of foreign investors on various measure of F/X exposure. Due to the availability of data on foreign ownership, the cross-sectional analyses on factors determining F/X exposure could be done only using yearly data. This seems to weaken the power of statistical tests. Recently, data on foreign ownership become available over daily intervals. If enough data are accumulated, further research on this topic should help understand the true factors of F/X exposure.

The remaining part of the paper is organized as follows. Section II provides the empirical models together with the explanations on the variables used for the analyses. Section II

also describes the data. The results from the empirical analyses are reported in Section III. Finally, Section VI presents the study's conclusions.

II. Empirical Models

2.1 Measurement of F/X Exposures

The measurement of F/X exposure hinges on the definition of exposure. A typical textbook on international finance would define exposure in three different concepts: transaction, translation and economic exposures. Transaction exposure measures the risks associated with the expected cash flows in foreign currency due to unexpected changes in exchange rates. Translation exposure measures the exchange rate risks in accounting income when consolidated financial statements are prepared for a multinational corporation. Lastly, economic exposure measures the exchange rate risks in firm value, and this is in line with how Adler and Dumas (1984) define a firm's F/X exposure: the correlation of the value of an asset or liability to the changes in real exchange rates. Most empirical studies on F/X exposure have largely focused on the measurement of economic exposure, especially of the exchange rate risks in equity returns. This is possibly due to data availability but

more importantly to the fact that only economic exposure measures the ultimate impact of exchange rates on the value of residual claim, *i.e.* equity, after all the effects on cash flows and accounting income have been considered.

The first such attempt is Jorion (1990). He develops a model to measure F/X exposure by estimating the 'currency beta': a slope coefficient of stock returns against exchange rate changes. Using data on US multinational firms, he finds that only 5 percent of his sample firms have a significant currency beta. Subsequent research finds that equity returns respond differently to the appreciation and depreciation of the local currency. For example, Miller and Reurer (1998) report a significant difference in US firms' currency betas in the period of currency appreciation as compared to those in the period of depreciation. By analyzing Japanese firms, Chow and Chen (1998) report that as compared to the appreciation of Japanese Yen, depreciation affects firm value more. Di Iorio and Faff (2000) also find significant asymmetric exposure in Australian data. Koutmos and Martin (2003b) estimate asymmetric exposure embedded in the industry stock returns of firms in Germany, Japan, the US, and the UK. They also find that about 40 percent of the cases exhibit significant asymmetric exposure.

In an attempt to explain the currency beta's weak significance as found by Jorion (1990),

Bartov and Bodner (1994) include lagged exchange rate movements as explanatory variables. They argue that the weak significance may arise from mispricing in the stock market, and provide evidence that US stock returns are significantly related to the lagged changes in exchange rates. Investigating the F/X exposure in Japanese firms, He and Ng (1998) also test whether stock returns are related to lagged exchange rate movements. Contrary to the findings of Bartov and Bodner (1994), in the case of Japanese MNCs, stock returns are affected by the current movement in exchange rates and not by the lagged ones. In an extensive case study on a German firm, Batram (2008) finds that various hedging activities taken by the managers cause the residual net exposure to be both economically and statistically small, even the company's operating cash flow is significantly exposed to exchange rate risk.

Recently, Koutmos and Martin (2003a) add exchange rate volatility to Jorion's (1990) measurement model. They argue that the exchange rate volatility can affect the cash flows of a firm by altering the volume of international trade or increasing the volume of hedging activities. They analyze whether the stock returns from nine major U.S. sectors are affected by the exchange rate volatility of five major currencies. They find that the non-

cyclical consumer and financial sectors have a significant sensitivity to exchange rate volatility for four countries' currencies.

In this paper, we take a comprehensive approach and include four measures of F/X exposure: first moment exposure, that is, the currency beta, asymmetric exposure, volatility exposure, and lag exposure. This will result in the following measurement model for F/X exposures at the firm level:

$$R_{it} = \beta_0 + \beta_m R_{mt} + (\beta_x + \beta_D D_t) R_{xt} + \beta_\sigma \sigma_{xt} + \beta_L R_{xt-1} + \varepsilon_t, \quad (1)$$

where

R_{it} = the log rate of return on the i^{th} firm's stock at month t ,

R_{mt} = the log rate of return on KOSPI at month t ,

R_{xt} = the log rate of change in the exchange rate at month t ,

σ_{xt} = the exchange rate volatility at month t ,⁶⁾

R_{xt-1} = the lagged rate of change in the exchange rate at month $t-1$,

D_t is a dummy variable, which is 1 if $R_{xt} < 0$, and

ε_t is the error term at month t .

Hence, the four slope coefficients of Equation (1), β_x , β_D , β_σ and β_L , are used to measure the four aspects of F/X exposure. Specifically, β_x measures currency exposure, β_D , the asymmetric exposure, β_σ , the volatility exposure, and lastly β_L , the lag exposure.

6) We measured exchange rate volatility by adopting a similar approach taken by Koutmos and Martin (2003a). The exact procedure is described in the Appendix.

Note that the response of R_{it} to the exchange rate will be equal to β_x if $R_{xt} > 0$, and $\beta_x + \beta_D$ if $R_{xt} < 0$. Therefore, the currency exposure, β_x , can be interpreted as the 'appreciation exposure', while $\beta_x + \beta_D$, the 'depreciation exposure'. In what follows, we redefine the depreciation exposure, $\beta_x + \beta_D$ as β_{Dep} . Equation (1) is similar to the measurement equation in Koutmos and Martin (2003a), except that in our model, the lag effect is added.

In estimating Equation (1), we use 84 monthly observations spanning seven years from 2000 to 2006. There are at least two reasons why we use monthly data instead of data with a higher frequency. First, because F/X exposure relates the exchange rate risks to firm value, we believe that it should be measured over medium- to long-term intervals. Second, in order to estimate Equation (1), we need data on exchange rate volatility, σ_{xt} . Due to data unavailability,⁷⁾ however, we cannot generate observations of σ_{xt} on a higher frequency data. To estimate the exchange rate volatility for month t , σ_{xt} , we take a similar approach as described along Equations (2) ~

(4) in Koutmos and Martin (2003a). In essence, we first assume that the conditional variance of innovations in the exchange rate movement follows a GARCH(1,1) process. Then, we take the sum of the daily conditional variances of the month. We take the square root of the sum to obtain σ_{xt} . The description of exact procedure is found in the Appendix.⁸⁾

As for the exchange rate, we use the trade-weighted exchange rates developed by JP Morgan.⁹⁾ This index is evaluated by taking the geometric weighted average of the exchange rates, where the weights are measured in terms of the trading partners' weights in the total volume of trades. In the case of Korea, its trading partners include the U.S., China, Japan, Hong Kong, the UK, Switzerland, Germany, and others. Jorion (1990), Bodnar and Gentry (1993), He and Ng (1998), and Batram (2004) all use trade-weighted exchange rates in their study of F/X exposure. Korea has had foreign activities across the globe over the years, so measuring F/X exposure against the trade-weighted index seems to be appropriate. Unlike the usual exchange rates such

7) For exchange rate data, we use the trade-weighted index provided by JP Morgan. This data set includes daily nominal indices and monthly real indices. In our paper, we use daily series.

8) When Bollerslev (1987) first introduced GARCH model, and the specification of GARCH(1,1) was used to explain foreign exchange dynamics. In addition, a specification of higher orders is not suitable for this paper, since the conditional variance is estimated for each month, which has only about 20 observations.

9) Naturally, a better way of identifying the F/X exposure and its determinants is by examining the exposures over individual currencies. This will be ideal if we can identify the sample of firms that are inclined to have a strongest exposure to a certain currency. This analysis, however, is practically impossible to conduct due to data availability. We replicated the empirical analyses with the US dollar exchange rate, and find out that for most of the variables, the signs of estimates remain the same, but the statistical significances generally go down. This is possibly due to the fact that in the overall sample, firms that are not strongly exposed to the U.S. dollar are also included.

as Won-Dollar exchange rate, this JP Morgan index becomes larger if Korean Won appreciates against the other currencies, and smaller, if depreciates. The exchange rates are obtained from the Bloomberg database. Data on the KOSPI index and returns on the sample firms are from the Korea Securities Research Institute (KSRI). The equity returns are adjusted for dividends, splits, and reverse splits.

2.2 Determinants of F/X Exposure

Once the exposure parameters, β_x , β_D , β_σ and β_L , are estimated at the firm level, we conduct cross-sectional analyses on these parameters to investigate how firm characteristics including foreign ownership (hereafter referred to as 'FO') are related to F/X exposure. We conjecture that foreign ownership plays an important role in linking the currency and the capital markets. From the foreign investors' point of view, the changes in currency

value will have at least two implications in their investment decisions. First, unless their investment value is properly hedged, the total return from their investment is directly affected by the currency return. Second, depending on the industrial structure of the firm and the degree of hedging activities the firm takes, the change in exchange rates will affect firm value by altering the operating income and balance sheet items. The latter effect does not seem to have direct impacts on foreign investors return, because these are rather longer-term effects. However, if the capital market prices the effects of the exchange rates properly into the stock price, then the latter effect should also have direct implications on foreign investors' investment decision. Therefore, if foreign investors are risk averse with only limited access to the markets for currency hedge, we predict that they will prefer stocks that are relatively immune to F/X risk.

Not only does the exchange rate affect foreign

(Table 1) Summary Statistics of Foreign Ownership

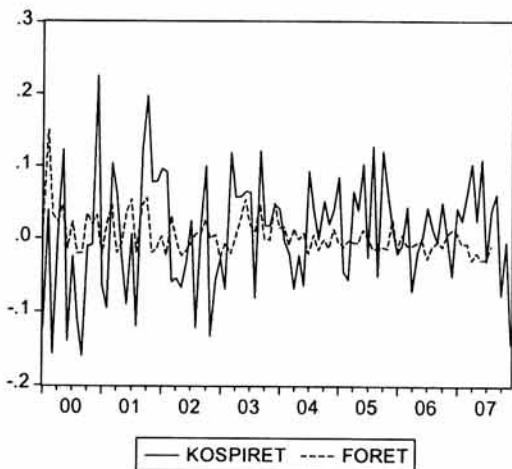
This table reports the summary statistics of FO (foreign ownership) of 571 firms in each sample year.

YEAR	2000	2001	2002	2003	2004	2005	2006	Full
Mean	5.72	6.23	6.88	8.97	10.95	11.79	12.27	8.98
Median	0.37	0.42	0.52	0.76	1.61	3.06	4.90	1.17
Q1	0.01	0.02	0.03	0.06	0.05	0.24	0.51	0.07
Q3	4.89	5.715	7.03	11.46	16.29	17.95	18.17	11.6
Max	85.95	82.94	86.06	92.43	92.97	85.47	87.55	92.97
Min	0	0	0	0	0	0	0	0
STD	11.74	12.55	12.99	15.12	17.14	16.96	16.30	15.04

ownership, but changes in foreign ownership may also affect the exchange rate. When the exchange rate moves significantly, foreign investors' large sales or purchases of Korean stocks are often quoted as one of the reasons for the significant move. Therefore, foreign ownership seems to link the stock market and the market for foreign exchange, and understanding the link would definitely help in understanding the pricing mechanisms in both markets.

〈Figure 1〉 Changes in Foreign Ownership and Stock Returns

In this figure, the changes in foreign ownership and the returns in the KOSPI index of the Korean Exchange from 2000 to 2006 are plotted. *FORET* is the monthly changes of foreign ownership over the sample firms, while *KOSPIRET* is the return on the KOSPI index. For the sample period, the correlation of average foreign ownership and KOSPI return is 14 percent.



〈Figure 2〉 Changes in Foreign Ownership and Currency Returns

In this figure, we plot the changes in foreign ownership and the returns in the trade-weighted index of the Korean Won provided by JP Morgan. The sample period is from 2000 to 2006. *FORET* is the monthly changes of foreign ownership over the sample firms, while *FXRET* is the return on the JP Morgan index. For the sample period, the correlation of average foreign ownership and KOSPI return is 0.14 percent.

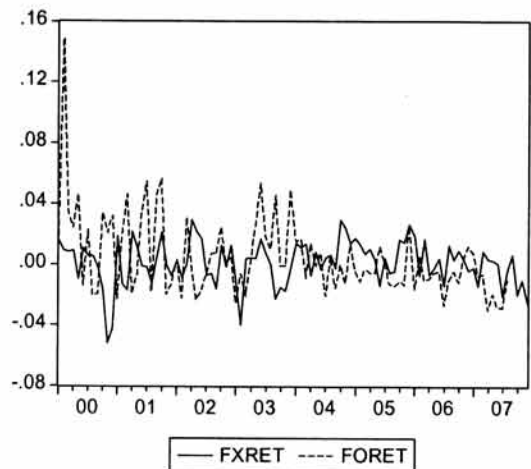


Table 1 shows how *FO* in our sample changed over time during the sample period. The average of foreign ownership has been gradually on the rise over the sample period—from 5.72 percent in 2000 to 12.27 percent in 2006. The average over the whole sample period is 8.98 percent. The median is much smaller than the average throughout the sample period, so the distribution of *FO* is largely skewed to the right. Figure 1 plots the relationship between the monthly changes in average *FO* and

the return on the KOSPI index. As the graph shows, the two variables seem to move in the same direction, indicating that they are inter-related. The correlation between these two variables is 14 percent. In addition, we plot the relationship between the monthly changes in average *FO*, and this time, the return on the exchange rates. This is reported in Figure 2. Unlike the relation between *FO* and the KOSPI index, at the aggregate level, the average *FO* and the exchange rates are almost unrelated, with the correlation coefficient standing at 0.14 percent. This weak association between the two variables may arise from loss of information at the aggregate level. We hope to uncover the lost information while investigating the relationship between the two at the firm level.

In the cross-sectional analyses, we include other firm-specific variables as controls. In previous literature, various variables have been used as explanatory variables for F/X exposure.¹⁰⁾ These variables can be largely grouped into two sets: (i) variables that proxy the firm's degree of foreign activities, and (ii) those of hedging activities. The variable that belongs to the first set is export ratio, while those that belong to the second set are, the amount of foreign debt, size, leverage ratio, market-

to-book ratio, and amount of derivative use.

Export ratio (hereafter referred to as '*ExpR*') is regarded as the most important variable that characterizes a firm's F/X exposure. Jorion (1990), He and Ng (1998) and Chow and Chen (1998) all find that the export ratio is positively related to a firm's exchange rate exposure. In our analyses, we also use the ratio of (foreign debt + foreign asset) to the total assets (hereafter referred to as '*FADF*') to measure the degree of foreign activities taken by a firm. We predict that firms with a higher ratio would exhibit a higher degree of F/X exposure.

Regarding the amount of foreign debt used (hereafter referred to as '*FDeR*'), Keloharju and Niskanen (2001), Kedia and Mozumdar (2003), and Elliott, Huffman and Makar (2003) find that most firms use foreign debt for hedging purpose, and as a result, those firms with a larger amount of foreign debt are less exposed to exchange rate fluctuation. Whether a firm uses foreign debt for hedging purposes or not can be evaluated by taking the difference between the foreign debt and the assets. This is because if a firm uses debt as hedging, then it will finance a foreign activity via a matching foreign currency debt. Therefore, a firm with well-balanced foreign

10) He and Ng (1994) also include quick ratio and dividend yield. We conducted the empirical analyses including these variables, but they turned out to be insignificant for all cases. In addition, leaving them out would not alter the results in a substantive way. Therefore, for the sake of parsimony, we decided to report the results without these variables. However, we include these variables in the first pass regression to obtain the predicted value for foreign ownership when we check for the endogeneity issue.

assets and debt would exhibit a lower degree of F/X exposure. In this paper, we also include the ratios of (foreign debt - foreign asset) to the total assets (hereafter referred to as '*NetFD*'), and the absolute value of (foreign debt - foreign asset) to the total assets (hereafter referred to as '*aNetFD*') as control variables.¹¹⁾

There are two conflicting views about how firm size (hereafter referred to as '*Size*') would affect the exchange rate exposure. Nance, Smith, and Smithson (1993) argue that larger firms have an economy of scale in hedging costs, so they should be able to hedge risks more effectively than smaller firms. This implies that larger firms should have a lower exchange rate exposure. On the other hand, Warner (1977) and He and Ng (1998) find evidence that firm size is positively related to F/X exposure. They contend that smaller firms actually have more incentives to hedge exchange rate risk because of high bankruptcy costs.

Leverage ratio is also widely tested as a factor of F/X exposure. Note that firms with a higher leverage ratio (hereafter referred to as '*LTD*') are exposed to a higher likelihood of bankruptcy. Therefore, they are expected to engage more actively in hedging activities. In fact, He and Ng (1998) and Chow and Chen (1998) report evidence that firms with a higher leverage ratio have a lower exchange

rate exposure.

Froot, Scharfstein and Stein (1993) argue that hedging will mitigate the underinvestment problem. By resorting to the underinvestment cost hypothesis that links the underinvestment problem with growth opportunities, and the assumption that market-to-book ratio (hereafter referred to as '*MB*') serves as a proxy for growth opportunities, Géczy, Minton and Schrand (1997) and He and Ng (1998) test whether *MB* is related to F/X exposure. In particular, they test whether firms with a higher *MB* engage in greater hedging activities, and find evidence to support the hypothesis. This implies a negative relation between *MB* and F/X exposure.

One of the obvious candidates as an explanatory variable for F/X exposure is the amount of derivative use (hereafter referred to as '*Deriv*'). A plethora of research exists to study the relationship between derivative use and firm value or firm risk. For example, Allayannis and Weston (2001) analyze 720 large U.S. non-financial firms to find a positive relation between derivative use and firm value. With respect to the relationship between derivative use and firm risk, using a sample of 254 U.S. non-financial firms that begin using derivatives, Guay (1999) finds a decline in firm risk following derivative use. We conjecture that derivative use would reduce F/X exposure.

11) One could create similar control variables from the income statements by using imports and exports. This, however, is not possible since data on imports are not available.

In sum, we use nine control variables together with foreign ownership ratio in the cross-sectional analyses. These variables are formally defined in the following:

<i>FO</i>	≡ number of shares held by foreigners / total number of shares
<i>ExpR</i>	≡ export / total sales
<i>FAFD</i>	≡ (foreign debt + foreign asset) / total assets
<i>Size</i>	≡ \log (total assets)
<i>LTD</i>	≡ long-term debt / total assets
<i>MB</i>	≡ market value of equity / book value of equity
<i>Deriv</i>	≡ total derivative use / total assets
<i>FDeR</i>	≡ foreign debt / total assets
<i>NetFD</i>	≡ (foreign debt - foreign asset) / total assets
<i>aNetFD</i>	≡ foreign debt - foreign asset / total assets

The sample in this research involves 571 Korean listed firms that have continually existed from 2000 to 2006. Data on these firm-specific variables are obtained from the Korea Listed Companies Association database. To conduct the cross-sectional analyses, we use the average of yearly observations. We cannot conduct panel estimation because we cannot produce the exposure β 's on a yearly basis. In order to obtain the yearly β s, Equation (1) has to be estimated on the year's 12 monthly observations, which are not enough

to generate power for the estimation.¹²⁾

III. Results

3.1 Measurement of F/X Exposures

Table 2 reports the summary information on the cross-sectional distribution of the coefficients from the estimation of Equation (1). The columns of the table, labeled as 'n+' and 'n-', show the number of firms with positive and negative exposure coefficients, while those of 'N+' and 'N-' show the number of firms with positive and negative coefficients significant at 10 percent. The last column labeled as 'N' shows the sum of 'N+' and 'N-' firm for the β under consideration. As it is reported at the bottom of the table, there are a total of 167 firms that have at least one significant β . This represents 29 percent of the total sample firms. This ratio is comparable to 25 percent found in He and Ng (1998), even though volatility and asymmetry exposures are added. This implies that even with the expanded notions of F/X exposure, more than two thirds of firms have their stock returns immune to changes in currency value, at least in a statistical sense. Moreover, with respect

12) Running OLS estimation using yearly averages produces estimates that are less powerful than those from panel estimation due to information loss. Therefore, OLS estimation is more conservative, and a statistically significant result under OLS would likely be even more significant under panel estimation.

(Table 2) Cross-Sectional Distribution of the F/X Exposure Coefficients

This table provides the summary information on the cross-sectional distribution of the coefficients from the estimation of Equation (1):

$$R_{it} = \beta_0 + \beta_m R_{mt} + (\beta_x + \beta_D D_t) R_{xt} + \beta_\sigma \sigma_{xt} + \beta_L R_{xt-1} + \varepsilon_t,$$

where R_{it} is the log rate of return on i^{th} firm's stock at time t ; R_{mt} , the log rate of return on the market index at time t ; R_{xt} , the log rate of change in the exchange rate at time t ; R_{xt-1} , the lagged rate of change in the exchange rate at time $t-1$; D_t , a dummy variable, which is 1 if $R_{xt} < 0$; σ_{xt} , exchange rate volatility at time t ; and ε_t , error term at time t . Five F/X exposure coefficients are reported: β_x is the currency exposure, which can be interpreted as 'appreciation' exposure; β_D , asymmetric exposure; β_σ , volatility exposure; β_L , lag exposure; and β_{Dep} , the sum of β_x and β_D , which can be interpreted as 'depreciation' exposure. n+ and n- shows the number of firms with positive and negative exposure coefficients, while N+ and N- report the number of firms with positive and negative coefficients significant at 10 percent. N is the sum of N+ and N-. The sample is comprised of 571 Korean listed firms having continually existed from 2000 to 2006.

Variable	Mean	Median	Max	Min	Q1	Q3	n+	n-	N+	N-	N
β_x	0.65	0.35	26.55	-10.85	-0.87	1.85	324	247	36	11	47
β_D	0.02	0.20	21.97	-41.05	-2.30	2.49	303	268	31	20	51
β_σ	-0.60	-0.58	24.08	-40.20	-3.25	1.70	236	335	17	33	50
β_L	-0.66	-0.51	3.42	-7.51	-1.36	0.25	182	389	4	76	80
$\beta_{Dep} (\equiv \beta_x + \beta_D)$	0.67	0.63	16.17	-14.51	-0.80	1.95	351	220			

The number of firms that have at least one significant β is 167 (29 percent).

to the individual β 's, the ratios of firms that have significant exposures range from about 9 percent for β_x , β_D , and β_σ , to 14 percent for β_L . Therefore, the spirit of Jorion's (1990) seemingly puzzling finding on prevalent insignificant F/X exposure looms large also to Korean firms that are quite open to global markets. As Batram (2008) finds with a German firm, we believe that the firms in our sample also engage in various hedging activities, both financial and non-financial,¹³⁾ to manage the risks originating from the currency

market. Later in this paper, we provide evidence that different firm characteristics affect the exposure measures in different directions, resulting in insignificant net exposures. Now, even though the F/X exposures seem to be largely insignificant, some observations can be made with regard to each measure of exposure.

First, if we confine our investigation only on the means or medians of the β -coefficients, the sample firms generally have a positive currency exposure, β_x , and asymmetry exposure, β_D . This implies that both the appreciation

13) Non-financial hedging activities are mostly operational hedges. These include matching foreign currency cash inflows and outflows, assets and liabilities, and geographically diversifying the sourcing and marketing countries.

and depreciation exposures are positive, but the depreciation exposure, $\beta_{Dep} (\equiv \beta_x + \beta_D)$, is in general greater than the appreciation exposure. In fact, the median of appreciation exposure is 0.349, while that of depreciation exposure is 0.627. The fact that the contemporaneous currency exposure, both appreciation and depreciation, is positive is somewhat surprising in that it is a widely held view that Korean companies, being mostly export oriented, would perform better when the value of the Korean Won weakens.¹⁴⁾ The data, however, tell that the converse is true. When the value of the Won appreciates, stock returns gain, and *vice versa*. In addition, the fact that β_{Dep} is generally greater than β_x implies that the negative impact on stock returns in response to currency depreciation is greater than the positive impact of currency appreciation on stock returns.

Second, the sample firms generally have a negative volatility exposure, β_σ . Out of the 50 firms that have a significant β_σ , the ones that have a negative sign outnumber those with a positive sign in a two-to-one margin. This implies that the stock returns are generally lower during the months when the exchange rate volatility is higher. In Koutmos and Martin (2003a), the financial sector is found to have a positively significant relationship. Unfortunately, in the present study, only

three firms are from the financial industry and a have significant β_σ , thus keeping us from making any statistically meaningful statement. Just for reference, however, out of the three firms, two have a positively significant β_σ .

Lastly, with respect to lag exposure, the mean and median are all negative. The ratio of firms that have a significant β^L_x is the greatest at 14 percent, and interestingly, 95 percent of these are negatively significant. This implies that for the sample firms, the equity returns are mostly negatively related to the value of the Korean Won in the previous month. The literature has regarded a significant β^L_x as an evidence of market inefficiency. The stock market's delayed reaction to the changes in exchange rates would make the stock price predictable, and therefore is an evidence of mispricing. In an attempt to explain the weak F/X exposure found in the work of Jorion (1990), Bartov and Bodner (1994) attempt to see whether the weak significance is due to this type of delayed reaction by the stock market. Using U.S. firms, they also find that the means of the estimated coefficients on the lagged exchange rates are negative. On the contrary, He and Ng (1998) find that in the case of Japanese MNCs, only six firms out of 171 (3.5 percent) of the sample firms have a significant lagged exposure.

14) In fact, in early 2008 when the new South Korean President Myung-Bak Lee took office, the government pushed for a weak Won in the hope of boosting the economy, only to see both the values of the Won and equities plummet.

Therefore, the results from the present paper are somewhat closer to those in the work of Bartov and Bodner (1994). Putting together the results on lagged exposure and contemporaneous exposure, we learn that policy makers should not make a sweeping judgment that the depreciation or appreciation of their

home currency will bring about deterministic changes in firm value. Now, we will turn our attention to the determinants of F/X measures.

3.2 Determinants of F/X Exposures

In Table 3, we report the summary stati-

(Table 3) Summary Statistics of Firm-Specific Variables

Table 3 provides the summary information about the firm-specific variables that are used as independent variables for the cross-sectional analyses on the determinants of F/X exposures. The first two rows of the table report the means and the standard deviation of the variables, while the remaining rows report the correlation coefficients among the variables. '*FO*' is foreign ownership; '*ExpR*', export ratio; '*FAFD*', foreign debt and asset ratio; '*Size*', firm size; '*LTD*', long-term debt ratio; '*MB*', market-to-book ratio; '*Deriv*', derivative usage; '*FDeR*', foreign debt ratio; '*NetFD*', ratio of net difference between foreign debt and equity; '*aNetFD*', the absolute value of '*NetFD*'. These variables are evaluated by taking averages over seven year period from 2000 to 2006.

	<i>FO</i>	<i>ExpR</i>	<i>FAFD</i>	<i>Size</i>	<i>LTD</i>	<i>MB</i>	<i>Deriv</i>	<i>FDeR</i>	<i>NetFD</i>	<i>aNetFD</i>
MEAN	0.089	0.259	0.130	12.507	0.062	1.002	0.044	0.083	0.021	0.066
STD	0.133	0.284	0.249	1.500	0.129	2.130	0.338	0.357	0.192	0.182
<i>FO</i>	1	0.049	0.010	0.542	-0.164	0.024	0.097	0.010	0.025	0.002
<i>ExpR</i>		1	0.293	0.022	0.006	0.002	-0.074	0.070	-0.066	0.126
<i>FAFD</i>			1	0.047	0.125	0.064	-0.008	0.871	0.599	0.921
<i>Size</i>				1	-0.158	-0.078	0.239	0.041	0.079	0.028
<i>LTD</i>					1	0.291	-0.056	0.112	0.157	0.154
<i>MB</i>						1	-0.007	0.022	0.013	0.028
<i>Deriv</i>							1	-0.013	-0.011	-0.033
<i>FDeR</i>								1	0.874	0.937
<i>NetFD</i>									1	0.758
<i>aNetFD</i>										1

FO ≡ number of shares held by foreigners / total number of shares

ExpR ≡ export / total sales

FAFD ≡ (foreign debt + foreign asset) / total assets

Size ≡ \log (total assets)

LTD ≡ long-term debt / total assets

MB ≡ market value of equity / book value of equity

Deriv ≡ total derivative use / total assets

FDeR ≡ foreign debt / total assets

NetFD ≡ (foreign debt - foreign asset) / total assets

aNetFD ≡ |foreign debt - foreign asset| / total assets

stics on the firm-specific variables that are used in the cross-sectional analyses. As we mentioned in the previous section, we take the average of the yearly observations of these variables, and run an OLS on the F/X exposure coefficients instead of panel regression. Therefore, the table reports the cross-sectional mean and standard deviation of the average of these variables, as well as correlations of each pair. First, with regard to foreign ownership, *FO*, it has the highest correlation with firm size, and this is somewhat expected. Second, it is interesting to see that derivative usage, *Deriv*, is negatively related to all the variables that measure the degree of a firm's foreign activities and hedging activities. The only exception is firm size. Recall that F/X exposures are insignificant for the majority of the firms. Therefore, the smaller firms seem to engage in hedging activities other than the use of derivatives. These activities may include matching foreign currency cash flows, and foreign currency assets and liabilities. Lastly, the variables that involve foreign debt and assets are highly correlated. This will pose a multicollinearity problem, so some caution is needed when running the regression. Now, we present the results of the cross-sectional estimations.

3.2.1 Appreciation Exposure: β_x

In Table 4, we report the results from the cross-sectional regression of appreciation exposure on firm-specific variables. We run two regressions: one of the exposure coefficient, β_x , itself, and the other of the *t*-statistics of β_x . We perform the latter regression because we believe that in understanding the determinants of F/X exposure, the significance of the estimates is also very important, if not more. Also, we can mitigate the problem associated with even including the non-significant β estimates in the cross-sectional regression.¹⁵⁾ Panel A shows the results on the exposure coefficient, and Panel B, on the *t*-statistics.

First of all, we find some evidence that foreign ownership and appreciation exposure are inversely related. This inverse relation is statistically significant only in the regressions of the *t*-statistics of β_x . Recall that β_x is on average positive. The fact that foreign ownership negatively affects β_x means that with a higher ownership the currency exposure actually decreases. This inverse relation implies that when the local currency appreciates, the stock return will be lower for firms with a higher foreign ownership. From the local investors' point of view, having a larger foreign

15) Most of the related literature such as the work of He and Ng (1998) also include the non-significant β estimates in the second-stage cross-sectional regression.

(Table 4) Determinants of Appreciation Exposure: β_x

This table reports the results from the cross-sectional regression of the appreciation exposure, β_x on firm-specific variables. We run two regressions: one of the exposure coefficient, β_x , and the other of the t -statistics of β_x . Panel A shows the results on the exposure coefficient, and Panel B, on the t -statistics. The heteroskedasticity-consistent t -statistics are shown in parentheses.

Variable	Model1	Model2	Model3	Model4
Panel A: Results from the regression of β_x				
<i>Intercept</i>	0.891 (0.67)	0.989 (0.73)	0.851 (0.62)	0.981 (0.72)
<i>FO</i>	-1.252 (-1.28)	-1.304 (-1.25)	-1.292 (-1.24)	-1.296 (-1.24)
<i>ExprR</i>	-1.162*** (-2.51)	-1.222*** (-2.46)	-1.339*** (-2.84)	-1.239*** (-2.63)
<i>FAFD</i>		-0.264 (-0.40)		
<i>Size</i>	0.012 (0.11)	0.009 (0.08)	0.021 (0.18)	0.010 (0.09)
<i>LTD</i>	1.847* (1.68)	1.897* (1.67)	2.108* (1.86)	1.983* (1.75)
<i>MB</i>	-0.038 (-0.88)	-0.036 (-0.84)	-0.040 (-0.90)	-0.038 (-0.88)
<i>Deriv</i>	-0.700*** (-5.01)	-0.765*** (-5.16)	-0.786*** (-5.27)	-0.776*** (-5.28)
<i>FDeR</i>	-0.284*** (-2.85)			
<i>NetFD</i>			-1.030* (-1.72)	
<i>aNetFD</i>				-0.647 (-1.02)
<i>Adj R-Sq</i>	0.0217	0.0251	0.0293	0.0260
Panel B: Results from the regression of $t(\beta_x)$				
<i>Intercept</i>	-0.352 (-0.96)	-0.399 (-1.09)	-0.456 (-1.23)	-0.406 (-1.10)
<i>FO</i>	-0.685*** (-2.07)	-0.748*** (-2.17)	-0.746*** (-2.17)	-0.747*** (-2.16)
<i>ExprR</i>	-0.589*** (-4.51)	-0.624*** (-4.67)	-0.654*** (-5.00)	-0.619*** (-4.76)
<i>FAFD</i>		0.044 (-0.22)		
<i>Size</i>	0.061*** (2.05)	0.067*** (2.23)	0.072*** (2.38)	0.068*** (2.26)
<i>LTD</i>	0.487* (1.92)	0.499* (1.87)	0.589** (2.26)	0.536** (2.02)
<i>MB</i>	-0.006 (-0.68)	-0.006 (-0.70)	-0.007 (-0.79)	-0.007 (-0.74)
<i>Deriv</i>	-0.439*** (-5.95)	-0.486*** (-6.47)	-0.494*** (-6.53)	-0.490*** (-6.50)
<i>FDeR</i>	-0.001** (-2.72)			
<i>NetFD</i>			-0.040* (-1.92)	
<i>aNetFD</i>				-0.037 (-1.09)
<i>Adj R-Sq</i>	0.0519	0.0611	0.0668	0.0625

The estimates with, ***, ** and * are significant at 1 percent, 5 percent, and 10 percent, respectively.

ownership would not help, since the stock return would not increase as much as for a company with a smaller foreign ownership.

With regard to the control variables, appreciation exposure is negatively related to the export ratio, derivative usage, and foreign debt, while it is positively related to firm size and long-term debt. First, our results on export ratio are generally in line with previous findings such as those of Jorion (1990) and He and Ng (1998).¹⁶⁾ When the local currency appreciates, the stock returns of firms with a higher export ratio would respond less favorably than those of firms with a lower export ratio. This is reasonable in that export-oriented firms will suffer from the operation when the value of their home currency appreciates.

Derivative usage has a similar effect as foreign ownership. When the local currency appreciates, the stock returns of firms that use derivatives more actively would respond less favorably than those that use derivatives less actively. Foreign debt also reduces the appreciation exposure. This, however, is somewhat surprising in that if the local currency value increases, the value of the foreign debt will decrease. Therefore, other things being equal, the stock return of firms with a higher foreign debt ratio should be higher than those

with a lower ratio. The fact that we have the opposite results would then mean that the condition of 'other-things-being-equal' does not apply here, and the decision on foreign debt is jointly made with the other policy variables possibly weighing its effect on hedging.

The effect of firm size on appreciation exposure also deserves a remark. There are two conflicting views on how the size of a firm would affect F/X exposure. Nance, Smith and Smithson (1993) contend that because larger firms have an economy of scale in hedging, they would have a lower exchange rate exposure than smaller firms. On the contrary, Warner (1977) and He and Ng (1998) argue that due to higher bankruptcy costs, smaller firms have more incentives to hedge. The present paper supports the former view in that firm size increases the *t*-statistics of appreciation exposure.

3.2.2 Depreciation Exposure:

$$\beta_{Dep} (\equiv \beta_x + \beta_D)$$

Before we investigate the determinants of depreciation exposure, we first present the results of the cross-sectional regression of asymmetry exposure. As Table 5 shows, asymmetry exposure is affected by most of the

16) In He and Ng (1998), the sign of this relationship is positive. This is not inconsistent with our result because they measured the exposure coefficient using the exchange rates quoted in direct quotation (the Japanese Yen's value of foreign currencies). Meanwhile, in the present study, we use the exchange rates quoted in indirect quotation (foreign currencies' value of the Korean Won).

(Table 5) Determinants of Asymmetry Exposure: β_D

This table reports the results from the cross-sectional regression of the appreciation exposure, β_D on firm-specific variables. We run two regressions: one of the exposure coefficient, β_D and the other of the t -statistics of β_D . Panel A shows the results on the exposure coefficient, and Panel B, on the t -statistics. The heteroskedasticity-consistent t -statistics are shown in parentheses.

Variable	Model1	Model2	Model3	Model4
Panel A: Results from the regression of β_D				
<i>Intercept</i>	6.046*** (2.52)	5.995*** (2.44)	6.258*** (2.52)	5.996*** (2.43)
<i>FO</i>	3.370** (2.00)	3.333* (1.85)	3.303* (1.83)	3.310* (1.83)
<i>ExpR</i>	1.385* (1.70)	1.411 (1.59)	1.671** (2.01)	1.476* (1.77)
<i>FAFD</i>		0.638 (0.51)		
<i>Size</i>	-0.533*** (-2.77)	-0.534*** (-2.71)	-0.556*** (-2.77)	-0.535*** (-2.70)
<i>LTD</i>	-2.912** (-2.10)	-2.914** (-2.07)	-3.307** (-2.33)	-3.050** (-2.14)
<i>MB</i>	0.051 (0.63)	0.046 (0.58)	0.054 (0.66)	0.050 (0.63)
<i>Deriv</i>	1.118*** (2.46)	1.207*** (2.35)	1.250*** (2.39)	1.229*** (2.37)
<i>FDeR</i>	0.720** (4.04)			
<i>NetFD</i>			2.050** (2.08)	
<i>aNetFD</i>				1.246 (1.01)
<i>Adj R-Sq</i>	0.0207	0.0203	0.0255	0.0214
Panel B: Results from the regression of $t(\beta_D)$				
<i>Intercept</i>	1.760*** (4.74)	1.825*** (4.84)	1.873*** (4.95)	1.829*** (4.84)
<i>FO</i>	1.040*** (3.06)	1.093*** (3.07)	1.088*** (3.06)	1.090*** (3.06)
<i>ExpR</i>	0.423*** (3.01)	0.443*** (3.07)	0.488*** (3.48)	0.449*** (3.24)
<i>FAFD</i>		0.109 (0.56)		
<i>Size</i>	-0.152*** (-5.08)	-0.159*** (-5.23)	-0.163*** (-5.35)	-0.159*** (-5.25)
<i>LTD</i>	-0.448** (-2.13)	-0.450** (-2.09)	-0.522*** (-2.45)	-0.489** (-2.24)
<i>MB</i>	-0.005 (-0.58)	-0.005 (-0.59)	-0.004 (-0.42)	-0.005 (-0.50)
<i>Deriv</i>	0.355*** (2.77)	0.392*** (2.70)	0.400*** (2.72)	0.397*** (2.71)
<i>FDeR</i>	0.125*** (3.72)			
<i>NetFD</i>			0.370** (2.31)	
<i>aNetFD</i>				0.279 (1.50)
<i>Adj R-Sq</i>	0.0472	0.0552	0.0596	0.0571

The estimates with ***, ** and * are significant at 1 percent, 5 percent, and 10 percent, respectively.

variables. Foreign ownership, export ratio, derivative use, and foreign debt all increase both the exposure coefficient and its t -statistic. On the contrary, firm size and leverage reduce both of them. The relationships between asymmetry exposure, β_D , and these variables are generally opposite to those between β_x

and them, so we can conjecture that firms generally respond differently to the appreciation of their home currency than to its depreciation. Now, we turn to the determinants of depreciation exposure, β_{Dep} , to see if this conjecture is corroborated by the data.

Table 6 reports the results. Unlike in the

(Table 6) Determinants of Depreciation Exposure: β_{Dep}

This table reports the results from the cross-sectional regression of the depreciation exposure, β_{Dep} ($\equiv \beta_x + \beta_D$) on firm-specific variables. For this table, we report the results only on the exposure coefficient, and not on the t -statistics. This is because β_{Dep} is not estimated directly, and instead we add β_x and β_D estimates from the estimation of Equation (1). Therefore, the t -statistics for β_{Dep} are not available. The heteroskedasticity-consistent t -statistics are shown in parentheses.

Variable	Model1	Model2	Model3	Model4
<i>Intercept</i>	6.937*** (5.20)	6.984*** (5.07)	7.108*** (5.12)	6.977*** (5.05)
<i>FO</i>	2.118** (2.34)	2.029** (2.11)	2.010** (2.09)	2.014** (2.09)
<i>ExpR</i>	0.223 (0.51)	0.188 (0.39)	0.332 (0.74)	0.237 (0.52)
<i>FAFD</i>		0.374 (0.60)		
<i>Size</i>	-0.521*** (-4.92)	-0.525*** (-4.80)	-0.536*** (-4.85)	-0.525*** (-4.79)
<i>LTD</i>	-1.065 (-1.13)	-1.017 (-1.06)	-1.199 (-1.23)	-1.066 (-1.10)
<i>MB</i>	0.013 (0.30)	0.010 (0.24)	0.014 (0.33)	0.012 (0.30)
<i>Deriv</i>	0.418 (1.15)	0.442 (1.06)	0.464 (1.10)	0.453 (1.08)
<i>FDeR</i>	0.436*** (4.43)			
<i>NetFD</i>			1.018** (2.22)	
<i>aNetFD</i>				0.599 (0.89)
Adj R-Sq	0.0454	0.0448	0.0486	0.0453

The estimates with, ***, ** and * are significant at 1 percent, 5 percent, and 10 percent, respectively.

case of the analyses on the other exposure coefficients, we report the results only on the coefficient and not on the t -statistics. This is because β_{Dep} is not estimated directly, and we instead add the β_x and β_D estimates from the estimation of Equation (1). Therefore, the t -statistics for β_{Dep} are not available. Even though most of the variables affect asymmetry exposure, only foreign ownership, firm size, and foreign debt ratio remain as the significant factors that determine depreciation exposure.

In fact, foreign ownership is positively related to depreciation exposure. Depreciation exposure is generally positive as shown in Table 2, so this implies that with a higher foreign ownership, the positive slope becomes steeper. Note that depreciation exposure measures the response of equity returns to the depreciation of the local currency. Therefore, the positively steeper slope means that the equity return goes down further for the same degree of currency depreciation. In other words, if the home currency depreciates, the stock returns of firms with a higher foreign ownership would go down more than those of firms with a lower foreign ownership. Therefore, even though the signs of depreciation and appreciation exposures are different, having a higher foreign ownership would have the

same negative impact to the stock returns whether the local currency depreciates or appreciates.

It appears that the effect of firm size is greater for depreciation exposure than that for appreciation exposure. In the case of home currency depreciation, firm size is significant even in the case of cross-sectional regression of the coefficient,¹⁷⁾ and the estimates are greater in absolute value terms. When the home currency depreciates, the stock returns of larger firms would respond more negatively than those of smaller firms. The effect of foreign debt is again somewhat counter-intuitive in that when the home currency depreciates, firms with a higher foreign debt ratio would witness their stock return perform better than those with a smaller ratio. However, as was argued above, this may evidence that firms make decisions on foreign debt jointly with the other policy variables possibly weighing its effect on hedging. Unlike in the case of appreciation exposure, derivative use is no longer a significant variable in explaining depreciation exposure. In other words, when the home currency depreciates, the use of derivatives would not have an impact on the exposure coefficient.

17) Even though a cross-sectional regression of the t -statistic is not conducted, we can conjecture that firm size is significantly related to the t -statistic because for most of the cases, the cross-sectional analyses provide more significant results on t -statistics than the coefficient itself.

3.2.3 Volatility Exposure: β_v

Table 7 shows the results of the cross-sectional regression to investigate the effects of firm characteristics on volatility exposure, β_v . To interpret the results properly, we first have to recall that β_v is generally negative for the sample firms. This implies that for most of the sample firms, the volatility of exchange rates has a negative impact on their stock returns. Both the mean and median of β_v are negative, and out of the 50 firms that have a significant β_v , two thirds of the firms have a negatively significant volatility exposure. Therefore, if some variables in the cross-sectional regression have a positive coefficient, this variable can be interpreted as reducing the volatility exposure, and *vice versa*.

There are three variables that are significant in explaining both β_v and its *t*-statistic. These are foreign ownership, size and long-term debt ratio. With regard to foreign ownership, the relationship is positive, implying that the stock returns of firms with a higher foreign ownership would react more favorably to the increase in exchange rate volatility than those with a lower foreign ownership. Since in general β_v has a negative relation with the stock return, we can interpret the positive relation between foreign ownership and β_v as foreign ownership's reduction of the negative impact of exchange rate volatility on stock returns. Therefore, in a period when the ex-

change rate volatility is higher, the existence of foreign investors would help the stock returns.

The other two variables, firm size and long-term debt ratio, have negative relations with volatility exposure. This implies that larger firms and firms with a high leverage are exposed to greater down-side risks in the face of a more volatile currency market.

3.2.4 Lag Exposure: β_L

A significant lag exposure is regarded as an evidence of mispricing in the stock market. About 14 percent of our sample firms have a significant lag exposure, β_L , and 95 percent of those have negative relations. Similar to volatility exposure, the mean and median of β_L are all negative, too. Therefore, in the cross-sectional regression, if some variables have a negative relation with lag exposure, this variable can be interpreted as decreasing efficiency in the stock market.

As Table 8 shows, not many explanatory variables seem to have a significant relation with lag exposure. However, one of them is foreign ownership. Even though foreign ownership does not have a statistically significant relation with the coefficient, it has a significantly negative relation with the *t*-statistics of β_L . Since this negative relationship can be interpreted as decreasing market efficiency, this suggests the weak evidence of foreign investors' actually decreasing the stock

〈Table 7〉 Determinants of Volatility Exposure: β_b

This table reports the results from the cross-sectional regression of the appreciation exposure, β_b on firm-specific variables. We run two regressions: one of the exposure coefficient, β_b and the other of the t -statistics of β_b . Panel A shows the results on the exposure coefficient, and Panel B, on the t -statistics. The heteroskedasticity-consistent t -statistics are shown in parentheses.

Variable	Model1	Model2	Model3	Model4
Panel A: Results from the regression of β_b				
<i>Intercept</i>	8.325*** (3.27)	8.956*** (3.43)	8.855*** (3.36)	8.925*** (3.41)
<i>FO</i>	8.429*** (5.36)	8.451*** (5.18)	8.448*** (5.18)	8.445*** (5.17)
<i>ExpR</i>	0.439 (0.47)	0.276 (0.28)	0.260 (0.27)	0.323 (0.33)
<i>FAFD</i>		0.048 (0.07)		
<i>Size</i>	-0.747*** (-3.64)	-0.791*** (-3.76)	-0.782*** (-3.67)	-0.787*** (-3.73)
<i>LTD</i>	-6.326*** (-2.81)	-6.536*** (-2.86)	-6.368*** (-2.75)	-6.422*** (-2.78)
<i>MB</i>	-0.038 (-0.29)	-0.041 (-0.31)	-0.042 (-0.33)	-0.041 (-0.32)
<i>Deriv</i>	-0.271 (-0.85)	-0.166 (-0.47)	-0.178 (-0.50)	-0.174 (-0.49)
<i>FDeR</i>	-0.155 (-0.67)			
<i>NetFD</i>			-0.591 (-1.06)	
<i>aNetFD</i>				-0.450 (-0.77)
<i>Adj R-Sq</i>	0.0536	0.0537	0.0541	0.0539
Panel B: Results from the regression of $t(\beta_b)$				
<i>Intercept</i>	1.554*** (3.86)	1.649*** (3.99)	1.630*** (3.94)	1.652*** (4.01)
<i>FO</i>	1.701*** (5.15)	1.662*** (4.85)	1.667*** (4.86)	1.666*** (4.85)
<i>ExpR</i>	0.121 (0.88)	0.122 (0.87)	0.088 (0.63)	0.108 (0.76)
<i>FAFD</i>		-0.098 (-0.73)		
<i>Size</i>	-0.147*** (-4.47)	-0.154*** (-4.50)	-0.152*** (-4.46)	-0.154*** (-4.53)
<i>LTD</i>	-0.906*** (-3.00)	-0.922*** (-2.97)	-0.895*** (-2.88)	-0.913*** (-2.94)
<i>MB</i>	0.013 (0.56)	0.012 (0.55)	0.011 (0.51)	0.011 (0.51)
<i>Deriv</i>	-0.096 (-1.19)	-0.084 (-0.92)	-0.088 (-0.96)	-0.086 (-0.95)
<i>FDeR</i>	-0.055 (-1.59)			
<i>NetFD</i>			-0.187 (-1.40)	
<i>aNetFD</i>				-0.137 (-1.32)
<i>Adj R-Sq</i>	0.0614	0.0599	0.0607	0.0600

The estimates with, ***, ** and * are significant at 1 percent, 5 percent, and 10 percent, respectively.

(Table 8) Determinants of Lag Exposure: β_L

This table reports the results from the cross-sectional regression of the appreciation exposure, β_L on firm-specific variables. We run two regressions: one of the exposure coefficient, β_L and the other of the t -statistics of β_L . Panel A shows the results on the exposure coefficient, and Panel B, on the t -statistics. The heteroskedasticity-consistent t -statistics are shown in parentheses.

Variable	Model1	Model2	Model3	Model4
Panel A: Results from the regression of β_L				
<i>Intercept</i>	-0.822 (-1.27)	-1.040 (-1.59)	-1.015 (-1.54)	-1.030 (-1.58)
<i>FO</i>	-0.051 (-0.10)	-0.289 (-0.52)	-0.290 (-0.52)	-0.289 (-0.52)
<i>ExpR</i>	0.166 (0.83)	0.183 (0.90)	0.198 (0.95)	0.172 (0.84)
<i>FAFD</i>		0.026 (0.11)		
<i>Size</i>	0.010 (0.20)	0.029 (0.56)	0.026 (0.51)	0.027 (0.53)
<i>LTD</i>	-0.730 (-1.00)	-0.810 (-1.05)	-0.848 (-1.10)	-0.855 (-1.11)
<i>MB</i>	0.032 (1.60)	0.031 (1.59)	0.031 (1.59)	0.031 (1.60)
<i>Deriv</i>	0.193* (1.71)	0.172 (1.49)	0.176 (1.52)	0.176 (1.53)
<i>FDeR</i>	0.007 (0.11)			
<i>NetFD</i>			0.168 (0.73)	
<i>aNetFD</i>				0.223 (0.95)
<i>Adj R-Sq</i>	-0.0043	0.0038	-0.0033	-0.0030
Panel B: Results from the regression of $t(\beta_L)$				
<i>Intercept</i>	-0.129 (-0.30)	-0.270 (-0.60)	-0.263 (-0.59)	-0.269 (-0.60)
<i>FO</i>	-0.641 (-1.37)	-0.873* (-1.78)	-0.877* (-1.79)	-0.876* (-1.79)
<i>ExpR</i>	0.102 (0.69)	0.098 (0.65)	0.123 (0.81)	0.104 (0.69)
<i>FAFD</i>		0.079 (0.50)		
<i>Size</i>	-0.028 (-0.81)	-0.016 (-0.44)	-0.016 (-0.45)	-0.016 (-0.45)
<i>LTD</i>	-0.240 (-0.76)	-0.297 (-0.87)	-0.305 (-0.89)	-0.319 (-0.94)
<i>MB</i>	0.018* (1.70)	0.016* (1.66)	0.017* (1.69)	0.017* (1.70)
<i>Deriv</i>	0.230** (2.13)	0.209* (1.78)	0.211* (1.81)	0.212* (1.82)
<i>FDeR</i>	0.036 (1.00)			
<i>NetFD</i>			0.099 (0.71)	
<i>aNetFD</i>				0.176 (1.26)
<i>Adj R-Sq</i>	0.0053	0.0072	0.0072	0.0079

The estimates with ***, ** and * are significant at 1 percent, 5 percent, and 10 percent, respectively.

market efficiency.

The other two variables that have a significant relation with lag exposure are derivative use and market-to-book ratio. For Model 1, derivative use has a significant relation even with the coefficient itself. This implies that for companies with a higher derivative usage or market-to-book ratio, the negative relation between the lagged home currency value and the stock return becomes less significant, thereby improving the market efficiency.

3.3 Robustness Check

3.3.1 Endogeneity Problem

So far, we have been analyzing the relation between foreign ownership and F/X exposure under the assumption that the latter is determined by the former. However, the causality may go in the opposite direction, and foreign investors may choose to invest in firms according to their preference toward F/X exposure. If the reverse causality exists, then the cross-sectional regressions are exposed to the endogeneity problem, and econometrically, the estimators will not be consistent. In this section, we attempt to check the degree of the endogeneity problem following the approach adopted by Lowry and Shu (2002) and Cliff and Denis (2004). In the first stage, we use the same set of exogenous variables to esti-

mate both foreign ownership and F/X exposures. In choosing the exogenous variables, we try to include other variables that are shown to affect both foreign ownership and F/X exposures in the literature. The additional variables included in the first stage are quick ratio and dividend ratio. Then in the second-stage estimation, we use the predicted value of foreign ownership from the first-stage estimation as the instrumental variables for the F/X exposures and their *t*-statistics, while we use the predicted values of F/X exposures as the instrumental variable for foreign ownership. In the second-stage estimation, as the other explanatory variables, we use only the ones that are estimated to be statistically significant in the first stage. The results are reported in Table 9.

For the sake of parsimony, we report only the coefficients of the instrumental variables. In Panel A, we report the coefficients of the predicted value of foreign ownership used as the instrumental value for the second-stage regression of F/X exposures and their *t*-statistics. In Panel B, on the other hand, we report the coefficients of the predicted values of the F/X exposures and their *t*-statistics used as the instrumental values for the second-stage regression of foreign ownership.

First, none of the F/X instrumental variables is statistically significant in explaining foreign ownership. On the other hand, the foreign ownership instrumental variable is

(Table 9) Endogeneity Check via Two Stage Least Square Estimation

This table reports the results from the two state least square estimations to check the degree of the endogeneity problem. In doing so, we follow the approach adopted by Lowry and Shu (2002) and Cliff and Denis (2004). In the first-stage estimation, the same set of exogenous variables is used to estimate both foreign ownership and F/X exposures. The exogenous variables used in this stage are export ratio, quick ratio, dividend ratio, foreign debt ratio, size, long-term debt ratio, M/B, and derivative use. Then, in the second-stage estimation, we use the predicted value of foreign ownership from the first-stage estimation as the instrumental variables for the F/X exposures and their t -statistics, while we use the predicted values of F/X exposures as the instrumental variable for foreign ownership. In the second-stage estimation, as the other explanatory variables, we use only the ones that are estimated to be statistically significant in the first stage. For the sake of parsimony, we report only the coefficients on the instrumental variables. In Panel A, we report the coefficients of the predicted value of foreign ownership used as the instrumental value for the second stage regression of the F/X exposures and their t -statistics. In Panel B, on the other hand, we report the coefficients of the predicted values of the F/X exposures and their t -statistics used as the instrumental values for the second-stage regression of foreign ownership. The heteroskedasticity-consistent t -statistics are shown in parentheses.

Panel A FO as IV for F/X exposure									
IV \ Dep	β_x	$t(\beta_x)$	β_D	$t(\beta_D)$	β_{Dep}	β_o	$t(\beta_o)$	β_L	$t(\beta_L)$
Predicted values of FO	-4.618**	-1.632*	5.857*	1.725**	1.239	5.334	1.80**	2.38**	1.304
	(-1.98)	(-1.82)	(-1.66)	(-1.97)	(-0.7)	(-1.46)	(-2.21)	(-1.97)	(-1.32)

Panel B F/X exposure as IV for FO									
Dep \ IV's	β_x	$t(\beta_x)$	β_D	$t(\beta_D)$	β_{Dep}	β_o	$t(\beta_o)$	β_L	$t(\beta_L)$
FO	0.004	0.007	-0.003	-0.008	-0.007	0.01	0.031	-0.013	-0.008
	(-0.2)	(-0.19)	(-0.19)	(-0.19)	(-0.17)	(-0.21)	(-0.2)	(-0.20)	(-0.19)

The estimates with, ***, ** and * are significant at 1 percent, 5 percent, and 10 percent, respectively.

generally statistically significant in explaining F/X exposures. The signs of the coefficients are consistent with those from the OLS regressions presented in the previous sections. These results provide evidence that the causality flows in one direction, namely, from foreign ownership to F/X exposures, and not the other way around. In other words, it appears that the investment decisions made by foreign investors affect F/X exposures, but F/X exposures do not affect foreign investors'

investment decisions. As a result, we can safely proceed with the assumption that the endogeneity problem is not a significant concern in our analyses.

3.3.2 Long-Term vs. Short-Term Investors

The research design of this paper is subject to a criticism that it fails to recognize the differences in goals of long-term and short-term investors. Short-term investors may not

care about firm characteristics that determine the F/X exposure. If these investors seek only short-term trading profits, they may not care about the changes in long-term firm value due to the changes in exchange rates. This criticism, however, is biased in favor of our results in that if we are able to separate the impact of long-term investors from that of short-term investors, we should be able to find stronger results. Even though it is not possible to cleanly separate the firms that

are mainly invested by long-term foreign investors, we use a screening device to create a sub-sample that are treated as firms with long-term foreign investors. First, for each firm, we evaluate the standard deviation and average of foreign ownership over the sample period. If the ratio of standard deviation to average is less than unity, this firm is regarded as the one with long-term foreign investors. A large standard deviation to average ratio implies that the foreign ownership has fluct-

(Table 10) Robustness Check with a Proxy for Long-Term Investors

This table reports the results from the second stage cross-sectional analyses on the determinants of F/X exposure using a subsample of firms that are estimated to have long-term foreign investors. We classify a firm as having long term foreign investors, if over the sample period, the standard deviation of foreign ownership divided by the average of foreign ownership is less than 1. There were 270 firms that satisfy this inequality. We report only the regression result for the estimation of Model 1. The heteroskedasticity-consistent t -statistics are shown in parentheses.

	β_{ix}	$t(\beta_{ix})$	β_D	$t(\beta_D)$	β_σ	$t(\beta_\sigma)$	β_L	$t(\beta_L)$
<i>Intercept</i>	-0.118 (-0.10)	-0.624 (-1.22)	6.790 *** (2.82)	2.077 *** (3.97)	5.858 ** (2.50)	1.146 ** (2.26)	-0.608 (-0.79)	-0.094 (-0.15)
<i>FO</i>	-2.117 * (-1.78)	-1.042 *** (-2.63)	3.459 * (1.70)	1.161 *** (2.85)	3.276 ** (1.97)	0.637 * (1.71)	0.046 (0.07)	-0.629 (-1.04)
<i>ExpR</i>	-1.803 *** (-4.09)	-0.807 *** (-4.06)	2.479 *** (2.69)	0.582 *** (2.78)	2.309 (2.46)	0.547 *** (2.96)	0.473 (1.62)	0.339 (1.35)
<i>Size</i>	0.103 (1.05)	0.089 ** (2.19)	-0.594 *** (-3.08)	-0.178 *** (-4.39)	-0.517 *** (-2.79)	-0.110 *** (-2.72)	-0.003 (-0.05)	-0.033 (-0.65)
<i>LTD</i>	1.056 (0.38)	-0.140 (-0.15)	-1.206 (-0.23)	0.428 (0.44)	-10.368 (-1.33)	-1.632 (-1.43)	0.731 (0.46)	0.408 (0.35)
<i>MB</i>	0.197 (0.85)	0.090 (0.93)	-0.200 (-0.47)	-0.074 (-0.74)	0.743 ** (2.12)	0.222 *** (2.83)	-0.093 (-0.80)	-0.014 (-0.13)
<i>Deriv</i>	-0.904 *** (-6.42)	-0.563 *** (-7.31)	1.782 *** (6.06)	0.578 *** (7.46)	-0.454 (-1.01)	-0.137 (-1.06)	0.166 (1.13)	0.264 * (1.73)
<i>FDeR</i>	0.938 (0.46)	0.254 (0.30)	-2.139 (-0.63)	-0.433 (-0.55)	-5.043 ** (-2.07)	-1.453 ** (-2.53)	-0.715 (-0.52)	-0.613 (-0.60)

The estimates with, ***, **, and * are significant at 1 percent, 5 percent, and 10 percent, respectively.

tuated greatly over the sample period, indicating active trading by short-term foreigners. On the other hand, a small ratio indicates that possibly the firm is dominated by long-term foreign investors. There are 270 firms that pass through this screen. For the sake of parsimony, we report the results from the second stage cross-sectional analyses only of Model 1.

The results largely confirm our conjecture. The estimates of the main variable, 'FO' still have the same signs for all the eight cases. In fact, for β_x , the statistical significance increases. This implies that even though the screen we use may not be perfect, when the firms that seem to attract long-term foreign investors, the impact of foreign ownership on F/X measures become clearer. In sum, short-term foreign investors seem to blur the relationship between foreign ownership and F/X exposure, but the overall results remain intact.

IV. Conclusion

In this paper, using the trade weighted currency index and monthly stock returns on 571 Korean firms from 2000 to 2006, we estimate four types of F/X exposure: appreciation, depreciation, volatility, and lag exposures. We then analyze how these exposures are affected by foreign ownership. Among other things, we find that during the months

of home currency depreciation, the stock returns of firms with a higher ownership experience a greater negative shock, but during the months of increased exchange rate volatility, those with a lower ownership receive a greater negative shock. Overall, various firm characteristics are found to affect F/X exposures in different directions, weakening their significance. This finding helps explain the previously documented weak association between exchange rates and stock returns.

This study can be meaningfully extended by further investigating the links between foreign ownership and F/X exposures. Do the positive or negative F/X exposures stem from the buying and selling decisions of foreign investors? The answer to this question is only possible if the data on 'buying' or 'selling' of foreign investors on individuals stocks are available on a higher frequency. Currently, over the sample period used in this study, ownership data are available only on a yearly basis. Recently, however, data on foreign investors' net buying or net selling became available on a daily basis. When enough data are accumulated, we hope to uncover the link between foreign ownership and F/X exposures. Also, since the data that are used for this study do not include the period of global financial crises, comparing the changes in exposure during or after the financial crisis can be an interesting future study.

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〈Appendix〉

The standard deviation of exchange rates, σ_x , is estimated by the following equation

$$S_t = S_{t-1} + s_t, \quad (A1)$$

where S_t is the logarithm of the exchange rate index, S_{t-1} , the lag of S_t , and s_t , the unexpected exchange rate changes. It describes the Martingale processes of exchange rates as most other studies indicate.

We assume that the conditional variation of s_t is defined as a GARCH(1,1) process indicated by

$$h_{s,t} = \alpha_{\varepsilon,0} + \alpha_{\varepsilon,1}s_{t-1}^2 + \alpha_{\varepsilon,2}h_{\varepsilon,t-1}, \quad (A2)$$

where the subscript s denotes the month of the data to be used in Equation (1). Then, we use the daily exchange rates of the year the month- s is in, and estimate (A1) and (A2) via maximum likelihood estimation. Then, for each month s , we add the daily conditional variances, $h_{s,t}$, to obtain σ_x .