

FOREIGN EXCHANGE EXPOSURE OF KOREAN FIRMS

By

Ji-Seon Kim

THESIS

Submitted to
KDI School of Public Policy and Management
in partial fulfillment of the requirements
for the degree of

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ABSTRACT

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The purpose of this study is to examine the relationship between the movements of exchange rate and value of Korean firms, so-called foreign exchange rate exposure using newly devised model to find the strong evidence. I use weekly data on Korean Firms that are listed on Korea Stock Exchange (KSE) for the period from January 1997 to December 2000. I find that about 70% Korean Firms are actually exposed to Won-dollar exchange rate movement at 10% significance level and these results are substantially different from the previous empirical study where little statistical significance was found. In comparing the foreign exchange exposures with three different exchange rates, in Won-dollar and Won-yen exchange exposures, value of Korean firms is positively related to depreciation of Korean Won and negatively related to depreciation of Korean Won with Won-euro exchange exposure. With magnitude of

three exposures, results can be interpreted that Dollar exposure seems to be the most significant among three foreign exchange exposures and Korean Firms' value is more sensitive to Won-dollar exchange rate. I also find that exchange exposure is strongly related to firm size and industry especially Electricity & Gas industry is most significantly related.

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I. Introduction

In the early 1970s, the U.S. government abandoned the fixed exchange rate system and adopted floating exchange rate regime. Since that time, there have been tremendous changes and fluctuations in the foreign exchange market and in international financial market.¹

As the degree of exchange rate fluctuation was getting increased in the globally integrated financial capital market, many countries concerned about change of their countries' return which is affected by the fluctuation. So seeking ways to hedge the foreign exchange rate risk became a main issue and many researchers started to study the relationship between the exchange rate and return of companies, which is so-called foreign exchange rate exposure.

According to Chung (1997), the KRW-USD exchange rates were allowed to fluctuate freely through the 1990s the exchange rate has increased accordingly. Through financial crisis in 1997, the volatility of the exchange rate proved itself to be so severe as to lead to major crises or even to defaults of some economies, and the importance of estimating the foreign exchange exposure came up to the surface again.

For the past decade, several researchers like Adler and Dumas (1984), Jorion

¹ See Rukstad (1997)

(1991), Banda & Gentry (1993), and Campa (1997) have been empirically investigating the foreign exchange exposure of corporations. Up to date, it is widely believed that the movements of exchange rate affect value of companies, which means their returns are significantly exposed to exchange rate movements; however, there has been weak or low statistical evidence.

The statistical inactivity is because, first, most of the previous empirical studies estimating the foreign exchange exposure focused on economy-leading countries, which have small portion of foreign operations.

Second, most of researchers used the uniform or similar Capital Asset Pricing Model (CAPM) regression model that includes market return as an explanatory variable, and single currency in their empirical studies.

Third, in actual capital market, market return is correlated with the movement of exchange rate, which is a point many researchers connived at. It is contrary to the fundamental that market return should not have correlations with independent variables in any kind of models, and it, after all, reduces statistical significance. Inclusion of the market portfolio return variable allows researchers to control market value-relevant factors and to improve the precision of the exposure estimates, but it is faulty since

market return is correlated with the exchange rate over the estimation period.²

The purpose of this study is to estimate Korean firms' foreign exchange exposure level using foreign exchange rate especially KRW-USD rate. Since dominant portion of Korean firms' international transactions are denominated in the U.S. dollar, the KRW-USD exchange rate would be particularly relevant.³ And if Korean firms are exposed to exchange rate movements, to what extent, Korean companies are actually exposed to exchange rate movements. It is expected that the value of Korean firm to be highly exposed to KRW-USD exchange rate changes. Adjusted weekly stock returns of companies which were listed in Korea Stock Exchange from 1997 to 2000 in order to include the financial turmoil of Korea in 1997 and composite stock price index (KOSPI) were used as explanatory and a market return, respectively. And to mitigate the correlation problem among independent variables, newly devised regression model, which excludes factors having effects on exchange rate movement from the market return, was used.

This paper possesses comparison and analysis of KRW's degree of exposure to the U.S. dollar, Euro and Japanese Yen exchange rate. Since the portion of investment in Euro increases continuously, and Japan is Korean firms' competitor in the world market,

² See Bodnar (2000)

³ Chung (1997) "Foreign Exchange Exposure of Korean Manufacturing Firms."

it is relevant to compare the three foreign exchange exposures.

However, in using Euro per dollar exchange rate, due to data availability, German Mark-dollar exchange rate was used for the first two years out of the 1997 to 2000 period instead of Euro-dollar rate.

Lastly, to identify the determinants of foreign exchange exposure, foreign exchange exposures were classified into twenty-one industry categories and firm size.

Definition and classification of foreign exchange rate exposure opens the section II. In section III, available and relevant data set for empirical study are introduced. Section IV presents empirical study including regression model of previous study and newly devised econometric model and its empirical findings that are estimated exchange exposure of Korean firms and three different exchange exposures. Section V reports the related factors' statistical significance in the explanation of exchange exposure. Section VI includes summary and concluding remarks.

II. Defining Exchange Rate Exposure

Exchange exposure, defined as the sensitivity of corporation's value to a change of exchange rate, is classified into three categories; Transaction, Translation and Economic Exposure.⁴

(1) Transaction Exposure

Transaction Exposure originates from the possibility when future income, which is expected to be earned by foreign currency denominated contract, changes during the time period of commitment to a transaction and an actual transaction. However, this kind of exposure usually is well defined and it can be hedged quite easily using derivatives.

(2) Translation Exposure

Translation exposure or accounting exposure is the difference between assets and liabilities that are exposed to the fluctuation of a certain currency. Generally, to evaluate the balance sheet of subsidiaries that are operating in foreign countries in the

⁴ See Jorin (1990) and Stefan Nydahl (1999)

foreign currencies, some constant exchange rates would have to be applied to each item in the balance sheet. At this moment, the value of subsidiaries varies on account of applying current or historical exchange rate.

(3) Economic Exposure

Economic exposure measures the degree to which exchange rate movements affect a firm's value. So, economic exposure depends on the operations of the firm, but is much more important and complicated than transaction exposure or translation exposure in terms of long-term management of firms.

However, it is very difficult and complex to distinguish the difference between transaction exposure, translation exposure and economic exposure.⁵ So in this paper, economic exposure will be regarded as the combination of transaction exposure and translation exposure.⁶

⁵ Even though their characteristics and hedging ways are different between the three-exchange exposures, in practice, it is very complicated to identify and hedge the three-exchange exposure.

⁶ Sercu and Uppal (1995). They say that the combined effect of transaction exposure and operating exposure is usually referred to as economic exposure.

III. Data Set

The data for the empirical research in this paper contains five sets of variables: weekly individual firms' rate of returns (observations are sampled on every Wednesday), weekly KRW-USD, KRW-euro and KRW-JPY exchange rates, crisis variable (dummy variable), firm-size and industry variables. The sample includes about 800 Korean firms that are listed on Korea Stock Exchange (KSE) and cover the period of four years from January 1997 to December 2000. Even though sample period is very short, there are basic shifts in Korean capital market as a result of the 1997's earthshaking financial crisis.

Each time series is divided into three sub-periods to examine any possible structural change in exchange exposure before and after the economic crisis.

Returns: Weekly individual firms' rate of returns that are dividend and stock-split adjusted are taken from Korea Stock Research Institute (KSRI) that is consistent with what is used in Dominguez and Tesar (2001).⁷

The weekly Korea Composite Stock Price Index from KSRI is used as the market

⁷ In her paper, she also used eight countries' individual stock returns that are sampled on Wednesdays.

return.

Exchange rates: If the value of Korean firms is affected by exchange rate, which exchange rate is appropriate? Many previous studies focused on single currency index; however, it is relevant to consider multiple currency indices. So, in this study, KRW-USD, KRW-JPY and KRW-euro rate are used, and it is different from previous studies where they use single currency index. The usage is designed to capture the following points: First, dominant portion of Korean firms' international transactions are denominated in the USD. Second, Japan is the main competitor in the world export markets. Third, recent investment portion in euro are increasing.⁸ KRW-USD, KRW-euro and KRW-JPY exchange rates measuring units of KRW per USD, per Euro and per JPY are from Federal Reserve Board.⁹ As a reference exchange rate, every Wednesdays' rates are used as weekly exchange rates. However, due to data availability of KRW-euro exchange rates, KRW-DM (German Mark) exchange rate in the first two years instead of KRW-euro. Using multiple exchange rates is the point of this study different from previous empirical studies.

⁸ See Table 2 and Figure 1 from Ministry of Commerce (2002)

⁹ <http://www.federalreserve.gov>

Crisis Variables: Sample period includes 1997's financial crisis to see whether there is structural change before and after the crisis. For that purpose, each period is designed to have three sub-periods that are pre-crisis (Dummy crisis variable equals to zero), in-crisis (Dummy crisis variable equals to one) and post-crisis (Dummy crisis variable equals to two), respectively.

Firm size: Large firms are expected to be more significantly exposed to exchange rate movements, so firm size was chosen as an explanatory variable. Total market value was calculated with the data from KSE by multiplying the number of outstanding shares with market price, and the companies' size were sorted by total market value. We define the top 10% companies of total market value as a large firm and the bottom 10% as a small firm.

Industry variables: To identify the determinant of exchange exposure, industry variables were considered with the expectation that all the industry does not have the same level of exposure. Each company was put into twenty-one industries classification,¹⁰ and the industry codes are presented in Table 6.

¹⁰ KSE classified Korean industry into 21 categories

IV. Empirical Study

1. Measuring exchange exposure of Korean firms

(1) Usual regression model

In the previous studies of Dumas (1978), Adler and Dumas (1980), and Hodder (1982), Jorion (1990), Allayannis (1995), Williamson (1998), they share several common methodological characteristics in testing of exchange exposure. They note that economic exposure can be measured through a standard Capital Asset Pricing Model (CAPM) regression model with changes in firm value as a dependent variable and exchange rate and market return which controls for market movements as independent variables.

The economic exposure is a coefficient (β_1) of exchange rate and can be obtained from following regression model,

$$R_t = \alpha_0 + \beta_1 \Delta S_t + \beta_2 R_{mt} + e_t \quad t = 1, \dots, T \quad (1)$$

where R_t is the return on the individual firm's rate of return, ΔS_t is the percentage change of exchange rate, and R_{mt} is the return on market portfolio and e_t is the error term.

β_1 refers to the economic exposure coefficient explaining relationships between

change of exchange rate and value of firm. However, in this regression model, it raises interaction problem between the market return and the exchange rate and it reduces statistical significance.¹¹

The result of the Usual regression

Table 1 and Figure 3 summarize the sign and magnitude of the KRW-USD exchange exposure profile using usual regression model. 79 firms out of 790 (10%) are significantly exposed to movements of KRW-USD exchange rate at the 10% level. And among the firms with significant coefficients, 59 firms (75%) have negative coefficients and only 20 firms (25%) firms have positive coefficients. It suggests that most Korean firms have negative exposure coefficient and if KRW depreciates against USD, their rate of returns would decrease, that is, value of companies decrease.

Table1 Distribution of Exposure Coefficients β_1 of Korean Firms (Usual Model)

$$R_t = \alpha_0 + \beta_1 \Delta S_t + \beta_2 R_{mt} + e_t \quad t = 1, \dots, T.$$

Exchange Exposure, β_1 (1997-2000)	
Mean	-0.09849

¹¹ In Journal of International Business Studies v.31 no4 (2000) p. 715-24, “In order to deal with this multicollinearity between the market factor and the exchange rate, Choi & Prasad (1995) orthogonalized the exchange-rate variable.”

Std. dev	0.30092
Median	-0.09201
Minimum	-7.75755
Maximum	6.96262
No. of total firm	790
No. of firms with significant β_1 at 10%	79(10%)
No. of firms with significant & pos β_1 at 10%	20(2.5%)
No. of firms with significant & neg β_1 at 10%	59(7.5%)

Mean estimates are average of 790 firms' coefficients (Mean = $\Sigma\beta_{1i}/790$)

Std.Err is the average standard error of 790 firms. The numbers in parentheses are percentage of significant firms in 10% significance level.

(2) Newly devised econometric model

To mitigate this interaction problem between market return and exchange rate, the exposure coefficient β_1 was estimated from newly devised regression model. In the new econometric model, $\hat{\varepsilon}_{it}$ is used as an independent variable.

The below shows the process of deriving newly adjusted regression model.

First process is the estimation of coefficients through simple but intuitive Ordinary Least Squares (OLS).

$$R_{mt} = \alpha_0 + \alpha_1 S_t + \varepsilon_{it}$$

The next is the calculation of the residual ($\hat{\varepsilon}_{it}$) from the below numerical formula,

$$\hat{\varepsilon}_{it} = R_{mt} - (\hat{\alpha}_0 + \hat{\alpha}_1 S_t)$$

where $\hat{\varepsilon}_{it}$ is the remainder that exclude foreign exchange rate factors from the factors that have effect on market return.

The final step is to put the calculated error terms into the model as dependent variables and regress them using OLS. And the coefficient of exchange rate change can be said to be the degree of exchange rate exposure.

$$R_{it} = \beta_0 + \beta_1 S_{t(\text{won/dollar})} + \beta_2 \hat{\varepsilon}_{it} + \mu_{it} \quad (2 - 1)$$

$$R_{it} = \beta_0 + \beta_1 S_{t(\text{won/euro})} + \beta_2 \hat{\varepsilon}_{it} + \mu_{it} \quad (2 - 2)$$

$$R_{it} = \beta_0 + \beta_1 S_{t(\text{won/100yen})} + \beta_2 \hat{\varepsilon}_{it} + \mu_{it} \quad (2 - 3)$$

The result of newly devised regression

Table 2 reports the sign and the magnitude of the KRW-USD, KRW-euro and KRW-JPY exchange rate exposure coefficients of Korean firms regressed by the new econometric model. The exposures of the three exchange rates are estimated separately from each equation (2 - 1), (2 - 2) and (2 - 3). In the KRW-USD exchange exposure, 333 of 791 firms (42%) are significantly exposed to exchange

rate movements at 1%, 484 (61%) at 5% and 554(70%) at 10% significance level.

The first column in Table 1 shows very interesting empirical results different from results of previous regression. Compared to the previous result, the sign of exposure coefficients is still negative, however, the percentage of significant coefficients increased dramatically and all significant coefficients are negative. Figure 4a KRW-USD exchange exposure distribution shows that most exposure coefficients including insignificant exposures are converged to negative coefficients.

For the KRW-euro exchange exposure, 55 of 791 firms (7%) are significantly exposed to exchange rate movements at 1%, 112(14%) at 5% level and 171(22%) at 10% significance level. Compared to KRW-USD exposure and KRW-JPY exposure, the number of significant coefficients of KRW-euro exchange rate is small and also the magnitude of exposure is relatively small.

Totally different thing is that most of KRW-euro exposures have positive signs. Figure 4b shows that most exposure coefficients are concentrated on positive signs. That means appreciation of Korean won against euro leads to increase of Korean firms' value. Even though 22% significance is not really small, compared to previous results, value of Korean firms is less affected by euro. It might be trade volume and portion of investment in EURO is increasing but still small.

In the same context, the KRW-JPY exchange exposure, 115 of 791 (15%) firms are significantly exposed to the rate's movement at 1% significance level. 255(32%) firms and 353(45%) were proven to be significant at the 5% and 10% significance level, respectively. It also has negative sign on exposure coefficients, but as shown in Figure 4c, magnitude of exposure is less severe than KRW-USD exposure.

With the results focusing only on the number of companies having significant exposure, Dollar exposure can be said to be the most significant among the three exchange exposures and are negatively affected by the depreciation of the KRW against USD.

Search for the extent and sign of significant exposure coefficient was done, but it is relevant to consider total and insignificant exposure coefficients altogether. The figures indicate that the magnitude of exposure $-6.11429 \sim 7.46443$ in KRW-USD, $-1.12613 \sim 1.175248$ in KRW-euro, and $-2.02008 \sim 3.38385$ in KRW-JPY.

Table 2 Distribution of Exposure Coefficients β_1 of Korean Firms (devised model)

$$R_{it} = \beta_0 + \beta_1 S_t + \beta_2 \hat{\varepsilon}_{it} + \mu_{it}$$

	KRW-USD	KRW-euro	KRW-JPY
	(2 - 1)	(2 - 2)	(2 - 3)
Mean	-0.5056	0.04787	-0.29548
Std. Err	0.28582	0.12948	0.25040
Median	-0.52415	0.06025	-0.308014
Minimum	-6.11429	-1.12613	-2.02008
Maximum	7.46443	1.175248	3.38385
No. of total firms	791	791	791
No. of firms with significant β_1 at 1%	333	55	115
No. of firms with significant β_1 at 5%	484	112	255
No. of firms with significant β_1 at 10%	554	171	353
No. of firms with significant & pos β_1 at 1%	0	53	1
No. of firms with significant & pos β_1 at 5%	0	108	3
No. of firms with significant & pos β_1 at 10%	1	160	6
No. of firms with significant & neg β_1 at 1%	333	2	114
No. of firms with significant & neg β_1 at 5%	484	4	252
No. of firms with significant & neg β_1 at 10%	553	11	347

Pos: positive exchange exposure coefficient Neg: negative exchange exposure coefficient

(3) The newly devised econometric model with crisis variables.

Asian countries including Korea underwent severe economic crisis in the late 1997 and, in the wake of that crisis, many Korean Chaebols went bankrupt.¹² Lee also says in his paper

“In the wake of the recent Korean economic crisis starting 1997, numerous

¹² In Byung-Joo Lee “Exchange rate Exposure of Korean Companies: Pre- and Post-Economic Crisis Analysis”

companies in Korea went bankrupt as a result of the currency and banking crises. In the early stage of the Korean economic crisis, large companies like Hanbo Steel and Kia Motors, once virtually guaranteed by the government (too-big-to- fail), sought protection from creditors after banks refused to extend their short-term debts.”

Even though there are various kinds of studies on causes and consequences of Korean and other Asian Crises, it is out of interest in this paper. We more focus on structural change before and after the crisis on exchange exposures. In this section the question “Is there any structural change before and after crisis in exchange exposure?” will be answered. To find out structural change before and after crisis, dummy variable was put into the newly adjusted model and get new regression model.

$$R_{it} = \beta_0 + \beta_1 S_t + \beta_2 \hat{\varepsilon}_{it} + \beta_3 D_{\text{crisis}} + \mu_{it} \quad (3)$$

where the dummy variable D equals to 0 for pre-crisis period (from January 1997 to October 1997), and 1 for in-crisis period (from November 1997 to December 1998) and 2 for post-crisis period (January 1999 to December 2000).

The full period was divided into three sub-periods on the basis of change of exchange rate and market return. In Figure 2a and 2c, KRW-USD, euro and JPY start to fluctuate abruptly from November 1997 and Figure 5 also shows the lowest KOSPI in In-crisis period, thus in-crisis period start in that month.

Result of newly devised model with crisis variable.

Table 3 and Figure 6 report the estimates of KRW-USD exchange exposure for the three sub-periods and distribution of exposure coefficients, respectively. The first thing to note is the change of sign on exposure coefficients and its implication that there actually was some structural change before and after crisis. Before the crisis, number of firms with positive exposure coefficients was 304(40%). However, after the crisis, the number went down to 159(21%). That can be interpreted that before the crisis, depreciation of KRW affected the value of 40% firms negatively, and after crisis most value of Korean firms are affected positively by depreciation of Korean won. This can also be explained by numerical evidence in Table 3b. 280 of 730 companies have changed sign of exposure coefficients after the crisis and 75% of their exposure coefficients have changed from positive to negative. These results are consistent in some part with Byung-Joo Lee's paper, saying

“This paper found that there were structural changes in the relationship between the exchange rate return and the stock returns before and after the economic crisis. Before the economic crisis, the depreciation (positive return of the exchange rate changes) increases the company valuations in general, thus positive parameters. However, after the economic crisis, depreciation affects the company valuation negatively.”

But there is some difference in number due to the size of sample selection.

Table 3a

Estimates of KRW-USD Exposure Coefficients β_3 with Crisis Variable

$$R_{it} = \beta_0 + \beta_1 S_t + \beta_2 \hat{\varepsilon}_{it} + \beta_3 D_{\text{crisis}} + \mu_{it}$$

	Pre-crisis (D=0) (1997.1~1997.10)	In-crisis (D=1) (1997.11~1998.12)	Post-crisis (D=2) (1999.1~2000.12)
Mean	-0.60451	-0.492018	-0.66519
Median	-0.436018	-0.504702	-0.91052
Minimum	-16.46155	-1.90588	-14.07413
Maximum	8.112141	1.493274	8.31447
No. of total firms	769	778	740
No. of firms with positive β_3	304(40%)	5(0.6%)	159(21%)
No. of firms with negative β_3	456(60%)	773(99.6%)	581(79%)

Parenthesis is percentage of positive and negative.

Table 3b

	Number of companies
Total changed	280
Positive to negative	210 (75%)
Negative to positive	70 (25%)

V. Determinant of Exchange Exposure

In the previous section, it has been proved that the estimated exposure coefficients varied substantially across companies. The purpose of this section is to identify whether exchange rate exposure is related to the size of firms and industries that the firms are in. Many previous researchers¹³ empirically studied the link between exchange exposure and firm size and industry. Some study found systematic relationship but some didn't.¹⁴ But we expect that most of Korean industries that depend on export and import would be highly exposed to exchange rate movements.

Each firm was divided by their size into two groups, that is, small and large with the criterion of total market value. Since industry code of Korea was revised on November 6th 2000 from KSE, market price and the number of listed shares outstanding of November 3rd 2000 were used to keep consistence.

Large firms are the companies with greatest market value from the top to upper 10 percent and small firms are the companies that are in the lower 10 percent band. In the Table 4 and Table 5, all exposure coefficients are sorted by firm size and industry level.

¹³ Dominguez, Chang-Young Chung, Byung-Joo Lee, Gordon M. Bonar M.H. Franco Wong.

¹⁴ In Dominguez and Tesar (2001), "We find that exposure is not systematically related to firm size.

Even though small firms and large firms have the same negative sign and similar magnitude, that is, they are negatively affected by depreciation of KRW-USD exchange rate; size plays a significant role in explaining the KRW-USD exchange exposure. Table 5 reports that 55 out of 70 large companies (83%) are exposed to KRW-USD exchange rate movements and 26 out of 70 small companies (37%) at 10 percent significance level. That can be interpreted that the bigger the firm is, the more exposure to exchange rate movement the firm has, and thus the exchange exposure has positive relationship with firm size.

To verify that larger firm is more exposed to exchange rate movement, we conduct two-tailed t-test using absolute mean of exposure coefficients. As the mean is the offsetting value between the positive and negative exposure coefficients, it is relevant to use absolute mean to examine relationship between the magnitude of exposure and firm size. Null hypothesis (H_0) is that the mean of small size firms equal to the mean of large and alternative hypothesis (H_1) is not equal. If we assume that μ_S is the Small firms' mean of foreign exchange exposure and μ_L is the mean of large firms' foreign exchange exposure, the hypotheses can be restated as following.

$$H_0: \mu_L - \mu_S = 0 \text{ firms}$$

$$H_1: \mu_L - \mu_S \neq 0$$

Following Table shows that t-value is -1.899237083 , and its p-value is 0.059698912 , so we can reject the null hypothesis at 10% significance level. Therefore, the foreign exchange exposure is different by size. And this result is contrary to Dominguez and Tesar (2001) where they didn't find systematic relationship between the foreign exchange exposure and firm size.

t-Test: Two-Sample Assuming Unequal Variances

	Small Firms	Large Firms
Mean	0.482211613	0.580112
Variance	0.102108828	0.079001
Observations	70	66
Hypothesized Mean Difference	0	
Degree of freedom	133	
t Stat	-1.899237083	
P(T<=t) one-tail	0.029849456	
t Critical one-tail	1.656389941	
P(T<=t) two-tail	0.059698912	
t Critical two-tail	1.977959982	

Even though most of Korean industries are significantly exposed to KRW-USD exchange rate, there are industry categories having relatively small exposure (fishing, food & beverage, textile & wearing apparel, and communications). A closer look reveals that as much as 25% of fishing industry is exposed to KRW-USD exchange rate movement, and, interestingly, communications industry is entirely out of exchange rate

movement. And Electricity & Gas industry is wholly exposed to movement of exchange rate due to huge foreign debt and import.

Table 4 Distribution of KRW-USD Exposure Coefficients (β_1)
for Top 10% and bottom 10% companies.

	Small size firms (Top 70 companies)	Large size firms (Bottom 70 companies)
Mean	-0.47677	-0.54147
Median	-0.41750	-0.56856
Minimum	-1.60097	-1.82619
Maximum	0.14261	1.27519
No. of firms with significant at 10%	26	55
No. of firms with pos sig at 10%	0	0
No. of firms with neg sig at 10%	26	55

Table 5 Distributions of KRW-USD Exposure Coefficients (β_1) for Industry Categories.

Industry	Mean	Median	Minimum	Maximum	No. of firms with significant at 10%
Fishing	-0.29905	-0.24010	-.76375	0.04773	1(25%)
Mining	-0.6337	-0.51578	-.89650	-0.48884	2(67%)
Food & Beverage	-0.41393	-0.43234	-.86321	1.31402	28(57%)
Textile & Wearing Apparel	-0.44523	-0.52476	-.48494	7.46443	40(58%)
Paper & Wood	-0.46371	-0.43533	-.89241	0.27568	19(63%)
Chemicals	-0.45509	-0.49935	-.02718	0.64001	65(78%)
Medical Supplies	-0.49455	-0.46509	-.60097	0.29527	27(79%)
Non-metallic Mineral Products	-0.72953	-0.57188	-.11429	-0.19088	21(75%)
Iron & Metal Products	-0.49153	-0.49003	-.88386	-0.07410	29(69%)
Machinery	-0.47666	-0.51048	-.06167	1.27519	31(70%)
Electrical & electronic Equipment	-0.52143	-0.55132	-.05489	0.84364	72(78%)
Medical & precision Machines	-0.4357	-0.49600	-.69631	-0.12446	5(63%)
Transport Equipment	-0.52551	-0.55394	-.83912	-0.05071	30(86%)
Other Manufacture Distribution Industry	-0.51495	-0.50882	-.86074	0.13709	19(73%)
Electricity & Gas	-0.55696	-0.61554	-.68071	2.59045	37(73%)
Construction	-0.46353	-0.41729	-.81409	-0.23814	8(100%)
Transport & Storage	-0.54619	-0.53325	-.12914	-0.09778	36(67%)
Communication	-0.49312	-0.58865	-.02919	-0.03326	12(80%)
Financial Companies	-0.33967	-0.17997	-.77555	-0.06349	0(0%)
Services	-0.5398	-0.57472	-.16457	1.37077	75(70%)
	-0.71161	-0.60484	-.82619	-0.19935	4(67%)

V. Conclusions

This empirical study investigated the relationship between exchange rate movement and value of firms, so-called foreign exchange exposure, of Korean Firms.

The results suggest that Korean firms are highly exposed to exchange rate movements, especially KRW-USD exchange rate. About 70 percent of sample shows significant exposure to the rate at 10% significance level, while 22 percent and 45 percent showed significant exposure to KRW-euro and KRW-JPY exchange rate, respectively. These results are substantially different from previous studies where it shows low statistical evidence.

It is also found that the sign and the magnitude of the exposures differ among the three sub-periods. Before the crisis of 1997, 40% of sample firms had positive exchange exposure implying appreciation of KRW leads to increase of return on Korean firms. However, after the crisis, about 75% firms had negative exchange exposure meaning the reversal effect of the depreciation on the rate of returns of Korean firms.

It was also investigated that exchange exposure can be explained by firm size and industry. The result reports that exchange exposure varies largely across the firm size and industry. Companies that were excessively exposed to exchange movement were

mostly large firms. Firms in fishing, food & beverage, textile & wearing apparel and communications industries showed less significant exposure while electricity & gas industry is wholly exposed to movement of exchange rate due to huge foreign debt and import.

More careful and developed empirical researches are needed in the studies of exchange rate exposure to hedge foreign exchange risk and not to endure another economic crises. And to develop more precise empirical study, new model with relevant controlling and explanatory variables are introduced. It is more precious to integrate this study with hedging policy and other factors that have implications with exchange exposure.

Table 6

Classification of Industry

Code	Industry	Number of Firms
05	Fishing	4
06	Mining	3
07	Food & Beverage	49
08	Textile & Wearing Apparel	69
09	Paper & Wood	30
10	Chemicals	83
11	Medical Supplies	34
12	Non-metallic Mineral Products	28
13	Iron & Metal Products	42
14	Machinery	44
15	Electrical & electronic Equipment	92
16	Medical & Precision Machines	8
17	Transport Equipment	35
18	Other Manufacture	26
19	Distribution Industry	51
20	Electricity & Gas	8
21	Construction	54
22	Transport & Storage	15
23	Communication	3
24	Financial Companies	107
30	Services	6

Table 7 Investment in Euro

May 14, 2002

Year	Amount Invested (USD Mill)	Percentage of Investment (%)
1962~1990	984	12.5
1991	749	53.7
1992	242	27.1
1993	299	28.7
1994	393	29.8
1995	461	23.7
1996	892	27.9
1997	2306	33.1
1998	2885	32.6
1999	6261	40.3
2000	4391	28
2001	3062	25.8

Figure 1

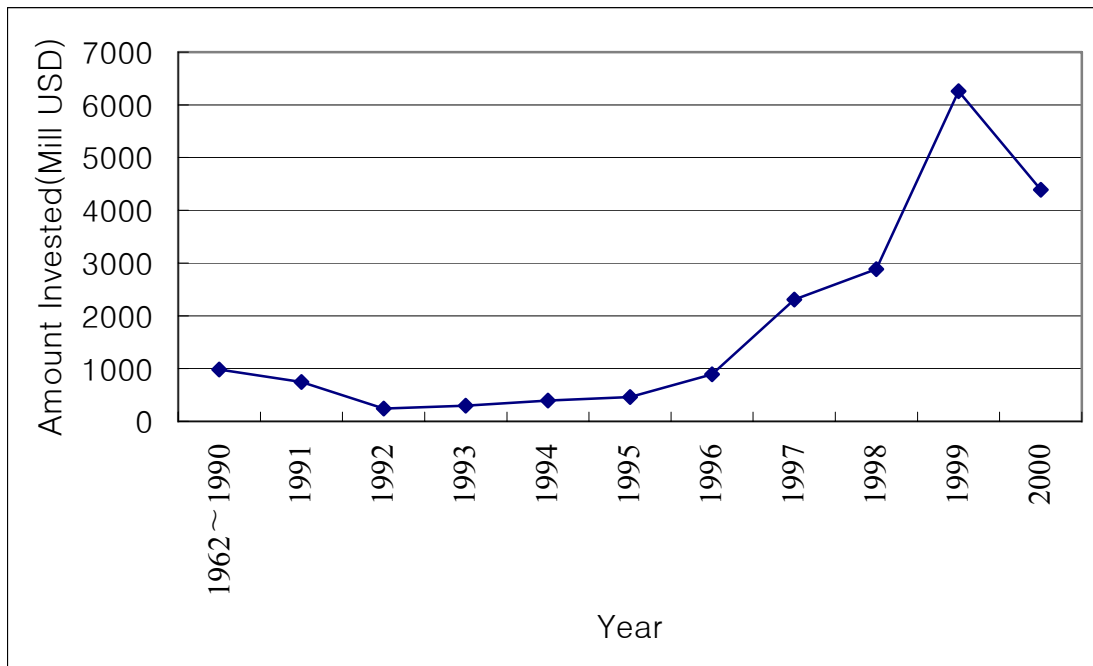


Figure 2a

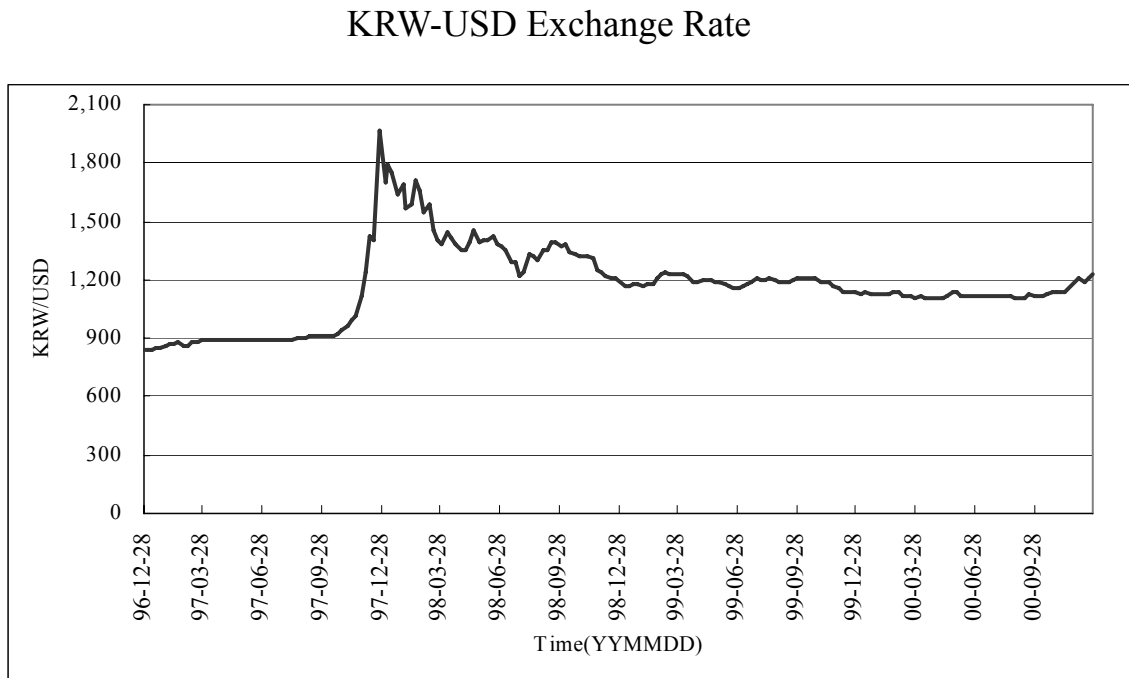


Figure 2b

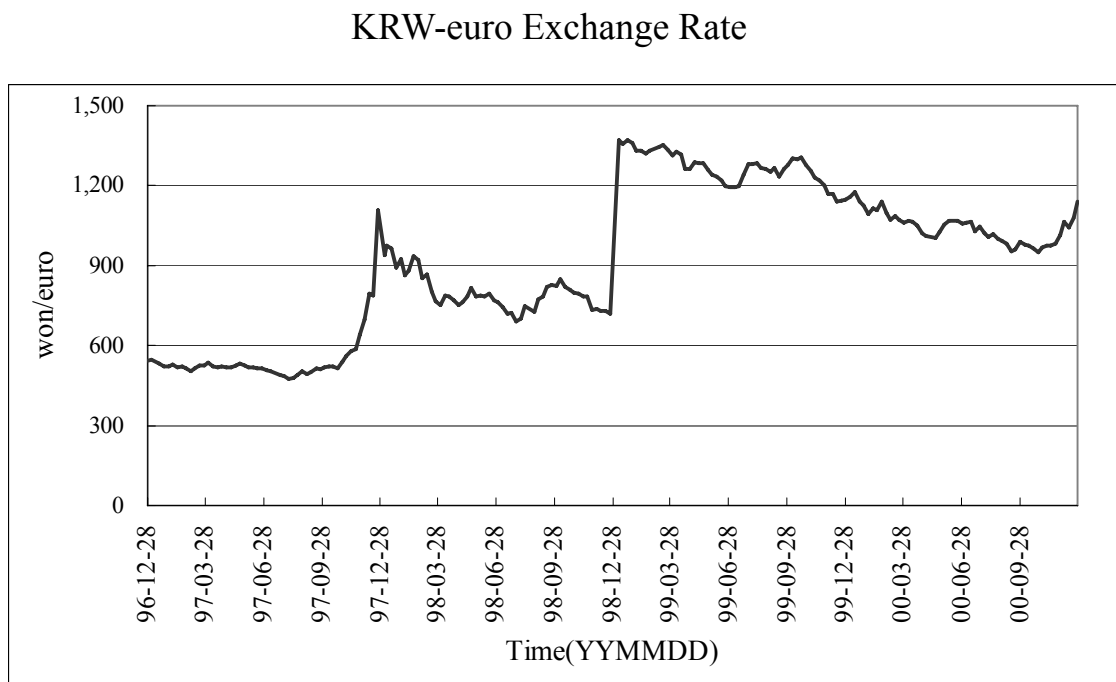


Figure 2c

KRW-JPY Exchange Rate

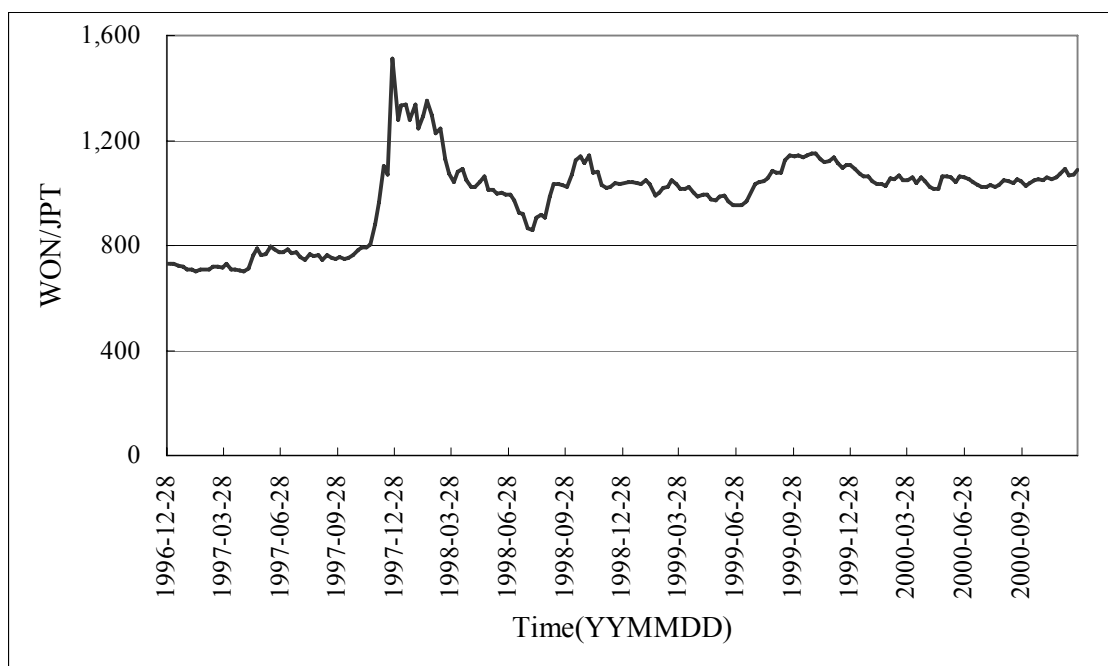
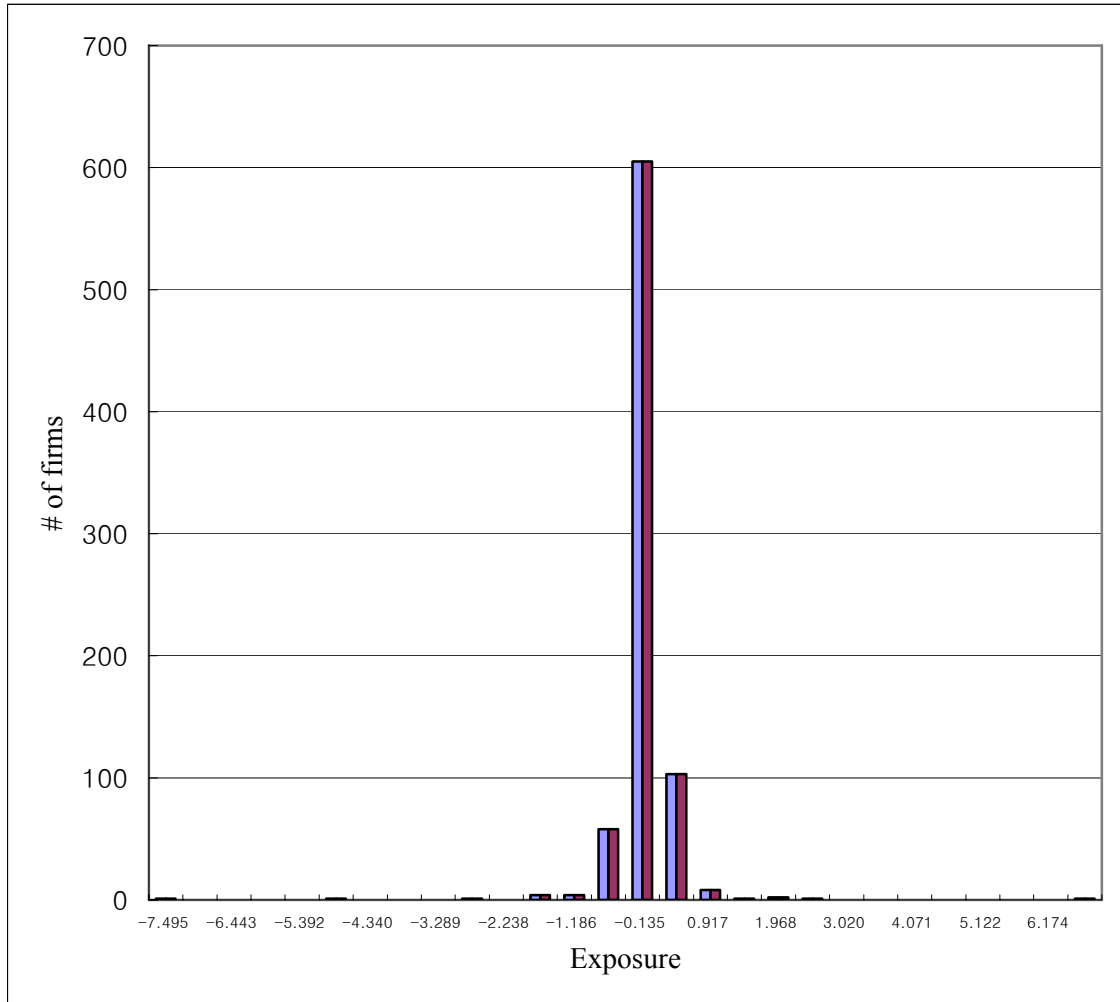


Figure 3

KRW-USD Exchange Rate Exposure Distribution by Usual Model



Values on the X-axis are the medians of the each interval.

Figure 4a

KRW-USD Exchange Rate Exposure Distribution by New Model

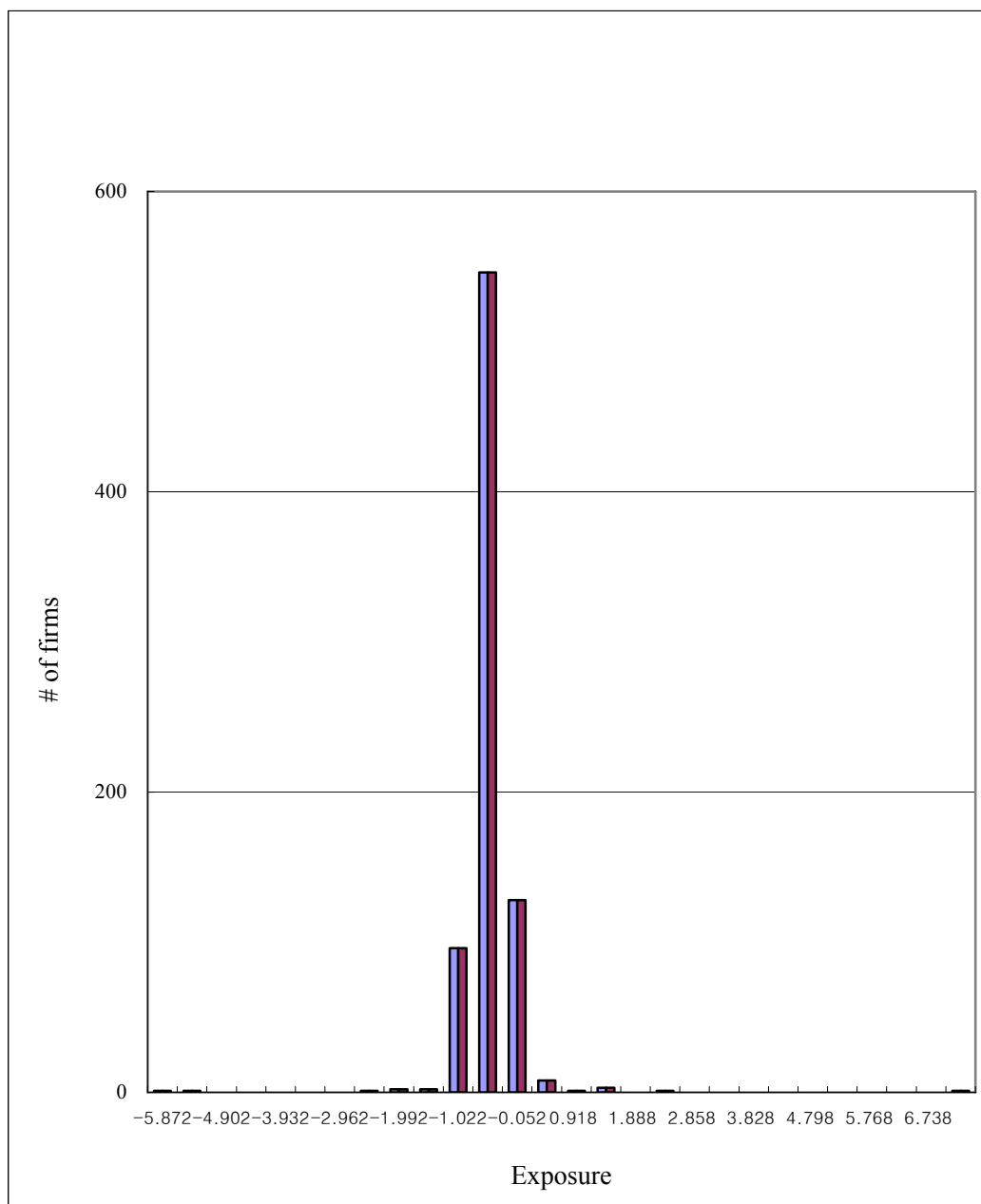


Figure 4b

KRW-euro Exchange Rate Exposure Distribution

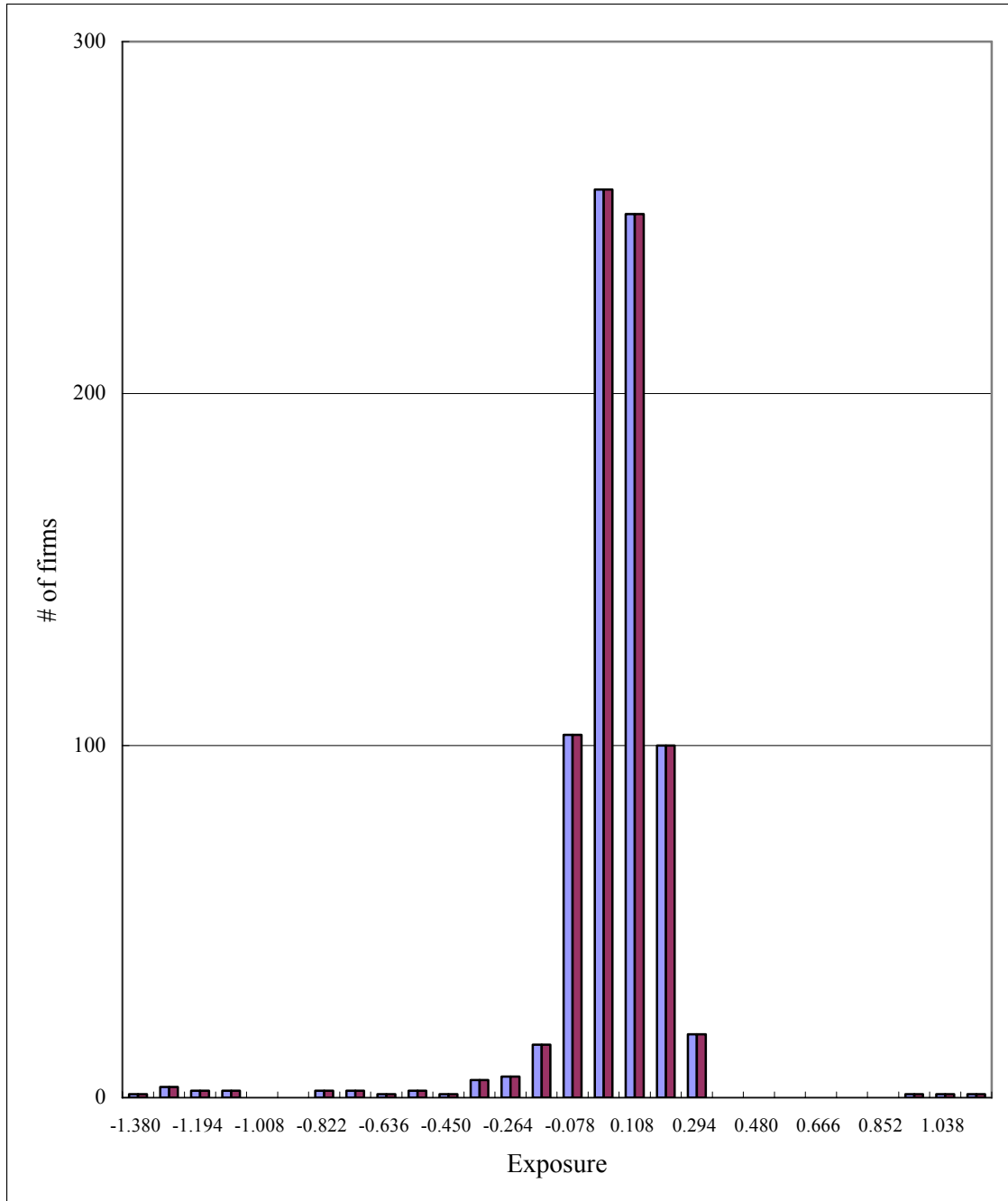


Figure 4c

Won-JPY Exchange Rate Exposure Distribution

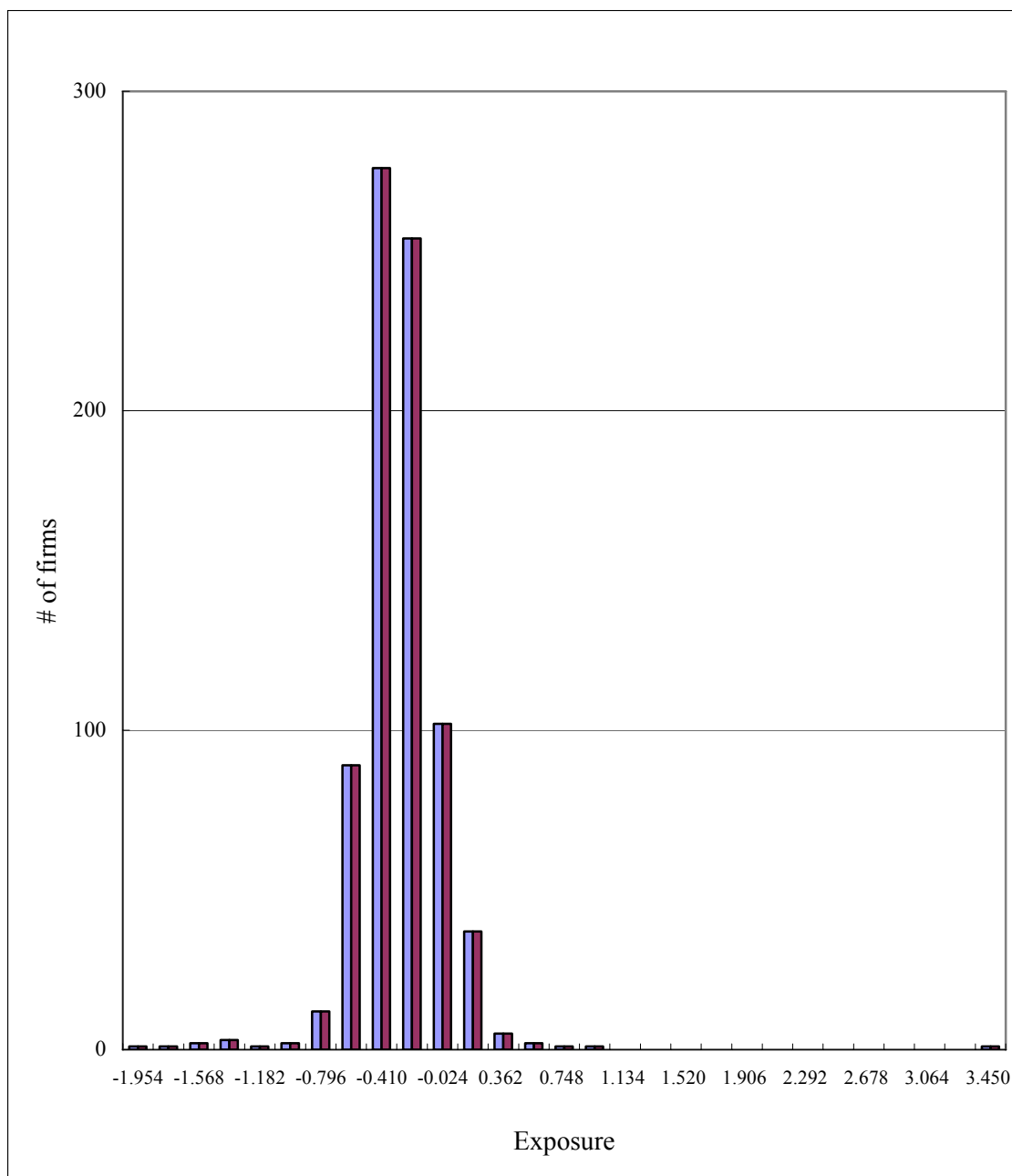
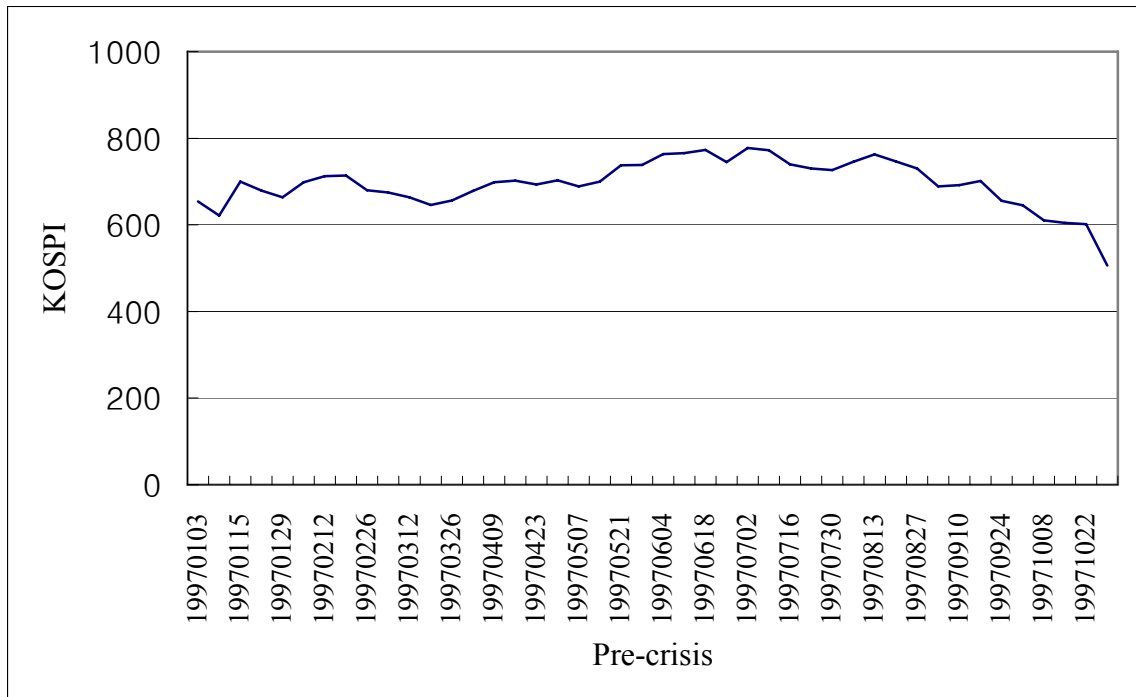
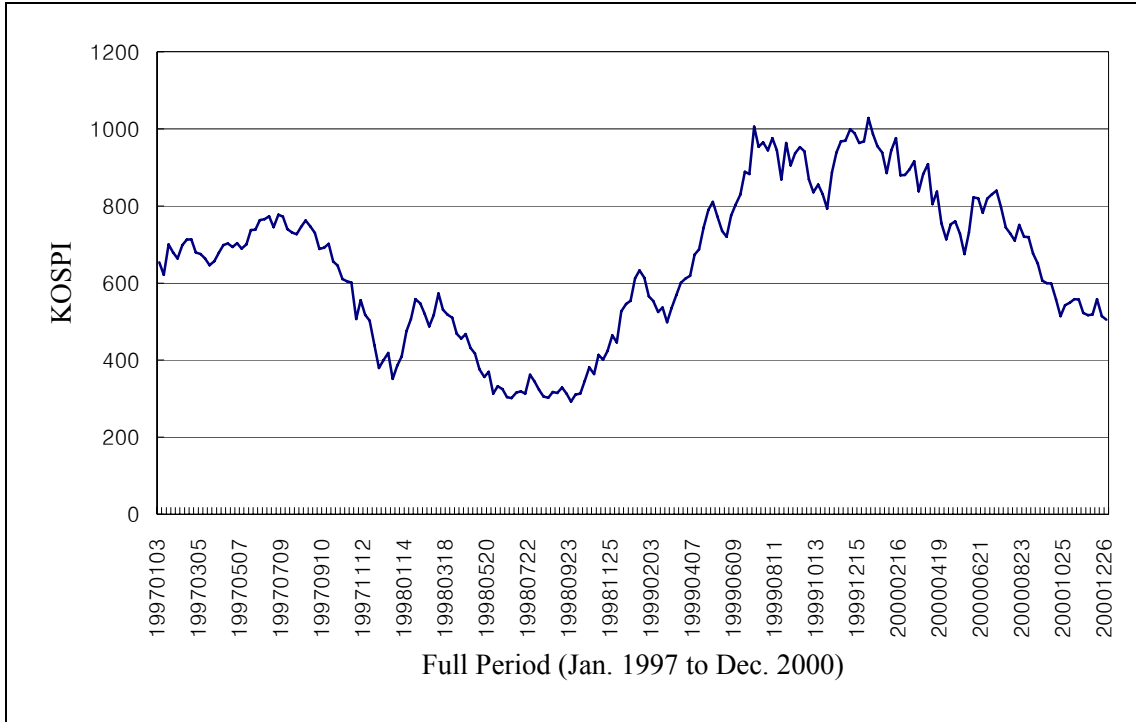


Figure 5

KOSPI for the Total Period



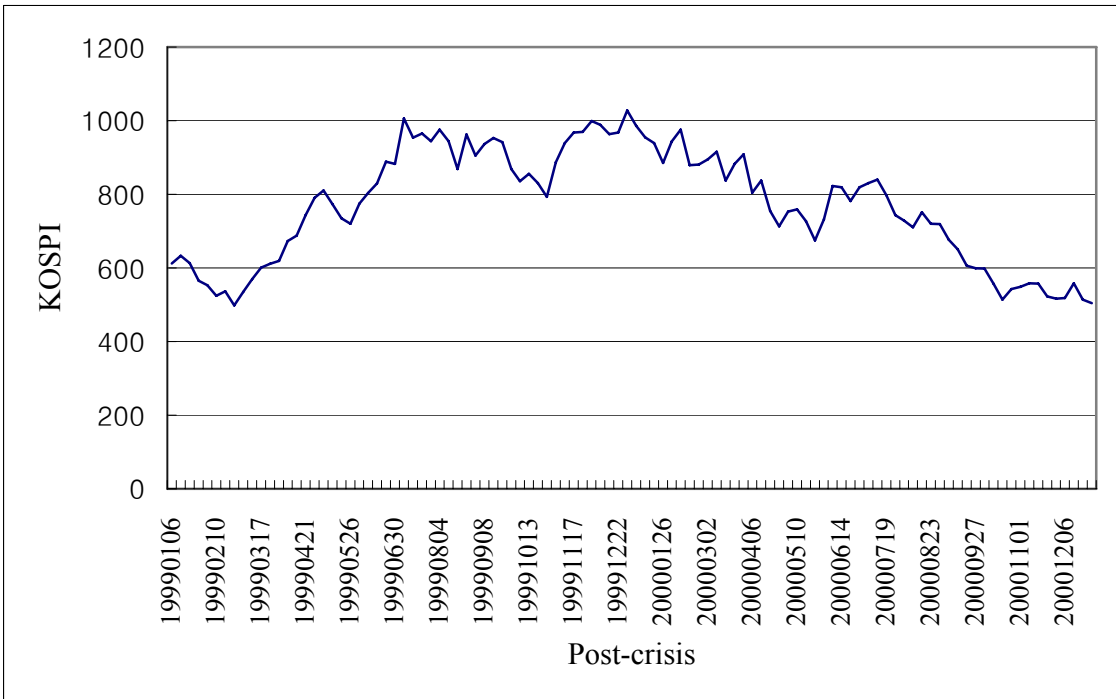
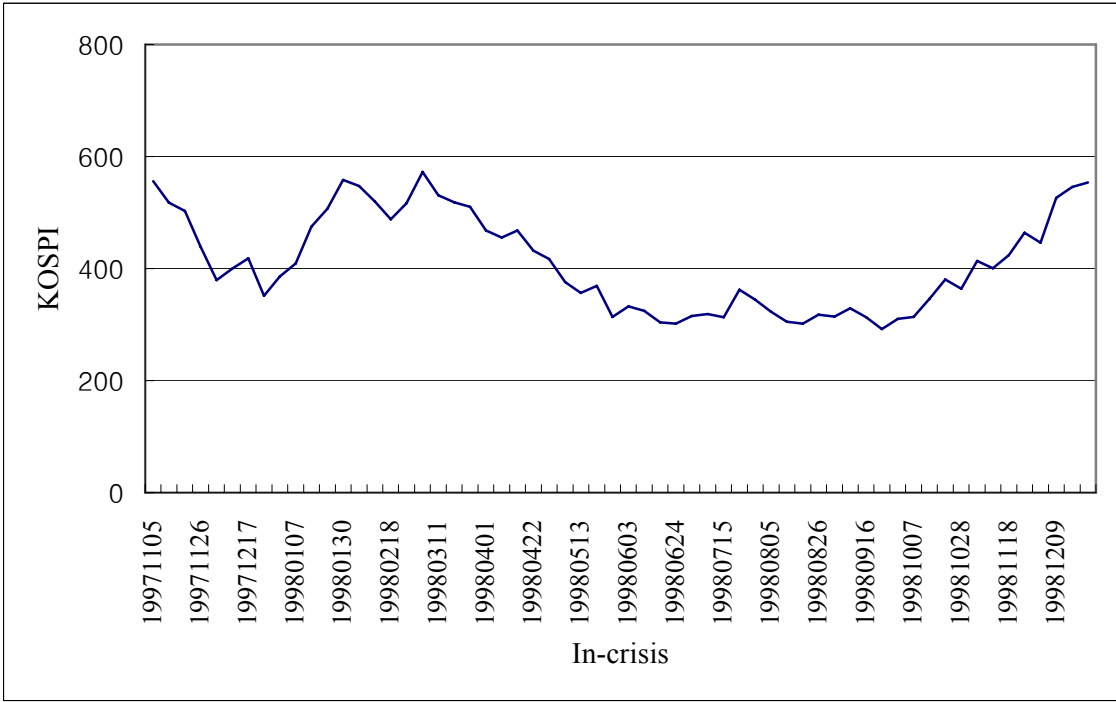
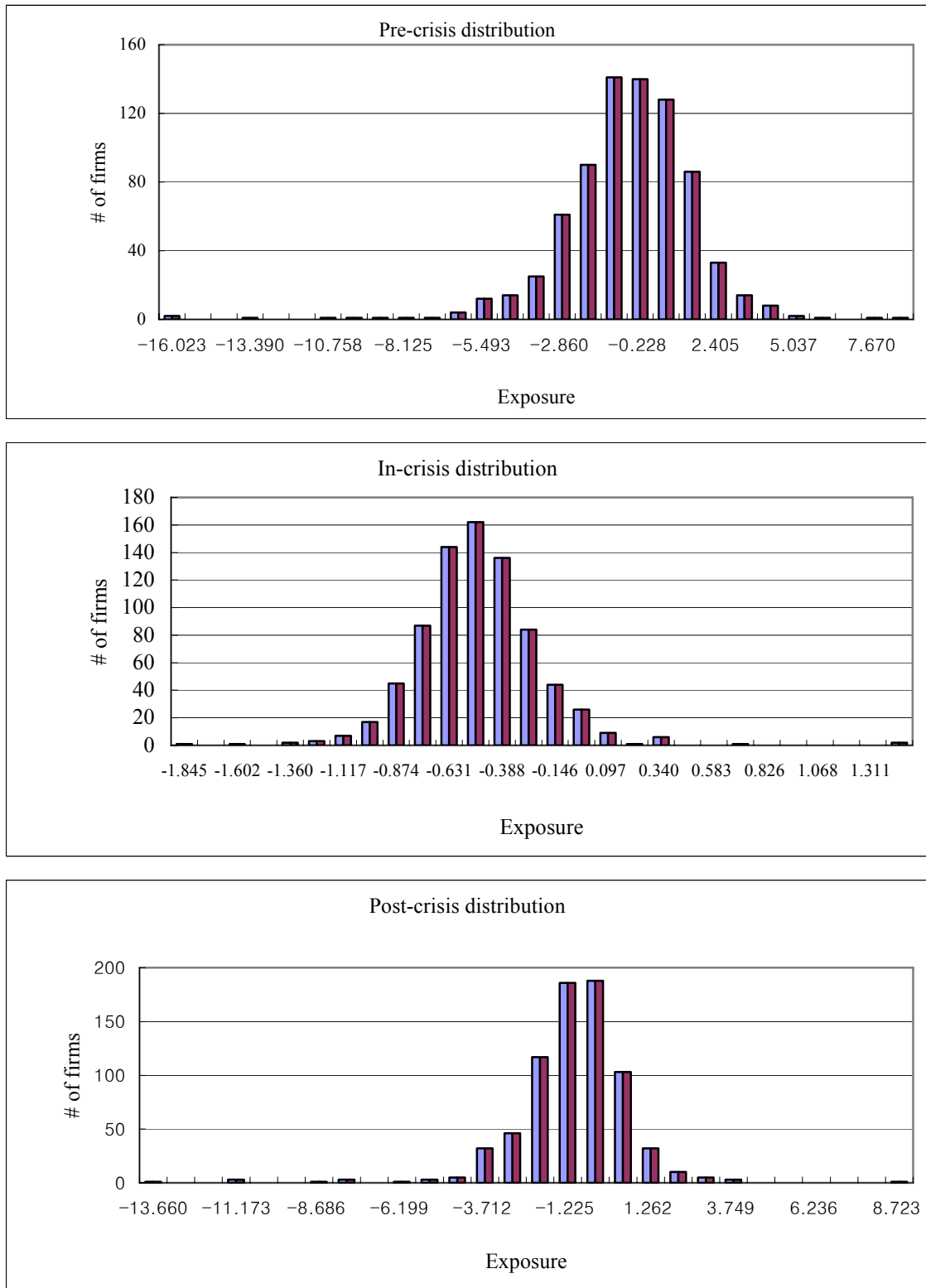


Figure 6

Distribution of KRW-USD Exposure Coefficients During Sub-periods using Crisis Variable



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