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Exchange Rate Exposure of Korean Companies: Pre- and Post-Economic Crisis Analysis*

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This paper examines the relationship between exchange rate movement and individual company's valuation, or exchange rate exposure, in a small open developing economy, specifically South Korea. This paper finds that about 20% of the Korean company's stock performance is statistically significantly impacted by the exchange rate fluctuations. This paper also finds that there is a structural change in the relationship between the exchange rate return and the stock returns before and after the economic crisis. One of the interesting findings of this paper is that the currency depreciation has significantly different impact on the larger companies and on the smaller companies. Before the economic crisis, the currency depreciation has improved the smallest 50 companies' competitiveness in the international markets, thus improving their stock returns. After the crisis, the stock returns of the smallest 50 companies are negatively correlated to the currency depreciation. This is largely due to the short-term foreign debt obligations, recessionary economic conditions, and government's policy heavily favoring larger chaebol companies during the economic crisis period.

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1. INTRODUCTION

It is widely believed that the exchange rate movement is closely related to a country's macroeconomic performance. The exchange rate is one of the most important prices in the country. It is the price of one country's currency in terms of another, and, as such, it converts prices denominated in one currency into prices denominated in another currency. Changes in the exchange rate should therefore have a fundamental effect on the country's macroeconomic policy variables. At the microeconomic level, there can also be a significant impact on the performance of companies involved in international activities. For example, currency depreciation will increase the competitiveness of a country's export industry by reducing the cost of exports while currency appreciation will help import industry by reducing the import prices. There have been several studies examining how this macroeconomic effect is transmitted into the valuation of individual company at the microeconomic level, especially for the multinational companies.

Recent studies, Jorin (1990), Amihud (1994), Bodnar and Gentry (1993), Bartov, Bodnar and Kaul (1996), Bodnar and Wong (2000) and Gao (2000), have empirically examined U.S. multinational companies' exchange rate exposures, i.e., the relationship between changes in the value of the U.S. dollar and the changes in the value of the companies measured by stock prices. Huang and Stoll (1996) used high frequency data to examine the relationship between exchange rate and company's stock performance. However, most of these studies found very little evidence between the exchange rate movement and the company's valuation. Bartov and Bodnar (1994) extended the previous study by examining not only the contemporaneous changes in the exchange rate but also the lagged change of the exchange rate. They achieved modestly limited success to link the exchange rate movement and the company's valuation by using the lagged exchange rate movement. Bondar and Wong (2000) also achieved a modest success on explaining the exchange rate movement and company's market

valuation using different measures of market portfolio and analyzing size effect on the exchange rate exposure. Gao (2000) reexamined the foreign exchange rate exposure for U.S. multinational companies and found the time variability of exchange rate exposure by taking into account firms' foreign sales and foreign production information. In contrast to these results, Grossman and Levinsohn (1989) found statistical significances between the exchange rates and stock returns using six import competing industry level data.

There are various explanations about why it is hard to find statistically significant evidence between exchange rate movement and the company's valuation, even though economic theory clearly indicates the relationship. First, multinational companies often reduce their foreign exchange exposure by diversifying their operations across different countries. This is accomplished by optimally locating production facilities, sources of inputs, and markets for their products. Thus, the valuation effect of the exchange rate movement may be offset over time as companies undertake the operational changes in response to exchange rate movement. Second, companies engage active risk management and hedge foreign exchange exposure through financial instruments that offset adverse valuation effects of exchange rate movement. Third, the empirical estimates of the effect of the exchange rate change do not capture true effect of the exchange rate change. The state of the nature of exchange rate exposure may be time-varying while the majority of existing study did not take this into consideration. Levi (1994), Amihud (1994) and Jorin (1990, 1991) partially confirmed the time-varying nature of the exchange rate exposure, and Gao (2000) considered the time variability of exchange rate exposure using detailed company level data for large U.S. multinationals. In short, while a company's specific economic activity, when examined in isolation, is clearly affected by exchange rate movement, for a company as a whole, its foreign exchange rate exposure may be small or non-existence due to the complicating forces canceling with each other.

This paper examines the relationship between exchange rate movement

and individual company's valuation, or exchange rate exposure, in a small open developing economy, specifically South Korea. This measure is called the exchange rate exposure elasticity, and it will serve as an important measure to each company's responsiveness to the foreign exchange volatility. One of the reasons that many of the previous studies fail to find a significant connection between exchange rate movement and a company's valuation is that the majority of the previous studies focus on large U.S. multinational companies that typically have a relatively small share of foreign operations compare to the entire company's operation. In addition, their operations (production facilities and markets) are well diversified around the world, which provides natural hedging instrument, physically and financially. Bodnar and Gentry (1993) estimated exchange rate exposure in three countries, Canada, Japan and U.S. Khoo (1994) studies the Australian mining companies, traditionally thought to be very sensitive to the exchange rate movements. Other than these two studies, there are virtually no studies examining the companies in the small open economy that is more sensitive to the exchange rate fluctuations than the large US multinational companies.

The next section briefly summarizes the characteristics of the Korean economy and the recent experiences of the Korean economic crisis and the more widespread South Eastern Asian economic crisis. Section 3 presents the analytical model and the data set. Section 4 is an empirical analysis of the exchange rates and the individual company relationship in Korean economy during the recent economic crisis. Conclusion and further studies are discussed in section 5.

2. KOREAN ECONOMIC CRISIS

Korea is heavily dependent on the international trade for her economic survival since the early stages of the economic development from the 1960s. Therefore, it is quite natural that most of Korean companies have a large share of foreign operations compared to large U.S. multinational companies.

In addition to the significant shares of foreign sales to total sales, Korean companies import a large portion of critical intermediate goods to produce the final goods. Also, the majority of the Korean companies do not have sophisticated foreign currency hedging operations like many of the multinational US companies have. Thus, Korean companies in a small open economic structure are expected to show more dramatic effect from exchange rate movement than the large U.S. multinational companies. In addition, many Korean companies, including the large companies, so-called "chaebol" companies, and small ones, have significant amount of foreign debts denominated in various foreign currencies. This is largely due to the growth oriented expansionary policy supported by the implicit government guarantee of the foreign debt. This is the often-cited "moral hazard" problem, which was one of the main causes of the recent economic crisis. Therefore, the valuation of Korean companies is very sensitive to the foreign exchange rate fluctuations.

In the wake of the recent Korean economic crisis starting in the late 1997, numerous companies in Korea went bankrupt as a result of the currency and banking crises. In the early stage of the Korean economic crisis, large chaebol 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. A large share of those debts is denominated in foreign currencies, and companies were not able to repay short-term debts due to the foreign reserve shortages. During the economic crisis periods, Korean companies experienced severe liquidity problems due to the large foreign debt-servicing obligation, thus crippling their normal economic operations. Even recently, there were several notable failures and severe financial crisis of large chaebol companies in Korea such as Hyundai Electronics and Daewoo Motors.

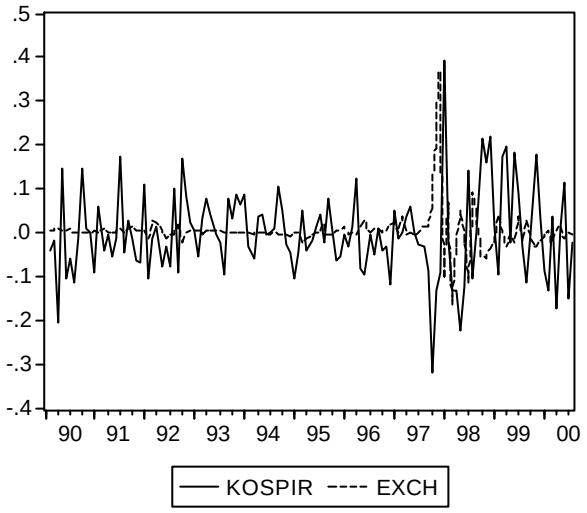
There have been numerous studies on the causes and consequences of the Korean and other Asian economic crisis. Among others, G. Corsetti, P. Pesenti and N. Roubini (1998), S. Radelet and J. Sachs (1998), and P. Krugman (1998) analyzed the causes of the Asian economic crisis in general,

mostly focusing on the macroeconomic conditions. D. Cho (1999), J. Hahn and F. Mishkin (2000), and H. Root (2000) investigated the specific problems of South Korean economy. K. Kim and B. Lee (2000) analyzed the Korean economic development and the recent economic crisis focusing on the government role of the economy. However, the majority of studies focused on the macroeconomic aspects of the economic crisis. This paper focuses on the microeconomic level impact of the economic crisis, more specifically, the impact of the exchange rate movement on the individual company. It is very important to understand the relationship between the exchange rate movement and company's valuation. This relationship will tell whether an individual company has a proper risk diversification through foreign currency hedging operations.

A brief summary of the Korean macroeconomic conditions will help understand the microeconomic analysis of the exchange rate and the stock market index. The steady growth of the Korean economy during 1990s came to a screeching halt in 1997-1998. The real GDP has grown over 5% throughout early to middle 1990s but it shrank to 5.8% in 1998. The unemployment rate increased from the low 2% during the middle 1990s to 7% in 1998. Foreign debt has increased to $158 billions at the end of 1997. The following figure will give you a brief idea how exchange rates and Korean stock market index have evolved throughout the 1990s of tranquil periods and turmoil periods.

From Figure 1, it is clear that the nominal exchange rates were stable from early 1990s to the middle of 1997. These are the periods of the managed floating exchange regime of the Korean Won. The market average exchange rate (MAR) system was adopted in March 1990. Under the MAR regime, the Korean exchange rate has been determined primarily by the market forces, with the occasional governmental intervention throughout the early to the middle 1990s. When the economic crisis hit the South Eastern Asian region during the early and the middle of 1997, Korean Won has been depreciated sharply, and the MAR system could not be maintained. In December 1997, the free floating exchange rate system was adopted to

Figure 1 Rate of Return for the Monthly Nominal Exchange Rate (Won/Dollar) and the Korean Stock Market Index (KOSPI) beginning January 1990 to August 2000



$KOSPIR = \ln(KOSPI_t) - \ln(KOSPI_{t-1})$, $EXCH = \ln(ExchangeRate_t) - \ln(ExchangeRate_{t-1})$

determine the nominal exchange rate. Since then, the Korean Won depreciated from around ₩800/$ to ₩2,000/$ at the end of 1997, and gradually stabilized around ₩1,200-1,400/$ in 1998 and after.

Throughout the 1990s, Korean stock market index was much more volatile than the nominal exchange rates. The volatility has increased dramatically after the economic crisis. During this period, the returns of the stock market index and the exchange rate (KOSPIR and EXCH) are negatively correlated with correlation coefficient of –0.33. When we break 1990s into two sub-periods, tranquil period and turmoil (crisis) period, where July 1997 is the beginning of the economic crisis, the tranquil period still has the negative correlation coefficient of –0.22, and the negative correlation coefficient between these two variables even increases (in absolute value) to –0.39 during the crisis period.

To investigate the causal relationship between key macroeconomic variables, the followings are two simple summary regressions among the returns of three variables, stock market index (KOSPIR), nominal exchange rate of Won per US dollar (EXCH), and nominal interest rate (INTR). KOSPIR and EXCH are rate of returns expressed as the first difference of the natural log of level variables. The OLS regression specification and estimation results are as following:

$$KOSPIR_t = \beta_0 + \beta_1 EXCH_t + \beta_2 EXCH_{t-1} + \beta_3 INTR_t + \varepsilon_t .$$

Table 1 OLS Results

	All period	Pre-Crisis	After-Crisis
Constant	0.0097(0.0067)	0.0172(0.0125)	0.0091(0.0099)
EXCH(t)	-0.7629(0.0829)*	-0.2259(0.2553)	-0.7885(0.1171)*
EXCH(t-1)	0.2364(0.0830)*	0.1117(0.2553)	0.2456(0.1171)*
INTR	-3.8912(2.6338)	-6.2150(4.6555)	-4.9171(4.3727)
F-signif. (p-value)	0.0000	0.4324	0.0000

Note: Pre-crisis: January 1992-June 1997, After-crisis: July 1997-September 2000. Standard errors are in the parenthesis. '*' indicates 5% statistical significance.

These regression results are consistent with findings of the simple correlation between those variables. Stock market index is negatively associated on the contemporaneous lag and positively associated on the first lag by the depreciation of the nominal exchange rates. This could be due to the time-lagged response of the exchange rate to the stock market, so-called the J-curve theory. Before the crisis period, depreciation still had the negative impact on the stock price even though it was not statistically significant. However, after the crisis, the negative impact of the depreciation is much more pronounced and statistically significant than before the crisis period. Interest rate remained unimportant to the stock market throughout the entire period.

In the OLS specification, we assume that the direction of causation goes form the exchange rate and interest rate to the stock market. To avoid this

arbitrary specification, we estimate the vector autoregression (VAR) model of three variables as following.

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_p Y_{t-p} + \varepsilon_t .$$

Y_t is 3x1 vector of three endogenous variables (in the order of INTR, EXCH, KOSPIR) expressed as the rate of return, $A_1, A_2, \cdots, A_p$ are matrices of coefficients, and ε_t is a vector of white-noise innovations that may be contemporaneously correlated with each other but uncorrelated with their lagged values. In the VAR estimation, the parameter estimates are oftentimes of the secondary importance, and we are more interested in the causal relationship among dependent variables. The followings are the Granger-causality test results for the VAR using 4 lagged values.

Table 2 All period

Lagged Var\Dependent	INTR	EXCH	KOSPIR
INTR	5424.9646(0.0000)	2.7500(0.0278)	0.0793(0.5301)
EXCH	26.2599(0.0000)	4.1282(0.0027)	3.6385(0.0063)
KOSPIR	0.9242(0.4496)	3.3597(0.0100)	2.9678(0.0194)

Note: Numbers in the parenthesis are p-values.

Table 3 Pre-Crisis

Lagged Var\Dependent	INTR	EXCH	KOSPIR
INTR	982.1337(0.00000)	0.7003(0.5924)	0.9074(0.4601)
EXCH	1.5483(0.1885)	5.4535(0.0003)	1.3781(0.2418)
KOSPIR	0.5489(0.7000)	2.4643(0.0455)	0.6938(0.5968)

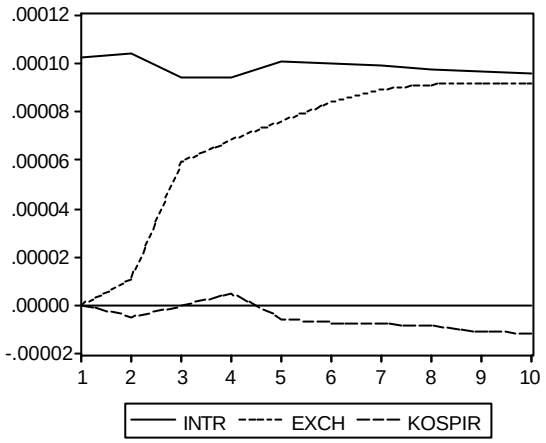
Note: Numbers in the parenthesis are p-values.

Table 4 After-Crisis

Lagged Var\Dependent	INTR	EXCH	KOSPIR
INTR	3581.8350(0.00000)	2.3866(0.0535)	0.7738(0.5438)
EXCH	23.2859(0.00000)	1.7063(0.1513)	2.0234(0.0938)
KOSPIR	0.7149(0.5830)	1.3734(0.2456)	1.9903(0.0986)

Note: Numbers in the parenthesis are p-values.

Figure 2 Response of INTR to Cholesky One S.D. Innovations



From Tables 3, we can see that the Korean stock market was not affected by the exchange rate before the crisis, but after the crisis, from Table 4, the exchange rate now affect the returns of the stock market at the 10% significance level. The useful aspect of the VAR analysis is that we can investigate the impact of each variable to the other variable using the impulse response function. For conveniences, we will assume that the ordering of innovations follows from INTR, EXCH and KOSPIR, and use the Cholesky decomposition to produce the one standard deviation impulse response functions for the entire periods (before and after the crisis).

From Figures 2 to 4, we can see that the impact of the external shocks to stock market and exchange rate is quickly diminishing while the impact to the interest rate appears to be long lasting. This tells us that the stock market and exchange rates adjust quickly to the external shocks, but once the interest rate has been affected by the external shock, interest rate contains the effect of the shocks fairly long period of time.

In a macroeconomic context, interest rate did not appear to be significant for the stock market performances, while exchange rates have different impact on the stock market before and after the economic crisis. It is

Figure 3 Response of EXCH to Cholesky One S.D. Innovations

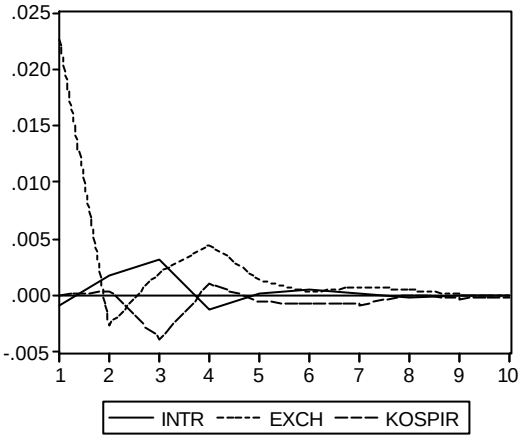
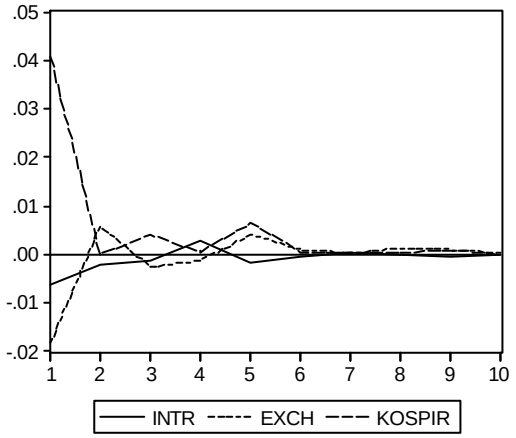


Figure 4 Response of KOSPIR to Cholesky One S.D. Innovations



interesting to see whether the similar relationship exists in the microeconomic context. For example, how exchange rate fluctuations affect individual company stock prices or the relationship between the exchange rate and the stock price remain stable during these periods.

This paper mainly focuses on the microeconomic impact of the exchange rates on the individual company. It is also very interesting to compare the responses of the individual company's valuation to the foreign exchange movement before and after the economic crisis. One of the several hypotheses to test in this paper is that Korean companies' market valuation to the exchange rate exposure behaves differently before and after the economic crisis. Before the economic crisis, export-oriented Korean companies responded positively (increase of the company's valuation) to the currency depreciation and negatively (decrease of company's valuation) to the currency appreciation. This is the expected consequence of the exchange rate movement under the normal economic conditions. However, when economic crisis hits the Korean economy, and the domestic currency depreciates, company's foreign denominated debt overburdens its normal economic operation and cash flow, thus crippling company's economic activity, and its fvaluation plummets. This is also largely due to the erosion of investors' confidence on Korean companies during the economic crisis and recession period. In this scenario, the standard economic theory fails to explain company specific response to the exchange rate fluctuations. Therefore, this paper will investigate the time varying nature of the foreign exchange rate exposure elasticity before and after the Korean economic crisis. This paper will help identify an individual company's exposure elasticity and give appropriate strategic recommendations about the foreign operations depending on the company characteristics.

Next section develops the econometric models to estimate the exchange rate exposure, and the detailed description of the data set used in this study.

3. ECONOMETRIC MODEL OF EXCHANGE RATE EXPOSURE

The basic econometric model is based on the market model of the Capital Asset Pricing Model (CAPM) with exchange rate change being additional explanatory variable. Individual company's excess stock return is a function of the excess market return and the exchange rate return. The estimation model is:

$$r_{it} - r_{ft} = \alpha_i + \beta_i \cdot (r_{mt} - r_{ft}) + \gamma_i \cdot e_t + \varepsilon_{it}. \quad (1)$$

In this model, r_{it} is company i's stock rate of return at time t, r_{mt} is the market rate of return at time t, r_{ft} is the risk-free interest rate, and e_t is the rate of change of exchange rate (Korean Won/US \$). The rate of returns for company, market and the exchange rate are measured as the natural log difference between time t and (t-1) ($r_{it} = \ln(P_{it}) - \ln(P_{i,t-1})$, $r_{mt} = \ln(KOSPI_t) - \ln(KOSPI_{t-1})$, and $e_t = \ln(ExR_t) - \ln(ExR_{t-1})$). The risk-free rate, r_{ft}, is the 91 day direct deposit rate. $(r_{it} - r_{ft})$ is an excess rate of stock return for company i and $(r_{mt} - r_{ft})$ is the excess market return. β_i measures company i's systematic market risk, and γ_i is company i's exchange rate exposure elasticity. In a typical market model, the unsystematic component is $u_{it} = \gamma_i \cdot e_t + \varepsilon_{it}$. In this model, we would like to separate the exchange rate effect component from the total unsystematic components of the fluctuation. Since the exchange rate is measured as Korean Won per US dollar, the increase of e_t represents the depreciation of Korean Won against US dollar. Under the normal macro economic conditions, when Korean Won depreciates, Korean export price becomes cheaper and more competitive in the international market. The currency depreciation will help export companies' sales and their cash flow. This will increase the (discounted) present value of the company and eventually lead to the increase of the company's stock price. Therefore, we expect the estimates of γ_i to be positive under the normal economic conditions.

However, after the recent Asian economic crisis, company's foreign debt burden may have overwhelmed any positive cash flow effect of the currency depreciation. Therefore, we expect that the economic crisis has the negative impact on the g_i. This will help test the time-varying nature of the exchange rate exposure before and after the economic crisis.

The econometric model is estimated by the two-stage estimation process suggested by Levinsohn and MacKie-Mason (1990) due to the bias problem of g_i estimation from equation (1). The first stage estimates the market model without the exchange rate changes. Then, we can estimate the unsystematic or company specific fluctuation from the market model. The exchange rate exposure will be estimated in the second stage using the residuals (unsystematic fluctuations) from the first stage regression as:

$$\hat{u}_{it} = (r_{it} - r_{ft}) - \hat{a}_i - \hat{b}_i \cdot (r_{mt} - r_{ft}). \quad (2)$$

In the second stage, the unsystematic risk is regressed on the several lagged values of the return of the exchange rate changes. The second stage regression with q lagged values of the return of the exchange rate is as follows:

$$\hat{u}_{it} = g_0 + \sum_{j=1}^{q} g_j e_{t-j+1} + d_{it}. \quad (3)$$

This regression provides the unbiased estimates of elasticity of the exchange rate exposure, g_i.

The data comes from the DataStream. The variables that we used in this analysis are: individual company stock price (P_{it}), Korean stock market index ($KOSPI_t$), total market valuation for each company measured as the stock price multiplied by the total number of the outstanding shares, and the official nominal exchange rate measured as the Korean Won per US dollar (ExR_t). Data frequency is monthly and data period starts from the beginning of 1990 when Korea opened her economy in a limited sense, and ends at August 2000 (128 monthly observations). Korean economic crisis began in

early September 1997. However, the general economic conditions in the South Eastern Asia began to deteriorate in the early and the middle of 1997. Therefore, the data is divided into two periods, before crisis and after crisis at the beginning of July 1997. There are 722 companies listed in the Korean Stock Exchange at the end of August 2000. However, in order to compare the before and after economic crisis effect of the exchange rate changes properly, we restrict our sample to companies with the complete price information for the entire period beginning January 1990 to August 2000. This reduces our sample to 506 companies. The list of companies includes large chaebol companies (such as Samsung Electronics, Hyundai Motor) as well as small to medium companies. This list also includes all branches of Korean industries from banking, textiles to petrochemicals and pharmaceuticals.

Exchange rate exposure will be different from one company to another depending on its characteristics. Therefore, I would like to examine how certain company specific characteristics such as company size will affect the exchange rate exposure. In the small open developing economy, the bigger company tends to have more foreign operations than a smaller company does. We expect that the larger company will be more sensitive to the exchange rate fluctuations. In the South Eastern Asian developing countries, it is true that the larger companies have accumulated more foreign debts for the rapid expansion under the implicit government loan guarantee. They are the ones that have the so-called moral hazard problem. However, as we have seen in the previous literature, large multinational companies have well diversified their foreign exchange exposure physically and financially. Therefore, it was very hard to find the empirical evidence of the foreign exchange exposure. It will be interesting to see whether the larger companies in the small open developing countries have the similar sophistication of the large US multinationals to diversify foreign exchange risks.

4. EMPIRICAL ESTIMATES OF THE EXCHANGE RATE EXPOSURE ELASTICITY

This section reports detailed empirical findings of the exchange rate exposure elasticity of Korean companies before and after the economic crisis. First, we estimated the market model for two sub periods to see if there were any statistically significant structural changes before and after the Korean economic crisis. This model is estimated by using the dummy variable to distinguish two sub periods.

$$r_{it} - r_{ft} = \alpha_{0i} + \beta_{0i} \cdot (r_{mt} - r_{ft}) + \alpha_{1i} \cdot d + \beta_{1i} \cdot d \cdot (r_{mt} - r_{ft}) + \varepsilon_{it}, \qquad (4)$$

where the dummy variable d equals to one for crisis period (from July 1997 to August 2000), and zero otherwise. This model will help to distinguish the structural changes of the market model and provides the statistical tools to test the hypothesis of the structural changes. Equation (4) is estimated by the simple least squares estimation. White's (1980) heteroskedasticity consistent covariance estimation method is used to estimate the consistent covariance matrix of the parameters. The estimation results are reported in Table 5.

Table 5 Estimates of the Market Model with Crisis Dummy

Parameters	*Mean*	*Standard Deviation*	*Statistical Significance*			
			P05%	*P10%*	*N05%*	*N10%*
α_0	0.0009	0.0100	2	6	5	19
β_0	0.8025	0.2444	481	491	0	0
α_1	-0.0276	0.0001	0	0	12	38
β_1	0.0997	0.3189	24	40	7	14

Note: Mean estimates are the sample average of 506 company's estimates for 128 monthly observations. For example, $\hat{\alpha}_0 = 1/506 \sum_{i=1}^{506} \hat{\alpha}_{0i} = 0.0009$. The standard deviation is the standard deviation of 506 estimates. The numbers in the statistical significance columns (P05%, P10%, N05%, N10%) are the number of estimates that are statistically significant at 5% and 10% for positive and negative values.

Table 6 Estimates of the Market Model without Crisis Dummy

Parameters	*Mean*	*Standard Deviation*	*Statistical Significance*			
			P05%	*P10%*	*N05%*	*N10%*
α_0	-0.0073	0.0112	2	4	14	26
β_0	0.8676	0.2454	481	488	0	0

Note: Mean of 506 companies for 128 monthly observations.

This table reports that the average market beta (β_0) of 506 companies is 0.8025 and its standard deviation is 0.2444. Also, it reports that 491 out of 506 company's betas are statistically significant at 90%. For dummy variable parameters, we can see that none of the intercept dummy parameters (α_1) are positively statistically significant while 24 out of 506 companies beta dummies are statistically significant at 5%. These results show that the market model was generally stable for the majority (more than 95%) of companies before and after the economic crisis. The market stability hypothesis is tested as follows. The null hypothesis is: $H_0 : \alpha_1 = \beta_1 = 0.$ For all 506 companies, 27 companies rejected this hypothesis using *F*-test at 5% significance level. This is slightly greater than 5% of the total companies, so we can reasonably consider this as the random variation. Therefore, to test the exchange rate exposure elasticity, we used the stable market model for the entire periods and obtained the residual from the single market model. The estimation result is reported in Table 6. The residual from the stable market model is used in the second stage regression to estimate the exchange rate exposure elasticity.

In the second stage regression, various specifications of the lagged values of the return rate of the exchange rate are considered. The same dummy variable is used to distinguish the effect of the economic crisis. The second stage regression model is:

$$\hat{u}_{it} = \gamma_{00} + \sum_{j=1}^{q} \gamma_{0j} \cdot e_{t-j+1} \gamma_{01} \cdot d + \sum_{j=1}^{q} \gamma_{1j} \cdot d \cdot e_{t-j+1} + \delta_{it} . \qquad (5)$$

Table 7 Exchange Rate Exposure Elasticity without Crisis Dummy

Parameters	*Mean*	*Standard Deviation*	*Statistical Significance*			
			P05%	*P10%*	*N05%*	*N10%*
g_{00}	0.0032	0.0041	0	0	0	0
g_{01}	-0.5585	0.5922	11	12	176	220
g_{02}	-0.1871	0.4788	26	39	79	108
g_{03}	-0.0826	0.4755	44	56	61	92
g_{04}	0.3309	0.5009	116	162	9	14
g_{05}	-0.4224	0.5215	11	11	147	182

Note: Mean of 506 companies for 128 monthly observations.

This regression is also estimated using the White's (1980) heteroskedasticity consistent covariance estimation method. For various specifications of the lag length, the estimation results are qualitatively similar and we chose the lag length 4 according to the Akaike information criteria. We estimate equation (5) for two separate models. The first model does not include the crisis dummy and the second model includes the crisis dummy variable. These two estimation results show interesting comparison of the structural changes of the before and after economic crisis. The empirical results are reported in Table 7 and Table 8.

Table 7 shows that the estimates of the exchange rate exposure elasticity throughout the 1990s are negative. The contemporaneous, the first and the second lagged elasticity estimates are all negatives $g_{01} = -0.5585$, $g_{02} = -0.1871$ and $g_{03} = -0.0826$). There are 220 and 108 companies statistically significant at 10% that have the negative contemporaneous and the first lagged elasticities. The second lagged elasticity does not have any clear trend. These results reveal that the Korean companies as a whole did not take advantage of the currency depreciation for the export competition throughout the 1990s. This finding is similar to the macroeconomic evidence that we have seen in Section 2. As we have seen the J-curve effect of the relationship, from this result, we can see that the time-lagged J-curve effect is much longer here, and the positive impact of depreciation is very short lived (only g_{04} is positive and g_{05} again turns to negative).

Table 8 Exchange Rate Exposure Elasticity with Crisis Dummy

Parameters	*Mean*	*Standard Deviation*	*Statistical Significance*			
			P05%	*P10%*	*N05%*	*N10%*
g_{00}	0.0055	0.0105	17	36	0	0
g_{01}	0.3097	1.4606	20	38	14	26
g_{02}	1.0932	1.5738	64	117	7	12
g_{03}	-0.7351	1.5175	4	10	65	85
g_{04}	-0.3049	1.2947	6	17	20	44
g_{05}	0.7477	1.3617	50	80	4	6
g_{10}	-0.0191	0.0281	0	0	6	24
g_{11}	-0.8914	1.5850	8	14	51	83
g_{12}	-1.3188	1.7388	8	12	89	143
g_{13}	0.6789	1.5180	48	78	7	8
g_{14}	0.6574	1.4257	47	83	5	10
g_{15}	-1.2031	1.4595	1	2	86	116

Note: Mean of 506 companies for 128 monthly observations (90 for pre-crisis, 38 for post-crisis).

However, if we introduce the structural breakdown for the dramatic changes of the macroeconomic conditions, there are very different and interesting results.

Table 8 reveals very interesting empirical evidences different from those of Table 7. First of all, the contemporaneous (lag zero) and the lag one exchange rate exposure elasticities are positive ($g_{01} = 0.3097$ and $g_{02} = 1.0932$) before the economic crisis and their corresponding dummy parameters measuring the effect of the economic crisis are negative ($g_{11} = -0.8914$ and $g_{12} = -1.3188$). This explains the effect of the exchange rate changes on the company valuation in the stock market. Before the economic crisis, the depreciation (positive return of the exchange rate changes) increases the company valuations immediately in general, thus the positive parameters for the contemporaneous and the first lag variables. However, after the economic crisis, the depreciation affects the company valuation negatively. This is largely explained by the heavy debt burden denominated by the foreign currencies. On the eve of the economic crisis, large Korean company's debt equity ratio was about 500%, far greater than the international norm. Even though the statistical significance of the

parameters is not very impressive, it is still a very important finding that we verified our conjecture that the exchange rate elasticity exposure has changed its sign after the economic crisis. For the first lagged elasticity estimates, we have 117 positively statistically significant at 10% significance level while 143 companies have negatively statistically significant dummy parameter estimates after the economic crisis. They represent approximately less than 30% of the entire 506 companies. But it is well documented that it is not unusual for failure of finding any meaningful statistical estimates for the exchange rate elasticities due to the complicated nature of company operations and sophisticated hedging strategies to diversify exchange rate risks. To examine more details about the company specific exchange rate exposure elasticity, the following four Figures show the empirical distributions of the current and the first lag parameters before and the after the economic crisis.

Figures 2 and 3 show the empirical distributions of the current and the first lagged parameters for the exchange rate exposures before economic crisis. Even though there are only 38 and 117 statistically significant parameters, respectively, at 10% significance level, they have positive means ($g_{01} = 0.3097$ and $g_{02} = 1.0932$) and positive skewness (0.2400 and 0.5410).

Figure 2 Empirical Distribution of g_{01} (g_{01} = Series B22)

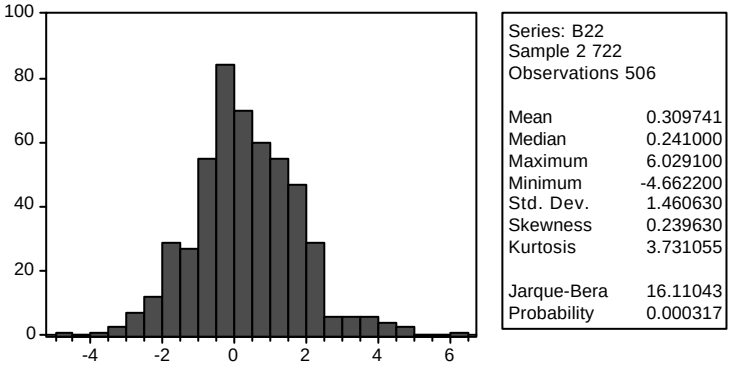


Figure 3 Empirical Distribution of g_{02} (g_{02} = Series B23)

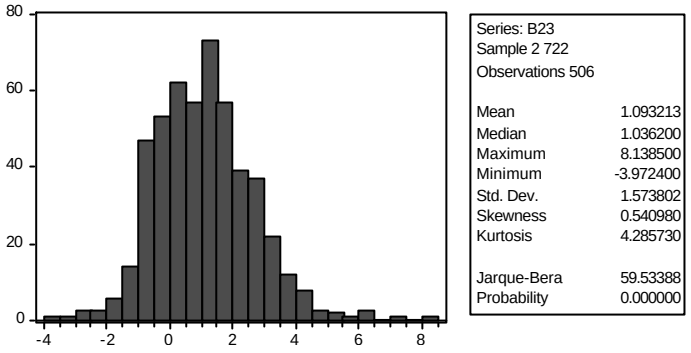


Figure 4 Empirical Distribution of g_{11} (g_{11} = Series B32)

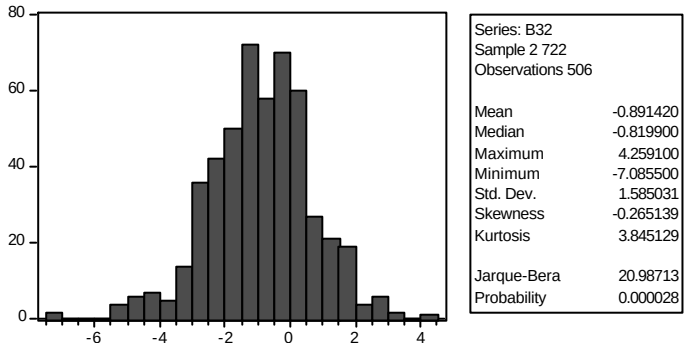
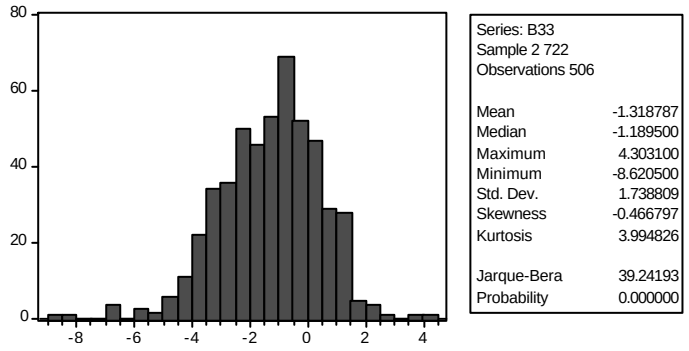


Figure 5 Empirical Distribution of g_{12} (g_{12} = Series B33)



Figures 4 and 5 are the empirical distributions of the current and the first lagged dummy interaction parameters for the exchange rate exposures after the economic crisis. They have negative means ($\gamma_{11} = -0.8914$ and $(\gamma_{12} = -1.3188)$, and negative skewness $(-0.2651$ and $-0.4668)$.

From Table 8, we can also find that the current and the first lagged exchange rate changes affect company valuations most. In fact, the second and the third lagged parameters have the opposite signs from the current and the first lagged parameters. These signs turn from positive to negative before the crisis while they turn from negative to positive after the crisis. The depreciation of the Korean currency against the US dollar affected companies negatively even before the economic crisis. This explains the fragile nature of the Korean companies' financial structure. Many Korean companies have operated under the large amount of foreign debt and most of the debts were short-term debts. Even before the economic crisis, the benefits of the currency depreciation are short lived. While the currency depreciation increased company's competitiveness for the short-term period, after few months later, the depreciated currency quickly turned into the negative factors as it increased the short-term debt servicing obligations. In fact, they are financially strapped by any foreign currency fluctuations.

To test the structural changes of the relationship between the unsystematic risk and the rate of the exchange rate before and after the economic crisis, *F*-test was performed for the null hypothesis. $H_0 : \gamma_{10} = \gamma_{11} = \gamma_{12} = \gamma_{13} = \gamma_{14} = \gamma_{15} = 0$. We rejected the null hypothesis 127 out of 506 companies at 5% (one-sided) significance level, and 181 companies at 10% significance level. This represents about 25% to 35% of all sample companies. While this result does not seem to be very impressive, this finding produces much better results than any of the existing studies regarding the exchange rate exposure elasticity estimation. One of the reasons for this success may be that the majority of the Korean companies, large and small, rely heavily on the international trade, and they are very sensitive to the foreign currency fluctuations.

While Table 8 provides the summary statistics for the parameter estimates

of the exchange rate exposure elasticity of the Korean companies, it is very hard to find any specific characteristics of individual company. In order to investigate more detailed characteristics of the exchange rate exposure elasticity, two sub samples are constructed: the top 50 largest companies and the bottom 50 companies according to the market valuation at the end of December 1996. December 1996 valuation was used to distinguish the top 50 and bottom 50 companies because the next several months have brought the dramatic changes of the economic conditions throughout the South Eastern Asia. Before 1997, it was still stable and tranquil period for the region. If there are any differences to the exchange rate changes between large companies and small companies, these two sub samples will contrast the differences. The following figures show very interesting results for the estimates of these two sub samples. Figures 6 to 9 show the empirical distributions of the exchange rate exposure elasticities for the top 50 largest companies. From Figures 6 and 7, it is very clear that the largest companies react negatively to the exchange rate depreciation even before the economic crisis. This is very different from the previous findings for the entire Korean companies. In general, the majority of the export oriented Korean companies reacted favorably to the exchange rate depreciation before the crisis. Figures 10 and 11 for the smallest 50 companies confirm our previous general findings that the currency depreciation will improve

Figure 6 Empirical Distribution of the Contemporaneous Elasticity (g_{01}) for Top 50 Companies

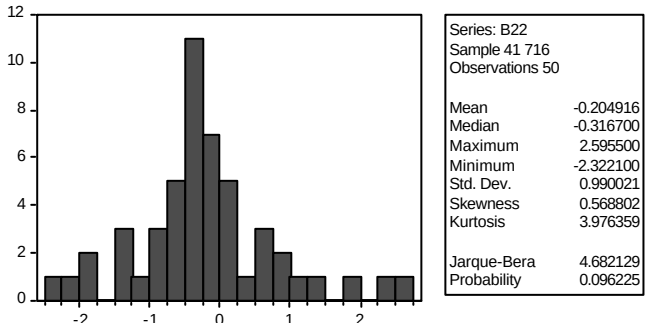


Figure 7 Empirical Distribution of the First Lagged Elasticity (g_{02}) for Top 50 Companies

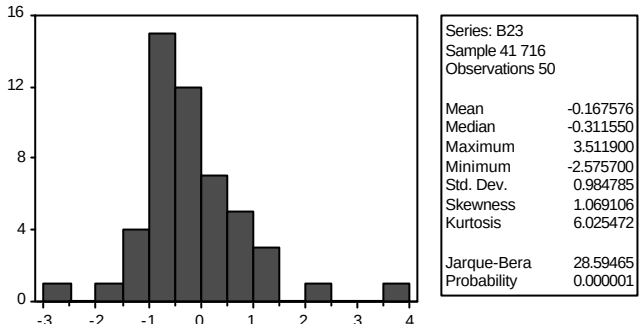


Figure 8 Empirical Distribution of the Contemporaneous Dummy Elasticity for Top 50 Companies

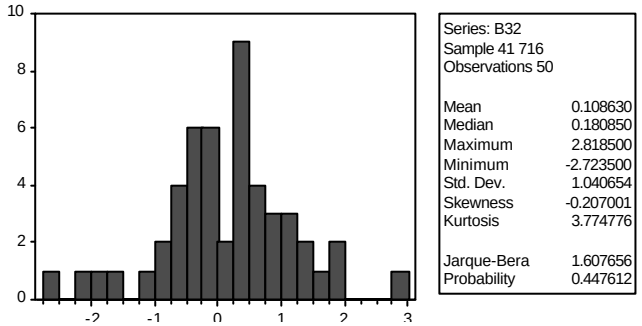


Figure 9 Empirical Distribution of the First Lagged Dummy Elasticity for Top 50 Companies

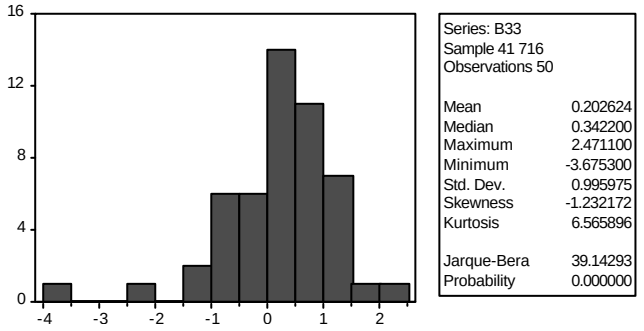


Figure 10 Empirical Distribution of the Contemporaneous Elasticity (g_{01}) for Bottom 50 Companies

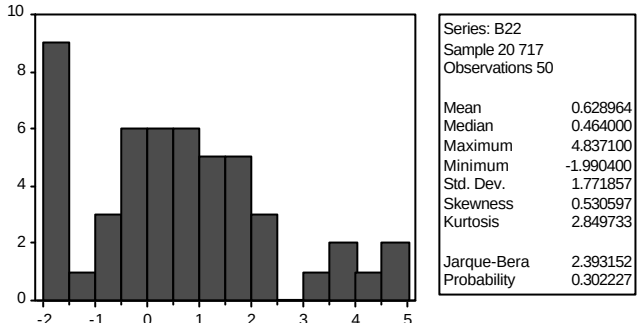
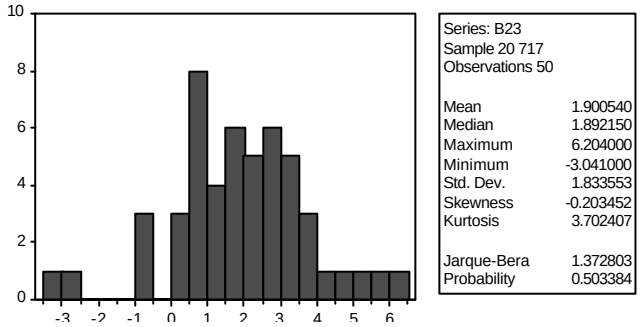


Figure 11 Empirical Distribution of the First Lagged Elasticity (g_{02}) for Bottom 50 Companies



company's stock performance. However, after the economic crisis, the smallest 50 companies shown in Figures 12 and 13 react very negatively to the depreciation while the largest companies' reaction to the depreciation in Figures 8 and 9 is mildly positive. These are very significant findings that have never been analyzed before. Before the economic crisis, the smallest companies with the minimal debts took the full advantage of the currency depreciation to be more competitive in the international markets, the largest companies, mostly chaebols, were not able to take advantage of the favorable exchange rate changes due to the heavy foreign debts. Their foreign debt servicing obligations overwhelmed the competitive advantages offered by the

Figure 12 Empirical Distribution of the Contemporaneous Dummy Elasticity for Bottom 50 Companies

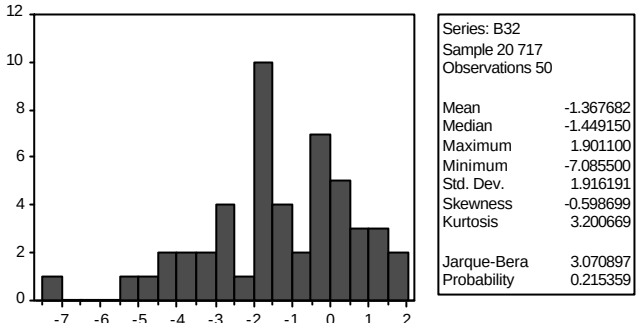
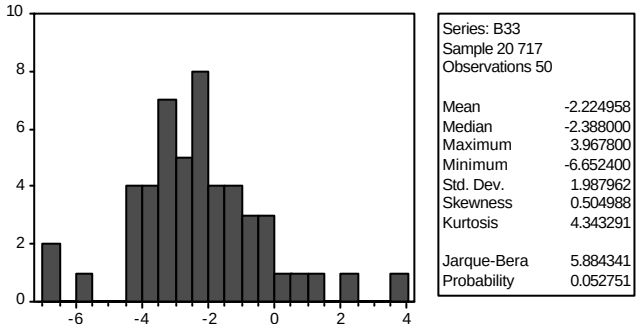


Figure 13 Empirical Distribution of the First Lagged Dummy Elasticity for Bottom 50 Companies



currency depreciation. Another explanation of these results could be the impact of the financial market. Foreign investors mainly hold the larger company stocks, and when the Korean Won depreciates, they hastily abandon those holdings for the fear of further erosion of the Korean economy. Therefore, the depreciation has the negative impact on the larger company stock valuations.

However, after the economic crisis, while most of the smallest companies suffer heavily due to the general recession and the domestic economic downturn, the largest companies took advantage of this economic downturn. There could also be explained by the financial market effect. After the

economic crisis, when the Won depreciation has been stabilized to its lowest is levels, stock prices in US dollar terms are doubly attractive due to the market slump and the exchange rates, foreign investors rush to accumulate Korean stocks mainly focusing on the larger and established companies. This is one of the reasons why the largest companies took advantage of the currency depreciation while most of the small companies suffer because of the recession. Another possible answer to this phenomenon is the government policy. After the economic crisis, Korean government policy turned favorably to the largest companies while neglecting the majority of the small companies. In early 1998, the newly elected Korean government took the initiatives to reform the chaebol oriented industry structure making them more efficient and competitive companies, so-called the "Big Deals" policy. This is the government-controlled industry restructuring policy, swapping assets of different companies of different industries among chaebol companies. This policy is designed to eliminate unnecessary competitions among similar companies in the same industry, and to strengthen international competitiveness of the chaebol companies. Asides from the evaluation of the Big-Deals policy, we can see from our empirical evidence that the larger chaebol companies have benefited from the fall of the Korean economy while the smaller companies are victims of the economic crisis. Government policy needs to focus more on the smaller companies to overcome economic hardship.

5. CONCLUSION AND FURTHER RESEARCH

This paper analyzed the impact of the microeconomic structure of the Korean economic crisis. To be more precise, this paper investigated the effect of the exchange rates on the individual company stock performances during the economic crisis. For large US multinational companies, the currency fluctuation did not cause any statistically significant impact on the stock prices thanks to the sophisticated financial and geographical

diversifications. This paper focuses on the companies in the small open economy, South Korea, that are much more highly exposed to the foreign currency fluctuations than US companies are.

This paper found that about 20% of the Korean company's stock performance are statistically significantly impacted by the exchange rate fluctuations. 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, currency depreciation generally helped company stock performances, but after the crisis, this relationship has been significantly weakened, and the currency depreciation actually hurt the majority of the Korean companies.

One of the interesting findings of this paper is that the currency depreciation has a significantly different impact on the larger companies and on the smaller companies. For the top 50 largest companies, the currency depreciation hurt their stock performances before the crisis but helped them after the crisis. Currency depreciation affected the smallest 50 companies exactly the opposite way of the largest 50 companies. Before the crisis, the currency depreciation improved the smallest 50 companies' competitiveness in the international markets, thus improving their stock returns. After the crisis, the stock returns of the smallest 50 companies are negatively correlated to the currency depreciation. This is largely due to the short-term foreign debt obligations and the general economic conditions of the South Korea during the crisis period.

This paper investigated the microeconomic relationships between the stock performance and the currency fluctuations focusing on the individual company. We have found marginally statistically significant relationship between these two variables before and after the economic crisis. However, from these results, it is very hard to draw any industry specific conclusions. Naturally, there are certain industries (Banking, Semi-conductor industries) that are more susceptible to the currency fluctuations than the other (Agricultural, Fisheries industries). Therefore, it is the logical next step that we extend our current research into the industry specific relationships. I

would like to extend the current research using the industry index rather than individual company stock prices.

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