Effects of Foreign Exchange Rates on Stock Returns

Hojoon CHI* · Youngil KIM**

ABSTRACT

This study is aimed to investigate the effects of foreign exchange rates on stock market returns. For the United States, the United Kingdom, Germany, Japan and Korea, the cross-correlation precedence of foreign exchange rate on stock market is found in the case of Germany and Korea. But that of stock market is not observed in any case. We performed three kinds of causality and exogeneity test of Granger test, Sims test and Geweke-Meese-Dent test. The analyses on the full period show the time-lag causal, exogeneous relation of foreign exchange rates with Granger, Sims and GMD test for Korea. The United Kingdom presents the significance with Granger and Sims test while Germany reveals the time-lag relation with Granger and GMD test. When we divide the period into two parts with the Louvre Accord, the first part give the less degree of time-lag relation. But in the second period the three kinds of causality and exogeneity test propose consistent time-lag relation with foreign exchange rates on stock markets for the United Kingdom and Korea with the three test methods. And Granger's test prove German foreign exchange market have a time-lag relation on stock market.

* Andong National University, Korea
** University of Utah, U.S.A

Ⅰ. Introduction

After the economic turmoil of late 1997, Korea employed free floating exchange rate system and demolished a lot of regulations that prevent firms to be more efficient and to compete freely. The speed of economic opening to foreign investors is never the same as ever before. All of these changes make market uncertainty much higher and force us to have a deep insight on economic mechanism.

Today, stock, bond, foreign exchange markets play the role of critical indicators that show the situations of global economy as well as each domestic economy. First of all, changes in stock prices are perhaps the only news that one could hear about every day. News media often report that stock prices fell because of bad economic and political news or rose because of an encouraging economic and political event. Thus, one area in finance literature includes studies that have tried to outline the major determinants of stock prices. Since it is not easy to quantify the political events, most studies have concentrated on economic variables for which data are readily available.

Consider the effects of a change in stock prices on exchange rates. Perhaps the simplest way of inferring the impact of a change in stock prices on exchange rates is to rely on the portfolio approach to exchange rate determination. The essence of all portfolio models of exchange rate determination is the notion that individuals allocate their wealth among alternative assets that mostly include foreign and domestic money and foreign and domestic securities. It is usually hypothesized that the demand for domestic money is inversely related to domestic as well as foreign interest rates, whereas the demand for the domestic securities is positively related to domestic interest rate and negatively to foreign interest rate.

By the same token it is assumed that the demand for foreign securities is

positively related to foreign interest rate and negatively domestic interest rate. The role of the exchange rate is to balance the asset demands and supplies. Therefore, any exchange in the demand for and supply of assets will change in the equilibrium exchange rate.

Consider now an exogenous increase in domestic stock prices. This will result in an increase in domestic wealth. According to portfolio approach, the increased wealth will result in an increase in demand for money, thus, an increase in interest rates. High interest rates in turn, will attract foreign capital, resulting in appreciation of domestic currency. An alternative of reaching this conclusion would be to say that an increase in domestic stock prices may result in an increase in foreign speculative demand on domestic assets.

The economic environment changes rapidly and therefore, the purpose of this study is to investigate the causal relation between foreign exchange market and stock market in relatively recent years with several test methods - cross correlation test, Granger causality test, Sims and Geweke-Meese-Dent exogeneity test. Test period is 22 years from January 1980 to December 2001. And we try to separate it into two parts at the point of Louvre Accord in 1987 that made G 7 countries control foreign exchange rate more strongly. It may help us to investigate how the relation between foreign exchange rate and stock price has been changed.

Ⅱ. The Review of Literature

Aggarwal (1981) has argued that a change in exchange rate could change the stock prices of multinational firm directly and those of the domestic firms indirectly. In the case of a multinational corporation, a change in exchange rate will change the value of that firms foreign operation which will be reflected

in its balance sheet as a profit or a loss. Although there will be a change in the firms assets as well as its liabilities, the set effect could be a profit or a loss. Once the profit or a loss is announced, the firms stock prices will change.

According to Malliaropulos (1998), a negative relationship exists between international stock return differentials relative to the United States and real exchange rates deviations from PPP. A model on stock market indexes of four major members of Organization for Economic Cooperation and Development (OECD) relative to the United States shows that stock markets of nations where the currency appreciates in real terms against the dollar were able to outperform the U.S. stock market. The relative price of domestic goods and equities is also found to real appreciations.

Smith (1992) derived an exchange equation from an international model of asset choice optimization and applied to the German mark-U.S. dollar and Japanese Yen- U.S. dollar markets. Unlikely previous specifications, the model includes equities aside from money and government bonds. Equities are strong determinant of the exchange rate, whereas money and government bonds have little impact. The results do not support portfolio balance model.

Choi, Elyasiani and Kopecky (1992) conducted a study of 48 U.S. Banks from 1975 to 1987 using a multifactor index model. The empirical examination focuses on the joint sensitivity of bank stock returns to interest and exchange rates and market risk factors. Results indicate that exchange rates have a significant negative relation to bank stock return for the period covered until after October 1979, when the effect became positive. The effects of market risk and interest rate factors on returns are temporal and dependent on the money-center status of banks.

By relying on the portfolio approach to exchange rate determination, Bhamani- Oskooee and Sojrabian (1992) argued that a change in stock prices could also have an impact on exchange rates, i.e. there could be a two-way relationship between exchange rates and stock prices. Granger concept of causality

as well as cointegration technique are employed to support this conjecture. The empirical results show that there is bidirectional causality between stock price measured by S&P 500 index and the effective exchange rates of the dollar, at least in the short run. The cointegration analysis reveals that there is no long-run relationship between the two variables.

Adrangi and Ghazanfari (1996) used a bilateral exchange rate model to evaluate the causal relationship between the United States dollars exchange value and a stocks local and foreign returns. The flexible exchange rate period for January 1978~June 1991 is considered for U.S. bilateral markets with Germany and Japan. After applying Granger's causality tests, it was shown that exchange value variations of the dollar did not affect stock returns. However, causal relationships were observed for the U.S. dollar and German mark.

Ⅲ. Methodology

1. Methodology

There have been many studies providing lead-lag relation among the macroeconomic variables in a country. Their studies have used the cross-correlation analysis and direction of causality and exogeneity. The cross-correlation analysis can provide the evidence about the lead-lag relation of variables.

The lead-lag relation of variables precedence can point out in applying the Ljung-Box Q-statistics test. The fact that future lags of $X_1(t)$ have coefficients which are significantly different form zero shows precedence of $X_2(t)$ over $X_1(t)$. On the contrary, coefficients which is significantly different from zero in the past lags of $X_1(t)$ mean the precedence of $X_1(t)$ over $X_2(t)$.

Where if $E(x_1)$ and $E(x_2)$ are the sample means for each of the series $X_1(t)$, $X_2(t)$ and estimates of the cross covariance function is the following :

$$c_k[X_1(t) : X_2(t)] = \begin{cases} \dfrac{1}{N}\sum_{t=0}^{N-k}[X_1(t) - E(x_1)][X_2(t-k) - E(x_2)] \\ \qquad \text{for k = 0, 1, 2, 3, } \cdots \\ \dfrac{1}{N}\sum_{t=0}^{N-k}[X_2(t) - E(x_2)][X_1(t-k) - E(x_1)] \end{cases} \quad (1)$$

These series may then be cross-correlated to obtain the cross-correlation coefficient :

$$\widehat{\gamma_k} = \gamma_k[X_1(t) : X_2(t)] = \frac{c_k[X_1(t) : X_2(t)]}{\sqrt{c_0[X_1(t)]}\sqrt{c_0[X_2(t)]}} \quad (2)$$

Haugh (1976) has shown that if the two series $X_1(t)$ and $X_2(t)$ are white noise series after filtering and the two series are independent, then the sets of cross-correlation estimators are asymptotically uncorrelated with one another and would be normally distributed with zero mean and constant variance $1/N$.

Given these asymptotic results under the null hypothesis of series independence, Ljung-Box Q-statistics for K lags is the following :

$$Q = T(T+2)\left[\sum_{j=1}^{k}\frac{\Pi_j^2}{T-J}\right] \quad (3)$$

where Π_j is the j th lag autocorrelation coefficient of residuals, K is the number of autocorrelation used and is selected according to the formula $K = \min(T/2, \sqrt[3]{t})$ with a maximum value for K of 36. T is the number of sample observations. Under a null hypothesis of no serial correlation, Q is asymptotically distributed as a x^2.

Prior to the test of causality, it is needed to make sure that the variables are stationary so that the unit root test is first performed. The Dickey-Fuller test and the augmented Dickey-Fuller test are examined to see whether the

two variables that are individually non-stationary become stationary when combined in a linear fashion. Finally, Granger's test of causality, Sims' and Geweke-Meese-Dent (GMD) test of exogeneity are performed.

Generally accepted definition of causality is due to Granger (1987) and is based on the time series notion of predictability. That is, given a set of variables, variable $X_1(t)$ causes variable $X_2(t)$ if present values of $X_2(t)$ can be predicted more accurately by using only past values of $X_1(t)$ than by using all or any combination of other variables in what follows as it is a suitable definition for empirical testing.

What makes Granger definition operational in the present case is the following :

$$\sum_{s=0}^{\infty} a_{11}(s)X_1(t-s) + \sum_{s=1}^{\infty} a_{12}(s)X_2(t-s) = e_1(t) \tag{4}$$

$$\sum_{s=1}^{\infty} a_{21}(s)X_1(t-s) + \sum_{s=0}^{\infty} a_{22}(s)X_2(t-s) = e_2(t) \tag{5}$$

where $e_1(t)$ and $e_2(t)$ are serially uncorrelated white noise processes with $a_{11}(0) = 1$ and $a_{22}(0) = 1$. Then, if $\{ a_{21}(0) = 0$, all s$\}$, $X_2(t)$ is said to be causally prior with respect to $X_1(t)$ in Granger's sense.

In order to overcome these conditions, Sims shows that with statistical exogeneity one way to proceed is to estimate the two-sided distribution lags :

$$X_1(t) = \sum_{s=-\infty}^{\infty} b_1(s)X_2(t-s) + e_1(t) \tag{6}$$

$$X_2(t) = \sum_{s=-\infty}^{\infty} b_2(s)X_1(t-s) + e_2(t) \tag{7}$$

where the first term on the right hand side represents the projection of $X_i(t)$, $i = 1, 2$, and where $e_1(t)$ and $e_2(t)$ are mutually orthogonal.

Under these conditions, he shows that the hypothesis $H_0 : \{ b_1(s) = 0, k_1 \leq$

$s < 0\}$ is then equivalent to the causal priority of $X_2(t)$ with respect to $X_1(t)$.

Geweke, Meese and Dent (GMD) examined several forms of exogeneity tests and found that the Sims exogeneity test was sensitive to failure to correct for serially correlated residuals. As an alternative, they proposed the exogeneity test using a two-sided distributed lag augmented with lagged dependent variables. Although the lag distribution on $X_1(t)$ is changed completely by the addition of the lagged dependent variables, the $X_1(t)$ coefficients are still one-sided under the null.

$$a_{11}(0)X_1(t) = a_1(t) + \sum_{s=1}^{\infty} a_{12}(s)X_1(t-s) + \sum_{s=-\infty}^{\infty} a_{13}(s)X_2(t-s) + e_1(t) \quad (8)$$

$$a_{21}(0)X_2(t) = a_2(t) + \sum_{s=-\infty}^{\infty} a_{22}(s)X_1(t-s) + \sum_{s=1}^{\infty} a_{23}(s)X_2(t-s) + e_2(t) \quad (9)$$

where $e_1(t)$ and $e_2(t)$ are mutually orthogonal. Under these conditions, if the null hypothesis $H_0(1) : \{ a_{13}(s) = 0, s < 0\}$ is rejected and $H_0(2) : \{ a_{22}(s) = 0, s < 0\}$ is not rejected, we suggest that $X_2(t)$ has exogeneity to $X_1(t)$. And if the two null hypotheses are not rejected, it is possible to say that $X_2(t)$ has the feedback relation to $X_1(t)$.

This investigation tests whether the logarithmic differences in nominal foreign exchange rates are exogenous in the bilateral relation with stock market returns for the United Kingdom, the United States, Germany, Japan and Korea. Using their recommendation, we compute a two-sided distribution lag of stock markets on oil, including lagged stock variables.

2. Data Description

This study investigates the lead-lag relation and causal, exogeneous relation between stock returns and foreign exchange rates of five countries : the United Kingdom, the United States, Germany, Japan and Korea. The relations between

the two variables are likely to vary considerably with each country depending on their economic structures, stock market efficiencies, exchange rate systems and so on.

We measure the stock returns by monthly logarithmic difference on each country's stock indexes. The selected indexes are Korea Composite Stock Price Index of Korea, FTSE-100 Stock Price Index of the U.K., Dow Jones Industrial Average of the U.S., DAX of Germany, and Nikkei of Japan.

And we employ monthly nominal foreign exchange rates of each country for this analysis. But in the case of the U.S. nominal exchange rate index is employed. We transform the foreign exchange rate data into the same form logarithmic difference as stock returns. The period of collected data is from January 1980 to December 2001.

The prewhitening by Hildreth-Lu scanning search is conducted to remove any serial correlation induced by the averaging of nonsynchronously measured components of the overall price index. This procedure has the advantage of removing any spurious statistical significance of lagged variables.

A number of criteria have been proposed for allowing the data to determine the length of distributed lag. According to Christiano and Ljungquivst (1988) and Geweek (1984) the consequences of cross-correlation analysis turn out to be very sensitive to the choice of lag length.

We select the lag length by minimizing the function over different choices for the length of lag. There are Likelihood Ratio Test, Akaike Information Criterion, Schwartz Criterion and Hannan & Quinn as the methods of lag length selection.

The results of AIC between stock returns and foreign exchange rates for each country show that the minimum is lag 5 in the U.K., lag 8 in the U.S., lag 12 in Germany, lag 6 in Japan and at lag 4 in Korea. We employ the lags above, as the criterion of lag length in the lead-lag relation and causality test.

Ⅳ. Findings

1. Lead-Lag Relation

To find the lead-lag relation between stock returns and foreign exchange rates we employed cross-correlation analysis. If changes of exchange rates and stock returns are independent each other, the cross-correlation coefficients will be zero for all lags. <Table Ⅳ-1> shows the cross-correlation coefficients computed between logarithmic differences in foreign exchange rates and stock returns using the function below. And we measured the lag length at the previous chapter.

〈Table Ⅳ-1〉 Cross-Correlation Coefficients

Series	Lags	1	2	3	4	5	6	7	8	9	10	11	12
U.S.A	1 to 12	.04	.03	-.05	-.02	.01	-.03	-.07	-.12	-.06	.03	-.04	-.05
	-1 to -12	.02	-.06	.02	-.04	.03	-.07	-.02	-.04	.02	.00	.01	-.07
U.K	1 to 12	.09	-.12	.04	.05	-.02	-.08	-.12	-.06	.03	-.09	-.01	.11
	-1 to -12	-.18	-.02	.03	.05	.04	-.07	-.03	.01	.04	.03	.02	-.07
GER	1 to 12	.08	.02	.07	-.09	-.06	-.13	-.17	-.11	.04	-.07	.06	-.15
	-1 to -12	-.10	.02	.04	-.12	-.14	.06	-.04	.07	.10	.06	-.13	-.06
JPN	1 to 12	.01	-.06	.05	.07	-.08	-.04	-.03	.00	.03	-.09	-.10	-.19
	-1 to -12	-.10	-.05	.02	.08	-.03	.01	.00	.02	-.04	.06	-.03	.01
KOR	1 to 12	-.29	-.16	-.14	-.08	-.06	.02	.01	-.04	-.03	-.04	-.02	-.01
	-1 to -12	-.25	-.09	-.06	-.02	-.01	-.00	-.06	-.03	-.07	-.02	-.09	-.06

We can find negative coefficients of foreign exchange rates with stock market returns at most lags for all analyzed countries. Therefore the changes of foreign exchange rates appear to cause reversal movements in stock markets. Also it suggests that the interaction between foreign exchange rates and stock market returns show reciprocal proportion in most periods.

In applying the Ljung-Box Q statistics test, we consider that the lead-lag relation of variables can be found. Under a null hypothesis of no serial cor-

relation, Q is asymptotically distributed as a x^2. The fact that future lags of the independent variable have coefficients significantly different from zero shows the precedence of the dependent variable over the independent variable. The Ljung-Box Q statistics can be computed by the equation (3).

〈Table Ⅳ-2〉 Results of Ljung-Box Q Statistics Test

Countries	Ljung-Box Q statistics		Significance Level
U.S.A	Q(1 to 8)	= 11.6702	0.1956
	Q(-8 to -1)	= 4.5634	0.9175
	Q(-8 to 8)	= 21.9251	0.2603
U.K	Q(1 to 6)	= 10.2527	0.2762
	Q(-6 to -1)	= 17.3346	0.0781
	Q(-6 to 6)	= 28.6027	0.0867
Germany	Q(1 to 12)	= 18.5144	0.0216*
	Q(-12 to -1)	= 16.2521	0.0852
	Q(-12 to 12)	= 42.6315	0.0032**
Japan	Q(1 to 5)	= 8.1249	0.5663
	Q(-5 to -1)	= 5.1667	0.7951
	Q(-5 to 5)	= 18.5958	0.3263
Korea	Q(1 to 4)	= 26.3267	0.0039**
	Q(-4 to -1)	= 12.5162	0.1521
	Q(-4 to 4)	= 79.3424	0.0000**

Note) ** : $P < 0.01$, * : $p < 0.05$

<Table Ⅳ-2> contains estimates of equation (3). The evidence shown that the logarithmic difference in foreign exchange rates have significant coefficients in Korea and Germany at 1% of significance level. But there is no significance and the other countries the U.K., the U.S., and Japan have no specific relation at both past lags and future lags.

These results suggest a unidirectional theory of causality. And we can find that in 1980s and 1990s foreign exchange rates variables have precedence over stock market returns for Korea and Germany. Instead there are no significant relation between changes of foreign exchange rates and stock returns at future lags for the three countries.

2. Causality-Exogeneity Relation

According to DF-test and ADF-test, unit roots are observed in level value of stock price indexes and foreign exchange rates. But none of logarithmic difference of the level data contains unit root at the same significance level. There it is reasonable to select logarithmic difference variables of stock price indexes and foreign exchange rate.

When we test the causal and exogeneous relation between stock market and foreign exchange market, the test period is from January 1980 to December 2001. We collected the monthly data after 1980 because Korea employed fixed exchange rate system at the prior period and the foreign exchange rate system was changed into multiple currency basket system in 1980.

In the test period there is a remarkable point. In February 1987 representatives of the United States, Japan, West Germany, France, Canada, Italy, and the United Kingdom (also known as Group of Seven or G-7 countries) signed the Louvre Accord to establish acceptable ranges for dollar's value relative to other currencies.

The central banks of each country intervened heavily in the foreign exchange markets after the Louvre Accord. So we consider that the Accord may be a significant turning point of foreign exchange market movement.

Therefore, we divided the test period into two parts : one period is before the Louvre Accord and another is after the Accord. If there exist any differences between the periods before and after the Accord, we may expect the influence of market intervention of the authorized organizations.

First we test the causal relation by the means of Granger's causality test and <Table Ⅳ-3> shows the test results. When we employ foreign exchange rates as independent variable and stock markets as dependent variable, the results shows that the past lags of foreign exchange rates on stock markets have significant F-statistics for the United Kingdom, Germany and Korea.

〈Table Ⅳ-3〉 Granger's Test of Causality

		Full Period		First Period		Second Period	
X	*Y*	*F*	*Sig.*	*F*	*Sig.*	*F*	*Sig.*
dUSF	dUSS	0.7825	0.713	0.6924	0.812	0.6513	0.763
dUSS	dUSF	0.8251	0.674	0.4516	0.925	0.8742	0.525
dUKF	dUKS	3.4924	0.005**	3.2251	0.011*	2.6425	0.025*
dUKS	dUKF	1.5965	0.187	0.4563	0.923	1.6293	0.093
dGMF	dGMS	1.8571	0.043*	0.7154	0.692	1.9624	0.036*
dGMS	dGMF	1.4463	0.216	0.5892	0.887	1.5531	0.119
dJPF	dJPS	0.6542	0.825	0.8924	0.576	0.5143	0.804
dJPS	dJPF	0.7253	0.769	0.7620	0.711	0.8637	0.596
dKOF	dKOS	7.5213	0.000**	1.2495	0.284	6.9426	0.000**
dKOS	dKOF	0.3903	0.825	0.9687	0.425	0.6253	0.779

Note) ** : $p < 0.01$ * : $p < 0.05$

On the other hands when we employed stock markets as independent variable and foreign exchange rates as dependent variable, it is found that the past lags of stock market on foreign exchange rates have insignificant F-statistics for all countries. Therefore, according to Granger's causality test, foreign exchange rates have an unidirectional causality on stock markets in Korea, the United Kingdom, and Germany.

The analysis on the period before the Louvre Accord generally shows lower degree of causal relation then the full period. In the case of the United Kingdom, Granger's causality test shows past lags of foreign exchange rates have significant causality as independent variable on stock market returns.

The F-statistic is 3.1497 and it is significant at 5% of significance level. But no other causal relations are discovered for any countries. Therefore, we can infer that there is unidirectional causality of foreign exchange rates on stock market returns on the United Kingdom in the period before the Louvre Accord.

In the period after the Louvre Accord, the results of causality tests show different aspect from the period before the Accord. Generally the appearance of test is similar to that of full period test. Granger test shows the causality of foreign exchange rates to stock market returns for the United Kingdom,

Germany and Korea.

When we employ foreign exchange rates as independent variable, past lags of foreign exchange rates have significant F-statistics for the three countries. But the United States and Japan show no causality of foreign exchange rates on stock market returns. And there is no causality of stock market returns on foreign exchange rates for all analyzed countries. Therefore we can say there are unidirectional causality of foreign exchange markets to stock markets in the United Kingdom, Germany and Korea.

<Table Ⅳ-4> Sims' Test of Exogeneity

		Full Period		First Period		Second Period	
X	*Y*	*F*	*Sig.*	*F*	*Sig.*	*F*	*Sig.*
dUSF	dUSS	1.5253	0.168	0.1757	0.981	1.1732	0.231
dUSS	dUSF	0.5127	0.711	1.3521	0.224	0.6763	0.786
dJPF	dJPS	1.5372	0.163	0.2127	0.973	1.7051	0.136
dJPS	dJPF	2.9716	0.009**	1.7460	0.150	2.9767	0.014*
dGMF	dGMS	1.2566	0.203	1.2481	0.307	1.2073	0.274
dGMS	dGMF	1.7503	0.063	1.0205	0.451	1.3362	0.211
dUKF	dUKS	1.0271	0.334	0.8573	0.602	1.1422	0.172
dUKS	dUKF	0.3364	0.896	0.7926	0.724	0.8078	0.603
dKOF	dKOS	0.4114	0.812	1.6452	0.166	0.2185	0.968
dKOS	dKOF	5.9525	0.000**	2.7153	0.028*	6.0724	0.000**

Note) ** : $p < 0.01$ * : $p < 0.05$

And we test the exogeneity of the two variables by the means of Sims exogeneity test and <Table Ⅳ-4> shows the results. Under the condition that error terms are mutually orthogonal, the evidence shows that future lags of the foreign exchange rates on stock markets have insignificant F-statistics different from zero for all countries. But future lags of stock markets on foreign exchange markets have insignificant F-statistics for the United Kingdom and Korea. And no additional significant relations for other countries are discovered.

In other words F-statistics estimated for future lags have significance in foreign exchange rates as dependent variable for the United Kingdom and Korea

but no significance as independent for all experimented countries. This result helps us determine that the changes of foreign exchange rates be exogenous with stock market returns for the Unites Kingdom and Korea.

At the Sims test of exogeneity before the Louvre Accord, in the case of Korea foreign exchange rates have exogeneity on stock market returns. Future lags of foreign exchange rates do not have significant F-statistic and future lags of stock market returns have insignificant F-statistic. But other experimented countries show no exogeneity between the two variables. So we can assume that there is an unidirectional exogeneity of foreign exchange market on stock market in Korea.

Sims exogeneity test also shows the same results as the full period test. Tests for Korea and the United Kingdom present an exogenous relation between the two variables. Future lags of foreign exchange rates have no significant F-statistics for all experimented countries. But Future lags of stock market returns have significant F-statistics at 5% in the United Kingdom and 1% of significance level in Korea.

〈Table Ⅳ-5〉 Geweke-Meese-Dent Variation

		Full Period		First Period		Second Period	
X	*Y*	*F*	*Sig.*	*F*	*Sig.*	*F*	*Sig.*
dUSF	dUSS	0.8914	0.507	0.5174	0.812	1.1725	0.341
dUSS	dUSF	1.2682	0.245	0.8867	0.628	1.5213	0.199
dUKF	dUKS	1.3216	0.219	1.1695	0.337	1.6172	0.097
dUKP	dUKF	2.9724	0.011*	1.5763	0.163	2.9236	0.015*
dGMF	dGMS	1.3325	0.203	0.6672	0.795	1.1527	0.345
dGMS	dGMF	1.8263	0.048*	0.9254	0.593	1.0378	0.392
dJPF	dJPS	1.0312	0.418	1.0927	0.372	0.2514	0.816
dJPS	dJPF	0.8767	0.524	0.5188	0.897	1.2109	0.297
dKOF	dKOS	0.3278	0.813	1.2766	0.306	0.1345	0.914
dKOS	dKOF	3.2526	0.007**	1.5928	0.169	2.7772	0.020*

Note) ** : $p < 0.01$ * : $p < 0.05$

In other words, F-statistics estimated for future lags have significance in

foreign exchange rate as dependent variable for the United Kingdom and Korea, but no significance as independent variables for tested countries. Therefore we can say foreign exchange rates of the United Kingdom and Korea have unidirectional exogeneity on stock markets.

In addition to the two previous tests, the third analysis employs Geweke-Meese-Dent variation test. In GMD test, it is found that future lags of foreign exchange rates on stock market returns have insignificant F-statistics for all experimented countries. But when we exchange the position of two variables, future lags of stock market returns shows insignificant F-statistics for Germany and Korea.

When we apply GMD test before the Louvre Accord to find the time-lag exogeneous relation between stock markets and foreign exchange markets, no significant result was found. Future lags of both foreign exchange rates and stock market returns have no significant F-statistics as independent variable. Therefore, GMD test cannot prove the time-lag exogeneous relation between the two variables.

GMD test also shows after the Louver Accord the time-lag exogeneous of foreign exchange rates on stock market returns for the United Kingdom and Korea. F-statistics estimated for future lags have significance in foreign exchange rate as dependent variable for the United Kingdom and Korea, but no significance was found as independent variables for tested countries. On the basis of the results we can infer that foreign exchange rates of the United Kingdom and Korea have an unidirectional exogeneity on stock markets.

According to the results of causality and exogeneity tests-Granger, Sims, and GMD test-the United Kingdom, Germany and Korea present generally the causality and exogeneity of foreign exchange rates on stock markets. Analyses on the full period show the time-lag causal and exogeneous of foreign exchange rates with Granger, Sims and GMD test for Korea. The United Kingdom presents the time-lag causal and exogeneous relation with Granger and Sims

test while Germany reveals the time-lag relation with Granger and GMD test.

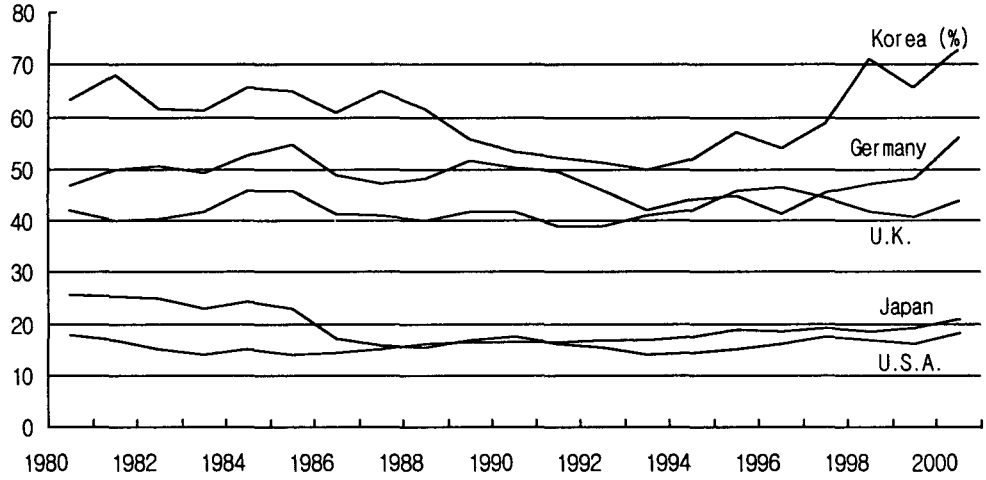
When we divide the period into two parts with the Louvre Accord, the prior part gives less degree of time-lag relation. Only Sims test for Korea and Granger test for the United Kingdom present the time-lag causal and exogeneous relation of foreign exchange rate on stock markets. But in the second period the three kinds of time-lag test propose the consistent time-lag relation of foreign exchange rates on stock markets for the United Kingdom and Korea with the three test methods. And Granger's test prove German foreign exchange market have a causality on stock market.

On the other hands, the United States and Japan never show any specific time-lag relation between stock markets and foreign exchange markets. We may infer the reason by investigating each country's economic dependence on foreign trade.

We can find the United Kingdom, Germany and Korea have high economic dependence on foreign trade. Korea presents 49.9% of minimum ratio and 72.7% of maximum ratio within the scanned period. The United Kingdom also indicates high economic dependence from 38.1% to 46.6%. And economic dependence of Germany is 41.2% of the lowest and 55.9% of the highest. But in the cases of Japan and the United States the economic dependence is relatively low. We can find that economic dependence of Japan is less than 25% and that of the United States is below 20%. [Figure Ⅳ-1] shows more visual trends of each country's economic dependence on foreign trade.

[Figure Ⅳ-1] displays very distinguished features two groups of experimented countries. Korea, Germany and the United Kingdom draw lines at higher place and the United States and Japan stay at lower place. So it can be inferred that countries that are highly dependent on foreign trade are likely to be affected by foreign exchange markets. Especially Korea, the country of highest dependence of the five analyzed countries, shows very strong significance of time-lag causality and exogeneity.

[Figure Ⅳ-1] Economic Dependence on Foreign Trade



It shows that the change of the exchange rate affected the company's profit directly in these country that the degree of dependence upon foreign trade are more than one regular level. But the change of the exchange rate is affected the company's profit indirectly in the opposite case. A trend of the exchange rate can be a cause variable, expecting the movement of the stock market in the degree of dependence upon foreign trade record high level like the United Kingdom, Germany and Korea. But in the case of the Economic dependence record low level like the United States and Japan it can't be a cause variable.

〈Table Ⅳ-6〉 The degree of dependence upon foreign trade and fan-shaped regression analysis of the change rate between the stock market and the foregin exchange rate

Variable		*B*	*SE B*	*Beta*	*t*	*P*
Full Period	Constant	0.494	0.102		4.826	0.000
	X	0.582	0.297	0.241	1.959	0.055
First Period	Constant	0.681	0.205		3.325	0.003
	X	0.347	0.571	0.118	0.607	0.549
Second Period	Constant	0.388	0.088		4.428	0.000
	X	0.653	0.263	0.392	2.487	0.018

A statistical verification about the effect which the degree of dependence upon foreign trade is affected both markets is difficult to say certainly. Because a possibility of the variable selection is so restrictive. In this study, the ratio of the stock market fluctuation with the exchange rate fluctuation of each year is treated as subordinate variable and the degree of dependence upon foreign trade was treated as autonomous variable for fan-shaped regression analysis, which provides an insight to the relationship between the fluctuation of exchange rate and stock market under the effect in degree of dependence upon foreign trade. These results indicate that during the whole period of observation time it is $y = 0.494 + 0.582X$ which had significance of 10%. Before the Louvre Accord, it is not significant but after it, it is $y = 0.388 + 0.653X$ with significance of 5%. Thus it appears with the fact that the inertia between stock market and a foreign exchange market is more strong from agreement. <Table Ⅳ-6> shows the result of the analysis.

Ⅴ. Conclusion

There are a lot of variables that affect a nations economic situation. Of all economic variables, stock market is considered as the most explicit factor that explains past and present economic situation and foresees future business atmosphere. Many researches examined the precedence of stock price to other economic variables. And globally connected economic environment in which a great number of multinational corporations compete each other makes exchange rates more important.

This study is aimed to investigate the relation between foreign exchange rates and stock market returns. In order to prove the cross correlated, causal and exogeneous relation between the two variables, we selected five countries : Korea, the United Kingdom, the United States, Germany, and Japan. The period

of analysis was restricted from 1980 to 2001 and we divided the period into two parts on the basis of the Louvre Accord in February 1987.

According to the cross-correlation precedence of foreign exchange rate on stock market returns is found in the case of Germany and Korea. But that of stock market returns is not observed in any case. So we can infer that there be an unidirectional time-lag relation of exchange rates on stock markets in Germany and Korea.

We performed three kinds of test Granger's test of causality, Sims and Geweke-Meese-Dent test of exogeneity. Analyses on the full period show the time-lag relation of foreign exchange rates with Granger, Sims and GMD test for Korea. The United Kingdom presents the time-lag relation with Granger and Sims test while Germany reveals the time-lag relation with Granger and GMD test.

When we divide the period into two parts with the Louvre Accord, the first part gives the less degree of causality and exogeneity. Sims's test for Korea and Granger's test for the United Kingdom present the time-lag relation of foreign exchange rates on stock markets. But in the second period the three kinds of test propose the consistent causality and exogeneity of foreign exchange rates on stock markets for the United Kingdom and Korea with the three test methods. And Granger's test prove German foreign exchange market have a causality on stock market.

The results can be explained with each country's economic dependence on foreign trade. Countries that have the higher dependence appeared to have the higher significance of time-lag relation. However, there exist several limitations in this study, a lot of efforts are needed to improve this study.

First, it is required to strengthen theoretical and structural proposition as well as statistical evidences. In this studies we proved the existence of causal and exogeneous relation between foreign exchange rates and stock markets by means of three kinds of causal and exogeneous tests. But we didn't present

sufficient theoretical explanation about the existence of the time-lag relation.

Second, considering other types of exchange rate may be recommended. Nominal exchange rates, we employed, can be replaced with real exchange rates which is involved in price level or effective exchange rates which is related with foreign trade.

References

Adrangi, Bahram and Farrokh Ghazanfari, "Bilateral Exchange Rate of the Dollar and Stock Returns," *Atlantic Economic Journal*, Vol.24, No.2, 1996, 179-196.

Aggarwal, R., "Exchange Rates and Stock Prices : A Study of the U.S. Capital Markets under Floating Exchange Rates," *Akron Business and Economic Review*, 1981, 7-12.

Akaike, Hirotugu, "Seasonal Adjustment by a Bayesian Modeling," *Journal of Time Series Analysis*, 1980, 1-13.

Bahmani-Oskooee, M. and Ahmad Sohrabian, "Stock Prices and the Effective Exchange Rate of the Dollar," *Applied Economics*, Vol.24, No.4, (April 1992), 459-554.

Chi, Hojoon, "Precedence and Exogeneity of Oil to the Stock Markets," *Seoul Business Review*, Vol.2 No.1, (Fall 1996), 39-53.

Choi, J. J., E. Elyasiani, and K. J. Kopecky, "The Sensitivity of Bank Stock Returns to Market, Interest and Exchange Rate Risks," *Journal of Banking and Finance*, Vol.16, No.5, 1992, 983-1004.

Christiano, L. J. & L. Ljungqvist, "Money does Granger causes output in the Bivariate Money-Output Relation," *Journal of Monetary Economics*, 1988, 217-235.

Cumby, R. E. and M. Obstfed, *International Interest Rate and Price Level Linkage under Flexible Exchange Tares : A Review of Recent Evidence, in Exchange Rates : Theory and Practice*, (eds) J. F. O. Bilson and R. C. Marston, University of Chicago Press, 1984.

Dickey, D. A., W. R. Bell and R. B. Miller, "Unit Roots in Time Series Models : Tests and Implications," *American Statisticians*, Vol.50, 1986, 12-26.

Dickey, D. A. and W. A. Fuller, "Likelihood Ratio Statistics for Autoregressive Time-Series with a Unit Root," *Econometrica*, Vol.49, (July 1981), 1057- 1072.

Engle, R. T. and C. W. J. Granger, "Cointegration and Error Correction : Re-

presentation," Estimation and Testing, *Econometrica*, Vol.55, (March 1987), 251-276.

Geweke, J., Inference and Causality in Economic Time Series Models in : Z. Griliches and M. Intrilligator eds., *Handbook of Econometrics*, Vol. II North-Holland. 1984.

Granger, C. W. J., "Testing for Causality : A Personal Viewpoint," *Journal of Economic Dynamics and Control*, Vol.2, (November 1987), 329-352.

Granger, C. W. J., "Development in the Study of Cointegrated Economic Variables," *Oxford Bulletin of Economics and Statistics*, Vol.48, 1986, 213- 228.

Kearney, Colm, "The Causes of Volatility in a Small, Internationally Integrated Stock Market : Ireland, July 1975~June 1994," *Journal of Financial Research*, Vol.21, No.1, (Spring 1998), 85-104.

Madura, Jeff, *International Financial Management 4th Ed.*, West, 1995.

Malliaropulos, Dimitrios, "International Stock Return Differentials and Real Rate Exchanges," *Journal of International Money and Finance*, Vol. 17, No.3, (June 1998), 493-511.

Malliaropulos, Dimitrios, "Conditional Volatility of Exchange Rates and Risk Premia in the EMS," *Applied Economics*, Vol.27, No.1, (Jan. 1995), 117-123.

Mishkin, Frederic S., *The Economics of Money, Banking, and Financial Markets, 4th Ed.*, Harper Collins College Publishers, 1995.

Mukherjee, T. K., and A. Naka, "Dynamic Relations between Macroeconomic Variables and the Japanese Stock Market : An Application of a Vector Error Correction Model," *Journal of Financial Research*, Vol.18, 1995, 223-237.

O'brien, Thomas J., *Global Financial Management*, Wiley, 1996.

Phillips, P. C. B. and P. Perron, "Testing for a Unit Root in Time Series Regressions," *Biometrika*, Vol.65, 1988, 335-346.

Rose, Peter S., *Money and Capital Markets The Financial System in an Increasingly Global Economy, 5th Ed.*, Irwin, 1994.

Smith, C. E., "Stock Markets and the Exchange Rate : a Multi-Country Approach," *Journal of Macroeconomics*, Vol.14, No.4, (Fall 1992), 607-629.

Soenen, L. A. and E. S. Hennigar, "An Analysis of Exchange Rates and Stock Prices The U. S. Experience between 1980 and 1986," *Akron Business and Economic Review*, (Winter 1988), 7-16.