Linkages Between The US And South Korean Markets: Evidence From Dually Listed Stocks

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EXTENDED ABSTRACT

Globalisation and reduction of restrictions on cross-border market listings have led to significant growth in cross-border capital flows between the US and all other countries. In making financial decisions with regard to investment and risk management, it is important for corporate management to understand the behaviour of information linkages and correlations between markets. Most studies focused on the dynamics of price transmission between American depository receipts (ADRs) and their underlying foreign securities in the developed markets and examined only the unidirectional effects of three pricing factors namely, the underlying shares, exchange rate, and the foreign markets, on the overseas listed shares such as ADRs based on a value-weighted portfolio.

This paper examines the behaviour of information linkages between dually listed stocks traded in the US and emerging South Korean market using a VAR model in a cointegration framework. The primary focus is to examine the dynamic of price transmissions between the South Korean shares and its ADRs for ten individual firms and a value-weighted portfolio of all firms. This study tests for possible long-run cointegrating relationship between five pricing factors, namely the prices of Korean ADRs and their underlying shares, the US and the Korean market indices, and the exchange rate. In addition, the short-run dynamics between the five pricing factors with feedback from the long-run relationship, and the effect and persistence of a shock in one pricing factor to itself as well as to the other factors in the system are also analysed.

Daily closing prices of the dually-listed Korean shares, exchange rate of US dollar per Korean won, and the Korean and the US total market return indices are obtained from Datastream International. With only four companies listed before 2000, this study covers the period from 3rd January 2000 to 30th June 2005 with a total of 1434 observations. The daily returns for each company are computed as logarithmic differences of daily share prices over the entire sample period.

The Johansen maximum likelihood method is used to test for the presence of cointegrating long-run relationship among the five pricing factors. Both the trace and maximal eigenvalue test statistics indicate that the individual firms and the portfolio have at least one long-run cointegrating relationship among the prices of five pricing factors at the 5% level of significance.

The generalized forecast error variance decompositions indicate that the price of Korean underlying shares is highly sensitive to price movement in the Korean markets, followed by the changes in the Korean ADRs and the US markets. Consistent with the dominant market theory, this study found that the US market is not affected by the Korean market, but rather by its own market conditions. The Korean market has the most significant influence on the Korean ADRs, with the Korean underlying shares and the US market also playing an important part on its prices. The exchange rate does not seem to have a significant influence on both prices in the short run. The generalised impulse response functions of the VAR model show that the price of Korean underlying shares is more responsive to its own shock and shock in the price of Korean ADRs. Similarly, for the Korean ADRs, the responses are mainly coming from their own shocks and that of the underlying shares.

Overall, the short-run regression results of the Korean underlying portfolio are quite in line with the VAR findings. However, the order of influence of individual factors has differed, with the lagged returns of Korean underlying portfolio, the Korean and the US markets overtook the Korean ADR return as the more dominant factors. These results represent the process of short-run adjustments with feedback from the long-run equilibrium of the VAR model. In the case of the Korean ADR return, it is more sensitive to its own lagged return, and returns of its underlying portfolio and the US market in the short run.

1. INTRODUCTION

Globalisations in capital markets and reduction of restrictions on international cross listings have led to greater flows of capital between economies, easier ownership and trading in securities from around the world. Advantages of international cross listing to a firm include lower cost of capital, greater global shareholder base, improved liquidity, and an effective diversification tools for investors because the risk from holding foreign equities can be diversified or hedged (see Bekaert and Harvey 1997, Hargis 2000, Hendry 2000, and Karolyi 1998). In making financial decisions with regard to investment and risk management, it is important for corporate management to understand the behaviour of information linkages and correlations between markets, and the net benefits of listing shares on overseas exchange.

Most companies list their shares in the United States (US) in the form of an American Depository Receipt (ADR). ADRs are priced in US dollar and traded as any other stock in the US markets. One would expect the dollar price of the ADR will not differ from the price of the underlying share in its home market after incorporating the exchange rate factor. However, ADRs are not perfect substitute for their home market shares. The price differential between the ADRs and their underlying shares could be attributed to foreign exchange risk and limits to arbitrage such as transaction costs, different market locations and different trading hours.

Studies of return distribution of dually-listed stocks found that the price of stock listed in overseas markets is significantly affected by the price of their underlying shares in their home country. These studies also suggest that the exchange rate movements as well as innovation in the markets where the shares are listed contributed to changes in their prices. Hauser *et al*. (1998) use vector autoregressive (VAR) methodology and showed that information flow of internationally listed stocks is unidirectional from domestic to the foreign market. A number of studies (see Copeland and Copeland 1998, Janakiramanan and Lamba 1998 and Jeong 1999) report significant correlation between international stock markets and established leadership role of the US equity market on other markets. Patro (2000) indicates that both the world market and the home market returns are significant sources of risk for the ADRs. Using a VAR model with cointegration constraint and a seemingly-unrelated regression equations model, Kim *et al*. (2000) found the price of the underlying shares as the most important factor with the exchange rate and the US market also have an impact on the ADR prices. Fang and Loo (2002) also found that ADR returns are significantly affected by their respective home market factors than by the US market and exchange rate movements. Alaganar and Bhar (2002) found a one-way information flow from the US equity market to the Australian market both with the dually listed stock and the stock indices using a bivariate generalized autoregressive conditional heteroskedasticity model.

Most studies examined only the unidirectional effects of three pricing factors namely, the underlying shares, exchange rate, and the foreign markets, on the overseas listed shares such as ADRs based on a value-weighted portfolio in the developed markets. This paper aims to provide an interesting avenue to further examine the behaviour of information linkages between dually listed stocks traded in the US and emerging South Korean markets using a VAR model in a cointegration framework. The primary focus is to examine the dynamic of price transmissions between the South Korean shares and its ADRs for individual firms and all firms. The Johasen maximum likelihood method is used to test for possible long-run cointegrating relationship between five pricing factors, namely, the price of Korean ADRs and the underlying shares, the Korean and US market indices and the exchange rate, for individual firm. The vector error correction model is used to estimate the short run dynamics of the five pricing factors for all firms. In addition, the effect and persistence of a shock in one pricing factor to itself as well as to the other factors in the system are also analysed. Results from the analysis will provide not only an indication of the direction of information transmission but also an assessment on the degree of influence by individual variables on both the Korean shares and their ADRs.

The plan of this paper is as follows. Section 2 proposes the time series method used to determine the information linkages between the US and the South Korean stock markets. Section 3 outlines the types of Korean ADRs and the data used in the study. Section 4 presents empircal results of the study and some concluding remarks are given in Section 5.

2 METHODOLOGY

Most economic variables are found to be non-stationary, and regressing one non-stationary variable against another can lead to spurious results and bias conventional significance tests. Econometric techniques of unit roots and cointegration are designed to overcome the problem of non-stationary data and dynamic adjustment. This paper applies the cointegration method to examine the information linkages between the US and the Korean markets. It

provides a way of analyzing the long-run relationship between economic variables, when they are separated from the short-run responses.

Testing for a long-run relationship between a set of variables in a cointegration framework requires each of the pricing factors, namely the prices of Korean ADRs, their underlying prices, the exchange rates, the Korean market index and the US market index, to be integrated of order one or I(1) variable. The augmented Dickey-Fuller (1981) (ADF) test is used to determine the order of integration for each variable and the Johansen maximum likelihood (ML) method (Johansen, 1988, 1991) is used to test for the presence of cointegrating long-run relationship among the five factors.

After determining the cointegrating relationships among the pricing factors, the impulse response function (IRF) and variance decomposition (VDC) of the forecast error of the VAR system for each firm will be computed. The IRF traces the impact of a shock in a variable onto the system over a time period which measures the time taken for information to be transmitted across different markets. On the other hand, the VDC of the forecast error is to measure the extent of shocks to a variable that can be explained by other variables considered in the system.

The short run dynamics of the five pricing factors with feedback from the long-run relationship are also examined by estimating the following two vector error correction models:

$$R_{K,t} = \sum_{i=1}^{4} a_1 R_{K,t-i} + \sum_{i=1}^{4} a_2 R_{U,t-i} + \sum_{i=1}^{4} a_3 R_{KM,t-i} + \sum_{i=1}^{4} a_4 R_{UIM,t-i} + \sum_{i=1}^{4} a_5 R_{EX,t-i} + a_6 EC_{t-1} + u_t \quad (1)$$

$$R_{U,t} = \sum_{i=1}^{4} b_1 R_{U,t-i} + \sum_{i=1}^{4} b_2 R_{K,t-i} + \sum_{i=1}^{4} b_3 R_{KM,t-i} + \sum_{i=1}^{4} b_4 R_{UM,t-i} + \sum_{i=1}^{4} b_5 R_{EX,t-i} + b_6 EC_{t-1} + \varepsilon_t \quad (2)$$

where $R_{K,t}$ is the return of Korean underlying value-weighted portfolio listed in the US market on day *t*, $R_{U,t}$ is the return of Korean value-weighted ADRs, $R_{EX,t}$ is the exchange rate return (i.e. percentage change of the US dollar against the Korean won), $R_{KM,t}$ and $R_{UM,t}$ are the returns on the Korean and the US market indices, respectively, *EC* is the error correction term and u_t and ε_t are the random disturbances with zero mean and constant variance.

3 DATA

There are twelve Korean ADRs that are traded on either the New York Stock Exchange or the NASDAQ. Two of the 12 companies listed in July 2004 and February 2005 and other ADRs listed on OTC with infrequent price movements are excluded from the study. The list of ten Korean ADRs, ADR to stock ratio and stock exchange are given in Table 1.

Table 1: List of South Korean ADRs

Name	Ratio (ADR:stock)	Exchange
Hanaro Telecom (HT)	1:1	NASDAQ
Kookmin Bank (KB)	1:1	NYSE
Korea Elec. Pwr (KE)	1:1	NYSE
KT Corp. (KT)	2:1	NYSE
MIRAE Corp. (MI)	1:2	NASDAQ
POSCO (PO)	4:1	NYSE
Shinhan Finl Grp (SF)	1:2	NYSE
SK Telecom (SK)	9:1	NYSE
Webzen Inc. (WE)	10:3	NASDAQ
Woori Fin. Hdg.(WF)	1:3	NYSE

Daily closing prices of the dually-listed Korean shares, exchange rate of US dollar per Korean won, and the Korean and the US total market return indices are obtained from Datastream International. With only four companies listed before 2000, this study covers the period from 3rd January 2000 to 30th June 2005 with a total of 1434 observations. The daily returns for each company are computed as logarithmic differences of daily share prices over the entire sample period. Due to differences of public holidays among markets, the non-trading day in a market is assumed to have the same closing price as the previous trading day. A value-weighted price index for a portfolio of ten companies is created using the corresponding daily Korean market value of each share against the daily Korean total market value of the portfolio.

4 EMPIRICAL RESULTS

Before testing for the cointegration of the five pricing factors, namely the prices of Korean ADRs and their underlying shares for the 10 Korean firms, the market indices for the Korean and the US markets, and the US exchange rates against the

Korean won, it is essential to determine the order of integration for each of the variable in logarithmic form using the ADF test. Although detailed results are not reported to save space, the ADF t-statistics do not reject the null hypothesis of a unit root for all the variables, implying that each factor is non-stationary. Upon taking first differences of all the series, which indicate stationarity of the transformed series, the test results indicate that all the series are integrated of order one.

An unrestricted VAR model of order 10 for each company is first estimated and the Akaike information criterion is used to determine the optimal order of the VAR model. The test statistics and choice criteria indicating a VAR model of order five. The Johansen ML method is used to test for the presence of cointegrating long-run relationship among the five pricing factors. Both the trace and maximal eigenvalue test statistics for a VAR(5) indicate that the individual firms and the portfolio have at least one long-run cointegrating relationship among the prices of the Korean ADRs and their underlying shares, the exchange rate, the Korean and the US market indices at the 5% level of significance. Of the 10 cointegrating firms, four firms (Hanaro Telecom, Kookmin Bank, Shinhan Financial Group and Woori Financial Holdings) are found to have at least two cointegrating relationships at the 5% level of significance.

4.1 Generalised Variance Decomposition

Given the existence of a cointegrating relationship among the five pricing factors, the variance decomposition (VDC) of the forecast error of a VAR(5) with cointegratin constraint for each firms are computed. It is an attempt to gauge the extent of shocks to a factor that can by explained by other factors considered in the system. Generally, the results based on orthogonalized variance decomposition and impulse response functions are found to be sensitive to the number of lag lengths used and the ordering of the variables in the equation. The errors in any equation in a VAR are normally serially uncorrelated by construction, however, there may have contemporaneous correlations across errors of different equations. To overcome this problem, the generalised variance decomposition of forecast error is applied (see Pesaran and Pesaran, 1997).

Table 2 shows the generalized VDCs from one-standard deviation shocks to each factor over the horizon of 0 to 5 days, 10 days and 20 days in the five-factor VAR(5) system, namely the prices of Korean underlying shares (P_K) and ADRs (P_U), the total market indices for South Korea (P_{KM}) and the United States (P_{UM}), and the exchange rate (P_{EX}). Each number reported in Table 2 denotes the percentage of forecast error variance of a value-weighted portfolio for the factors shown on the left-hand side that are explained by innovations in the factors listed on the top.

Table 2. Generalized Variance Decompositions of Forecast Error

Days relative variance in	Percentage of forecast variance explained by innovations in				
	P_K	P_U	P_{KM}	P_{UM}	P_{EX}
$\boldsymbol{P_K}$					
0	100.0	25.44	41.85	1.120	0.764
1	95.05	34.19	36.61	7.374	0.873
2	92.19	38.74	34.31	9.789	0.767
3	89.41	41.84	32.54	12.02	0.724
4	87.75	42.83	31.51	14.06	0.786
5	86.90	43.43	31.10	15.30	0.794
10	85.16	45.55	30.33	17.68	0.733
20	83.67	47.43	29.76	19.41	0.692
$\boldsymbol{P_U}$					
0	25.44	100.0	38.20	22.90	3.492
1	24.51	99.94	37.32	23.65	3.092
2	23.25	99.69	37.84	24.56	3.693
3	22.12	99.19	37.99	26.51	3.731
4	21.74	98.65	38.51	28.35	3.972
5	21.71	98.31	39.08	29.56	4.107
10	22.99	97.29	41.70	32.49	4.469
20	27.33	95.31	45.99	34.48	5.126
$\boldsymbol{P_{KM}}$					
0	41.85	38.20	100.0	2.04	8.528
1	38.16	52.37	91.37	14.77	7.905
2	35.82	56.41	88.05	19.26	7.542
3	32.81	58.14	84.29	23.81	7.045
4	30.84	57.57	81.23	27.86	7.075
5	29.44	57.01	79.46	30.20	6.951
10	26.47	55.68	74.86	34.55	6.443
20	25.46	54.17	69.502	36.75	6.243
$\boldsymbol{P_{UM}}$					
0	1.120	22.90	2.040	100.0	0.054
1.	0.975	22.28	2.165	99.78	0.060
2	0.688	20.66	1.726	99.51	0.077
3	0.531	18.90	1.562	98.73	0.215
4	0.460	17.70	1.505	97.95	0.293
5	0.400	16.87	1.484	97.46	0.336
10	0.227	14.79	1.563	96.43	0.425
20	0.184	12.96	1.795	95.55	0.423
$\boldsymbol{P_{EX}}$					
0	0.764	3.492	8.528	0.054	100.0
1	1.041	3.092	11.05	1.764	98.22
2	1.380	3.693	12.62	2.895	97.06
3	1.495	3.731	13.66	3.618	96.13
4	1.494	3.972	14.99	5.268	94.39
5	2.136	4.107	15.76	6.382	93.26
10	2.580	4.469	17.52	8.725	90.88
20	3.435	5.126	19.08	9.809	89.48

Among the five factors in the VAR(5) system, the US market and exchange rate seem to be the most exogenous as most of the shocks are explained by their own innovations over the horizon of 20 days. The next most exogenous variables are the prices of Korean ADRs and their underlying shares. Innovation from the Korean ADRs explained a substantial portion of innovations in their underlying shares (about 47%) in day 20, followed by the Korean and the US markets (about 30% and 19%, respectively); while the impact of the exchange rate on the Korean underlying shares is only about 1%.

In contrast to findings of past studies, innovations from Korean underlying shares explain a smaller portion of innovations in the Korean ADRs (about 25%) compared to innovations from the Korean and the US markets (i.e. about 40% and 30%, respectively). At the individual firm level, however, the innovations in the Korean underlying shares and ADRs have substantial influences on each other (on average, about 55%), followed by the Korean market and the US market.

4.2 Generalised Impulse Response Functions

The impulse response function (IRF) traces the effect and persistence of a shock in one variable to itself as well as to the other variables in the system. It tells us how fast information transmits from one market to another market. As discussed in Section 4.1, the generalized IRF is used to overcome the dependence on the ordering of the variables in the equation. Estimation of generalised IRFs for the prices of underlying shares and ADRs for the value-weighted Korean portfolio are provided in Table. The numbers reported in Panel A and Panel B of Table 3 are the generalised impulse responses of the prices of Korean underlying firms and ADRs on the *i*th day to a unit innovation in each of the five pricing factors.

Table 3. Generalized Impulse Responses of the P_K (Panel A) and P_U (Panel B) to a Unit Shock in Each Factor

Panel A – Price of Underlying Share (P_K)

Days after shock	P_K	P_U	P_{KM}	P_{UM}	P_{EX}
0	0.0279	0.0134	0.0127	0.0013	0.0004
1	0.0290	0.0127	0.0129	0.0011	0.0005
2	0.0263	0.0105	0.0115	0.0002	0.0006
3	0.0231	0.0098	0.0102	0.0001	0.0006
4	0.0228	0.0099	0.0105	0.0005	0.0008
5	0.0228	0.0104	0.0103	0.0003	0.0008
10	0.0229	0.0115	0.0104	0.0001	0.0008
20	0.0226	0.0131	0.0108	0.0006	0.0010

Panel B – Price of ADR (P_U)

Days after shock	P_K	P_U	P_{KM}	P_{UM}	P_{EX}
0	0.0141	0.0266	0.0122	0.0058	0.0009
1	0.0196	0.0262	0.0174	0.0056	0.0014
2	0.0197	0.0233	0.0165	0.0047	0.0015
3	0.0190	0.0228	0.0166	0.0041	0.0017
4	0.0176	0.0218	0.0161	0.0041	0.0020
5	0.0173	0.0219	0.0159	0.0040	0.0019
10	0.0176	0.0215	0.0157	0.0039	0.0018
20	0.0178	0.0205	0.0155	0.0036	0.0016

The price of Korean shares is found to respond more to its own shocks and shocks in the price of Korean ADRs and the Korean market. In addition, the results also indicate that its responses to a unit shock in the US market, and exchange rate are positive but relatively small, and decline gradually over time (see Panel A of Table 3). The responses for the price of the Korean ADRs are mainly from its own shocks and that of the underlying shares and the Korean market (see Panel B of Table 3). Similar to the Korean underlying shares, its responses to a unit shock in the other two factors are small and positive, and tend to decline gradually over time.

4.3 Error Correction Models

Estimation results of the vector error correction models for the five-factor VAR(5) for a value-weighted portfolio of 10 Korean firms and ADRs are reported in Tables 4 and 5, respectively. As the coefficient of the error correction term in both models is statistically significant at the 5% level, but rather small, suggesting that it would take a long time to correct the deviation from the long-run equilibrium. It is evident from Table 4 that the Korean underlying shares return is highly sensitive to returns on both the Korean and US markets, followed by the ADRs and its underlying returns. The coefficients for the Korean market returns are negative and highly significant for day (-1). This negative influence may be attributed to the composition of the underlying shares having opposite movements with the Korean market or the short-run adjustment to the positive long-run relationship between the two pricing factors. The coefficients of its lagged returns and the returns on ADRs, the Korean and the US markets may be smaller in magnitude for days (-2) and (-3), they remain significant, indicating that not all of the adjustments to the Korean underlying shares return take place within the next day. It is rather surprising to find that the exchange rate changes have no significant short-term effect on the Korean underlying shares return.

Table 4. Error Correction Model for Korean Underlying Share Returns (R_K), January 2000 to June 2005

Regressor	Coefficient	t-Ratio[Prob]
$R_{K(-1)}$	0.0735	2.0432[.041]
$R_{K(-2)}$	-0.1023	-2.8495[.004]
$R_{K(-3)}$	-0.0836	-2.3501[.019]
$R_{K(-4)}$	0.0336	0.9551[.340]
$R_{U(-1)}$	0.1923	4.5770[.000]
$R_{U(-2)}$	0.1374	3.2465[.001]
$R_{U(-3)}$	0.0915	2.1650[.031]
$R_{U(-4)}$	-0.0540	-1.3428[.180]
$R_{KM(-1)}$	-0.3252	-5.6306[.000]
$R_{KM(-2)}$	-0.1063	-1.8310[.067]
$R_{KM(-3)}$	-0.1062	-1.8210[0.69]
$R_{KM(-4)}$	-0.0425	-0.7839[.433]
$R_{UM(-1)}$	0.4752	6.6629[.000]
$R_{UM(-2)}$	0.0696	0.9243[.355]
$R_{UM(-3)}$	0.1769	2.3595[.018]
$R_{UM(-4)}$	0.2901	3.8471[.000]
$R_{EX(-1)}$	0.2378	1.5314[.126]
$R_{EX(-2)}$	-0.0107	-0.0674[.946]
$R_{EX(-3)}$	0.0262	0.1649[.869]
$R_{EX(-4)}$	0.2673	1.7142[.087]
$EC_{(-1)}$	-0.0584	-2.0941[.036]
R-Squared	0.1323	
F-stat. F(20,1408)		10.7344[.000]

Table 5. Error Correction Model for Korean ADRs returns (R_U), January 2000 to June 2005

Regressor	Coefficient	t-Ratio[Prob]
$R_{U(-1)}$	0.0273	0.6826[.495]
$R_{U(-2)}$	-0.1064	-2.6393[.008]
$R_{U(-3)}$	-0.0327	-0.8129[.416]
$R_{U(-4)}$	-0.0657	-1.7171[.086]
$R_{K(-1)}$	-0.0371	-1.0846[.278]
$R_{K(-2)}$	-0.0739	-2.1623[.031]
$R_{K(-3)}$	-0.0366	-1.0808[.280]
$R_{K(-4)}$	0.0017	0.0496[.960]
$R_{KM(-1)}$	-0.0186	-0.3381[.735]
$R_{KM(-2)}$	0.0637	1.1524[.249]
$R_{KM(-3)}$	0.0226	0.4074[.684]
$R_{KM(-4)}$	0.0120	0.2320[.817]
$R_{UM(-1)}$	0.0367	0.5403[.589]
$R_{UM(-2)}$	0.0974	1.3580[.175]
$R_{UM(-3)}$	0.1441	2.0197[.044]
$R_{UM(-4)}$	0.1091	1.5198[.129]
$R_{EX(-1)}$	-0.1372	-0.9279[.354]
$R_{EX(-2)}$	0.2423	1.6070[.108]
$R_{EX(-3)}$	-0.1249	-0.8268[.408]
$R_{EX(-4)}$	0.1591	1.0715[.284]
$EC_{(-1)}$	0.0791	2.9814[.003]
R-Squared	0.0343	
F-stat. F(20,1408)		2.5036[.000]

As shown in Table 5, the variables that have significant influence on the Korean ADRs are lagged returns on Korean ADRs on day(-2), its underlying shares on day (-2) and the US market on day (-3). Both returns on the Korean market and exchange rate do not have significant short-run effect on ADR return.

5 CONCLUSION

This paper examines the inter-market information flow of the dually-listed South Korean shares traded in the US market. Fundamentally, the Korean ADRs should be priced based on the underlying shares. As Korean ADRs are traded in US dollar, their cash flows are generated from their underlying stocks in South Korea. One would expect the Korean ADRs to be sensitive to Korean home market conditions and exchange rate movements. With the convertibility of the Korean ADRs and their underlying shares, however, changes in the value of the exchange rate is most likely to have been incorporated in the price of Korean ADRs. In addition, price movements in the US market may also have been reflected in the price of Korean ADRs.

Analysis of the inter-relationship between the prices of Korean ADRs and underlying shares, the Korean and the US markets and the exchange rate is conducted using a VAR model with cointegration constraints. The generalized forecast error variance decompositions indicate that the price of Korean underlying shares is highly sensitive to price movement in the Korean markets, followed by the changes in the Korean ADRs and the US markets. On the other hand, the influence of the exchange rate is found to be insignificant. Consistent with the dominant market theory, this study found that the US market is not affected by the Korean market, but rather by its own market conditions. It is noted that the Korean market has the most significant influence on the Korean ADRs, with the Korean underlying shares and the US market also playing an important part on its prices. At the individual firm level, however, the innovations in the Korean underlying shares and ADRs have substantial influences on each other. The exchange rate does not seem to have a significant influence on both prices in the short run. The generalised impulse response functions of the VAR model show that the price of Korean underlying shares is more responsive to its own shock and shock in the price of Korean ADRs. Similarly, for the Korean ADRs, the responses are mainly coming from their own shocks and that of the underlying shares.

Overall, the short-run regression results of the Korean underlying shares are quite in line with the VAR findings. However, the order of influence of individual factors has differed. The regression results show that for the lagged returns of the Korean underlying portfolio, the Korean and the US markets overtook Korean ADR return as the more dominant factors. These results represent the process of short-run adjustments with feedback from the long-run equilibrium of the VAR(5) model. Based on the t-ratio results, the US market conditions had the most significant influence on the underlying portfolio traded in the Korean market.

On the other hand, the Korean ADRs return is more sensitive to its own lagged return and returns of its underlying portfolio and the US market in the short run. This phenomenon may be attributed to the different trading hours between the Korean and the US market. As the Korean market closes ahead of the US market, any new information will be adjusted in these markets before the Korean market on the following day. Thus, the influence of the US market seems to be more dominant than the Korean underlying shares and the Korean market.

The findings of inter-market information flow of dually-listed Korean shares in this paper are rather restrictive as the sample only includes the US market. For more conclusive inferences on inter-market linkages of dually-listed shares, it is recommended that this research be extended to include other shares listed in the emerging stock markets in the Asia Pacific region.

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