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A cointegration analysis of price transmission between ADRs and dually listed South Korean stocks

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Abstract

This paper examines the dynamics of price transmissions between the South Korean shares and its American Depository Receipts (ADRs) for individual firms and a portfolio of all firms using a vector autoregressive (VAR) model in a cointegration framework. The results show a long-run cointegrating relationship among five pricing factors, namely the prices of Korean ADRs and their underlying shares, the Korean and the United States (US) market indices, and the exchange rate. Although the US market index is in the cointegrating vector, it is found to be an exogenous variable in the long-run. The short-term dynamics of the Korean portfolio returns are influenced by the deviation from the long-run equilibrium and the lagged changes of all pricing factors except for the exchange rate. On the other hand, its ADR portfolio returns are influenced by lags of its own returns, the US market return and changes in exchange rate. While innovations in the price of underlying shares explain a large portion of innovations in the ADRs for individual firms, shocks to the Korean and the US markets are more important at the aggregate level.

Keywords: ADRs; Cointegration; Market shock; Price transmission

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 for example, Bekaert and Harvey [2], Hargis [6], Hendry [8], and Karolyi [13]. Understanding the behaviour of information linkages and correlations between markets, and the net benefits of listing shares on overseas exchanges is important for corporate management and fund managers aiming to diversify risk.

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.

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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. [7] 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, Copeland and Copeland [3], Janakiramanan and Lamba [9] and Jeong [10], report significant correlation between international stock markets and established leadership role of the US equity market on other markets. Patro [15] 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. [14] 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 [5] 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 [1] 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 generalised 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 a value-weighted portfolio. The Johansen maximum likelihood (ML) 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 ADR firms and a portfolio of all ADR firms. 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 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 empirical 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 analysing 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 and Fuller [4] (ADF) test is used to determine the order of integration for each variable. As the ADF test has been criticised to have relatively low power in testing stationarity, the Phillips–Perron [17] semi-parametric test which applies the Newey-West correction to the variance matrices will also be used in testing for a unit root in the time series regression.

In this study, the Johansen [11,12] maximum likelihood method is used to test for the presence of cointegrating long-run relationship among the five factors. If the five factors are cointegrated, the Johansen procedure permits hypothesis testing of a zero restriction on the coefficients in the cointegrating vector, using the likelihood ratio (LR) test which follows a chi-squared distribution. This method determines whether one or more factors in the cointegrating VAR model are ‘long-run forcing’ variables or variables that are not ‘caused’ by other factors in the VAR model in the long-run.