The Structure of Interdependence in International Stock Markets

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The authors believe that prior studies examining the cointegration of stock prices fail to address the contemporaneous structure of interdependence in international stock markets. Therefore, they use two relatively new techniques—error-correction modeling and directed acyclic graphs—to explore the structure of interdependence. The results show that of the nine markets studied, the Japanese market is the most exogenous and the Canadian and French markets are the least exogenous. Although the U.S. market exhibits influences from other markets, it is the only market in the study that has a consistently strong impact on price movements in other markets over the long run.

Investors have long recognized that stock markets around the world exhibit some degree of integration with respect to price discovery and the co-movement of prices. Recent research, which has focused on the degree of interdependent behavior exhibited by national stock market prices and the structure of such interdependence, has followed two tracks: One concentrates on stock returns and/or return volatility, and the other, which recognizes the nonstationarity of stock prices, explores the cointegration of stock prices. The authors argue that the cointegration approach, although promising, fails to address the contemporaneous structure of interdependence. They recommend using a new statistical method that provides an in-depth look at the structure of interdependence in international stock markets.

The authors apply a directed acyclic graphs (DAG) technique to sort out causal ordering on price innovations in stock markets. The DAG approach allows for the determination of the causal flow from one market to another using vector autoregressive and error-correction modeling techniques, especially when strong contemporaneous cor-

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relation exists across markets. The authors state that this empirical framework, which can be used with any vector autoregressive representation of three or more time series, improves the ability to sort out empirical relationships in price discovery and interest rate linkages.

The data consist of daily stock index closing prices from nine major stock markets: Australia, Japan, Hong Kong, the United Kingdom, Germany, France, Switzerland, the United States, and Canada. The data are available in each country's native currency and as converted U.S. dollars.

The results show that the Japanese market is the most exogenous, in the sense that price information from other markets explains a relatively small proportion of the stock-price movement in Japan. In addition, price innovations in Japan explain relatively little of the stock-price movement in other markets. This finding suggests that the Japanese market is isolated from other markets; thus, Japan appears to be a good candidate for investors seeking international diversification.

The Canadian and French markets are found to be the least exogenous of the nine markets. Although the U.S. market is shown to be highly influenced by its own historical price innovations, it is also influenced by market innovations from the United Kingdom, Switzerland, Hong Kong, France, and Germany. The U.S. market, however, is the only market that has a consistently strong impact on price movements in other major stock markets on a long-term basis. This fact is consistent with the perception of the U.S. market's role as the leader of the world's stock markets. Overall, the results show that international stock markets are neither fully integrated nor completely segmented; furthermore, the potential for international diversification exists, as shown for the Japanese market.

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