

# International portfolio diversification: A study of linkages among the U.S., European and Japanese equity markets

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## Abstract

In this paper, we examine the short-term linkages among five leading stock markets with the objective of evaluating the case for international portfolio diversification as well as the stability of stock market interdependence after an exogenous shock. We utilize daily closing equity price data from U.S., U.K., France, Germany and Japan during the period from January 1999 to February 2002 and investigate the joint impact of any four equity markets on the fifth market. The findings indicate that even though the interdependencies among the markets are significant, there is still room for international portfolio diversification. Also, the study provides mixed results for the hypothesis that the international market correlations change after an exogenous shock. The tests of stability of correlations are based on before-and-after analyses of two events: the introduction by the European Union of the euro as official currency and the September 11, 2001, terrorist events in U.S.

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## 1. Introduction

The main objective of this study is to contribute to and expand upon the literature on the linkages among international equity markets. In examining the co-movements of American, Japanese

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and European (U.K., France and Germany) equity markets, we seek to identify diversification opportunities for international investors and investigate the stability of the relationships among the markets. The originality of this paper stems from two sources: (1) its use of data as three-month moving segments in calculating moving correlations and (2) the utilization of the multivariate-auto-regressive-moving average (MARMA) models in identifying the inter-market linkages to test the hypotheses previously advanced in the international finance literature.

Two well-known theories in the Finance literature, the Capital Asset Pricing Model (CAPM) and the Modern Portfolio Theory, suggest that individual and institutional investors should hold a well-diversified portfolio. While mutual funds offer quick and relatively inexpensive ways of diversification, there is yet another way to diversify investment portfolios. It is argued that since differences exist in levels of economic growth and timing of business cycles among various countries, international portfolio diversification can be used as a vehicle to reduce risk. In fact, the 1990s witnessed an explosion of international portfolio investment. Mutual fund companies such as Janus and Templeton achieved phenomenal rates of return on their investments, particularly in emerging markets.

National economies have recently become more closely linked, not only because of growing international trade and investment flows, but also in terms of international financial transactions. Influences contributing to an increased general level of correlation among markets and markets integration include the following: (1) the development of global and multinational companies and organizations; (2) advances in information technology; (3) deregulation of the financial systems of the major industrialized countries; (4) explosive growth in international capital flows; (5) the abolishment of foreign exchange controls (Bracker and Koch, 1999).

While some controversy exists among investment professionals regarding the benefits and costs of international portfolio investment, there is agreement that international equity portfolio diversification recommendation is based on the existence of a low correlation among national stock markets. Specifically, previous studies have shown that international diversification allows for reduced total risk without sacrificing expected returns (Cosset and Suret, 1995).

These findings are a direct result of the conclusion that the stock returns display much higher positive correlation within a country than across countries. On the other hand, if it is true as some recent studies have shown that cross-country correlation is increasing due perhaps to the growing interdependence among the international markets, then benefits of international portfolio diversification may be overstated. In the present paper, we aim to shed light on international equity market interdependence by utilizing data from five major equity markets in a three-month moving average format, and seeking to improve upon methodology of previous studies by employing multivariate-auto-regressive-moving average models.

In the literature, numerous studies exist that deal with the issue of stock market integration and interdependencies. Madura (2003) finds that correlations markedly increased over time. Longin and Solnik (1995) investigate the behavior of monthly international equity returns over the period 1960–1990 and find that the correlations rise in periods of high market volatility. Solnik et al. (1996) indicate that deregulation and the opening of the British economy to foreign investment was the main reason that the British market became more correlated with the U.S. market. Meric and Meric (1997) study the changes in the co-movements of the 12 European equity markets after the 1987 crash. Their results indicate that the co-movements of these equity markets increased significantly after the crash, implying that the benefits of international diversification decreased considerably after the crash.

Ball and Torous (2000), utilizing data from January 1987 to May 1999, also find evidence that the correlations tended to increase in response to higher volatility. Karolyi and Stulz (1996), using

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