



# The determination and international transmission of stock market volatility

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## Abstract

This paper extends the literature on low-frequency analysis of the causes and transmission of stock market volatility. It uses end-monthly data on stock market returns, interest rates, exchange rates, inflation, and industrial production for five countries (Britain, France, Germany, Japan, and the US) from July 1973 to December 1994. Efficient portfolios of world, European, and Japanese/US equity are first constructed, the existence of multivariate cointegrating relationships between them is demonstrated, and the transmission of conditional volatility between them is described. The transmission of conditional volatility from world equity markets and national business cycle variables to national stock markets is then modeled. Among the main findings are: first, world equity market volatility is caused mostly by volatility in Japanese/US markets and transmitted to European markets, and second, changes in the volatility of inflation are associated with changes of the opposite sign in stock market volatility in all markets where a significant effect is found to exist. To the extent that the volatility of inflation is positively related to its level, this implies that low inflation tends to be associated with high stock market volatility. © 2000 Elsevier Science Inc. All rights reserved.

*Keywords:* Stock markets; Volatility; International transmission

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## 1. Introduction

The question of why stock market returns exhibit volatility and changes in volatility over time is important for a number of reasons. To begin with, substantial changes in the volatility of stock market returns are capable of having significant negative effects on risk

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averse investors. Such changes can impact on corporate capital budgeting decisions, investors' consumption decisions, and other business cycle variables. Partly because of this, and spurred on by the stock market crash of October 1987, the finance literature has recently witnessed a growth in interest in the issue of stock market volatility (see, *inter alia*, Barclay, Litzenberger, & Warner, 1990; Engle & Susmel, 1993; Koutmos, 1996; Koutmos & Booth, 1995; Rahman & Yung, 1994). The purpose of this paper is to contribute to the literature on stock market volatility by examining how volatility is transmitted to national stock markets from international stock markets as well as from domestic components of the business cycle. A number of studies have examined this issue using daily data. This paper uses low-frequency data consisting of end-monthly observations on stock market indices for five countries (Britain, France, Germany, Japan, and the US) over the period July 1973–December 1994. The stock market indices employed in the analysis are the FT All Share index (FTSE), the Paris CAC general index (CAC), the Frankfurt FAZ index (FAZ), the Nikkei 225 index (Nki), and the Dow Jones Composite index (DJ). The dataset also includes financial and business cycle variables including interest rates, exchange rates, inflation, and industrial production for each country over the data period.

The paper proceeds in two stages. It first constructs world, European, and Japanese/US international Markowitz-efficient equity portfolios and uses the multivariate cointegration methodology to establish the existence of a long run equilibrium relationship which ties price movements in these portfolios over time. It then employs the Davidian and Carroll (1987) model of conditional volatility to illustrate how volatility is transmitted across these portfolios. The second stage focuses on the transmission of volatility from world equity markets and national business cycle variables to the national stock markets. Amongst the main findings are the following. First, world equity market volatility is predominantly caused by volatility in Japanese/US markets rather than by volatility in European stock markets, and world equity market volatility is transmitted more to European than to Japanese/US stock markets. Second, changes in the degree of volatility in Japanese/US stock markets are associated with changes in the opposite direction in the degree of volatility of European stock markets and vice versa, with the magnitude of effects being greater from the former than from the latter. Third, changes in world equity market volatility are transmitted directly to all national stock markets examined, with the effects being strongest for Japan and weakest for the US. Finally, although the degree of volatility in national stock markets tends to be influenced in different ways by the degree of volatility in the components of the domestic business cycle, changes in the volatility of inflation are associated with changes of the opposite sign in stock market volatility in all markets where a significant effect is found to exist. Given the stylised fact that the volatility of inflation tends to be positively related to its level, this implies that low inflation tends to be associated with high stock market volatility.

The paper presents new evidence which is interpretable as an extension of the low-frequency analysis of Schwert (1989), who did not include international factors such as the exchange rate in his investigation of the causes of stock market volatility in the US. In addition, Schwert's (1989) vector autoregressive model of the determination of

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