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# Differences in the price of risk and the resulting response to shocks: an analysis of Asian markets

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**Abstract**

In this study, a conditional version of the international CAPM for Asian markets is tested using a parsimonious generalized autoregressive conditional heteroskedasticity (GARCH) model in which the risk premia, betas and correlations vary through time. The results show that unlike the static CAPM, the time-varying CAPM prices market risk. Cross-country correlations increase toward the Asian crisis in mid 1997. The price of covariance risk appears to be higher for emerging markets than the industrialized markets The impulse response functions of the time-varying price of covariance variables from the VAR model estimations show that movements in the price of covariance risk belonging to the U.S. or an Asian emerging market can be contagious with varying degrees of strength in the region.


*JEL classification:* F36; G15

*Keywords:* Emerging markets; International asset pricing; Time-varying CAPM

## 1. Introduction

Despite the 1997 Asian economic crisis, financial markets in Asia have grown rapidly in the past decade. Such economic swings however, impose great challenges to private

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investors and regulatory bodies when assessing the extent of market integration, the benefits from international diversification, and market contagion. The importance of meeting these challenges has increased research interest on the interconnectedness of Asian financial markets to better understand the effect of equity flows and prevent future contagion-induced crises similar in nature.

This study investigates the impact of the recent changes in Asian financial markets on the benefits of international portfolio diversification and contagion following the methodology used by De Santis and Gerard (1997). First, a conditional version of the capital asset pricing model (CAPM) is tested using the data from four Asian emerging markets (Korea, Malaysia, Taiwan and Thailand) and three developed markets (Japan, the U.K., and the U.S.). Next, the price of covariance risk series derived from GARCH estimations are used in a vector autoregression (VAR) model to investigate whether the impulse response functions and their confidence bands for emerging and developed markets have similar patterns.

To achieve parsimony, the parameterization suggested by Ding and Engle (1994) is incorporated in the multivariate GARCH model estimations. This parsimonious representation of the GARCH process enables greater number of markets to be analyzed simultaneously. Although the conditional density of asset returns is assumed to have a normal distribution, the quasi-maximum likelihood estimates for the standard errors are utilized to yield robust results to violations of the normality assumption.

The findings provide evidence in support of the conditional CAPM prediction with certain caveats. The time-varying price of covariance risk appears to be generally higher for emerging markets than industrialized markets. The price of covariance risk for emerging markets increases shortly after the crisis period of July 1997 and exhibits a mean reverting behavior in the later periods. After the first quarter of the year 2000, the price of covariance risk rises for all markets, consistent with a slowdown in the U.S. economic activity beginning about the same period, and other related events affecting world markets in the following months. In the static estimations, the price of country specific risk is found to be statistically different between Asian emerging markets and the larger markets of the world. The time-varying correlations with the world show a rising pattern before the onset of the Asian crisis similar to the rise in correlations before the October 1987, the U.S. stock market crash. The time-varying correlations fall below the mean towards the latter part of the sample together with the recent slow down in the U.S. economic performance and other related events. The results from the VAR estimations also show that a one-time shock in the U.S. price of covariance risk is rapidly transmitted to other markets but the pattern of such response varies across markets. For example, the price of covariance risk response for Malaysia to a one time shock to Thailand is different than a similar shock emanating from the U.S. and Malaysia's own market. Thus, Malaysia seems to be processing information differently when shocks originate in its own market, than say a shock originating in the U.S. or another emerging market such as Thailand, given the capital controls in Malaysia. The evidence from this study suggests that the conditional CAPM performs better than its static version in terms of predicting the changes in risk premia and correlations. Therefore, the time-varying CAPM yields useful information to investors and policymakers on the dynamics of such variables.

The results also have interesting implications for international portfolio diversification decisions. The time-varying correlations with the world as well as the impulse response functions from the VAR model show that movements in the U.S. are contagious in Asian