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Dynamic correlations and domestic-global diversification



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ABSTRACT

This study designs a generalized dynamic conditional correlation (DCC) model to examine three dynamic elements involved in the correlations between domestic and world stock markets. Further, we apply this generalized DCC model to the domestic-global portfolio establishment and a comparative analysis with the conventional CCC (constant conditional correlation) is conducted. Our empirical results are consistent with the following notions. First, the domestic and global markets are strongly correlated when both simultaneously find themselves in the same state of volatility. Conversely, this correlation is weaker when a different volatility state characterizes each market. Second, persistence and correlation clustering are presented in domestic-global markets, whereas this self-dependent process involved in cross-market correlations is insignificant in certain markets. Third, market integration leads to an increase in co-movement between domestic and global markets. Finally, although the domestic-global portfolio effectiveness tests demonstrated the superior performance of our generalized DCC model in comparison with the conventional CCC and DCC models, we further indicate that the benefits mainly rely on reductions in risk, rather than increases in mean returns.

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1. Introduction

The benefits of investing in international equity are widely recognized, especially with regards to increased efficiency and decreased risk. However, the home bias puzzle, as evidenced by [French and Poterba \(1991\)](#), asserts that the representative agent does not hold enough foreign shares according to his expected utility maximizing behavior. It has been shown that the U.S. investors have increased their proportions in foreign shares from less than 10% in 1997 to more than 13% in 2004.

As global equity markets turn volatile, investors are advised to boost their allocations for mutual funds. Mutual fund plays a special role in international finance and it allows a retail investor to diversify their portfolio with a lower capital outlay. Two significant benefits of investing in mutual funds are diversification and lower transaction costs. Buying shares in a mutual fund gives investors access to global stock market assets. However, one further key problem for investors who optimize their investment portfolio by choosing between investments in global and domestic market assets is determining optimal domestic-global portfolio loadings, namely how much money should be placed on global/domestic stock market assets. The portfolio loading establishment for the domestic-global portfolio is well known to be heavily dependent on the sizes of co-movements existing between domestic and global markets. Consequently, this study considers the accurate

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measurement of the strength of the correlation between domestic and global markets to be a key issue in international stock allocation.

Engle (2002) proposed the dynamic conditional correlation (DCC) model in which the conditional correlations are allowed to change over time. The DCC model has already proven useful in modelling correlation dynamics among assets (e.g., Franses and Hafner, 2003; Goetzmann et al., 2005; Billio et al., 2006; Cappiello et al., 2006; Durai and Bhaduri, 2011; Jacobs and Karagozoglou, 2014; Tamakoshi and Hamori, 2016). Importantly, the DCC model developed by Engle (2002) basically assumes that the correlation on one day is a function on the correlation on the previous day.

This study attempts to extend existing research and to improve on some of its perceived shortcomings. A new, more general class of DCC model forms the basis of our investigation of three distinguishing cross-market correlation dynamics. In particular, following Engle's (2002) study, we consider correlation clustering process: periods of high (low) correlation are likely to be followed by periods of high (low) correlation. Further, our generalized DCC setting allows the correlation among international stock markets depending on the variance regime of returns in a framework where the variance regime is endogenously determined. Last but not the least, the conditional correlation defined in this study is a function of market integration variables.

It should be noted that this study focuses both on the development of new DCC parameterizations and on their use in empirical applications, demonstrating a high capability to adapt to practical problems. In particular, international diversification theory suggests that investors should differentiate their portfolio by non-domestic markets. This fact suggests developing a domestic-global portfolio and modelling the domestic-global correlation.

In sum, a novel approach is presented to research into issues related to dynamic correlations in international stock markets with the aim of designing a strategy enabling the development of an optimal domestic-global investment portfolio. Its novelty results from the fact that the determination of the optimal allocation ratio of stock assets relies heavily on being able to accurately measure domestic-global market correlations, an aspect addressed in this study.

The following are examples of issues addressed in this study. First, is the magnitude of domestic-global correlations consistent across various volatility regimes? Secondly, are integration- and self-dependent characteristics significantly involved in domestic-global correlations? Last but not the least, compared with the conventional CCC and DCC models, could the generalized DCC framework designed in this study help investors design a more effective strategy for domestic-global portfolios? To the best of our knowledge, this article is one of the first to address such meaningful issues regarding the determination of international equity asset allocation.

The remainder of this paper is organized as follows. Section 2 outlines our generalized DCC setting and a comparative analysis with the conventional CCC and DCC models is examined. Section 3 presents domestic-global portfolio establishment process which is applied to the evaluation of relative model performance. Section 4 presents the empirical results and provides economic and financial explanations. Finally, Section 5 draws conclusions and identify future research directions.

2. Model specifications

Given that r_t^w and r_t^d stand for the return rates in world and domestic stock markets, respectively, the generalized dynamic conditional correlation multivariate Markov-switching autoregressive conditional heteroskedasticity (MVSARCH) model used in this study is specified as follows:

$$r_t^w = \alpha^w + \beta^w \cdot r_{t-1}^w + e_t^w \quad (1)$$

$$r_t^d = \alpha^d + \beta^d \cdot r_{t-1}^d + e_t^d \quad (2)$$

$$e_t | \psi_{t-1} = \begin{bmatrix} e_t^w \\ e_t^d \end{bmatrix} | \psi_{t-1} \sim BN(0, H_t) \quad (3)$$

$$H_t = \begin{bmatrix} h_t^w & h_t^{w,d} \\ h_t^{w,d} & h_t^d \end{bmatrix} \quad (4)$$

where Ψ_{t-1} refers to the information available at time $t-1$ and BN denotes the bivariate normal distribution.

One key feature of the MVSARCH setting is that the variance-covariance matrix, namely H_t , is characterized as both time-varying and state-dependent. In particular, the following equations determine the conditional variance settings of world and domestic market returns:

$$\frac{h_t^w}{g_{s_t^w}^w} = \tau^w + \eta^w \cdot \frac{(e_{t-1}^w)^2}{g_{s_{t-1}^w}^w} \quad (5)$$

$$\frac{h_t^d}{g_{s_t^d}^d} = \tau^d + \eta^d \cdot \frac{(e_{t-1}^d)^2}{g_{s_{t-1}^d}^d} \quad (6)$$

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