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Global and regional range-based volatility spillover effects

Yen-Hsien Lee *

Chung Yuan Christian University, Department of Finance, 200 Chung Pei Road, Chung Li 32023, Taiwan

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ABSTRACT

This study extends the univariate Weibull conditional autoregressive range (CARR) model to establish a bivariate Weibull CARR (BWCARR) model to investigate the range-based volatility spillover effect. The empirical results indicate that a conditional autoregressive range relationship exists on the US, Japan, mainland China, Hong Kong and Taiwan stock markets. The new BWCARR model is more credible and efficient than the CARR model. Moreover, the range-based volatility for the US and Japan has an impact on Taiwan, indicating that there exists a range-based global and regional stock market spillover effect that has an impact on the Taiwanese stock market.

1. Introduction

The volatility spillover effect occurs when the volatility in one market gives rise to a lagged impact on volatility in other markets, a phenomenon that appears to be widespread in financial markets. Recently, the literature has continued to focus attention on the volatility spillover effect (see Arouri, Jouini and Nguyen, 2011; Jiang and Sun, 2011; Rittler, 2011; Sadorsky, 2011; Serra, 2011; Siklos, 2011; Soytas and Oran, 2011; Turhan et al., 2012; and Vit et al., 2011). Most studies on the volatility spillover effect highlight how an international market or world market affects other stock markets; however, they do not distinguish between regional and world market factors. Understanding the volatility spillover effect across regional and world markets is valuable and can be helpful to devising investment policies and hedging strategies in internationally diversified portfolios.

Bekaert and Harvey (1997) focused on volatility spillovers and distinguished between regional and global shocks across emerging stock markets. In addition, Chowdhury (1994), Liu and Pan (1997), Ng (2000), Miyakoshi (2003), Wongswan (2006), Chuang et al. (2007), Beirne et al. (2010), Singh et al. (2010) and Wang and Wang (2010) and Zhou et al. (2012) found evidence of the effects of volatility

* Tel.: +886 3 265 5711.
E-mail address: yh@cycu.edu.tw.

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spillovers from Japanese or US stock markets on Asian stock markets. Johansson and Ljungwall (2009) indicated that geographically and economically close markets exhibit significant influence over each other; moreover, geographic locality is also likely to be a factor in volatility spillovers. FDI stock from China, Hong Kong and Taiwan surged more than 26.815%, 14.993% and 18.766% between 2000 and 2011 (FDI stocks of China, Hong Kong and Taiwan were 193,348, 455,469 and 19,521 million of dollars in 2000 and 711,802, 1,138,365 and 56,154 million of dollars in 2011) on World Investment Report 2012 for United Nation Council of Trade and Development. The Greater China region (China, Hong Kong, and Taiwan) is attracting the interest of policy-makers, fund managers and international investors in relation to investment and risk management decisions. Owing to the rapid development of the Chinese capital market being critical for financial market participants and academics, Johansson and Ljungwall (2009) investigate the volatility spillover within the Greater China region.[1] While a number of studies investigate the volatility spillover relationships from the US and Japanese markets to the Taiwanese stock market, few consider the relationship between the Chinese market and the Taiwanese stock market. This study therefore aims to bridge this gap by investigating the volatility spillover effects of the US, Japan, mainland China and Hong Kong markets on the Taiwanese stock market.

The volatility of financial assets has a crucial role to play and has caught the attention of financial market participants, policy-makers and academics as they make rational portfolio risk diversification, derivatives pricing and management decisions. The modeling of international financial market volatility spillovers has also attracted many investors, and the empirical literature has separated the estimated asset volatility into two major concepts that involve the use of return-based GARCH (generalized autoregressive conditional heteroskedasticity) models and range-based CARR (conditional autoregressive range) models. While the GARCH models only use the closing prices of the interval, CARR models by contrast use the whole price path within the interval to compute the range.[2] Furthermore, most of the return-based volatility measures suffer from informational inefficiency compared to the range-based volatility measures. Moreover, Chou (2005) has combined a dynamic model with a range-based model to establish the CARR model and has found that the CARR model performs very satisfactorily in forecasting the volatilities of the S&P 500, while the CARR model serves as a good approximation of the standard deviation GARCH process.[3] Recently, the literature using CARR models has started to grow (see Chiang and Wang, 2011; Chou, 2006; Chou et al., 2009; Fernades et al., 2005; Lin et al., 2012; Wu and Liang, 2011). To the best of the authors' knowledge, there have been no studies that have considered the CARR model with global and regional spillover effects. Consequently, this paper uses a proper dynamic structure range model to analyze the global and regional range-based volatility spillover effect. It is of great interest to investigate how the volatility of the Taiwanese stock market is related to emerging markets in the same economic and geographical region (Japan, mainland China and Hong Kong) as well as major world markets (e.g., the US).

Parkinson (1980), Andersen and Bollerslev (1998), Alizadeh et al. (2002), Brandt and Jones (2006), Christensen and Podolskij (2007), Chiang and Wang (2011) and Lin et al. (2012) pointed out that range-based volatility models are a more efficient measure of volatility than return-based volatility models. This study thus focuses on the range-based volatility spillover effect in financial data. The correlation between two assets can be expressed in terms of their individual volatility levels as well as the correlation structure between the two assets. However, we require that the bivariate Weibull CARR (BWCARR) model be built to estimate the volatility spillover effect. Very few studies have focused on the markets of Japan, mainland China, Hong Kong and Taiwan in the Asian region and, to the best of our knowledge, none has applied the BWCARR model that incorporates possible volatility spillover effects to shed light on the dynamic relationships generated by the global (US) and regional (Japan, mainland China and Hong Kong) range-based volatility spillover effects. Understanding volatility spillover across markets is important, because volatility is a measure of risk

[1] Although much of the previous work has focused on stock markets in Asia, very few articles have been directed toward the Greater China region. With the continued growth of the economy of mainland China, the handover of Hong Kong to China in 1997, and Taiwan's growing economic ties with the mainland, it is clear that the Greater China region is becoming an important player in global financial markets.

[2] A measure of range-based volatility defined by the difference between the highest and lowest log-prices observed during the day.

[3] Fernades et al. (2005) noted that the CARR model entails two advantages. First, the range of the log-prices is observable in contrast to the volatility. Second, volatility estimates based on the CARR model are presumably more efficient than GARCH-based estimates since they take advantage of a richer information set.