

Chapter 8

The Volatility for Pre and Post Global Financial Crisis: An Application of Computational Finance

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ABSTRACT

The asymmetric volatility, temporary volatility, and permanent volatility of financial asset returns have attracted much interest in recent years. However, a consensus has not yet been reached on the causes of them for both the stocks and markets. This paper researched asymmetric volatility and short-run and long-run volatility through global financial crisis for eight Asian markets. EGARCH and CGARCH models are employed to deal with the daily return to examine the degree of asymmetric volatility (temporary volatility and permanent volatility). The authors find that after global financial crisis asymmetric volatility is lower (except Hong Kong), and the long-run effect is more than the short-run effect. The empirical results for the short-run show that, after global financial crisis, there is significant decreasing in China and Taiwan but not in Japan; the others are significantly increasing. For the long-run, there is significant decreasing (except Thailand and Korea).

1. INTRODUCTION

The phenomenon of asymmetric volatility refers to a situation when new information often causes price change. When new information is positive, future price volatility is smaller; on the contrary,

when new information is negative, future price volatility is greater (Chelley-Steeley & Steeley, 1996; Hung, 1997; Laopodis, 1997; Yang, 2000).

Asymmetric volatility is firstly observed in stock market research. Black (1976) examines data and firstly finds that current returns have a negative correlation with future volatility. Christie (1982) and Schwert (1990) also find the same results. Based on these studies, it can be assumed

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that when new information results in the falling of stock prices, then, the financial leverage of companies will be rose; in other words, the risk of holding a stock will be increased, and future returns will be more volatile. On the other hand, when new information causes stock price to be rose, the financial leverage of companies will be decreased, and future returns will be less volatile. This phenomenon is called the leverage effect. However, Sentana and Wadhvani (1992) assume that the phenomenon of asymmetric volatility is due to herding behaviors by traders; while Lo and MacKinlay (1987) consider it as resulting from non-synchronous trading. It is still not conclusive whether asymmetric volatility of stock return values is caused by leverage effects or not.

In the empirical modeling, when dealing with high-frequency financial data, Engle (1982) establishes the ARCH model (autoregressive conditional heteroskedasticity) to solve self-relative and heteroskedasticity problems. Bollerslev (1986) extends it into the GARCH model (generalized ARCH) to describe the phenomenon of volatility clustering of returns. However, the GARCH model cannot distinguish the difference of volatility between positive and negative information (the phenomenon of the volatility asymmetries), thus, Nelson (1991) develops the exponential GARCH model (EGARCH) to distinguish this difference; Campbell and Hentschel (1992) distribute the asymmetric volatility by the quadratic GARCH model (QGARCH). Later, Engle and Ng (1993) compare these two models and find that the EGARCH model has a better distribution, and Hafner (1998) proves that, with empirical data, the EGARCH model is better at distributing the volatility of high-frequency data. In addition, the EGARCH model is widely applied to high-frequency data; therefore, this research uses the EGARCH model to discuss the asymmetric volatility of stock returns.

As to the persistence of stock return volatility, Ding and Granger (1996), Ding, Granger, and Engle (1993) and Engle, Granger, and Robins

(1986) all proclaim that volatility contains high persistence and it can have long memory behavior or be fractionally integrated. In the volatility model, long memory behavior can be divided into two parts, an approximate unit root and a quick reduction with time. French, Schwert, and Stambaugh (1987), Chou (1988), Pagan and Schwert (1990) and Bollerslev, Engle, and Nelson (1994), extend these two parts into a more complicated academic process, and conclude it to a permanent and transitory volatility. Permanent volatility can be regard as long-run volatility, while transitory volatility can be considered short-run volatility. The distinguishing feature of these two types of volatility is that short-run volatility is faster mean-reverting compared to long-run volatility. Besides, the model of component GARCH has been widely used in the empirical analysis. Christoffersen, Jacobs, and Wang (2008) analyze the volatility of the option by long-run and short-run effects; they find that the biased estimate of the volatility of the option can be decreased. Tobias and Rosenberg (2008) also think the risks at stock markets can be influenced by short-run and long-run volatility, and even if the mean of the risk premium is smaller than the long-run volatility effect, the important factor is that the return of the volatility for size and the book-to-market ratio can be influenced by short-run volatility effect. According to the above, we claim that the volatility of return has long-run and short-run effects. Hence, this research uses the CGARCH model to discuss long-run and short-run effects of volatility.

This paper extends the lemma of heterogeneous expectation made by Hogan and Melvin (1994) and Tse and Tsui (1997), considering that the more the government interferes in the stock market, the more heterogeneous expectations there are; thus, asymmetric volatility is more significant. That is to say, government's interference and the asymmetric volatility should exhibit positive relations. Other researchers like Ding and Granger (1996), Ding, Granger, and Engle (1993), and Engle, Granger, and Robins (1986) all declare that volatility has

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