Nonlinear and Time-Varying Volatility Dynamics of Economic Time Series in Financial Markets

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（金融市場における経済時系列の非線形性と時変ボラティリティ動学）

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論　文　内　容　の　要　旨

In this thesis, we examine the nonlinear and time-varying volatility dynamics in economic and financial time series of selected emerging and developed financial markets using various nonlinear models. The aims and objectives of the study are as follows: (1) to empirically analyse nonlinear features of financial and macroeconomic time series and the nature of their volatility, (2) to capture the form of nonlinearity in the variances of financial series, (3) to investigate the impact of shocks to financial markets, (4) to compare and contrast selected nonlinear models and highlight their merits and demerits, (5) to trace the effects of shocks on volatility using nonlinear models, (6) to check the forecast performance of selected nonlinear models.

Chapter 1 covers discussions on nonlinearities in variances of economic and financial returns, background, objectives and potential contribution of the study. Chapter 2 investigates the nonlinear features of selected stock market and exchange-rate returns using several nonlinearity tests. Results of these tests reveal that the financial returns volatility series exhibit nonlinear behaviour. Accordingly, we estimate and compare nonlinear models such as GARCH, SWARCH, MS-GARCH and Stochastic Volatility (SV) models in analysing the nonlinear dynamics in financial returns volatility. We identify different regimes causing high volatility in financial markets. The results suggest evidence of nonlinearity of volatility in Japan's financial market.

Chapter 3 examines volatility dynamics of 4 emerging and 4 developed stock markets using GARCH models and identifies breaks in the return series using the ICSS algorithm. We did a comparative analysis of selected MINT economies (Mexico, Indonesia, Nigeria and Turkey) and Malaysia with those of 4 developed market returns, in the context of sudden volatility changes and linkages among stock markets. This chapter also compares GARCH models with and without breaks to assess the impact of variance shifts on stock returns. We find evidence of variance breaks in the unconditional variance of returns over the sample period. Furthermore, results reveal that the incorporation of variance shifts reduces persistence in GARCH models. Stability and fluctuation tests suggest that returns and conditional volatilities in the selected stock markets have not been stable, especially during periods of financial crises.

Chapter 4 investigates the estimation of SV models for financial series using the state space (SS) approach. We reviewed recent techniques and examined the rapid growth of SS models in

finance. The SV techniques are used to analyse exchange rates, Nikkei-225 and gov't bond returns. We find that volatility persistence parameter in SV models is comparable with that of GARCH models. In examining dynamics of these series, the SS models are compared with GARCH models within the framework of efficient estimation and forecasting performance.

Chapter 5 analyses volatility and contagion in emerging and developed stock markets using multivariate GARCH models. The chapter compares and contrasts 8 stock returns, in the context of global financial crisis (2007 to 2009) and examines market interdependence. Structural break test finds significant evidence of breaks in 5 out of 8 indexes returns. Findings reveal that correlations among emerging markets tend to be lower compared with among developed markets. Own-volatility spillovers are largely higher than cross-volatility spillovers especially for emerging markets, while these tend to be negative for developed markets.

Chapter 6 focuses on the analysis of volatility impulse response functions (VIRF) and Dynamic Conditional Correlations (DCC) models. We analyse VIRF and transmission dynamics in selected exchange rate markets using data on YEN, Pounds and Euro returns against the US dollar. We first estimate a bivariate BEKK (1,1) model to determine the nature of the dynamics of conditional variance, covariance and correlations among the exchange rates. In order to trace the effects of shocks (e.g. monetary policy decisions) on exchange rate volatility, we employ the Hafner and Herwartz's (2006) VIRF method to quantify the impact of shocks on conditional volatility. To examine time-varying nature of the relations we estimate a GARCH model with multivariate skew t densities and DCC models using simulation techniques such as the Metropolis-Hastings and MCMC methods. We find evidence of time-varying return and volatility correlations among the major currencies and the relationship between currency volatility and correlations is positive. Results reveal that the DCCs increase during periods of major financial crises and monetary policy changes.

Chapter 7 presents a Bayesian analysis of time-varying vector autoregression (TVP-VAR) model with SV. We examine the impact of monetary policy on inflation, external reserves and real GDP in Nigeria using a TVP-VAR model with SV. We further compare estimates from the constant VAR with the TVP-VAR model. For this model, the sources of time variation are both the coefficients and the variance covariance matrix of the model's innovations. The study finds that the role played by monetary policy shocks in some periods is not significant in explaining real GDP and inflation dynamics. The empirical results reveal the time-varying structure of the economy and monetary policies during the period 1960 to 2014.

Chapter 8 presents the conclusions, implications and scope for further research. We found that most of the nonlinear models have one main objective: to bring the application of economics and finance closer to the real world to allow us to make better decisions and improve model building. Much of their findings suggest that taking proper account of nonlinearities may improve our understanding of the behaviour of these variables.