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Monte Carlo option pricing with asymmetric realized volatility dynamics

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Abstract

What are the advances introduced by realized volatility models in pricing options? In this short paper we analyze a simple option pricing framework based on the dually asymmetric realized volatility model, which emphasizes extended leverage effects and empirical regularity of high volatility risk during high volatility periods. We conduct a brief empirical analysis of the pricing performance of this approach against some benchmark models using data from the S&P 500 options in the 2001–2004 period. The results indicate that as expected the superior forecasting accuracy of realized volatility translates into significantly smaller pricing errors when compared to models of the GARCH family. Most importantly, our results indicate that the presence of leverage effects and a high volatility risk are essential for understanding common option pricing anomalies.

Keywords: Realized volatility; Option pricing; Volatility of volatility; Leverage effects

1. Introduction

The advent of high frequency stock market data and the subsequent introduction of realized volatility measures represented a substantial step forward in the accuracy with which econometric models of volatility could be evaluated and allowed for the development of new and more precise parametric models of time varying volatility. Several researchers have looked into the properties of *ex post* volatility measures derived from high frequency data and developed time series models that invariably outperform latent variable models of the GARCH (Generalized Autoregressive Conditional Heteroskedasticity) or stochastic volatility family of models [3] in forecasting future volatility, to the point that the comparison has been dropped altogether in recent papers.

Recent contributions to the realized volatility modeling and forecasting literature are exemplified by Andersen et al. [3], the HAR (heterogeneous autoregressive) model of Corsi [10], the MIDAS (mixed data sample) approach of Ghysels et al. [15] and the unobserved ARMA component model of Refs. [18,23]. Martens et al. [20] develop

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