A comparison between correlated stochastic volatility models

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The multiplicative diffusion process known as the geometric Brownian motion is considered as one of the most popular models for speculative markets. However, the multiplicative diffusion model assumes that the volatility σ is constant and their statistical properties are unable to describe the main properties observed in real markets, those called stylized facts.

The stochastic volatility (SV) models are a natural way out to avoid these inconsistencies. There are many SV models in the literature which are good candidates for improving the market modelisation. We confront the most common SV models such as the Heston (or CIR) [1], the Ornstein-Uhlenbeck (OU) [2], and the expOU models [3], among many others. We try to decide which is the most appropiate one by studying their kurtosis, their skewness, the volatility autocorrelation and the leverage [4], and thus outline the limitations of each model.

We also add some empirical research on a large collection of market indices and stock shares. This study confirms the universal behaviour of the leverage and volatility correlations. While empirical leverage shows that the return and volatility noises must be negatively correlated [5], the empirical volatility correlation insists on the necessity of at least two characteristic time scales in any market modelisation [6].

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