Application of Wavelet method in de-noising option prices

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Abstract

In so much financial time series are known to carry noise, elimination of noise is necessary. Due to multi-scaling property, the wavelet method is very efficient in dealing with noisy data series. In specific, we propose to use the wavelet method to de-noise option prices before estimating the option-implied risk neutral density (RND) and forecasting future option prices. We use of two RNDs estimated from the perturbed prices and the filtered prices to forecast the out-of-sample options, respectively. Moreover, we compare them with the true Black-Scholes option prices. Results of this study show that, through the use of Monte Carlo simulations, the power of the wavelet method in the de-noising of option price data. It is clearly seen that, by de-noising the perturbed option prices using the wavelet method, most of the noise is removed and the wavelet de-noising method is robust to different levels of noise variance.

Keywords and phrases: De-noise, Option pricing, RND, Wavelet analysis, Monte Carlo simulation.

1. Introduction

We can distinguish three types of applications of the wavelet method in economics and finance. In brief, those are applications which, (1) relate to the analysis of multi-scale problems; (2) relate to the estimation of unknown parameters of a model; and (3) relate to the removal of noise from raw data series. The goal of this paper relates to the third objective. As example of the first type of application, Ramsey and Lampart (1998a, b)[6], they use wavelets to analyze the relationship between expenditure and income, and between money and income at six different time scales. As example of the second type of application, Haven (2009)[4] use wavelets to estimate the risk-neutral moment generating function of the stochastic process followed by the underlying asset of a European option. The wavelet method is shown to perform very well in estimating unknown parameters. Finally, the third type of application, Sun

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