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Distribution of Maximum Loss of Fractional Brownian Motion with Drift

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Abstract : In finance, the price of a volatile asset can be modeled using fractional Brownian motion (fBm) with Hurst parameter H>1/2. The Black-Scholes model for the values of returns of an asset using fBm is given as, Y_t=Y_0 e^((r+μ)t+σB)_t^H, 0≤t≤T where Y_0 is the initial value, r is constant interest rate, μ is constant drift and σ is constant diffusion coefficient of fBm, which is denoted by B_t^H where t≥0. Black-Scholes model can be constructed with some Markov processes such as Brownian motion. The advantage of modeling with fBm to Markov processes is its capability of exposing the dependence between returns. The real life data for a volatile asset display long-range dependence property. For this reason, using fBm is a more realistic model compared to Markov processes. Investors would be interested in any kind of information on the risk in order to manage it or hedge it. The maximum possible loss is one way to measure highest possible risk. Therefore, it is an important variable for investors. In our study, we give some theoretical bounds on the distribution of maximum possible loss of fBm. We provide both asymptotical and strong estimates for the tail probability of maximum loss of standard fBm and fBm with drift and diffusion coefficients. In the investment point of view, these results explain, how large values of possible loss behave and its bounds.

Keywords : maximum drawdown, maximum loss, fractional brownian motion, large deviation, Gaussian process
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