

MT-353 Discrete -Time Finance

Notation, naming, and general definitions: historical, centered and realized quantities, returns, volatilities, volatility increments, average, expectation, EMA, MA, and operators on time series, stylized facts: probability, density function, Pdf for the return, Pdf for the volatility, Pdf for the volatility increment, scaling for the return, scaling for the volatility, correlations for the volatility, correlation with the realized volatility: autocorrelation for the volatility, correlations between the realized volatility and the historical volatility increment, trend and leverage effects, logarithmic versus relative random walks: the definitions of the return, logarithmic process, one asset, constant volatility, long time properties of the (constant volatility) random walk process, enforcing the condition. Stochastic volatility processes: exponential stochastic volatility process, one-component exponential stochastic volatility process, long-memory exponential stochastic volatility process, one-component heston stochastic volatility process, long-memory heston stochastic volatility process, time-reversal asymmetry: statement of the problem, empirical time reversal statistics, test statistics. Characterizing heteroscedasticity: volatility and correlation estimators, the volatility estimator, exponential decay, two exponentials with fixed ranges, logarithmic decay, the cost function and parameter estimation, montecarlo simulations, lagged correlations for empirical time series. Leverage effect: empirical statistics, processes with leverage and Monte-Carlo simulations. Processes and market risk evaluation: background on risk evaluation, "return-based" versus "innovation-based" risk methodologies, the main innovation-based risk methodologies; the rm 1994 risk methodology.

Recommended Books

1. "Discrete Time Series, Processes, and Applications in Finance", Gills Zumbach, Springer, Verlag BerlinHeidelberg 2013.
2. "Stochastic Finance An Introduction In Discrete Time", Hans Follmer, Alexander Schied, Deutsche Nationalbibliothek, 3rd Edition, 2011.