Generalized extreme value distribution with time-dependence using the autoregressive model in state space form[*]

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Abstract

A new state space approach is proposed to model the time-dependence in an extreme value process. The generalized extreme value distribution is extended to incorporate the time-dependence using a state space representation where the state variables follow an autoregressive or moving average process with Gumbel error distribution. Using Bayesian approach, an efficient algorithm is proposed to implement Markov chain Monte Carlo method where we exploit the fine approximation of the Gumbel distribution by a ten-component mixture of normal distributions. The methodology is illustrated using extreme returns of high-frequency stock data. The model is fit to daily series of minimum return and the empirical results support the strong evidence of the time-dependence among minimum returns.

Key words: Extreme values, Generalized extreme value distribution, Markov chain Monte Carlo, Mixture sampler, State space model, Stock returns.