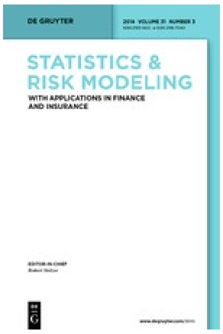

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Dividend maximization in a hidden Markov switching model P. 143-148

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A1bstract

In this paper we study the valuation problem of an insurance company by maximizing the expected discounted future dividend payments in a model with partial information that allows for a changing economic environment. The surplus process is modeled as a Brownian motion with drift. This drift depends on an underlying Markov chain the current state of which is assumed to be unobservable. The different states of the Markov chain thereby represent different phases of the economy. We apply results from filtering theory to overcome uncertainty and then we give an analytic characterization of the optimal value function. Finally, we present a numerical study covering various scenarios to get a clear picture of how dividends should be paid out.

Exact and approximate hidden Markov chain filters based on discrete observations P. 149-176

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Abstract

We consider a *Hidden Markov Model* (HMM) where the integrated continuous-time Markov chain can be observed at discrete time points perturbed by a Brownian motion. The aim is to derive a filter for the underlying continuous-time Markov chain. The recursion formula for the discrete-time filter is easy to derive, however involves densities which are very hard to obtain. In this paper we derive exact formulas for the necessary densities in the case the state space of the HMM consists of two elements only. This is done by relating the underlying integrated continuous-time Markov chain to the so-called asymmetric telegraph process and by using recent results on this process. In case the state space consists of more than two elements we present three different ways to approximate the densities for the filter. The first approach is based on the continuous filter problem. The second approach is to derive a PDE for the densities and solve it numerically. The third approach is a crude discrete time approximation of the Markov chain. All three approaches are compared in a numerical study.

Analyzing model robustness via a distortion of the stochastic root: A Dirichlet prior approach P. 177-195

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Abstract

It is standard in quantitative risk management to model a random vector $\mathbf{X}:=\{X_{t_k}\}_{k=1,\dots,d}$ of consecutive log-returns to ultimately analyze the probability law of the accumulated return $X_{t_1}+\dots+X_{t_d}$. By the *Markov regression representation* (see [25]), any stochastic model for $\mathbf{X}$ can be represented as $X_{t_k}=f_k(X_{t_1},\dots,X_{t_{k-1}},U_k)$, $k=1,\dots,d$, yielding a decomposition into a vector $\mathbf{U}:=\{U_k\}_{k=1,\dots,d}$ of i.i.d. random variables accounting for the randomness in the model, and a function $f:=\{f_k\}_{k=1,\dots,d}$ representing the economic reasoning behind. For most models, f is known explicitly and U_k may be interpreted as an exogenous risk factor affecting the return X_{t_k} in time step k. While existing literature addresses model uncertainty by manipulating the function *f*, we introduce a new philosophy by distorting the source of randomness **U** and interpret this as an analysis of the model's robustness. We impose consistency conditions for a reasonable distortion and present a suitable probability law and a stochastic representation for **U** based on a Dirichlet prior. The resulting framework has one parameter $c\in[0,\infty]$ tuning the severity of the imposed distortion. The universal nature of the methodology is illustrated by means of a case study comparing the effect of the distortion to different models for **X**. As a mathematical byproduct, the consistency conditions of the suggested distortion function reveal interesting insights into the dependence structure between samples from a Dirichlet prior.