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Filtering and parameter estimation of an electricity spot price model

We propose a model for electricity spot price dynamics. The spot price is assumed to follow an exponential Ornstein–Uhlenbeck (OU) process with an added compound Poisson process. In this way, the model allows for mean-reversion and possible jumps. The model has also a seasonal component given by a sinusoinal function with positive trend. All parameters in the OU and Poisson processes are modulated by a hidden Markov chain in discrete time. They are able to switch between economic regimes representing the interaction of various factors. Through the application of reference probability technique, adaptive filters are derived, which in turn, provide optimal estimates for the state of the Markov chain and related quantities of the observation process. The EM algorithm is applied to find optimal estimates of the model parameters in terms of the recursive filters. We implement this self-calibrating model on a deseasonalised series of daily spot electricity prices compiled by the Nordic exchange Nord Pool. On the the basis of one-step ahead forecasts, we found that the model is able to capture the empirical characteristics of Nord Pool spot prices. The pricing of expected spots on delivery shows an application of our model to pricing, which can be adopted easily by practitioners.

Joint work with Fred Espen Benth (Universiy of Oslo, Norway) and Christina Erlwein (Fraunhofer Institute for Industrial Mathematics, Kaiserslautern, Germany).