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Long-term swings and seasonality in energy markets

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Abstract

This paper introduces a two-factor continuous-time model for commodity pricing under the assumption that prices revert to a stochastic mean level, which shows smooth, periodic fluctuations over long periods of time. We represent the mean reversion price by a Fourier series with a stochastic component. We also consider a seasonal component in the price level, an essential characteristic of many commodity prices, which we represent again by a Fourier series. We obtain analytical pricing expressions for futures contracts. Using futures price data on Natural Gas, we provide evidence on the presence of long-term fluctuations and show how to estimate the long-term component simultaneously with a seasonal component using the Kalman filter. We analyse the in-sample and out-of-sample empirical performance of our pricing model with and without a seasonal component and compare it with the Schwartz and Smith (2000) model. Our findings show the in-sample and out-of-sample superiority of our model with seasonal fluctuations, thereby providing a simple and powerful tool for portfolio management, risk management, and derivative pricing.

Keywords Finance, Energy Markets, Seasonality, Long-term swings, Kalman filter

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