

Calibration and filtering for multi factor commodity models with seasonality: incorporating panel data from futures contracts

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We examine a general multi-factor model for commodity spot prices and futures valuation. We extend the multi-factor long-short model in Schwartz and Smith (2000) and Yan (2002) in two important aspects: firstly we allow for both the long and short term dynamic factors to be mean reverting incorporating stochastic volatility factors and secondly we develop an additive structural seasonality model. Then a Milstein discretized non-linear stochastic volatility state space representation for the model is developed which allows for futures and options contracts in the observation equation. We then develop numerical methodology based on an advanced Sequential Monte Carlo algorithm utilising Particle Markov chain Monte Carlo to perform calibration of the model jointly with the filtering of the latent processes for the long-short dynamics and volatility factors. In this regard we explore and develop a novel methodology based on an adaptive Rao-Blackwellised version of the Particle Markov chain Monte Carlo methodology. In doing this we deal accurately with the non-linearities in the state-space model which are therefore introduced into the filtering framework. We perform analysis on synthetic and real data for oil commodities.

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