ADVANCES IN PRICING COMMODITY FUTURES: MULTIFACTOR MODELS

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Abstract:

In recent years commodity markets have experienced a dramatic growth in trading volume, the variety of contracts and underlying commodities. Futures as well as forward are contracts for future delivery of an underlying asset. The asset can be a physical commodity (corn, oil, precious metals, and so on) or financial instruments (bonds, currencies, stocks indices, and so on). Commodities differ from most financial assets in that they are continuously produced and consumed.

The no-arbitrage based models of commodities dominate the current literature and practice on energy derivatives. These models are based on mean reverting stochastic processes which give as a result affine models such as Schwartz (1997) or Nielsen and Schwartz (2004). These models are particular attractive from practitioner's perspective since they provide closed-form solutions to evaluate futures and some other derivatives contracts. This in turn allows for a relatively easy calibration and computational implementation. In these models, however, the drift and the volatility of the stochastic processes are usually specified as simple parametric functions for pure simplicity and tractability and it is not clear that these stochastic processes are the best in order to explain the behaviour of the spot prices and the convenience yields.

In this paper, we derive some exact results which relate the risk-neutral drifts to the slope of the commodities futures price jointly with the factors. This fact allows us to estimate some of the coefficients of the pricing partial differential equation directly from the futures data available in the markets. Moreover, we do not have to estimate either the physical drift or the market price of risk. Therefore we considerably reduce the number of functions to estimate and, as a consequence, we reduce the computational cost as well as the misspecification error. Analogous results, although for a term structure model, are showed in Gómez-Valle and Martínez-Rodríguez (2008).

In order to investigate the finite sample properties of this approach we carry out some numerical experiments. Finally, an application to crude oil and natural gas futures contracts traded at the New York Mercantile Exchange (NYMEX) is also illustrated.

References:

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