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Modeling Energy Spreads with a Novel Mean-reverting Stochastic Process

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The spread between two related energy prices is a very important quantity throughout energy finance. Of particular interests are the spread between two different energy types, location spreads, and calendar spreads.

At times it is appropriate to consider the spread as a distinct process from the underlying price processes which can be modelled directly. We introduce a new mean-reverting random walk, derive its continuous stochastic differential equation and obtain some analytical results about its solution. This new mean-reverting process is compared with the Vasicek process and its advantages discussed. Since the analytical transition density does not exist for this nonlinear stochastic process, to estimate the model parameters, the local linearization method is deployed. We apply this method to empirical data for modeling the spread between West Texas Intermediate (WTI) crude oil and West Texas Sour (WTS) crude oil.