Commodity Prices and Regime Switching Bases

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In the natural gas market the basis is the difference in the price of gas at two delivery points. The usual reference in the U.S.A. for a basis differential is NYMEX. For example, if the May Henry Hub price is \$5.25 and the May NYMEX price is \$5.45 then the basis differential for May NYMEX is \$0.20 to Henry. The usual reference for Canada is the price at the AECO facility.

In this article we propose to model the basis as a mean reverting diffusion, $X = \{X_t, t \geq 0\}$. Unlike a price process the basis process X can take positive or negative values. The new feature in our model is that we suppose the mean reverting level in our dynamics can change according to the state of the economy. The economy is modelled as a finite state Markov chain $Z = \{Z_t, t \geq 0\}$ and the economy can perhaps be in two states ('good' and 'bad'), or possibly three states.

Our continuous time model is discretized and the results of Elliott *et al* [1], are adapted to obtain a recursive filter for the state of the economy given observations of X. In turn, this allows predictions to be made of the basis at the next time. If the observed basis is then higher or lower than the predicted value, it suggests one price is possibly higher than it should be and the other lower. Consequently, a trading strategy can be implemented based on these predictions. Computer simulations are provided to demonstrate the benefit of the Markov modulated mean reverting model we propose and the estimation schemes developed to facilitate the trading strategies just described.

1. Elliott, R. J., Aggoun, L. and Moore, J. B., Hidden Markov Models: Estimation and Control, *Applications of Mathematics* 29, Springer Verlag, New York 1994.