NCCC-134
APPLIED COMMODITY PRICE ANALYSIS, FORECASTING AND MARKET RISK MANAGEMENT

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Suggested citation format:

Leads, R., C. Zulauf, S. Irwin, T. Jackson, and W. Distad. 1993. "Mean Reversion in the Corn and Hog Bases." Proceedings of the NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management. Chicago, IL. [http://www.farmdoc.uiuc.edu/nccc134].

Mean Reversion in Corn and Hog Bases

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Once a hedge is established, the only undetermined component of the final price earned by a producer is the basis at which the hedge is lifted, assuming the hedge is maintained until the cash commodity is sold. Thus, when hedging, the ability to forecast basis behavior is instrumental to maximizing the selling price. The linkage to profit underpins a tradition of research aimed at understanding and predicting basis behavior. This tradition dates from Working's (1949) study of the storage basis for wheat and continues through the more recent econometric research which addresses the economic factors associated with the bases of various commodities (e.g., Ward and Dasse, 1977; Thompson, 1986; and Naik and Leuthold, 1991).

A second, previously unrelated body of literature has emerged concerning "mean reversion" in security and commodity markets (e.g., DeBondt and Thaler, 1985 and 1987; Fama and French, 1988 and 1989; Poterba and Summers, 1988; Cutler, Poterba, and Summers, 1991; and McQueen, 1992). In a mean reversion process, price is expected to return to its underlying (mean) value whenever market forces push the price sufficiently far from this underlying value (Poterba and Summers). A mean reversion process implies a straightforward forecast model: if current price is greater (less) than its underlying value, price is expected to decrease (increase) back toward its underlying value.

This study brings together these two bodies of literature by investigating whether mean reversion exists in the corn and hog bases. Specifically, it examines whether the deviation of the corn and hog bases from their mean value can predict subsequent movement in these bases.

No previous study has examined mean reversion in the basis, but previous research does suggest that mean reversion may exist in the basis. In particular, Working argued that the basis not only reflected the cost of storage but also provided a strategy for deciding when to store, i.e., storage should be undertaken only when the expected change in the basis equalled or exceeded the cost of storage over the expected storage horizon. Working (1953), Heifner (1966), Martin and Hope (1984), and Tomek (1987) have shown that this strategy can increase returns to storage.

Working's strategy can be viewed as a subset of mean reversion in the basis. If the current basis differs from the expected mean basis at the end of the storage period by more than the cost of storage and mean reversion exists, then the basis should change by more than the cost of storage as it reverts back to its mean. A positive return to storage results. This mean reversion scenario parallels Working's strategy when the basis change is expected to cover the cost of storage. On the other hand, if the current basis differs from the expected mean basis at the end of the storage period by less than the cost of storage and mean reversion exists, then the basis should change by less than the cost of storage as it reverts to its mean value. A negative

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return to storage results. This mean reversion scenario parallels the implied consequence of Working's strategy when the basis change is not expected to cover storage costs.

If Working's strategy is a subset of mean reversion in the basis, then mean reversion may exist in nonstorable as well as storable commodities, leading to a widely applicable basis forecasting model. The methodology and data used to test for mean reversion in the corn (storable) and hog (nonstorable) bases are discussed in the next section. Analysis of the results generated by a return predictability test for mean reversion follows. Last, conclusions and implications are drawn.

Mean Reversion Forecast Model

If stochastic process X_t is mean reverting, the conditional expectation of $X_{t+1} - X_t$ at time t depends on information available at time t, specifically the distance from the mean. For example, the further price is from its mean, the greater the amount the price should change back toward the mean price. In other words, magnitude of the change in price is positively related to the distance from its mean. This hypothesis rests on the common sense notion that, if mean reversion exists, mean reversion forces should become stronger the further price is from its mean. The mean reversion forecast model can be summarized as follows:

$$(1)\quad (P_{t+n} - P_t) = f(MP - P_t)$$

where: P_{t+n} = price at the end of the forecast period
P_t = price at the beginning of the forecast period
MP = mean price
t = time

To test the predictive power of a forecast that prices revert to some fundamental value, Cutler, Poterba, and Summers (1991) suggest regressing the actual change in price over a return horizon on the deviation of price from an estimate of its fundamental value. Their regression takes the following form:

$$(2)\quad R_t = \alpha + \beta D_t + \epsilon_t$$

where: R_t = $(P_{t+n} - P_t)$
D_t = $(EMP_t - P_t)$
α = intercept term
β = slope term
ϵ_t = error term
EMP_t = estimate of mean price at time t
P_{t+n} and P_t are as defined in equation 1

The β (slope) coefficient is interpreted as the fraction of the deviation from the mean price which is eliminated over the holding period (Cutler, et al.). A finding that β is significantly greater than zero is consistent with the existence of a mean reversion process.