Does Price Asymmetry Exist in Commodity and Energy Markets?

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ABSTRACT

- This study uses a price asymmetry model to determine if the price of corn, soybeans, wheat, oil, and ethanol adjust prices asymmetrically depending on whether their actual price is over- or under- predicted with respect to one another. Monthly time series data incorporated into a distributed lag error correction model distinguishing between positive and negative price differences and positive and negative values of the error correction term accomplishes the goal of determining if asymmetric price relationships exist within the commodity and energy markets.

- We concluded that asymmetric price changes are found in the commodity and energy markets and that most of these price changes occur when the actual price is higher than predicted with respect to other variables.

OBJECTIVE

The objective of this study is to examine the linkage between commodity and energy markets.

Monthly time series data for the prices of soybeans, corn, wheat, crude oil and ethanol from January 1995 – December 2010 is utilized in this study.

Granger causality will be estimated using the price changes of the variables to determine if price changes in one variable can be a leading indicator or future price changes in another.

Monthly price changes of the variables are also applied to a price asymmetry model to determine if prices are more likely to exhibit asymmetric responses if their actual price is above of below their predicted price with respect to one another.

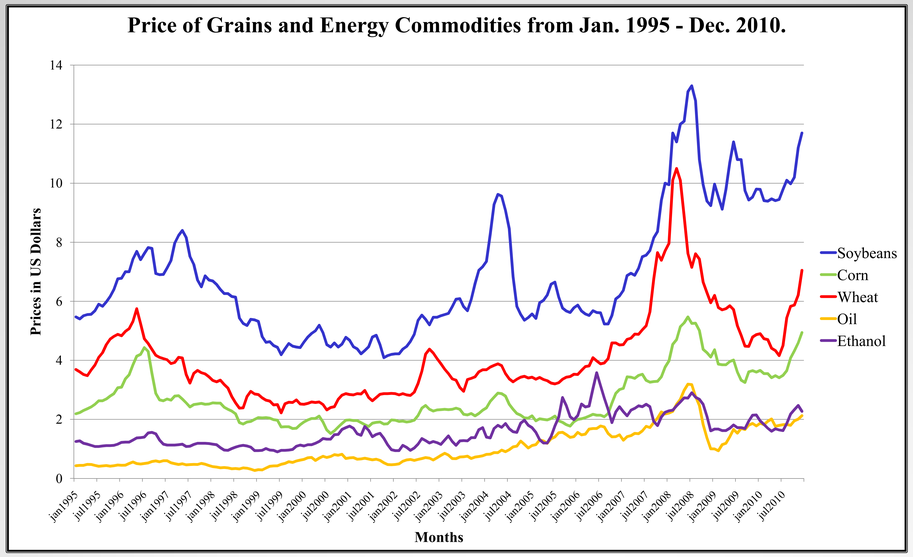
For example, if the actual price is below predicted price with respect to the price of another study variable then prices would be expected to rise in the following time period.

We expect to observe asymmetric price relationships, especially in relationships where Granger causality results were significant.

F-Statistics of Granger Causality Tests
(Variable on horizontal axis is dependent variable)

	Soybeans	Corn	Wheat	Oil	Ethanol
Soybeans	-	0.09	0.29	3.28**	2.37*
Corn	3.34**	-	0.97	3.85*	6.02***
Wheat	12.21***	6.45***	-	3.93**	1.53
Oil	0.47	1.62	0.22	-	10.69***
Ethanol	1.15	1.59	0.47	0.81	-

*** 1% significance level ** 5% significance level * 10% significance level



METHODOLOGY

Step 1: Estimate long-run relationships.

$$p_{i,t} = a + bp_{j,t} + \varepsilon_t$$

$p_{i,t}$ and $p_{j,t}$ are prices for commodities i and j in time t and ε_t is a normal i.i.d. error term. The error term is interpreted as the actual value of the dependent variable less the predicted value of the dependent variable.

Step 2: Separate error correction term according to positive and negative values.

$$ECT_t^+ = \begin{cases} ECT_t \; if \; ECT_t > 0 \\ 0 \; if \; ECT_t \leq 0 \end{cases} \quad \text{and} \quad ECT_t^- = \begin{cases} ECT_t \; if \; ECT_t < 0 \\ 0 \; if \; ECT_t \geq 0 \end{cases}$$

Step 3: Lagged price differences are also separated into positive and negative values thus leading to the following price asymmetry model specification.

$$\Delta p_{i,t} = \alpha + \sum_{m=1}^{M} (\beta^+ D^+ \Delta p_{j,t-m}) + \sum_{m=1}^{M} (\beta^- D^- \Delta p_{j,t-m}) + \theta^+ ECT^+_{t-1} + \theta^- ECT^-_{t-1}$$

Interpretation: A positive value of the error correction term, ECT^+, would be interpreted as the price of i being above its equilibrium price with respect to the price of j and if the coefficient of Θ^+ is negative we would expect the price of i to adjust downward in the following time period. A negative value of the error correction term, ECT^- would mean that the price of i is below its equilibrium price with respect to j and would be expected to adjust upward toward long-run equilibrium in the subsequent time period.

RESULTS

Significance of Positive and Negative Values of Error Correction Term Determining Asymmetric Price Relationships: Dependent Variable is Change in Price ($\Delta p_{i,t}$)

	Dependent Variables				
	i = Soybeans	*i* = Corn	*i* = Wheat	*i* = Oil	*i* = Ethanol
Soybeans ECT^+_{t-1}	-	-.0892*	-.0083	-.0510	-.0910**
Soybeans ECT^-_{t-1}	-	.0999	.0388	.0275	.0103
Corn ECT^+_{t-1}	-.1668	-	.0258	-.0367	-.1192***
Corn ECT^-_{t-1}	.3778***	-	.0646	.0233	.0601
Wheat ECT^+_{t-1}	-.0690	-.1599***	-	.0568	-.1173***
Wheat ECT^-_{t-1}	-.0791	-.0366	-	.0191	.0366
Oil ECT^+_{t-1}	-.0891**	-.0465	-.0041	-	-.2161***
Oil ECT^-_{t-1}	.0483	.0099	-.0545	-	-.0356
Ethanol ECT^+_{t-1}	-.0447	-.0288	-.0446	.0041	-
Ethanol ECT^-_{t-1}	.0484	.0344	.1077	.0473	-

*** 1% significance **5% significance *10% significance

CONCLUSIONS

We conclude that asymmetric price changes **DO** occur within the commodity and energy markets.

Most of the asymmetric price changes occur when the actual price of a variable is below its equilibrium price as determined by the price of another study variable and would therefore be expected to exhibit a downward adjustment in price the following month.

We notice that the price of soybeans being lower than expected with respect to corn is the most responsive relationship with a 38% upward adjustment of the error correction term. This is also the only occurrence where a lower than predicted price will most likely respond with an upward price adjustment in the following month.

Ethanol prices adjust downward in the following month when its prices is higher than predicted as predicted by soybeans (9%), corn (12%), wheat (12%) and oil (22%). Granger causality also showed that changes in the price of each of the additional study variables (with the exception of wheat) was a leading indicator of changes in the price of ethanol.

We conclude that none of the study variables exhibit asymmetric price changes with respect to ethanol. This result is consistent with our expectation regarding Granger causality where changes in the price of ethanol was not a leading indicator of future price changes in the other study variables.

Grain producers can use this information in helping to determine the prices they receive for their crop based on the price relationships between grains and the price relationship between grain and energy markets.

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