Is Commodity Price Volatility Persistent? Another Look Using Improved, Full-Sample Estimates

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Background and Motivation

- Understanding the volatility of futures prices matters for risk management, forecasting and options pricing
- How persistent is the effect of random shocks on price volatility?
- Practitioners need to know, if markets are currently volatile, will they remain so?
- Traditionally, shocks are assumed to be:
  - Transitory: geometric rate of decay, or
  - Permanent: no decay
- Empirical evidence suggests that in many economic and financial time series, shocks display long memory
  - Slow, hyperbolic rate of decay
  - Easily confused with permanent shock
- Previous literature has found long memory in commodity futures price volatility (Jin and Frechette; Sephton)
- Futures prices, however, are partially overlapping time series and "splicing" futures contracts introduces nontrivial bias (Smith)

Research Questions

- How do the findings of long memory in futures price volatility change, if at all, when the futures "splicing" bias is corrected for?
- Are there differences across commodities and particularly between storable/nonstorable?

Methodology

- To address the overlapping nature of futures price series, the first step is to use the GLS method of Karali and Thurman to account for contemporaneous correlations among futures price observations from the same day
- Regress absolute futures price log-returns over economically significant variables
  - Stocks-to-use ratio (if applicable)
  - Contract time-to-delivery
  - Time trend
- Consistent with the literature, volatility is defined as absolute or squared demeaned residuals (instead of demeaned log-returns)
- Estimate degree of long memory as the fractional difference parameter $-1<d<1$ with limit cases d=0 (stationarity and no long memory) and d=1 (non-stationarity and permanence of shocks)
- Apply Shimotsu's recently developed feasible exact local Whittle estimator, preferable to alternatives, based on simulation
- Also apply alternative estimators to evaluate robustness of results
- Futures price data are for agricultural, energy and metal commodities and are obtained from the Commodity Research Bureau
- Inventory and stocks-to-use data are obtained from the National Agricultural Statistics Service, Energy Information Administration and the American Bureau of Metal Statistics

Results

Estimates of fractional difference parameter *d* representing long memory

Note: $0<d<1$ with a higher *d* implying greater persistence of volatility

Variable	Corn	Live cattle	Lean hogs	Soybeans	Wheat	
Residuals	0.019	-0.045	-0.006	-0.024	0.023	
Absolute	0.242	0.030	-0.138	0.268	0.008	
Squared	0.242	0.192	-0.019	0.301	0.117	
Variable	**Crude oil**	**Gold**	**Copper**	**Heating oil**	**Natural gas**	**Silver**
Residuals	-0.067	-0.037	0.030	-0.049	0.062	-0.077
Absolute	0.124	0.163	0.172	0.153	0.074	0.145
Squared	0.312	0.274	0.202	0.296	0.206	0.226

Results and Conclusion

- Consistent with previous findings, there is no significant long memory in residuals
- If volatility is defined as absolute residuals, there is long memory in all futures except for live cattle, lean hogs and Chicago wheat
  - Lean hogs volatility is anti-persistent
  - E.g., high volatility is followed by low volatility
- If volatility is defined as squared residuals, there is long memory in all futures except lean hogs
- Absolute residuals are the preferred specification when price log-returns are leptokurtic

Comparison with findings of previous literature

- Our results confirm the presence of long memory in the volatility of most commodity futures price series
- However the value of *d* is generally very small
- Preferred estimate $d<0.2$ for most commodities
- Our estimates are lower than what most previous studies have found for agricultural commodities:
  - $0.4<d<0.65$ (Jin & Frechette)
  - $0.3<d<0.6$ (Sephton)
  - $0.1<d<0.3$ (Elder & Jin)
  - $0.3<d<0.4$ (Baillie et al.)

Implications for researchers and practitioners

- Volatility in commodity futures prices is weakly but significantly persistent for most commodities
- No volatility persistence for the only two nonstorable commodities considered in this research paper

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