

# Commentator presentation

## Hedging Agriculture Commodity Futures with Histogram Data: *A Markov Switching Volatility and Correlation Model*

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# Summary

## ▶ What:

Model prices of (wheat spot, wheat futures), focusing on their correlation and volatilities.

## ▶ How:

Use (Bivariate) Flexible Markov-Switching Dynamic Copula GARCH on price representative from histogram-valued data.

Flexible – allows all parameters of dynamic correlation to change across regimes.

Histogram-valued data – more accurate than closing price in terms of actual buying/selling price.

## ▶ Why:

Hedge wheat spot positions with futures.

# Highlights

## ▶ Gaussian copula function for correlation

Captures some realistic properties of spot-futures correlation (**time-varying and symmetric**)

**Single-step maximum likelihood estimation** makes the model fits with data more accurately than a traditional two-step estimation (e.g. DCC-GARCH)

## ▶ Combined with Markov-Switching regime

Result shows much **improvement in parameter estimation in both AIC and BIC criteria**

Model	Wheat spot-futures	
	AIC	BIC
CCC-GARCH (1,1)	1528.931	1553.554
DCC-GARCH (1,1)	1514	1542.14
MS-CCC-GARCH (1,1)	2255.851	2312.066
MS-DCC-GARCH (1,1)	1370.743	1434.058
Copula GARCH(1,1)	1030.632	1062.325
MS-Copula GARCH(1,1)	1203.944	1207.461
Dynamic Copula GARCH(1,1)	1012.368	1022.92
MS Dynamic Copula GARCH(1,1)	1040.629	1072.322
<b>Flexible MS Dynamic Copula GARCH(1,1)</b>	<b>-29.6059</b>	<b>40.7431</b>

# Comments I

## On technicality

- ▶ Histogram-valued data is absent (or is replaced by a single-valued price/return of the day?)
- ▶ Spot and futures price of same underlying security could exhibit near perfect correlation from time to time. However, the logistic function:

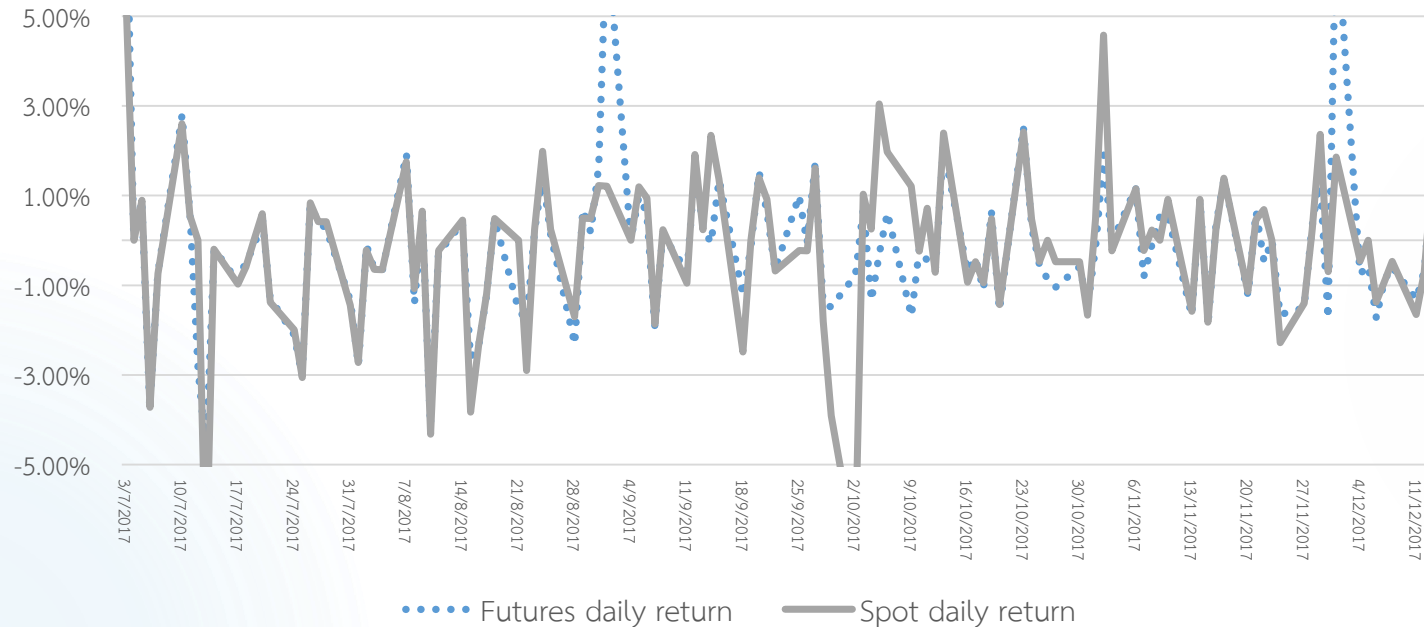
$$\rho_t = \Lambda(x_t) \approx \frac{1 - e^{-x_t}}{1 + e^{-x_t}}$$

$$x_t = \omega_0 + \omega_1 \rho_{t-1} + \text{forcing var}$$

is restricting the correlation to hardly goes near 1.

# Comments I

Futures and spot daily returns



Data\*: 1. Return on wheat futures continuous series [1 July 2017 – 31 Dec 2017]

2. Return on wheat spot price [1 July 2017 – 31 Dec 2017]

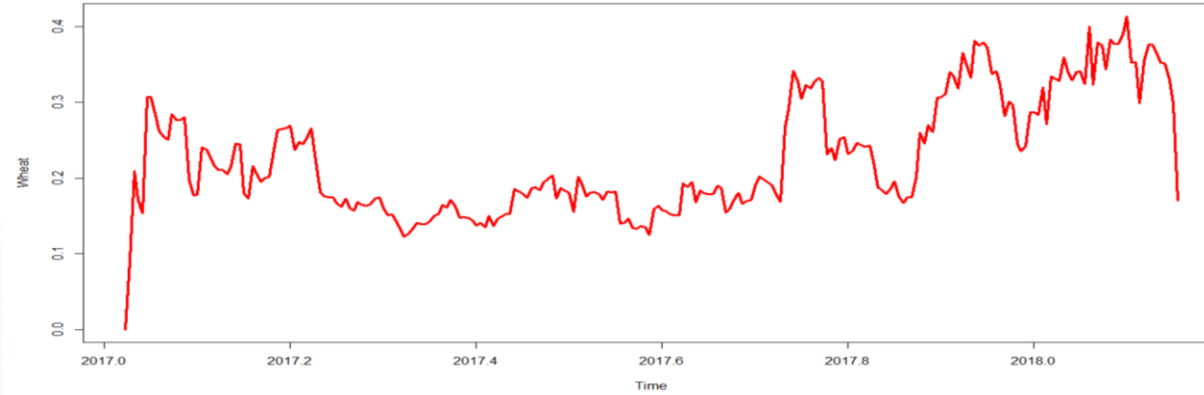
Correlation of return [1 July 2017 – 30 June 2018] = 0.736865

Correlation of return [1 Jan 2018 – 28 Feb 2018] = **0.993023**

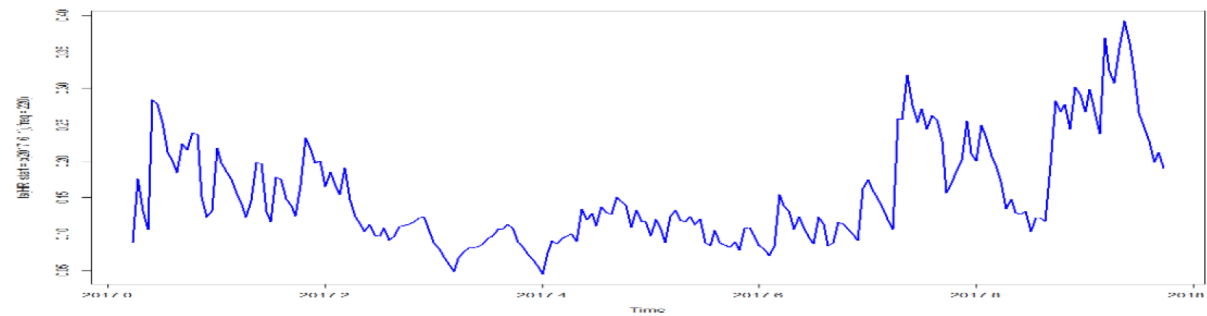
\*Source: DataStream

# Comments I

Conditional correlation and hedge ratio suggested in the paper.



**Fig 3. Dependence of wheat spot and future.**



**Fig 5. Hedge ratio**

# Comments II

## On hedging application

- ▶ (Liquidity issue) Futures contract has an expiration date, its lack of trading activity near expiration could result in deviation of recorded price from the actual value.

Wheat futures expirations: 15<sup>th</sup> of Mar, May, Jul, Sep, Dec

- ▶ (Settlement vs trade) At expiration, the futures position is automatically closed with settlement price, usually referred to current spot price. This could make the actual portfolio value very different from the assumed close-out trade.
- ▶ All in all, your hedging ratio may only be applicable for hedging positions that need closing out further away from expiration date.