The determinants of marginal convenience yield in agricultural commodity markets

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Background - Motivation

- Marginal convenience yield for holding commodity inventory: Two main channels driving the dynamics of marginal convenience yield in commodity futures markets:

- Theory of Storage-Working curve: "inverse carrying charges" in times of scarce inventory supplies (Brennan, 1958; Gordon et al., 2013; Milonas and Photina, 2024; Kaldor, 1939; Working, 1948)

- Theory of normal backwardation: Speculators who demand an insurance premium from hedgers result in normal backwardations in commodity futures markets (Bessembinder, 1992; Carter et al., 1983; Chang, 1985; Basu and Miffre, 2013; Miffre, 2000).

This Paper

- We develop a unified framework testing all the relevant theories and models explaining the convenience yield dynamics in agricultural futures markets.

- We show that the convenience yields have turned to negative on average during the post-2000 period.

- We show that speculative activity in those futures markets has contributed to the gradual disappearance of convenience yields.

- Our results are in favor of the normal backwardation theoretical view, showing that the hedging pressure is the most important factor driving the dynamics of convenience yields.

Estimation of the marginal convenience yield

- Futures basis decomposition:

$$F(t,T) - S_t = r(t,T)S_t + W(t,T) - CY(t,T)$$

Ignoring storage costs, the convenience yield CY can be approximated by the equation below:

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$$\frac{CY(t,T)}{S_t} = r(t,T) - \frac{F(t,T) - S_t}{S_t}$$

r(t,T) is the 3-month US Treasury bill. Consequently, the convenience yield is approximated as the interest-adjusted commodity futures basis (Fama and French, 1987; Gospodinov and Ng, 2013; among others).
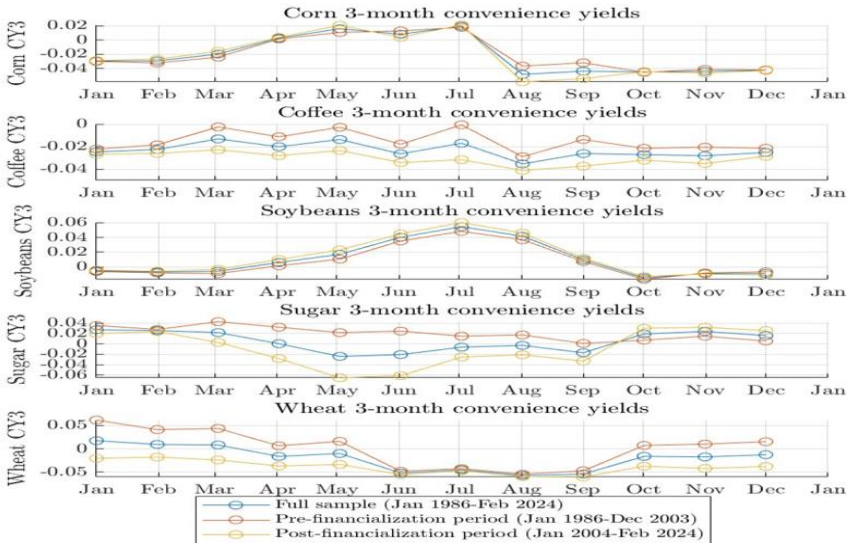
Agricultural convenience yields

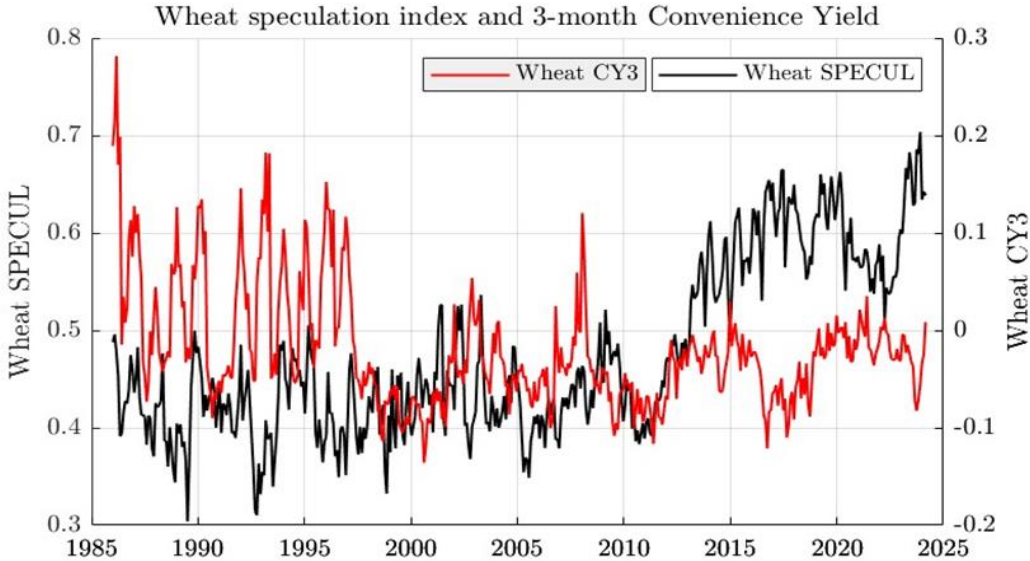

Agricultural 3-month convenience yields (CY3)

Seasonalities in agricultural convenience yields
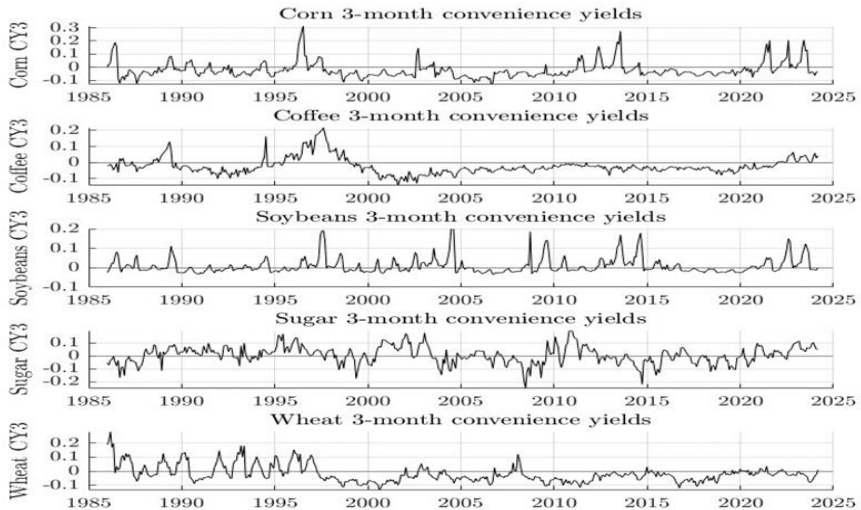
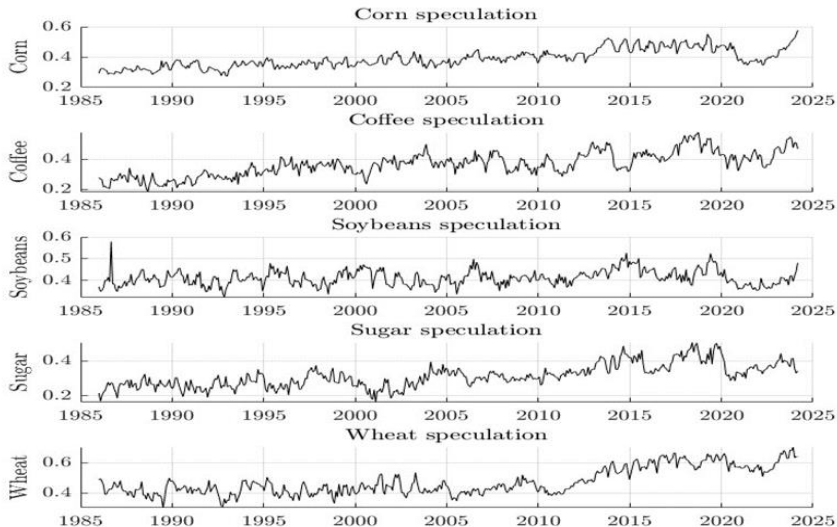Seasonal agricultural 3-month convenience yields (CY3)

Wheat speculation and convenience yields

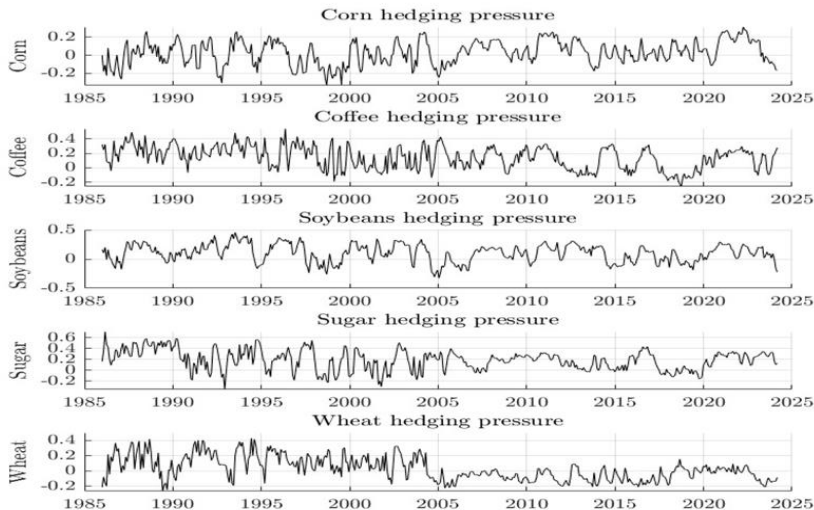Wheat speculation index and 3-month Convenience Yield

Speculation in agricultural futures markets

Speculation in agricultural commodity futures markets

Hedging pressure in agricultural futures markets

Hedging pressure in agricultural commodity futures markets

Descriptive statistics for agricultural convenience yields

Full sample (Jan 1986-Feb 2024)					
	CORN CY3	**COFFEE CY3**	**SOYBEANS CY3**	**SUGAR CY3**	**WHEAT CY3**
Mean	-0.0214	-0.0233	0.0098	0.0052	-0.0200
Median	-0.0361	-0.0319	-0.0041	0.0052	-0.0321
Maximum	0.3130	0.2160	0.2928	0.1945	0.2814
Minimum	-0.1299	-0.1424	-0.0349	-0.2508	-0.1357
Std. Dev.	0.0611	0.0510	0.0420	0.0678	0.0610
Skewness	2.1622	1.6988	2.5669	-0.1600	1.3870

Pre-financialization sample (Jan 1987-Dec 2003)					
	CORN CY3	**COFFEE CY3**	**SOYBEANS CY3**	**SUGAR CY3**	**WHEAT CY3**
Mean	-0.0201	-0.0152	0.0071	0.0203	0.0010
Median	-0.0349	-0.0276	-0.0033	0.0227	-0.0234
Maximum	0.3130	0.2160	0.1906	0.1763	0.2814
Minimum	-0.1254	-0.1424	-0.0325	-0.1754	-0.1357
Std. Dev.	0.0614	0.0685	0.0348	0.0648	0.0760
Skewness	2.2419	1.1248	2.5059	-0.2752	0.8118

Post-financialization sample (Jan 2004-Feb 2024)					
	CORN CY3	**COFFEE CY3**	**SOYBEANS CY3**	**SUGAR CY3**	**WHEAT CY3**
Mean	-0.0226	-0.0306	0.0123	-0.0082	-0.0389
Median	-0.0364	-0.0340	-0.0058	-0.0111	-0.0352
Maximum	0.2741	0.0650	0.2928	0.1945	0.1204
Minimum	-0.1299	-0.0939	-0.0349	-0.2508	-0.1212
Std. Dev.	0.0610	0.0253	0.0475	0.0676	0.0340
Skewness	2.0914	1.1082	2.4231	-0.0427	0.4467

SVAR model

- We estimate the SVAR model with the following VAR ordering:

$$Z_t = [RV_t \quad SPECUL_t \quad HP_t \quad CY3_t]$$

The SVAR model representation is:

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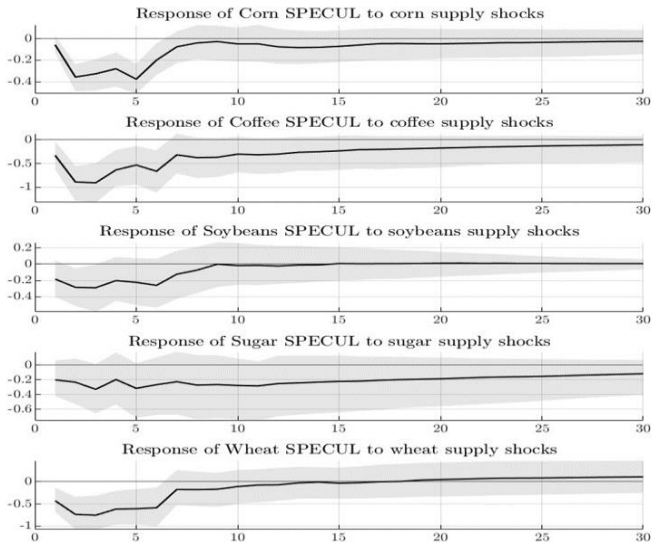$$A_0 Z_t = b + \sum_{i=1}^{h} A_i Z_{t-i} + \varepsilon_t$$

The matrix Ao has a recursive structure such as the reduced form innovations are decomposed as shown below:

$$e_t = \begin{bmatrix} e_t^{RV} \\ e_t^{SPECUL} \\ e_t^{HP} \\ e_t^{CY3} \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix} \begin{bmatrix} e_t^{commodity\ supply\ shock} \\ e_t^{speculative\ demand\ shock} \\ e_t^{hedging\ demand\ shock} \\ e_t^{convenience\ yield\ shock} \end{bmatrix}$$
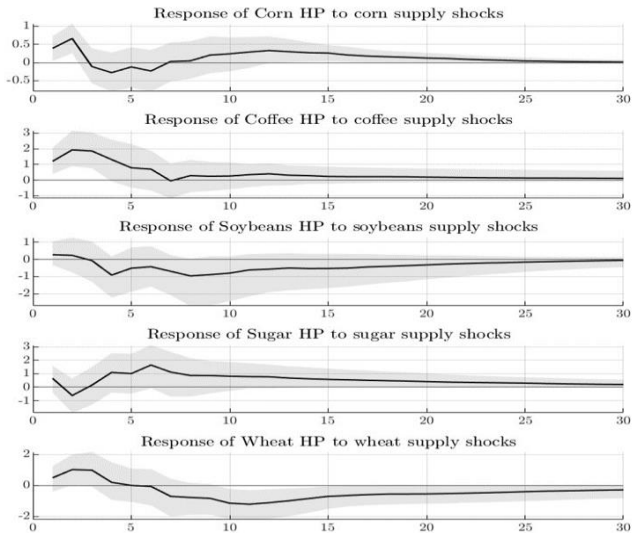
Impulse Response Functions
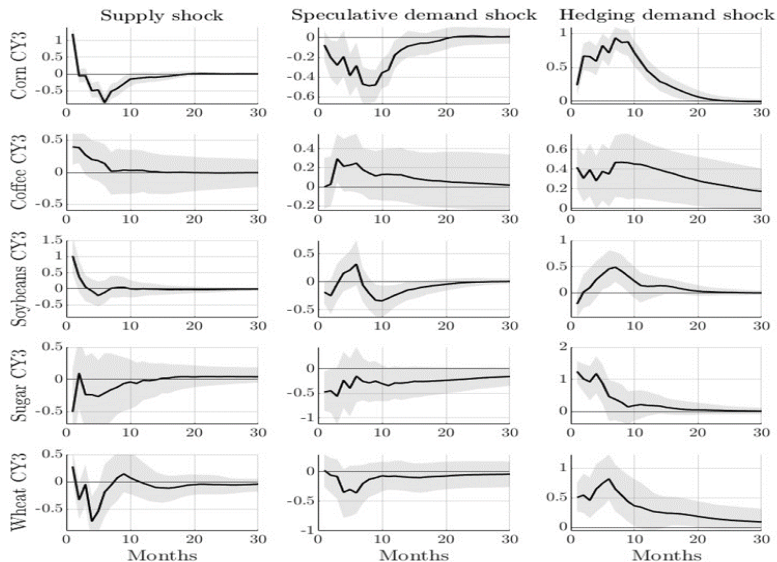
Response of speculation to supply shocks

Response of Corn SPECUL to corn supply shocks

Response of Coffee SPECUL to coffee supply shocks

Response of Soybeans SPECUL to soybeans supply shocks

Response of Sugar SPECUL to sugar supply shocks

Response of Wheat SPECUL to wheat supply shocks

Response of hedging pressure to supply shocks

Response of Corn HP to corn supply shocks

Response of Coffee HP to coffee supply shocks

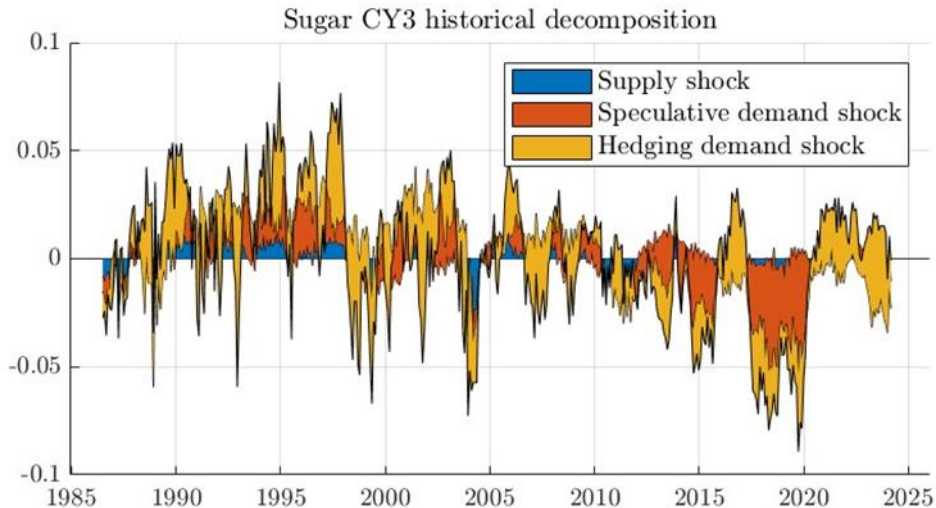Response of Soybeans HP to soybeans supply shocks

Response of Sugar HP to sugar supply shocks

Response of Wheat HP to wheat supply shocks

Soybeans historical decomposition of shocks

Soybeans CY3 historical decomposition

Sugar historical decomposition of shocks
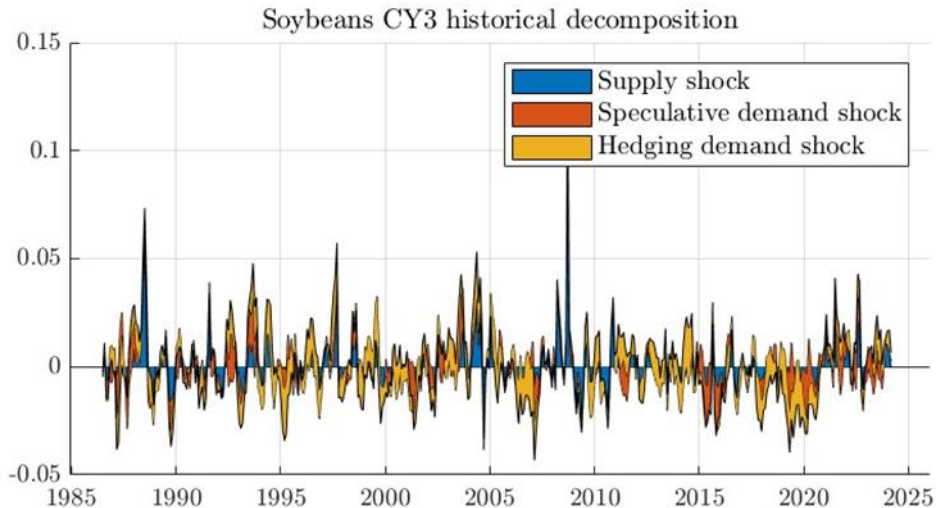
Sugar CY3 historical decomposition

Conclusions

- We show that there is a downward trend in agricultural convenience yields, becoming negative on average in the post-2000 period.

- Speculative demand shocks result to decreasing agricultural convenience yields.

- The most significant factor driving the dynamics of convenience yields is hedging pressure (theory of normal backwardation). Soybeans is an exemption.

- Future research: what happens in energy and metals commodity futures markets? More detailed information on the types of traders in commodity futures markets would provide more insights.

Policy Implications

- Where is the convenience if the market share of speculators is rising? Is there a significant need for physical delivery of commodities in agricultural commodity futures markets?

- Rarer backwardations in agricultural futures markets-have they changed, is speculation the reason for these much rarer backwardations? Have they become more of a financial and less of a physical market?

- Investors should expect more contangoed (backwarded) agricultural futures markets in times of unexpected speculative (hedging) demand shocks.