

# Financialization of commodity markets: A multi-methodological approach on a controversial issue

Mayer H., Rathgeber A., Stöckl S., Wanner M.

Working Paper, University of Augsburg and ICN  
Business School Nancy-Metz - CERFIGE, 2015

Opening Conference of the Thematic Semester on "Commodity  
Derivatives Markets: Industrial Organization, Regulation and  
Financialization"

**University of Augsburg  
Prof. Dr. Andreas Rathgeber**

Professorship of Business Informatics, Finance &  
Information Management  
Institut of Materials Resource Management  
[www.mrm.uni-augsburg.de](http://www.mrm.uni-augsburg.de)

# Outline

---

- (1) Motivation
- (2) The controversial debate
- (3) Research design and first results
- (4) Discussion and further analysis
- (5) Conclusion & Outlook

- (1) Motivation**
- (2) The controversial debate
- (3) Research design and first results
- (4) Discussion and further analysis
- (5) Conclusion & Outlook

## Motivation (I)

- **Strong fluctuations and increases of commodity prices** in the last decade
- **Massive growth of commodity related investments** in commodity futures markets
- Besides for traditional market participants, **commodity futures** have become a **new asset class for portfolio investors**
- Emerging **financialization** of commodity (futures) markets



This development has led to **renewed interest** in the **effect** of **commodity futures trading** on **spot markets**.

## Motivation (II)

- The general perception (e.g. of policymakers and practitioners) is that **speculators** in the futures markets are **responsible for commodity price fluctuations** (e.g. “**Masters Hypothesis**”).

→ Some **regulatory changes** were introduced in order **to stabilize** the market by restricting speculative trading (e.g. Dodd-Frank Act).

- The **academic debate continues** over whether commodity price fluctuation is due to futures **speculation or economic fundamentals\***



\*see Fattouh et al. 2012 or Cheng and Xiong 2013

## Outline

---

- (1) Motivation
- (2) The controversial debate**
- (3) Research design and first results
- (4) Discussion and further analysis
- (5) Conclusion & Outlook

# Theoretical and empirical background



In theory, the **futures market contributes to market completion**, an increase in market depth, and information dissemination\*.

→ Therefore, **trading in futures markets stabilizes the spot market.**



Other authors argue that once **badly informed speculators** trade in the futures market to take advantage of lower transaction costs and higher leverage

→ **the benefits of futures markets diminish**

\*Danthine, 1978; Kyle, 1985; Grossmann, 1988; Froot and Perold, 1995

\* Hart and Kreps, 1986; Stein, 1987

# Current state of research

Name	Year	Commodity	Time frame	Data source of trading activity	Influence <sup>1</sup>	Methodology
Bessembinder and Seguin	1993	Agricultures, metals	1982-1990	Columbia Business School Futures Center, Data Resources Inc.	Yes (V)	Regression
Bohl et al.	2012	Agricultures	2006-2011	CFTC	No (V)	Regression
Bohl and Stephan	2013	Agricultures, Energy	1992-2012	CFTC	No (V)	Regression (GARCH)
Brunetti and Büyüksahin	2009	Oil, gas, agricultures	2005-2009	CFTC	No (P) Yes (V)	Granger-causality
Brunetti, Büyüksahin, and Harris	2011	Oil, gas, agricultures	2005-2009	CFTC	No (P) Yes (V)	Granger-causality
Büyüksahin and Harris	2009	Oil	2000-2009	CFTC	No (P)	Granger-causality
Bryant, Bessler, and Haigh	2006	Gold	1995-2003	CFTC	No (V)	Causality analysis
Chatrath and Song	1999	Agricultures	1983-1995	CFTC	Yes (V)	Regression
Gilbert	2010a	Oil, metal, agricultures	2006-2008	CFTC	Yes (P)	Granger-causality
Gilbert	2010b	Agricultures	2006-2008	CFTC	Yes (P)	Granger-causality
Irwin and Sanders	2010	Agricultures, gas	2006-2009	CFTC	No (P) Yes (V)	Granger-causality
Irwin and Sanders	2012a	Oil, gas	2007-2011	CFTC	No (P) No (V)	Granger-causality
Irwin et al.	2009	Oil	1995-2006	CFTC	No (P)	Granger-causality
Kocagil	1997	Metals	1980-1990	Simulation	No (V)	Monte Carlo Simulation & Regression
Mayer	2012	Oil, metals, agricultures	2006-2009	CFTC	Yes (P)	Granger-causality
Mutafoglu et al.	2012	Metals	1993-2009	CFTC	No (P)	Granger-causality
Robles et al.	2009	Agricultures	2002-2008	CFTC	Yes (P)	Granger-causality
Sanders and Irwin	2010	Agricultures	2006-2008	CFTC	No (P)	Regression analysis
Sanders et al.	2004	Oil, gas	1992-1999	CFTC	No (P)	Granger-causality
Yang et al.	2005	Agricultures	1992-2001	Datastream	Yes (V)	Granger-causality

# The controversial debate

- **Polarized views** on whether **financial investors** (speculative futures trading) have **destabilized commodity markets** in terms of, e.g.
  - commodity prices
  - volatility and
  - market quality.



Name	Year	Commodity	Time frame	Data source of trading	Influence <sup>1</sup>	Methodology
Bessembinder and Seguin	1993	Agricultures, metals	1982-1990	Columbia Business School Data Resources Inc.	Yes (V)	Regression
Bohl et al.	2006	Agriculture	1992-2011	CFTC	No (V)	Regression
Bohl and Stephan	2013	Agricultures, Energy	1992-2012	CFTC	No (V)	Regression
Brunetti and Büyüksahin	2009	Oil, gas, agricultures	2005-2009	CFTC	No (P) Yes (V)	Regression
Brunetti, Büyüksahin, and Harris	2011	Oil, gas, agricultures	2005-2009	CFTC	No (P) Yes (V)	Regression
Büyüksahin and Harris	2012	Oil, gas, agricultures	2000-2009	CFTC	No (P)	Regression
Bryant, Bessler, and Haigh	2006	Oil, gas, agricultures	1995-2003	CFTC	No (V)	Regression
Chatrath and Song	1999	Agricultures	1983-1995	CFTC	Yes (V)	Regression



**Ambiguity of results** in literature, the issue seems to be unsolved. In other words, the **results are inconclusive** so far.



Do **financial investors** really **influence/destabilize commodity markets?**

What are the reasons for the **ambiguous results** in literature?

Yang et al.	2005	Agricultures	1992-2001	DataStream	Yes (V)	Granger-causality
-------------	------	--------------	-----------	------------	---------	-------------------

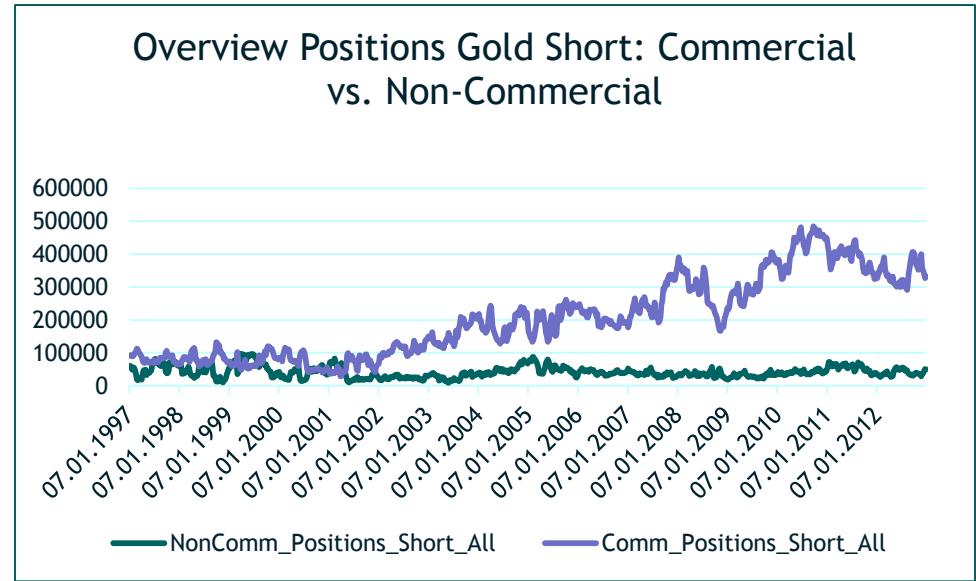
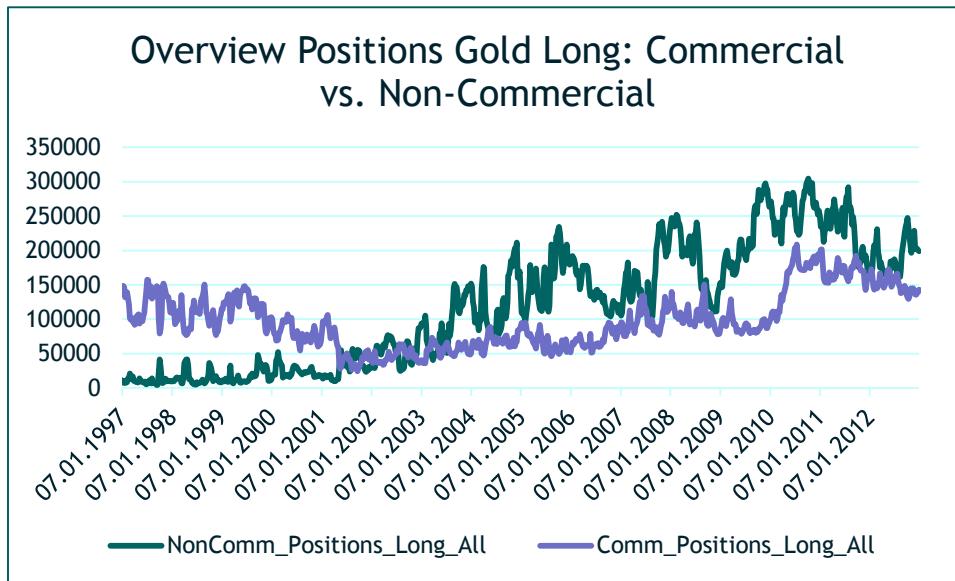
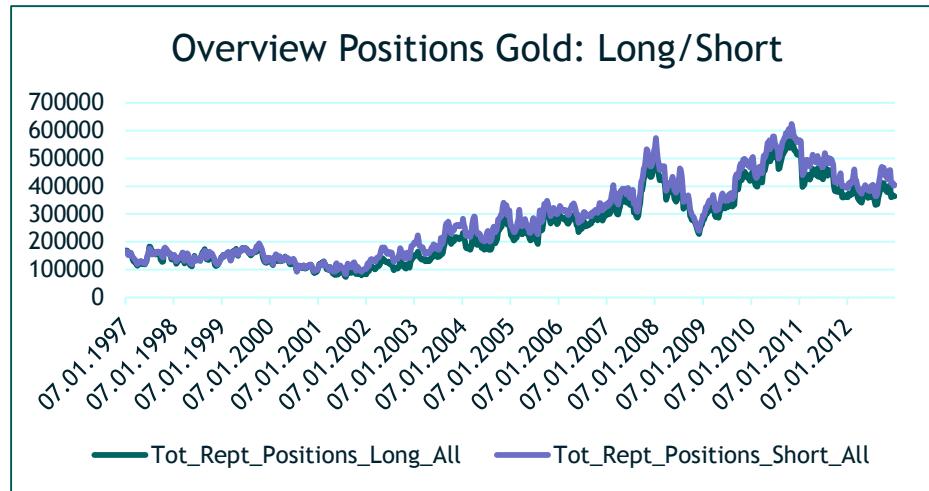
# Previous own research for metals

## *Financialization of metal commodity markets: Does futures trading influence spot prices and volatility?*

(Mayer, H., Rathgeber, A., Wanner, M.)



- Major metals: copper, gold, platinum, palladium and silver
- Timeframe from **January 1993 to December 2013** in a weekly frequency (20 years, 1095 observations)
  - Full time frame and
  - Sub-sample with time frames of 3 years
- Weekly trading data from **CFTC Commitments of Traders COT reports**
  - Open interest
  - Number of Traders
  - Total reportable positions-long
    - non-commercial positions-long
    - commercial positions-long
  - Total reportable positions-short
    - non-commercial positions-short
    - commercial positions-short



# Methodology: Indicators

- Indicators of trading activity (CFTC COT reports)



absolute measures					
open interest <b>(OI)</b>	number of traders <b>(NT)</b>	total reportable positions-long <b>(TRL)</b>	total reportable positions- short <b>(TRS)</b>	commercial positions- long <b>(CL)</b>	commercial positions- short <b>(CS)</b>
relative measures					
ratio of open interest to number of traders	ratio of commercial long positions to total reportable long positions	ratio of commercial short positions to total reportable short positions	ratio of non- commercial long positions to total reportable long positions	ratio of non- commercial short positions to total reportable short positions	ratio of open interest to number of traders
<b>(OI/NT)</b>	<b>(CL/TRL)</b>	<b>(CS/TRS)</b>	<b>(NCL/TRL)</b>	<b>(NCS/TRS)</b>	<b>(OI/NT)</b>
ratio of commercial long positions to total reportable long positions					
					<b>(CL/TRL)</b>

# Methodology

## Bidirectional Granger-causality test

$$R_t^{S,V} = \phi + \sum_{i=1}^m \lambda_i R_{t-i}^{S,V} + \sum_{i=1}^n \theta_j X_{t-i}^F + \varepsilon_t$$

$$X_t^F = \phi + \sum_{i=1}^m \lambda_i X_{t-i}^F + \sum_{i=1}^n \theta_j R_{t-i}^{S,V} + \varepsilon_t$$



$R_t^{S,V}$  is the weekly logarithmic return of spot price  $S$  or volatility  $V$ .

$X_t^F$  denotes the logarithmic weekly change in the respective proxy for futures trading activity  $F$ , where

$$F \in \{\text{OI}, \text{NT}, \text{TRL}, \text{TRS}, \text{CL}, \text{CS}, \text{NCL}, \text{NCS}, \frac{\text{OI}}{\text{NT}}, \frac{\text{CL}}{\text{TRL}}, \frac{\text{CS}}{\text{TRS}}, \frac{\text{NCL}}{\text{TRL}}, \frac{\text{NCS}}{\text{TRS}}\}$$

# Results (1993-2013)

→ Spot price granger causing trading positions (full time frame)

Period	Com.	OI <sup>a</sup>	NT	TRL	TRS	CL	CS	NCL	NCS	OI/ NT	CL/ TRL	CS/ TRS	NCL/ TRL	NCS/ TRS
Jan 93- Dec 13	Ag <sup>b</sup>	0.317	0.017*	0.130	0.130	0.123	0.001***	0.007**	0.002**	0.113	0.031*	0.061	0.006**	0.000***
	Au	0.194	0.431	0.109	0.114	0.015*	0.121	0.095	0.143	0.020*	0.126	0.253	0.124	0.060
	Co	0.020*	0.010*	0.105	0.002**	0.113	0.000***	0.000***	0.012*	0.366	0.006**	0.002**	0.000***	0.001**
	Pd <sup>c</sup>	0.064	0.150	0.035*	0.110	0.236	0.019*	0.001***	0.318	0.001**	0.115	0.140	0.000***	0.042*
	Pl	0.269	0.009**	0.110	0.121	0.013*	0.163	0.610	0.515	0.520	0.276	0.328	0.520	0.214
# of significant values < 0.05		1	3	1	1	2	3	3	2	2	2	1	3	3
														27

→ Trading positions granger causing spot price (full time frame)

Period	Com.	OI <sup>a</sup>	NT	TRL	TRS	CL	CS	NCL	NCS	OI/ NT	CL/ TRL	CS/ TRS	NCL/ TRL	NCS/ TRS
Jan 93- Dec 13	Ag <sup>b</sup>	0.116	0.909	0.384	0.368	0.939	0.674	0.263	0.965	0.455	0.905	0.811	0.986	0.963
	Au	0.458	0.485	0.652	0.369	0.040*	0.916	0.962	0.660	0.914	0.003**	0.996	0.981	0.889
	Co	0.905	0.836	0.547	0.969	0.148	0.208	0.889	0.494	0.268	0.328	0.408	0.619	0.605
	Pd <sup>c</sup>	0.059	0.447	0.053	0.006**	0.009**	0.002**	0.256	0.419	0.177	0.039*	0.272	0.353	0.873
	Pl	0.464	0.744	0.377	0.492	0.061	0.750	0.701	0.904	0.339	0.320	0.599	0.320	0.973
# of significant values < 0.05		0	0	0	1	2	1	0	0	0	2	0	0	0
														6

- **Less evidence** for futures positions driving spot prices.
- **More indication** for spot price causing traders' positions

# Results (1993-2013)

→ Spot price granger causing trading positions (full time frame)

Period	Com.	OI <sup>a</sup>	NT	TRL	TRS	CL	CS	NCL	NCS	OI/ NT	CL/ TRL	CS/ TRS	NCL/ TRL	NCS/ TRS	
Jan 93- Dec 13	Ag <sup>b</sup>	0.317	0.017*	0.130	0.130	0.123	0.001***	0.007**	0.002**	0.113	0.031*	0.061	0.006**	0.000***	7
	Au <sup>c</sup>	0.194	0.431	0.100	0.114	0.015*	0.121	0.095	0.143	0.020*	0.126	0.253	0.124	0.060	2
	Co	0.020*	0.010*	0.105	0.002**	0.113	0.000***	0.000***	0.012*	0.366	0.006**	0.002**	0.000***	0.001**	10
	Pd <sup>c</sup>	0.064	0.150	0.055*	0.110	0.236	0.019*	0.001***	0.318	0.001**	0.115	0.140	0.000***	0.042*	6
	Pl	0.269	0.009**	0.110	0.121	0.013*	0.163	0.610	0.515	0.520	0.276	0.328	0.520	0.214	2
# of significant values < 0.05		1	3	1	1	2	3	3	2	2	2	1	3	3	27

→ Trading positions granger causing spot price (full time frame)

Period	Com.	OI <sup>a</sup>	NT	TRL	TRS	CL	CS	NCL	NCS	OI/ NT	CL/ TRL	CS/ TRS	NCL/ TRL	NCS/ TRS	
Jan 93- Dec 13	Ag <sup>b</sup>	0.116	0.909	0.384	0.368	0.939	0.674	0.263	0.965	0.455	0.905	0.811	0.986	0.963	0
	Au <sup>c</sup>	0.458	0.485	0.652	0.369	0.040*	0.916	0.962	0.660	0.914	0.003**	0.996	0.981	0.889	2
	Co	0.905	0.836	0.547	0.969	0.148	0.208	0.889	0.494	0.268	0.328	0.408	0.619	0.605	0
	Pd <sup>c</sup>	0.059	0.447	0.053	0.006**	0.009**	0.002**	0.256	0.419	0.177	0.039*	0.272	0.353	0.873	4
	Pl	0.464	0.744	0.377	0.492	0.061	0.750	0.701	0.904	0.339	0.320	0.599	0.320	0.973	0
# of significant values < 0.05		0	0	0	1	2	1	0	0	0	2	0	0	0	6

# Results – extract (sub-samples)

→ Trading positions granger causing spot price (sub samples)

Period	Com.	OI <sup>a</sup>	NT	TRL	TRS	CL	CS	NCL	NCS	OI/ NT	CL/ TRL	CS/ TRS	NCL/ TRL	NCS/ TRS
Jan 93- Dec 95	Ag <sup>b</sup>	0.637	0.537	0.783	0.628	0.678	0.357	0.293	0.264	0.965	0.930	0.409	0.666	0.263
	Au	0.934	0.070	0.561	0.838	0.841	0.745	0.904	0.872	0.148	0.444	0.820	0.607	0.842
	Co	0.414	0.615	0.616	0.478	0.707	0.809	0.750	0.400	0.275	0.983	0.223	0.953	0.370
	Pd <sup>c</sup>	0.556	0.630	0.750	0.595	0.360	0.956	0.449	0.157	0.658	0.308	0.837	0.214	0.462
	Pl	0.704	0.880	0.867	0.744	0.496	0.344	0.976	0.367	0.520	0.866	0.544	0.313	0.365
Jan 96- Dec 98	Ag	0.917	0.383	0.425	0.831	0.308	0.312	0.447	0.784	0.877	0.211	0.369	0.130	0.800
	Au	0.772	0.119	0.273	0.588	0.497	0.033*	0.798	0.298	0.440	0.477	0.094	0.990	0.494
	Co	0.322	0.506	0.662	0.168	0.720	0.128	0.761	0.799	0.983	0.228	0.154	0.438	0.856
	Pd	0.900	0.385	0.517	0.869	0.248	0.746	0.736	0.449	0.406	0.448	0.476	0.172	0.082
	Pl	0.258	0.310	0.109	0.452	0.056	0.015*	0.159	0.527	0.978	0.318	0.044*	0.021*	0.530
Jan 99-Dec 01	Ag	0.552	0.210	0.283	0.476	0.803	0.009**	0.118	0.167	0.086	0.320	0.159	0.400	0.072
	Au	0.940	0.773	0.841	0.570	0.927	0.196	0.416	0.031*	0.255	0.133	0.196	0.381	0.092
	Co	0.280	0.033*	0.272	0.179	0.180	0.135	0.024*	0.262	0.851	0.115	0.880	0.200	0.180
	Pd	/	/	/	/	/	/	/	/	/	/	/	/	/
	Pl	0.568	0.593	0.107	0.900	0.633	0.863	0.900	0.563	0.899	0.672	0.782	0.849	0.570
Jan 02-Dec 04	Ag	0.152	0.232	0.101	0.065	0.203	0.062	0.092	0.376	0.990	0.239	0.552	0.385	0.238
	Au	0.539	0.884	0.849	0.882	0.663	0.705	0.893	0.926	0.156	0.853	0.493	0.843	0.931
	Co	0.217	0.528	0.157	0.145	0.995	0.369	0.431	0.170	0.244	0.241	0.405	0.827	0.236
	Pd	/	/	/	/	/	/	/	/	/	/	/	/	/
	Pl	0.857	0.913	0.745	0.904	0.730	0.680	0.811	0.333	0.975	0.848	0.495	0.614	0.536
Jan 05-Dec 07	Ag	0.255	0.221	0.331	0.135	0.660	0.057	0.678	0.802	0.306	0.380	0.320	0.783	0.670
	Au	0.675	0.975	0.691	0.814	0.353	0.562	0.541	0.363	0.837	0.512	0.252	0.223	0.440
	Co	0.961	0.204	0.841	0.541	0.565	0.354	0.937	0.477	0.069	0.961	0.183	0.985	0.257
	Pd	0.005**	0.048*	0.001**	0.002**	0.000***	0.001***	0.778	0.448	0.000***	0.000***	0.352	0.018*	0.125
	Pl	0.525	0.642	0.509	0.520	0.361	0.551	0.974	0.696	0.100	0.491	0.350	0.173	0.852
Jan 08-Dec 10	Ag	0.682	0.123	0.927	0.814	0.023*	0.196	0.010**	0.251	0.251	0.005**	0.125	0.005**	0.214
	Au	0.278	0.743	0.145	0.100	0.262	0.155	0.039*	0.005**	0.187	0.370	0.719	0.389	0.012*
	Co	0.124	0.213	0.026*	0.028*	0.604	0.181	0.008**	0.299	0.826	0.035*	0.560	0.047*	0.491
	Pd	0.558	0.705	0.146	0.308	0.044*	0.242	0.785	0.197	0.888	0.078	0.566	0.893	0.393
	Pl	0.042*	0.299	0.142	0.047*	0.005**	0.023*	0.037*	0.005**	0.832	0.059	0.000***	0.120	0.007**
Jan 11-Dec 13	Ag	0.352	0.814	0.346	0.080	0.511	0.055	0.176	0.512	0.697	0.898	0.995	0.489	0.630
	Au	0.758	0.367	0.358	0.095	0.242	0.780	0.965	0.503	0.045*	0.688	0.259	0.762	0.629
	Co	0.088	0.448	0.070	0.110	0.016*	0.191	0.401	0.244	0.409	0.358	0.832	0.560	0.780
	Pd	0.752	0.576	0.339	0.400	0.258	0.295	0.749	0.266	0.179	0.358	0.191	0.214	0.256
	Pl	0.803	0.978	0.955	0.740	0.450	0.896	0.851	0.125	0.837	0.464	0.579	0.676	0.182

# of significant values < 0.05

2

2

2

3

5

5

5

3

2

3

2

4

2

40

# Results – extract (sub-samples)

→ Trading positions granger causing spot price (sub samples)

Period	Com.	OI <sup>a</sup>	NT	TRL	TRS	CL	CS	NCL	NCS	OI/ NT	CL/ TRL	CS/ TRS	NCL/ TRL	NCS/ TRS
Jan 93- Dec 95	Ag <sup>b</sup>	0.637	0.537	0.783	0.628	0.678	0.357	0.293	0.264	0.965	0.930	0.409	0.666	0.263
	Au	0.934	0.070	0.561	0.838	0.841	0.745	0.904	0.872	0.148	0.444	0.820	0.607	0.842
	Co	0.414	0.615	0.616	0.478	0.707	0.809	0.750	0.400	0.275	0.983	0.223	0.953	0.370
	Pd <sup>c</sup>	0.556	0.630	0.750	0.595	0.360	0.956	0.449	0.157	0.658	0.308	0.837	0.214	0.462
	Pl	0.704	0.880	0.867	0.744	0.496	0.344	0.976	0.367	0.520	0.866	0.544	0.313	0.365
Jan 96- Dec 98	Ag	0.917	0.383	0.425	0.831	0.308	0.312	0.447	0.784	0.877	0.211	0.369	0.130	0.800
	Au	0.772	0.119	0.273	0.588	0.497	0.033*	0.798	0.298	0.440	0.477	0.094	0.990	0.494
	Co	0.322	0.506	0.662	0.168	0.720	0.128	0.761	0.799	0.983	0.228	0.154	0.438	0.856
	Pd	0.900	0.385	0.517	0.869	0.248	0.746	0.736	0.449	0.406	0.448	0.476	0.172	0.082
	Pl	0.258	0.310	0.109	0.452	0.056	0.015*	0.159	0.527	0.978	0.318	0.044*	0.021*	0.530
Jan 99-Dec 01	Ag	0.552	0.210	0.283	0.476	0.803	0.009**	0.118	0.167	0.086	0.320	0.159	0.400	0.072
	Au	0.940	0.773	0.841	0.570	0.927	0.196	0.416	0.031*	0.255	0.133	0.196	0.381	0.092
	Co	0.280	0.033*	0.272	0.179	0.180	0.135	0.024*	0.262	0.851	0.115	0.880	0.200	0.180
	Pd	/	/	/	/	/	/	/	/	/	/	/	/	/
	Pl	0.568	0.593	0.107	0.900	0.633	0.863	0.900	0.563	0.899	0.672	0.782	0.849	0.570
Jan 02-Dec 04	Ag	0.152	0.232	0.101	0.065	0.203	0.062	0.092	0.376	0.990	0.239	0.552	0.385	0.238
	Au	0.539	0.884	0.849	0.882	0.663	0.705	0.893	0.926	0.156	0.853	0.493	0.843	0.931
	Co	0.217	0.528	0.157	0.145	0.995	0.369	0.431	0.170	0.244	0.241	0.405	0.827	0.236
	Pd	/	/	/	/	/	/	/	/	/	/	/	/	/
	Pl	0.857	0.913	0.745	0.904	0.730	0.680	0.811	0.333	0.975	0.848	0.495	0.614	0.536
Jan 05-Dec 07	Ag	0.255	0.221	0.331	0.135	0.660	0.057	0.678	0.802	0.306	0.380	0.320	0.783	0.670
	Au	0.675	0.975	0.691	0.814	0.353	0.562	0.541	0.363	0.837	0.512	0.252	0.223	0.440
	Co	0.961	0.204	0.841	0.541	0.565	0.354	0.937	0.477	0.069	0.961	0.183	0.985	0.257
	Pd	0.005**	0.048*	0.001**	0.002**	0.000***	0.001***	0.778	0.448	0.000***	0.000***	0.352	0.018*	0.125
	Pl	0.252	0.814	0.212	0.880	0.511	0.855	0.176	0.512	0.809	0.059	0.000***	0.120	0.007**
Jan 08-Dec 10	Ag	0.682	0.123	0.927	0.814	0.023*	0.196	0.010**	0.251	0.251	0.005**	0.125	0.005**	0.214
	Au	0.278	0.743	0.145	0.100	0.262	0.155	0.039*	0.005**	0.187	0.370	0.719	0.389	0.012*
	Co	0.124	0.213	0.026*	0.028*	0.604	0.181	0.008**	0.299	0.826	0.035*	0.560	0.047*	0.491
	Pd	0.558	0.705	0.146	0.308	0.044*	0.242	0.785	0.197	0.888	0.078	0.566	0.893	0.393
	Pl	0.042*	0.299	0.142	0.047*	0.005**	0.023*	0.037*	0.005**	0.832	0.059	0.000***	0.120	0.007**
Jan 11-Dec 13	Ag	0.758	0.367	0.358	0.095	0.242	0.780	0.965	0.503	0.045*	0.688	0.259	0.762	0.629
	Au	0.088	0.448	0.070	0.110	0.016*	0.191	0.401	0.244	0.409	0.358	0.832	0.560	0.780
	Co	0.752	0.576	0.339	0.400	0.258	0.295	0.749	0.266	0.179	0.358	0.191	0.214	0.256
	Pd	0.803	0.978	0.955	0.740	0.450	0.896	0.851	0.125	0.837	0.464	0.579	0.676	0.182
	Pl	0.252	0.814	0.212	0.880	0.511	0.855	0.176	0.512	0.809	0.059	0.000***	0.120	0.007**

# of significant values < 0.05

2

2

2

3

5

5

5

3

2

3

2

4

2

40

## Intermediate Results

- **Less significant influence** of financialization on **metal spot price** levels in **the long run** (supporting e.g. Sanders, Irwin et al. (2004, 2009, 2012), Büyüksahin and Harris (2009))
- **Slightly higher influence** on **spot price volatility**
- Evidence can be found partially by regarding **individual commodities** or **specific time frames** (e.g. financial crisis)



**Less evidence using linear Granger Causality models.**  
**But: Is this relationship really linear?**

# Methodological Issues



Current test results are commodity specific and cannot easily be aggregated for an overall statement.



## Extension 1: We apply a Panel Granger Causality test

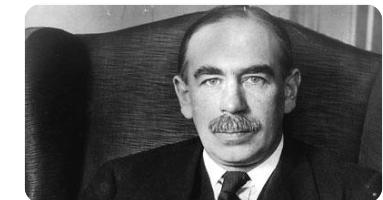


Expected movement in drivers are adapted by market participants. Only unexpected changes lead to price changes in general (Bessembinder and Seguin 1993).



## Extension 2: We distinguish between expected and unexpected terms

**Keynes:** *A specific amount of speculative traders is necessary for functional markets, whereas a high amount can be harmful...*



Relationship between speculative trading and spot prices might be non-linear.



## Extension 3: We apply a non-linear Granger Causality tests

# Outline

---

- (1) Motivation
- (2) The controversial debate
- (3) Research design and first results**
- (4) Discussion and further analysis
- (5) Conclusion & Outlook

# Panel Granger Test

- Test on average Wald statistics according to  
**Dumitrescu, E.I, Hurlin, C. (2011)**
- **Idea:** x and y; two stationary variables observed for N commodities on T periods.
- The null hypothesis of Homogenous Non-Causality:
  - $H_0: \beta_i = 0$  for all  $i = 1,.., N$
  - $H_1: \beta_i <> 0$  for all  $i = 1, ..., N_1$
  - $\beta_i = 0$   $i = N_1 + 1, ..., N$
- Estimation of restricted and unrestricted model
- Comparision by Wald Teststatistics (Chi^2 distributed)

# Panel Granger - Results

Period	Lag.	NOT	OI/NOT	NCL	NCS	TRL	TRS	NCL/TRL	NCS/TRS	CL	CS	CL/TRL	CS/TRS
Jan 93- Dec 13	1	0.41	0.42	1.81	1.24	1.66	0.63	0.31	0.71	0.29	2.45	0.48	1.09
	2	1.10	2.01	2.50	1.46	1.50	0.96	0.78	2.48	0.95	3.26	0.59	1.72
	3	2.36	2.21	4.13	2.12	1.81	1.65	1.90	3.22	1.18	4.89	1.39	2.65
	4	4.28	3.35	5.06	2.95	2.85	3.82	3.88	5.08	1.35	6.36	2.98	4.14
	5	4.51	3.55	6.04	3.40	3.40	4.31	4.27	6.01	2.26	7.48	3.03	4.94
	6	4.59	4.11	5.87	3.79	3.73	4.55	4.22	7.42	3.77	8.06	3.10	5.92
	7	5.61	5.50	6.90	4.76	4.01	5.82	5.33	8.23	4.37	9.38	4.52	6.72
	8	6.83	7.08	6.97	5.00	5.20	6.88	6.17	9.00	5.19	12.68	5.10	7.40
	9	9.86	7.31	9.68	5.93	5.81	9.13	9.39	10.93	5.88	13.44	7.87	9.39
	10	10.69	8.16	11.03	6.11	6.11	9.80	10.08	12.20	6.46	14.94	9.07	10.90

In Panel test no significant results, even after adjusting the laglength

# Unexpected / expected Terms

- Following **Bessembinder and Seguin (1992) in JFQA**, Trader's position are partitioned into three components:
  - Expected, unexpected and long-term variation.
- Moving Average (MA) deducting a 100-day moving average for positions (log Variables)
- *Expected* and *unexpected* using a multivariate vector autoregression (VAR) model:
- $Y_t = a + Y_{t-lag} + controls + error$
- where  $Y_t$  is the transpose of a vector, [Speculators' position, Hedgers' position, Futures volume, ...].
- MA is long-term variation, unexpected is error,  $\hat{Y}$  is expected.

# Unexpected / Expected - Results

	Expected				Moving Average				Unexpected					
Period	NCL	NCS	TRL	TRS	NCL	NCS	TRL	TRS	NCL	NCS	TRL	TRS		
Jan 93- Dec 13	Au	0.726	0.463	0.760	0.153	0.813	0.332	0.032	0.011	0.041	2.961	0.006	0.300	<b>0</b>
	Ag	0.166	2.838	0.198	0.198	0.988	<b>6.279***</b>	0.556	0.338	2.640	<b>4.782**</b>	0.598	<b>3.022*</b>	<b>2</b>
	Co	0.969	0.160	0.301	0.191	0.493	<b>3.368*</b>	0.279	0.391	0.975	0.025	0.000	0.697	<b>0</b>
	Pd <sup>c</sup>	0.643	1.129	0.699	0.765	0.083	0.072	0.508	0.507	0.005	0.188	0.675	0.675	<b>0</b>
	Pl	0.081	0.144	0.022	0.059	1.184	0.188	0.029	0.019	0.420	0.204	2.216	0.610	<b>0</b>
# of significant values < 0.05		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>2</b>

- Rarely significant results.
- Only silver is sometimes significant.
- These results might be more or less spurious

# Panel Unexpected - Results

Period	Lag.	Expected				Moving Average				Unexpected			
		NCL	NCS	TRL	TRS	NCL	NCS	TRL	TRS	NCL	NCS	TRL	TRS
Jan 93- Dec 13	1	0.31	0.99	0.34	0.21	0.61	2.02	0.28	0.29	0.82	1.63	0.73	0.90
	2	1.10	1.69	1.46	1.51	0.93	2.35	0.57	0.53	4.96*	3.13	0.83	2.01
	3	2.39	2.06	3.01	2.54	2.82	2.82	1.54	1.69	7.71*	4.00	1.46	3.77
	4	3.66	2.99	3.78	3.71	4.48	3.51	3.44	4.31	11.29**	6.78	3.69	6.11
	5	4.32	3.28	4.60	4.62	5.02	4.22	5.08	6.23	13.88**	7.08	4.89	8.03
	6	4.89	4.05	6.85	6.61	5.89	6.61	5.60	6.72	16.23**	8.95	5.85	9.74
	7	5.80	4.31	7.43	7.29	7.29	7.27	6.44	7.76	17.21**	9.93	6.69	10.47
	8	9.84	5.01	8.16	8.24	8.27	8.78	7.07	8.34	17.83**	11.97	7.48	11.23
	9	10.59	6.82	8.89	8.66	11.44	9.52	9.47	11.05	21.25**	12.30	12.20	16.71*
	10	12.86	7.42	9.66	10.00	13.39	11.10	10.92	12.22	23.30***	12.84	14.52	19.37**

- Significant results in case of the unexpected component, astonishing due to non existence for single metals.
- Maybe the result of **aggregation of drivers**.
- However, might not be spurious.

Idea: Comparison of **Conditional and Unconditional** probabilities

- $Y_{t+m} = [y, y_{t+1}, \dots, y_{t+m}]$  with m lead
- $Y_{t-ly} = [y_{t-ly}, y_{t-ly+1}, \dots, y_{t-1}]$  with ly lag in variable y
- $X_{t-lx} = [x_{t-lx}, x_{t-lx+1}, \dots, x_{t-1}]$  with lx lag in variable x

**H0:** Conditional and unconditional probabilities are equal.

$$\begin{aligned} & \text{prob} (\|Y_{t+m} - Y_{s+m}\| < e \mid \|Y_{t-ly} - Y_{s-ly}\| < e, \|X_{t-lx} - X_{s-lx}\| < e) \\ &= \text{prob} (\|Y_{t+m} - Y_{s+m}\| < e \mid \|Y_{t-ly} - Y_{s-ly}\| < e) \end{aligned}$$

... for  $t < s$

# Nonlinear Granger Causality Test (II)

- Initial Testidea: Hiemstra, C. and Jones J.D. (JoF 1994)

- Statistics :

$$\frac{\text{prob}(\|Y_{t+m-ly} - Y_{s+m-ly}\| < e, \|X_{t-lx} - X_{s-lx}\| < e)}{\text{prob}(\|Y_{t-l} - Y_{s+-ly}\| < e, \|X_{t-lx} - X_{s-lx}\| < e)} -$$

$$\frac{\text{prob}(\|Y_{t+m-ly} - Y_{s+m-ly}\| < e)}{\text{prob}(\|Y_{t-ly} - Y_{s-ly}\| < e)}$$

With lagged and lead variable  $Y_{t-ly} = [y_{t-ly}, y_{t-ly+1}, \dots y_{t+m}]$

→ Measured with the help of indicator functions and asymptotic normal distribution

# Nonlinear Granger Causality Test (III)

- Diks, C., Panchenko, V. (2006) in JoEDC:
- Unconditional Probability is inappropriate

$$\frac{\text{prob}(\|Y_{t+m} - Y_{s+m}\| < e, \|Y_{t-ly} - Y_{s-ly}\| < e, \|X_{t-lx} - X_{s-lx}\| < e)}{\text{prob}(\|Y_{t+m} - Y_{s+m}\| < e, \|Y_{t-ly} - Y_{s-ly}\| < e)} - \frac{\text{prob}(\|Y_{t-ly} - Y_{s-ly}\| < e, \|X_{t-lx} - X_{s-lx}\| < e)}{\text{prob}(\|Y_{t-ly} - Y_{s-ly}\| < e)}$$

... leads to...

$$\begin{aligned} & \text{prob}(\|Y_{t+m} - Y_{s+m}\| < e, \|Y_{t-ly} - Y_{s-ly}\| < e, \|X_{t-lx} - X_{s-lx}\| < e) \\ & \text{prob}(\|Y_{t-ly} - Y_{s-ly}\| < e) - \text{prob}(\|Y_{t+m} - Y_{s+m}\| < e, \|Y_{t-ly} - Y_{s-ly}\| < e) \\ & \text{prob}(\|Y_{t-ly} - Y_{s-ly}\| < e, \|X_{t-lx} - X_{s-lx}\| < e) \end{aligned}$$

→ Measured with the help of indicator functions and asymp. normal. distribut

# Nonlinear Granger H&J - Results

Period	Com.	NOT	OI/NOT	NCL	NCS	TRL	TRS	NCL/TRL	NCS/TRS	CL	CS	CL/TRL	CS/TRS	
Jan 93- Dec 13	Au	-0.505***	-0.267***	-0.138***	-0.515***	-0.644***	-0.685***	-0.471***	-0.264***	-0.793	-0.193	-0.590***	-0.235***	10
	Ag	-0.421***	-0.373***	-0.333***	-0.298***	-0.520	-0.526***	-0.439***	-0.555	-0.847***	-0.515	-0.484***	-0.556	8
	Co	-0.150***	0.000	-0.052***	-0.275***	-0.518***	-0.092***	-0.107***	-0.214***	-0.244	-0.122***	-0.154***	-0.201***	10
	Pd <sup>c</sup>	-0.047	-0.156***	0.105	-0.133	-0.370***	0.022***	0.091***	0.022***	-0.156***	0.311***	0.150	0.006***	8
	Pl	-0.476	-0.198	-0.338***	-0.339***	-0.305***	-0.421***	-0.394***	-0.411***	-0.367***	-0.324***	-0.432***	-0.381***	10
# of significant values		3	3	4	4	4	5	5	4	3	3	4	4	46
< 0.05														

- Nearly everything significant which might be the result of the test procedure.
- Test is according to D&P biased, as it generates too many significant results.

# Nonlinear Granger D&P - Results

Period	Com.	NOT	OI/NOT	NCL	NCS	TRL	TRS	NCL/TRL	NCS/TRS	CL	CS	CL/TRL	CS/TRS
Jan 93- Dec 13	Au	-0.666	-0.275	-0.150	0.000	0.000	-1.012	<b>-1.526*</b>	0.000	-0.837	0.000	-1.225	0.000 <b>0</b>
	Ag	-0.105	-0.903	-0.374	-0.506	-0.559	-0.173	-0.202	-0.546	-0.433	-0.257	-0.423	-0.299 <b>0</b>
	Co	-0.012	-0.115	-0.018	-0.080	-0.360	-0.029	0.054	0.032	0.000	-0.079	0.002	0.000 <b>0</b>
	Pd <sup>c</sup>	0.000	0.000	0.000	0.035	-1.188	0.000	0.000	0.257	-0.183	0.000	<b>1.713**</b>	0.000 <b>1</b>
	Pl	<b>-2.226***</b>	<b>-1.285*</b>	<b>-1.447*</b>	<b>-2.871***</b>	-1.251	<b>-3.226***</b>	<b>-2.276***</b>	<b>-2.935***</b>	<b>-1.434*</b>	-0.498	<b>-6.356***</b>	-0.370 <b>6</b>
# of significant values < 0.05		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>
													<b>7</b>

- Only in few case nonlinear granger causality measurable after excluding a possible linear relationship
- However, most of the cases relate to Platinum.

## Outline

---

- (1) Motivation
- (2) The controversial debate
- (3) Research design and first results
- (4) Discussion and further analysis**
- (5) Conclusion & Outlook

## Discussion and further analysis

- Maybe, the ambiguous results are the **consequence of specific characteristics** in the existing empirical studies.
- These characteristics include,
  - the chosen **samples** (regarding period of time and commodity),
  - the used **definition of speculation** and
  - the **applied model specifications** (methodology).
- Last but not least, financialization might have transformed commodity markets in subtle ways

- 
- **Other explanations and deeper theoretical analyses** need to be considered.
  - **Sharper tests** are needed.
  - An opportunity to study **general economic forces** applicable to financial markets

## Further explanations/channels

- Cheng and Xiong (2013) **demand researchers** to **test** whether **financialization has affected** commodity markets **through** the following **mechanisms**:

**Storage**

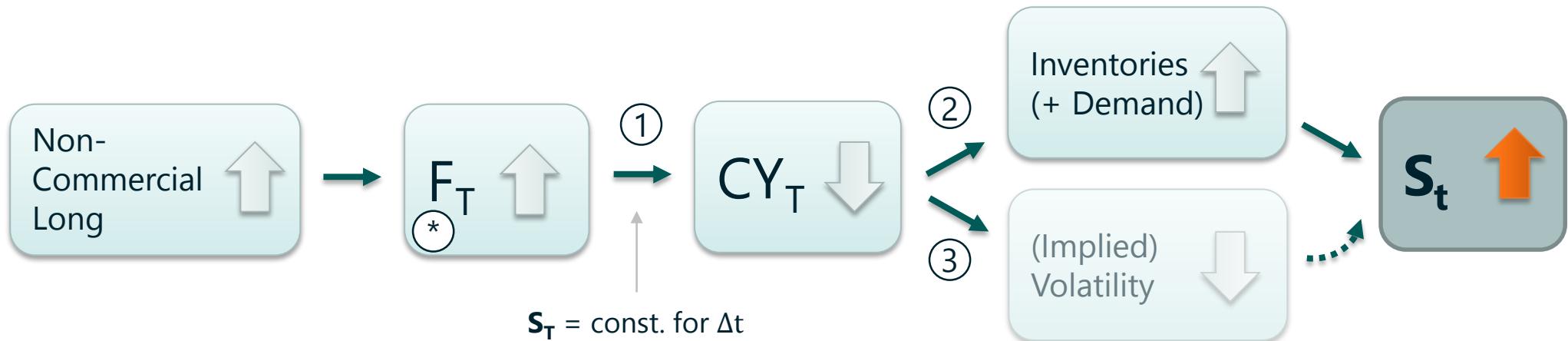
**Risk Sharing**

**Information  
Discovery**

- These are **essential for the functioning** of these markets and offer **potential channels** through futures trading may affect spot prices.

# Channel 1: Theory of Storage

Storage

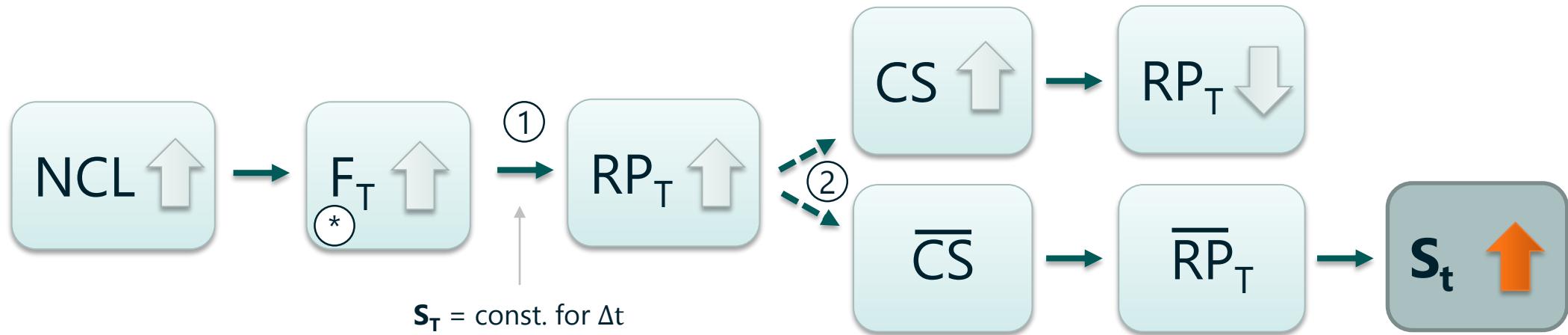


- ④ → Especially Long Term Futures
- ① Def.: Convenience Yield (CY) see Working (1949)
- ② Empirical evidence see Brennan (1959), Telser (1958) or Weymar (1966)
- ③ Egelkraut et. al (2007)

# Channel 2: Theory of Normal Backwardation

Risk  
Sharing

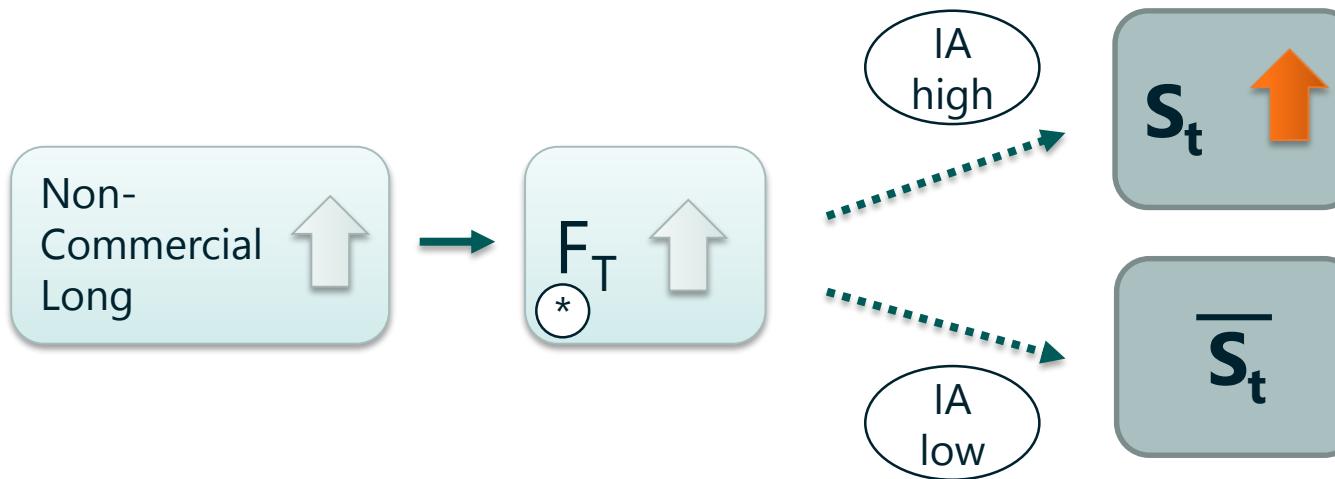
→ Risk Premium dependent on hedging pressure  
(Commercial Traders Short (CS), Normal Backwardation  $\rightarrow RP < 0$ )



- ④ \* → Especially Long Term Futures
- ① Def.: Risk Premium (RP) see Keynes (1930)
- ② Hedging Pressure rather short-term see MacDonald (1988), Graham-Higgs et al. (1999) or Otto (2011)

## Channel 3: Information Asymmetry

- $F_T$  and  $S_t$  in average are in Equilibrium
- Shocks firstly affect  $F_T$  followed by  $S_t$  (Information Asymmetry (IA))



④ See Cheng and Xiong (2013)

# Further Analysis: Additional Data

## Previous Data

*Financialization of metal commodity markets: Does futures trading influence spot prices and volatility?* (Mayer, H.; Rathgeber, A.; Wanner, M.)

- Major metals: copper, gold, platinum, palladium and silver
- Timeframe from **January 1993 to December 2013** in a weekly frequency (20 years, 1095 observations)
  - Full time frame and
  - Sub-sample with time frames of 3 years
- Weekly trading data from **CFTC Commitments of Traders COT reports**
  - Open interest
  - Number of Traders
  - Total reportable positions-long
    - non-commercial positions-long
    - commercial positions-long
  - Total reportable positions-short
    - non-commercial positions-short
    - commercial positions-short



## Additional Data (channel analysis)

- Inventory levels
- Specific future price data (3, 6, 12m) → Convenience yield
- Liquidity (Amihud Measure)
- ...

→ First approach conducted for Copper

# Theory of Storage - Results

Example: „OI/NOT granger causes NCL“

Period	DI/NOT	NCL	NCL/TRL	Fut 6M	CY 6M	Inv	Vola
Jan 93- Dec 13	NCL	24.207***					
	NCL/TRL	5.214**	3.127*				
	Fut 6M	1.435	2.116	0.068			
	CY 6M	1.992	1.282	0.577	0.196		
	Inv	2.447	1.564	1.652	3.985**	1.616	
	Vola	0.549	1.099	0.293	4.684**	0.182	0.867
	Spot	1.672	0.332	0.130	3.908**	7.974***	1.032

Period	MA	Expected	Unexpect.	Fut 6M	CY 6M	Inv	Vola
Jan 93- Dec 13	Expected	127.70***					
	Unexpect	1.665	0.859				
	Fut 6M	0.270	0.127	0.077			
	CY 6M	0.226	0.195	1.797	0.196		
	Inv	1.993	1.597	1.003	3.985**	1.616	
	Vola	1.639	0.080	0.147	4.684**	0.182	0.867
	Spot	0.314	0.969	0.975	1.601	3.908**	7.974***
							1.032

- Classical results regarding the theory of storage (CY, Inventories, Spot) and Inverse Leverage (Vola and Spot)
- No results significant results regarding NC Trader

## Theory of Normal Backwardation

Period	OI/NOT	NCL	NCL/TRL	Fut 1M	CY 1M	CS
	NCL	<b>24.207***</b>				
	<b>NCL/TRL</b>	<b>5.214**</b>	3.127*			
Jan 93-	Fut 1M	1.668	2.329	0.076		
Dec 13	CY 1M	1.259	3.096*	1.190	1.846	
	CS	0.863	0.123	<b>17.303***</b>	<b>5.417**</b>	0.891
	Spot	1.672	0.332	0.130	1.113	2.019
						0.320

Period	MA	Expected	Unexpect.	Fut 1M	CY 1M	CS
Expected		<b>127.70***</b>				
Unexpect		1.665	0.859			
Jan 93- Fut 1M		0.648	0.198	0.068		
Dec 13 CY 1M		0.141	1.954	2.838*	1.846	
CS		0.309	<b>6.499***</b>	<b>8.913***</b>	<b>5.417**</b>	0.891
Spot		0.314	0.969	0.975	1.113	2.019
						0.320

- Significant granger causality in case of NCL, Expected and unexpected
- Future Prices Granger causes Commercial Short
- No influence on spot prices

# Theory of Information Asymmetry

## Information Discovery

Period	OI/NOT	NCL	NCL/TRL	Ami 1M	Ami 6M	Fut ErrVec Sp Err Vec
Jan 93- Dec 13	NCL	<b>24.207***</b>				
	NCL/TRL	<b>5.214**</b>	3.127			
	Ami 1M	0.430	0.033	1.008		
	Ami 6M	0.643	0.182	0.167	<b>14.73***</b>	
	Fut ErrVEC	<b>9.124***</b>	<b>7.475***</b>	<b>6.700***</b>	<b>6.604***</b>	<b>6.523***</b>
	SpoErrVec	<b>4.581**</b>	<b>3.580*</b>	<b>3.440*</b>	<b>3.129*</b>	<b>3.175*</b>
Spot				0.002	0.001	<b>5.680**</b>
				0.130		0.655

## AMIHUD Illiquidity Ratio ILLIQ

(Standard measure of liquidity):

$$ILLIQ_T^i = \frac{1}{D_T} \sum_{t=1}^{D_T} \frac{|R_{t,T}^i|}{V_{t,T}^i}$$

Price change in relation to volume change

Amihud (2002)

Period	MA	Expected	Unexpect.	Ami 1M	Ami 6M	Fut ErrVec	Sp Err Vec
Jan 93- Dec 13	Expected	<b>127.70***</b>					
	Unexpect	1.665	0.859				
	Ami 1M	1.392	<b>4.511**</b>	0.136			
	Ami 6M	0.038	1.059	0.044	<b>14.728***</b>		
	Fut						
	ErrVEC	<b>7.291***</b>	<b>6.475***</b>	<b>6.424***</b>	<b>6.604***</b>	<b>6.523***</b>	
Spot	SpoErrVec	<b>3.624*</b>	<b>3.513*</b>	<b>3.699*</b>	<b>3.129*</b>	<b>3.175*</b>	3.186
		0.314	0.969	0.975	0.002	0.001	<b>5.680**</b>

- Errors in VEC Model (Futures) are driven by CL and Information Asymmetry (Liquidity)
- Errors in VEC Model (Spot) are only partly affected

# Nonlinear Granger Results channels

Period	OI/NOT	NCL	NCL/TRL	Fut 6M	CY 6M	Inv	Vola
Jan 93- Dec 13	NCL	0.000					
	<b>NCL/TRL</b>	0.000	-0.202				
	Fut 6M	-0.100	-0.088	-0.208			
	CY 6M	0.192	0.720	0.073	0.000		
	Inv	-0.086	0.188	0.057	<b>1.768***</b>	0.672	
	Vola	-0.261	-0.346	-0.410	1.071	0.000	1.140
	Spot	-0.018	-0.080	0.032	0.000	0.672	0.000

Period	OI/NOT	NCL	NCL/TRL	Fut 1M	CY 1M	CS	Period	OI/NOT	NCL	NCL/TRL	Ami 1M	Ami 6M	Fut ErrVec
Jan 93- Dec 13	NCL	0.000					Jan 93- Dec 13	NCL	0.000				
	<b>NCL/TR</b>	0.000	-0.202					<b>NCL/TRL</b>	0.000	-0.202			
	L	0.000	-0.202					Ami 1M	0.421	0.435	0.431		
	Fut 1M	0.164	0.135	0.110				Ami 6M	-0.415	-0.654	-0.818		
	CY 1M	0.000	0.291	-0.102	0.404	0.000		Fut					
	CS	0.000	0.000	0.000	0.412	<b>2.888***</b>		ErrVEC	0.000	-0.223	-0.488	-0.421	0.428
	Spot	-0.018	-0.080	0.032	0.340	0.000		SpoErrVec	-0.226	-0.429	-0.440	-0.427	-0.467

- No significant results regarding NC Trader after excluding the possible linear relationship
- One case could be spurious...

## Outline

---

- (1) Motivation
- (2) The controversial debate
- (3) Research design and first results
- (4) Discussion and further analysis
- (5) Conclusion & Outlook**

## Conclusion

- Less significances on the long run
- At least three hot leads:
  - Panel analysis on unexpected components
  - Channel Hedging Pressure
  - Impact on Platinum in non-linear Granger

→ However, many inconclusive results...



## Next steps:

- Channel analysis including more data (invent Implied Volas etc.)
- Panel Analysis
- Cointegration analysis (MVARM)
- Extending the analysis on dataset with soft-commodities and energy commodities
- Including sub-samples
- Non-aggregated COT (shorter sample)



© adpic

**Thank you very much for  
your attention!**