



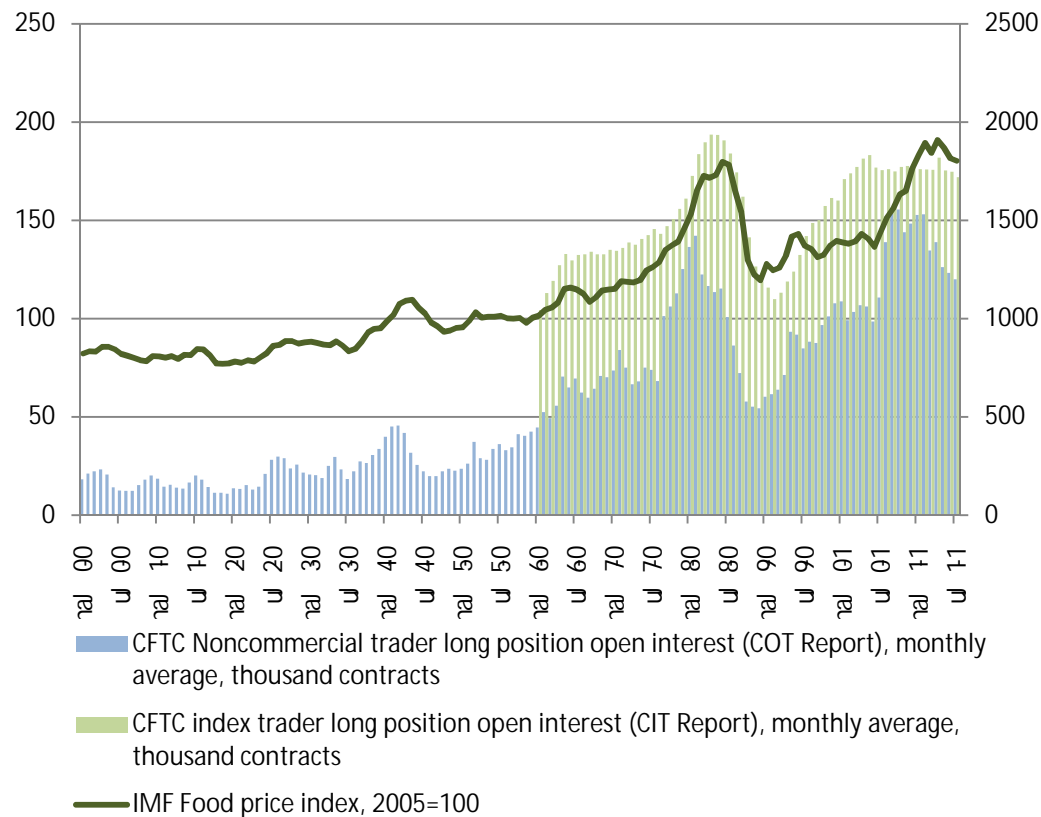
Limitations of Granger Causality Tests in Assessing the Price Effects of the Financialization of Agricultural Commodity Markets under Bounded Rationality

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An increase in financial trading activity coincides with higher price levels and volatility...

Development Jan 2000 – Jul 2011

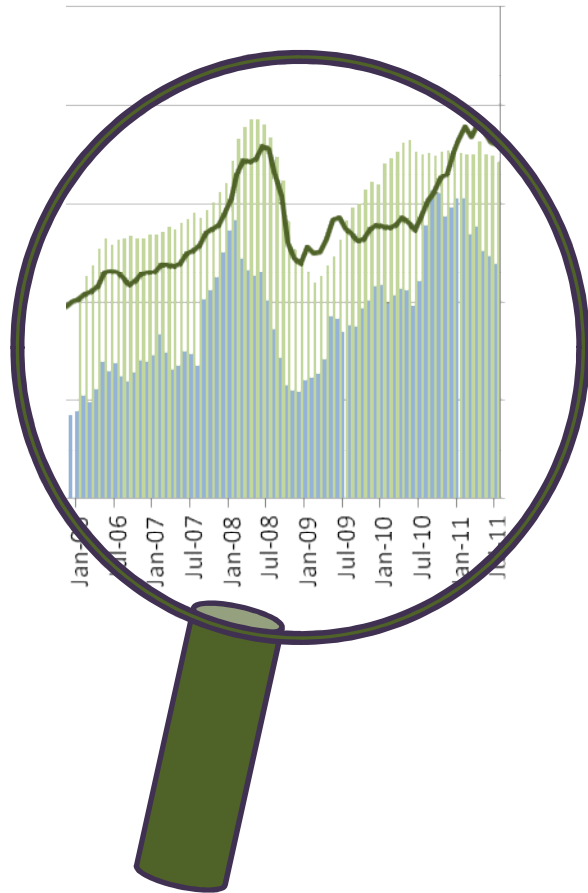


Events:

- § Discovery of portfolio benefits of (agricultural) commodity “assets”
- § Growth in (agricultural) commodity-linked investment products

Source: CFTC 2011, IMF 2011; ERB and CAMPBELL 2006; GORTEN and ROUWENHORST 2006; MIFFRE and RALLIS 2007

“Index trading” has particularly moved into focus



Definitions

- § Replicating commodity index via long-positions (CFTC n.d.a)
- § Passive strategy to gain exposure to commodity price movements (CFTC n.d.b)

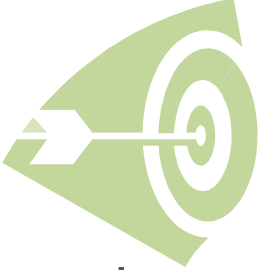
Potential effects

- § Future market:
 - Price level \uparrow
 - Volatility \uparrow

Empirical investigation

- § Method: Granger Causality Analysis (GCA)
- § Results: Combined, somewhat inconclusive

Research objective



§ Review existing empirical studies on direct price level effects of index trading and interpret their results

§ Extend theoretical basis with findings from financial economics such as effects from bounded rationality and informational efficiency of markets

Agenda

- § GCA methodology and data
- § Review of empirical models and results
- § General sensitivities of GCA results
- § Extension of theoretical basis
- § Open questions and conclusion

GCA to better understand underlying causality

General concept	Operational definition	Statistical tests
<p>X Granger-causes Y, if including past values of X in an information set Ω_t used to predict Y improves probability of correct prediction.</p>	<p>X_t not prima facie cause in mean for Y_{t+h}, $h>0$, if</p> $MSE(E[Y_{t+h} \Omega_t]) = MSE(E[Y_{t+h} \Omega'_t])$ <p>where Ω'_t includes current and lagged X_t</p>	<p>§ Bivariate linear, e.g.</p> <ul style="list-style-type: none"> – Standard F-test – M-Wald <p>§ Multivariate, e.g.</p> <ul style="list-style-type: none"> – h-step non-causality <p>§ Nonlinear, e.g.</p> <ul style="list-style-type: none"> – nonparametric tests

Source: GRANGER (1969, 1980); HAMILTON (1994); LÜTKEPOHL (2007), TODA and YAMAMOTO (1995); HIEMSTRA and JONES (1994)

Data on financial trading activity

CFTC Report ¹	Reporting trader categories ²	Time period	Content
CIT	INDEX, NON, COM	Since 2006	§ LPOI, SPOI § Published Fridays at 3:30 pm EST § Position holdings of previous Tuesday CIT: futures/options combined
COT	NON, COM	Since 1986 (futures)/ 1995 (futures and options)	
DCOT	Producer, SWAP, MM, other	Since 2006	

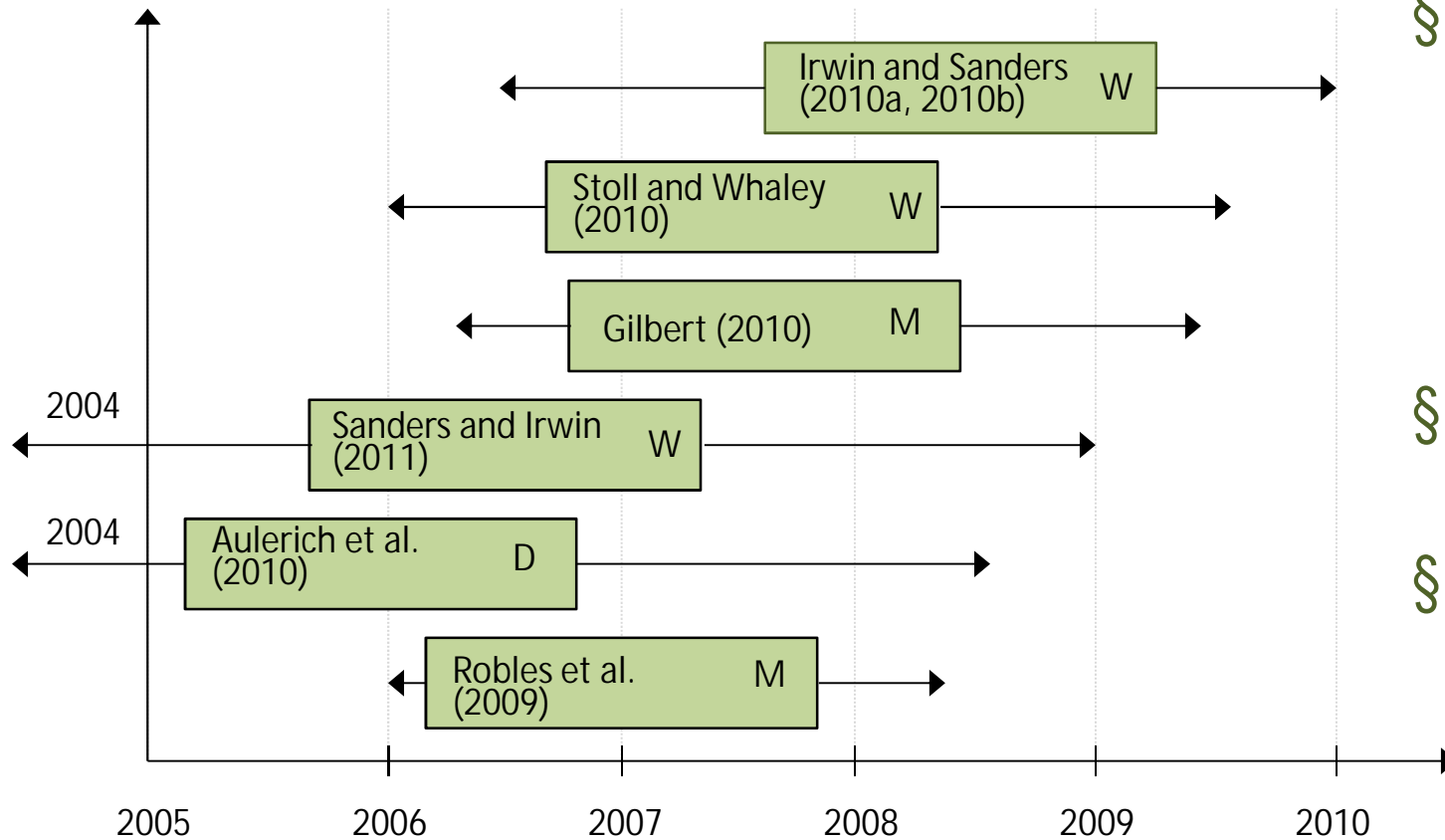
1 CIT = Commodity Index Trader; COT = Commitment of Traders; DCOT = Disaggregated Commitment of Traders

2 NON = Noncommercial, COM = Commercial, SWAP = Swap dealers, MM = Managed money, INDEX = index trader

Studies concentrate on price effects in the period 06-09

Sampled studies

Market focus



- § Grains and oilseeds:
W- (CBOT, KCBT), C-, S-, BO
- § Livestock:
LC, FC, LH,
- § Softs:
CC, KC, SB, CT

Data aggregation: M = Monthly; W=Weekly; D = Daily

Models and hypothesis tests

Bivariate VAR models, standard F-test:

$$H_0: \beta_1 = \beta_2 = \dots = \beta_j = 0$$

$$\begin{aligned} Level_t^{Com} = & c_1 + \alpha_1 Level_{t-1}^{Com} + \alpha_2 Level_{t-2}^{Com} + \dots + \alpha_i Level_{t-i}^{Com} \\ & + \beta_1 Activity_{t-1}^{Com} + \beta_2 Activity_{t-2}^{Com} + \dots + \beta_j Activity_{t-j}^{Com} + \varepsilon_t \quad \text{for } t = 1, \dots, T \end{aligned}$$

Com = Commodity

Variable specifications:

Level:

- § Relative return ($\ln FP_t - \ln FP_{t-1}$)
- § Absolute return ($FP_t - FP_{t-1}$)
- § Return spread ($\ln FP1_t - FP0_t$)
- ... nearby vs. deferred contracts

Activity:

- § Flow...
- § Relative magnitude ...
- § Absolute magnitude...
- ...of position holdings

Synthesis of results

General findings

Different time periods/ data aggregation/ variable specifications hinder comparability of results

- § Few evidence on GC, direction varies
- § Time lag of GC varies from one day (AULERICH et al. 2010) to one month (ROBLES et al. 2009, GILBERT 2010)
- § STOLL and WHALEY (2010) find indication of reverse GC from price levels to index activity

Interpretation of results requires taking into account sensitivities of the method

Sensitivities and potential consequences for results of GCA

Sources of sensitivity

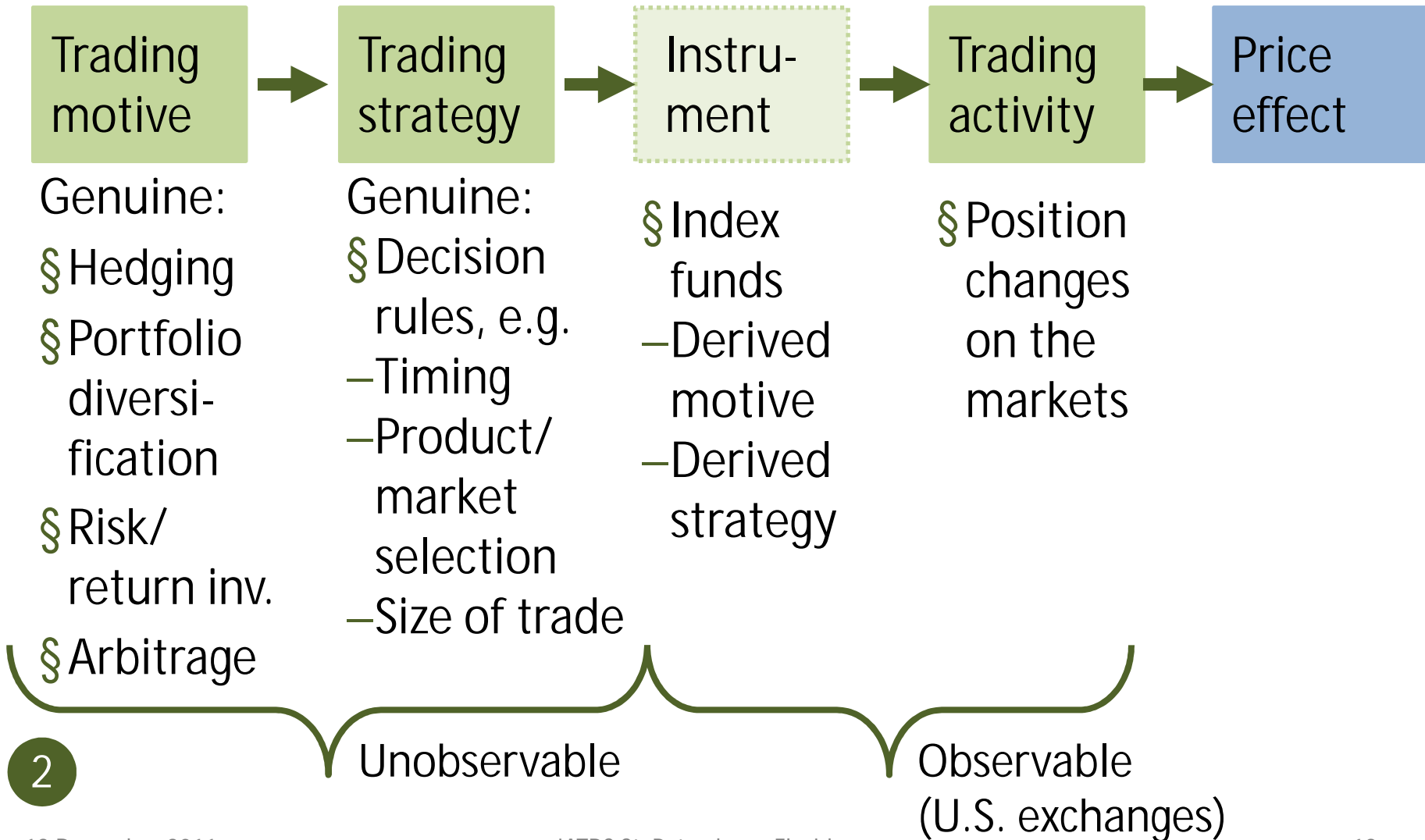
Potential consequences

1	Omission of relevant variables	▶	§ Spurious GC
2	Variable specification	▶	§ Failure to detect GC
3	Forward-looking behavior	▶	§ GC in “wrong” direction
4	Temporal data aggregation	▶	§ Failure to detect GC
5	Time-varying effects	▶	§ Spurious GC
6	Feedback relations	▶	§ GC in “wrong” direction/ spurious GC

We need adequate theoretical hypotheses on potential cause-and-effect relations

Source: GRANGER (1969; 1980); LÜTKEPOHL (1982); HAMILTON (1994); BREITUNG and SWANSON (2002)

1 Information set needs to include the (measurable) determinants of index trading activity



- 3 Informational efficiency of markets determines time
- 4 lags and degree of forward-looking effects in prices

Efficient Market Hypothesis

Current market price includes....

- a)...all relevant information (strong-form)
- b)...only relevant public information (semi-strong form)
- c)...only information contained in past prices (weak form)

Predictability Hypothesis

Short-term inefficiencies may exist, due to e.g.

- § Institutional setup of markets
- § Costly information acquisition
- § Bounded rationality of market participants

Source: FAMA (1970, 1991); FIGLEWSKI (1978); TIMMERMANN & GRANGER (2004)

- 5 Interaction of heterogeneous boundedly rational
- 6 traders can lead to time-varying and feedback effects

Trading strategies	Stand alone effects	Interaction effects
§ Fundamental value trading $D^{FVT} = \gamma (P^E - P_t^M)$	§ Mean reversion to P^E	§ (nonlinear) dynamic and time-varying effects
<hr/> § Technical trading, e.g. trend-following $D^{TF} = \delta (P_t^M - P_{t-1}^M)$	§ Trend extrapolation § Positive feedback	§ Depend on e.g. learning behavior, relative power of the trader groups

Source: CHIARELLA et al. (2002); FARMER and JOSHI (2002); WESTERHOFF and REITZ (2005); REITZ and WESTERHOFF (2007)

Some open questions remain...

- ① What trading motives/strategies will have the largest effect on agricultural commodity markets → Where to focus on?
- ② How informationally efficient are agricultural commodity markets?
- ③ What interaction effects occur between financial trading strategies and those related to physical commodity exposure?

Addition:

- ④ What spillover effects exist to the spot market?

Conclusions

- § Incorporation of theoretical background from financial market research helps to better interpret GCA results and to assess limitations
- § However, financial market element and its interaction with fundamental factors is still under-researched
- § Precision of our hypotheses needs to improve such that adequate models can be used
- § Interdisciplinary research (financial + ag. economics) can improve our understanding of modern ag. commodity markets

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