

Speculation and Equity-Commodity Linkages



**Bahattin
Büyüksahin**



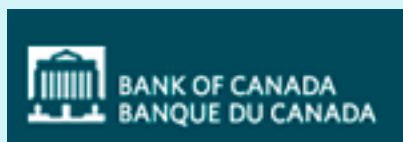
**Michel
Robe***



Does It Matter Who Trades?



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Büyüksahin**



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Robe***



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Background

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- **Large investment money flows in commodity futures markets**

- ✦ Thousands of hedge funds, commodity index funds, etc.

- ✦ Commodity assets under management (AUM):

- Peak in Fall 2011, at \$425bn; inflows = \$360+bn in prior decade (*Barclays, 2012*)

- **What could this development mean for...**

- ✦ Commodity Price Levels?

- Yes: Singleton (2013)

- No: ITF Report (2008), Büyükşahin & Harris (2011), Hamilton (2011), Kilian & Murphy (2012)

- ✦ Oil Market Volatility?

- No: Brunetti *et al* (volatility-regime switching, 2011), Boyd *et al* (herding, 2011)

- Maybe: Büyükşahin, Haigh & Robe (extreme events, 2010), Cheng, Kirilenko & Xiong (“convection”, 2012)

- ✦ Cross-Market Linkages? → **Our focus today**

Background

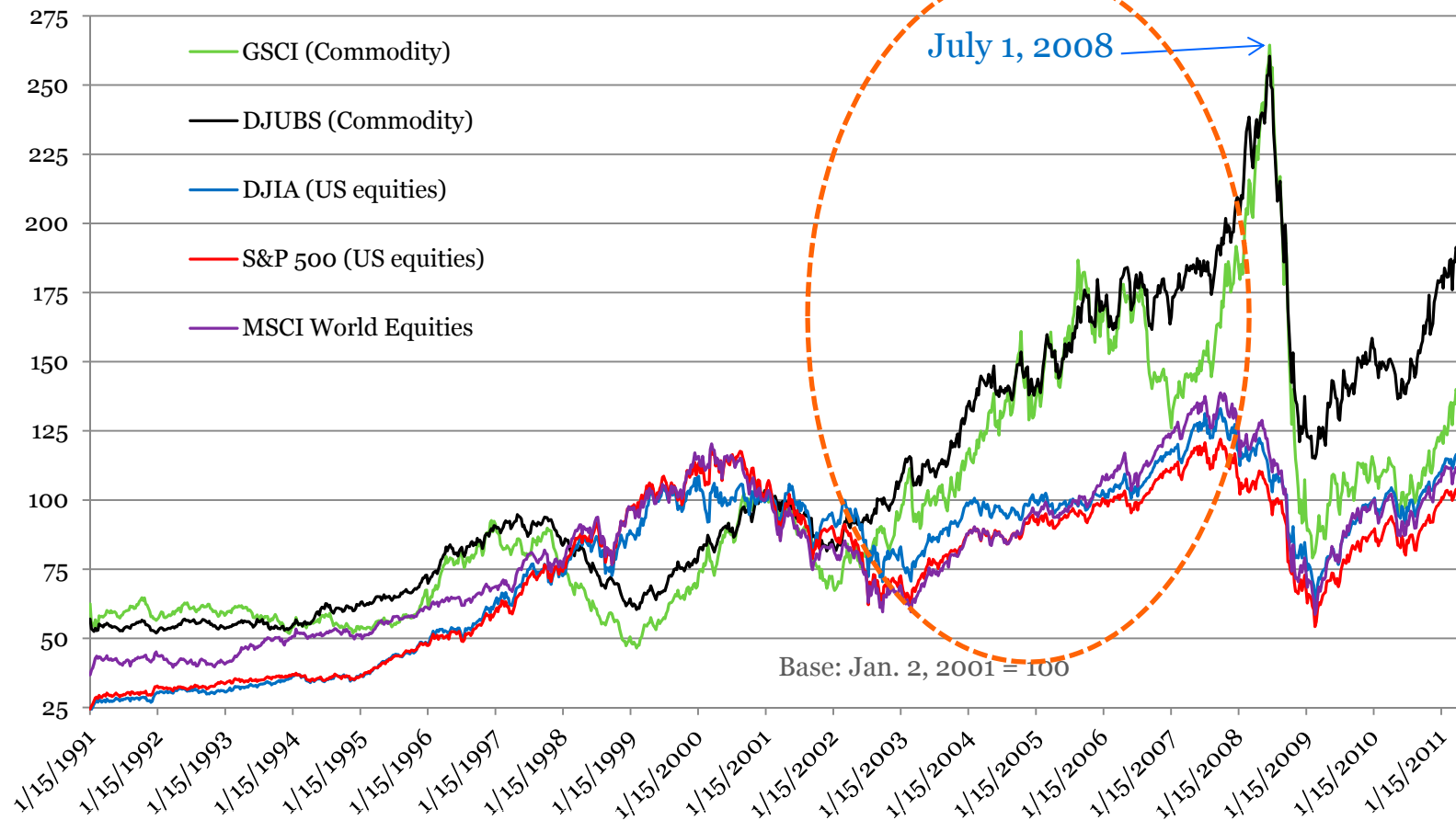
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“As more money has chased (...) risky assets, correlations have risen. By the same logic, at moments when investors become risk-averse and want to cut their positions, these asset classes tend to fall together. The effect can be particularly dramatic if the asset classes are small—as in commodities. (...) This marching-in-step has been described (...) as a ‘market of one’.”

The Economist, March 8, 2007.

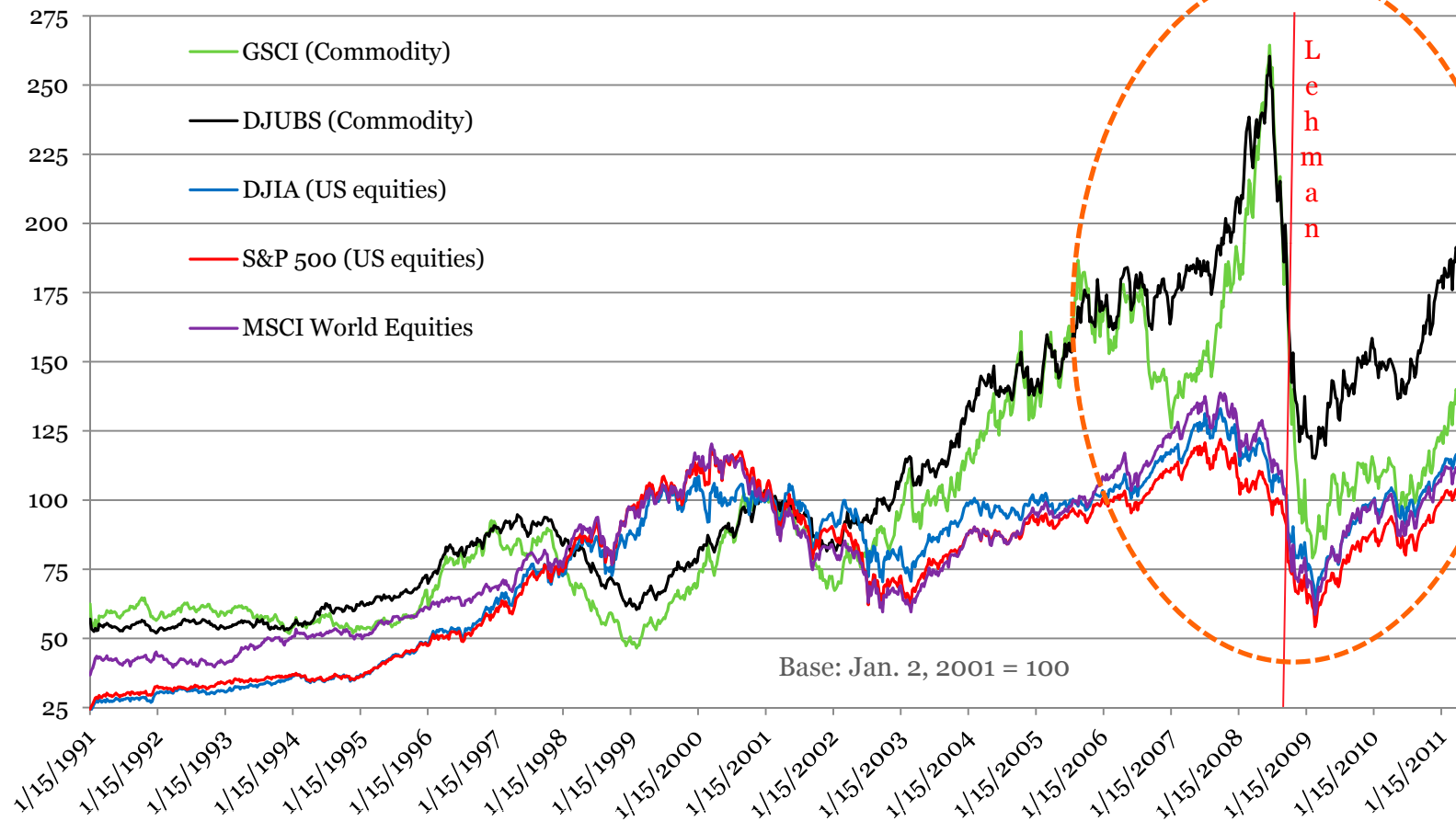
The “Marching in Step” Observers had in Mind

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“Marching in Step” since Lehman

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A “Market of One” – Really?

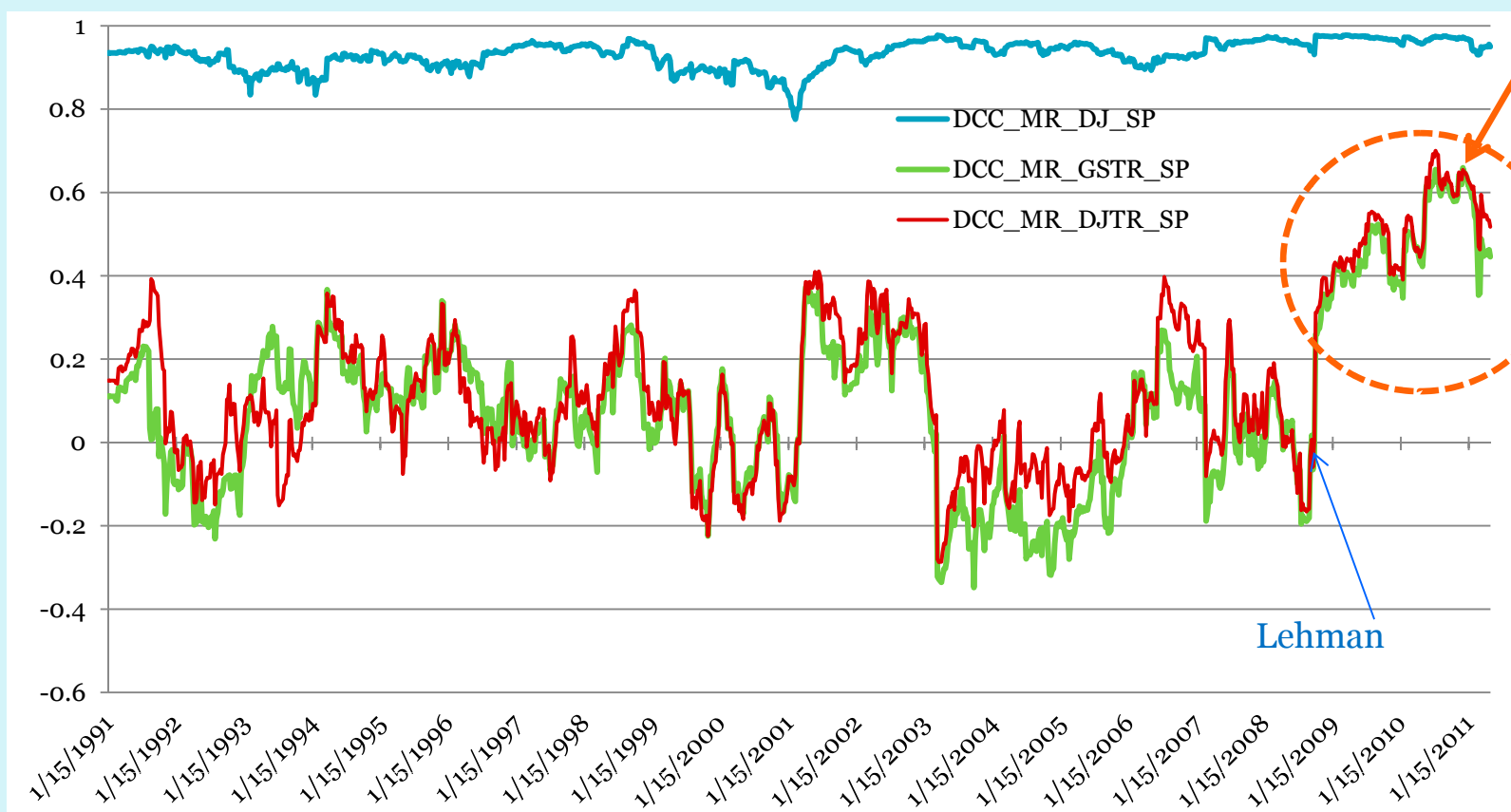
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- Pre-Lehman
 - Büyüksahin, Haigh & Robe (*JAI* 2010):
 - Look at return correlations, not index levels
 - Findings:
 - On average, return correlations between passive commodity and equity investments were about zero (*pre-Lehman*)
 - No secular increase in dynamic conditional correlations (DCC)
 - True at daily, weekly & monthly frequencies
 - True regardless of index choice (GSCI or DJ-UBS; S&P or DJIA)
 - Extreme-event correlations patterns changed in second-half of 2008
- **Post-Lehman?**

SP500 & GSCI Correlation (DCC), 1991-2011

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- DCC estimates average \emptyset – but fluctuate substantially over time



Correlation Facts

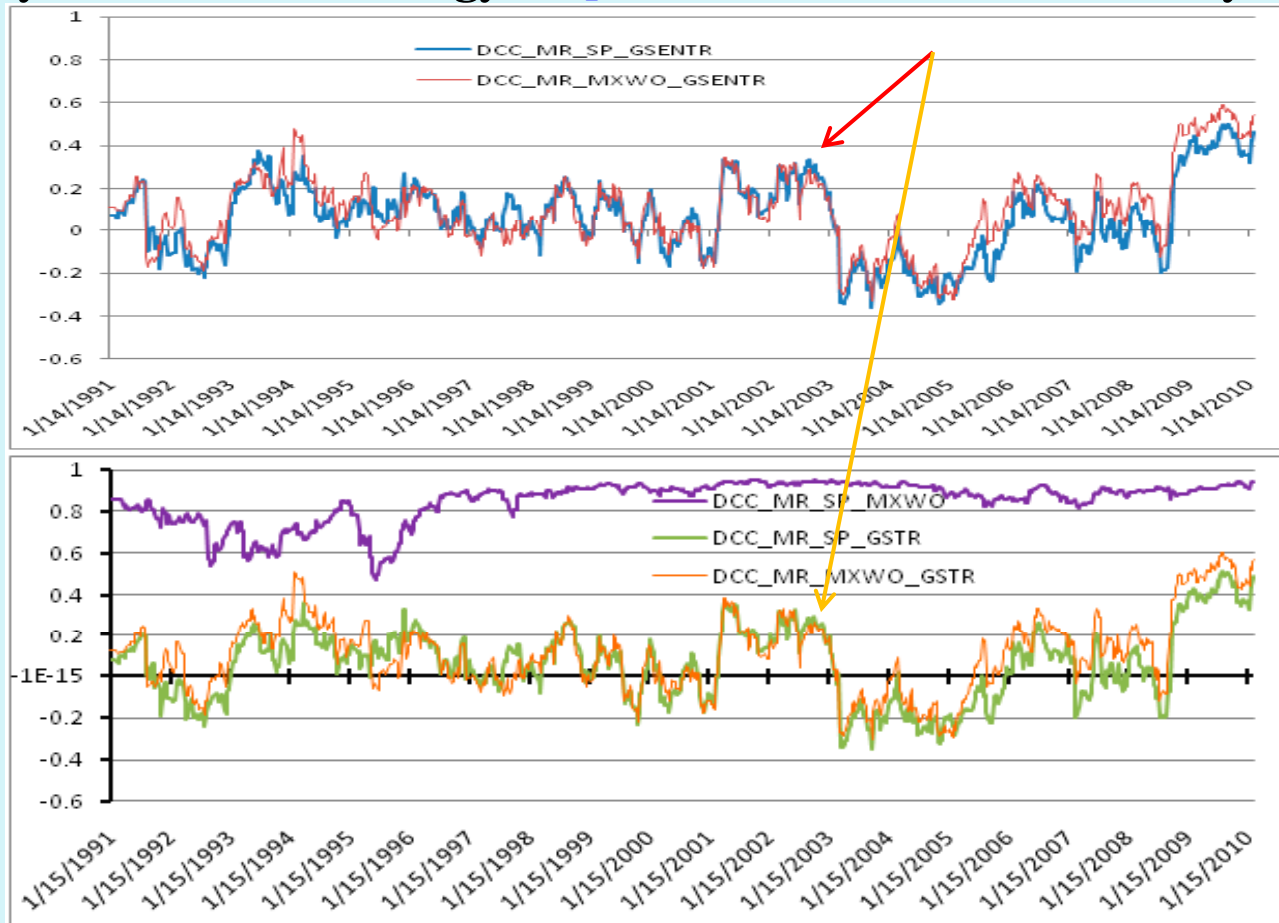
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- How confident are we of the correlation pattern:
 - **0. Frequency?**
 - ✦ **Irrelevant** – *Similar patterns at daily, weekly & monthly frequencies*
 - **1. Specific to one commodity?**
 - ✦ **Nope** – *Similar for energy, metals, grains*
 - **2. Does it matter how we estimate correlations?**
 - ✦ **Yep** – *Very different patterns with rolling correlations*
 - **3. What about cross-commodity correlations?**
 - ✦ **Differences** – *Ags or Livestock vs. industrial commodities*
 - ✦ **Similar** – *Post-Lehman behavior*

1. Equity Returns *vs.* Energy & Other Commodities

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- Equity Returns *vs.* Energy (Top) or Diversified Commodity Portfolio



2.

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DCC Analysis

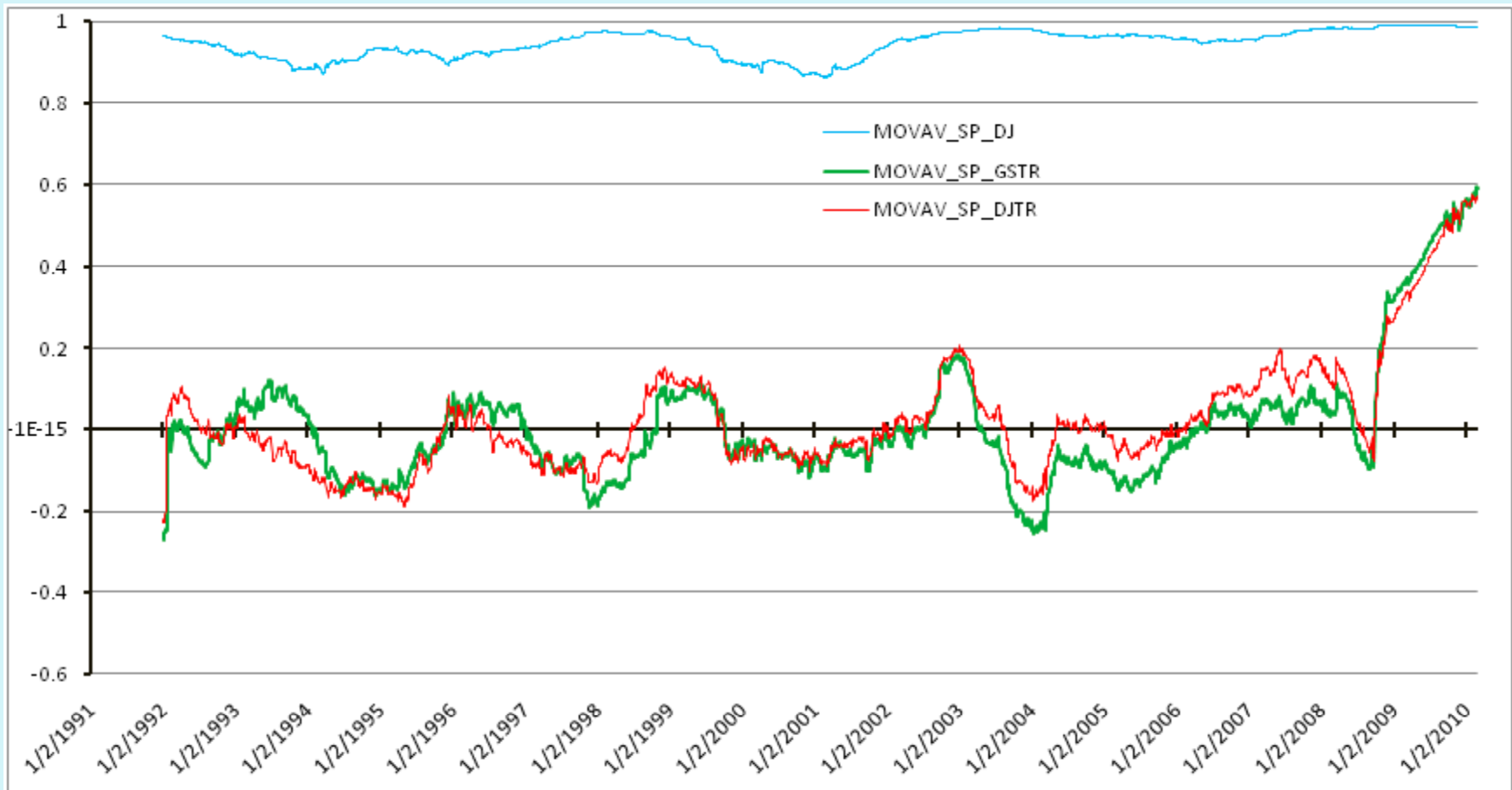
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- Dynamic Conditional Correlation (Engle, *JBES* 2002)
 - 2-stage estimation:
 - ✦ First stage -
 - n univariate GARCH(1,1) estimates are obtained (simultaneously), producing consistent estimates of time-varying variances (Dt).
 - ✦ Second stage -
 - The correlation part of the log-likelihood function is maximized, conditional on the estimated Dt from the first stage.
 - Advantages:
 - ✦ Takes into account the time-varying nature of the relationship between equity and commodity returns
 - ✦ Accounts for changes in return volatilities
 - Important – see Forbes & Rigobon (*JF* 2002) for emerging mkts

Without accounting for time-varying volatility...

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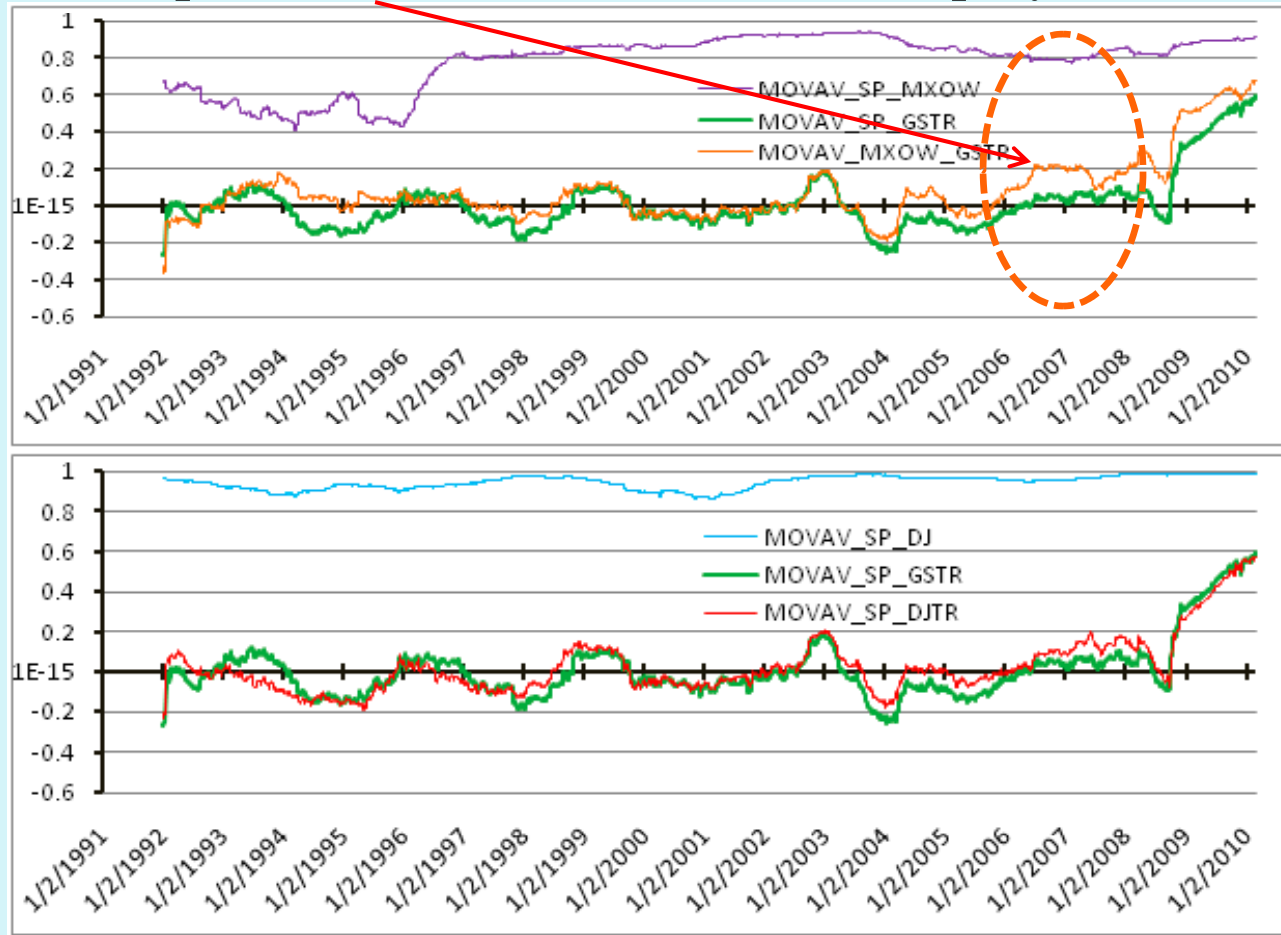
- ... we'd mis-estimate how much & when correlations change



Without accounting for time-varying volatility...

13

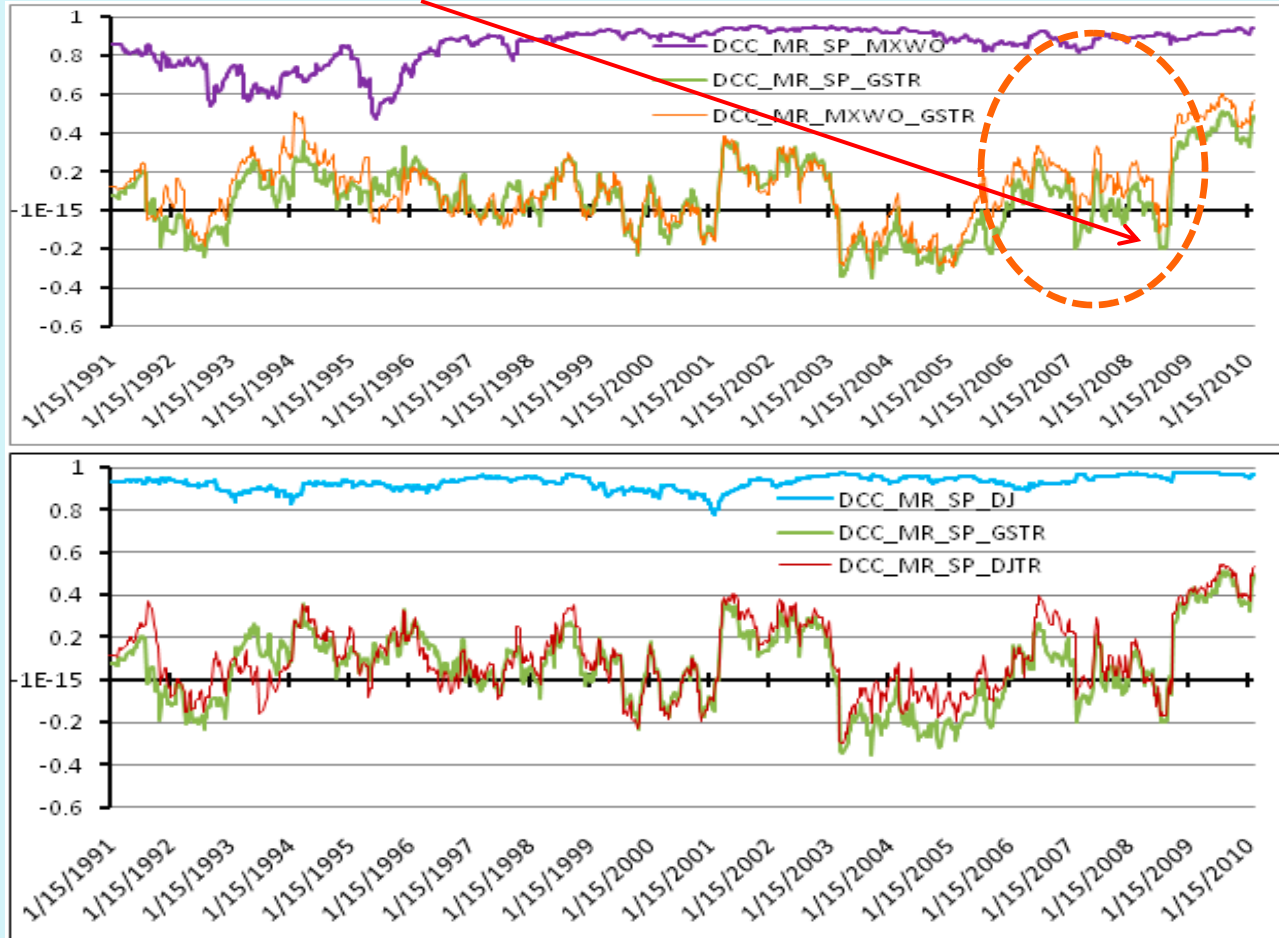
- Even worse problem with the MSCI World Equity Index



Vs. accounting for time-varying volatility...

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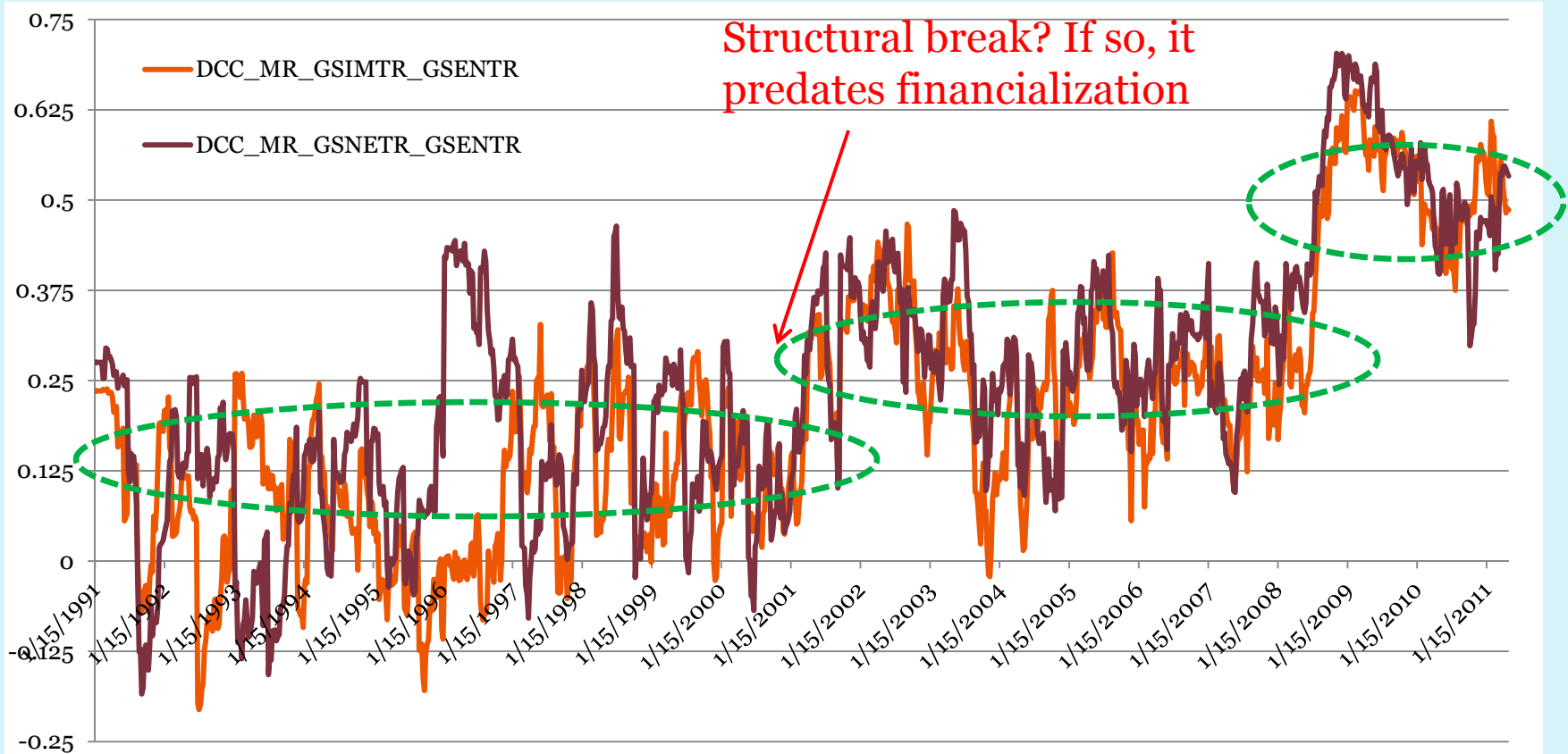
- Using DCC, we find no *visible* trend before Lehman



3. Cross-Commodity Correlations

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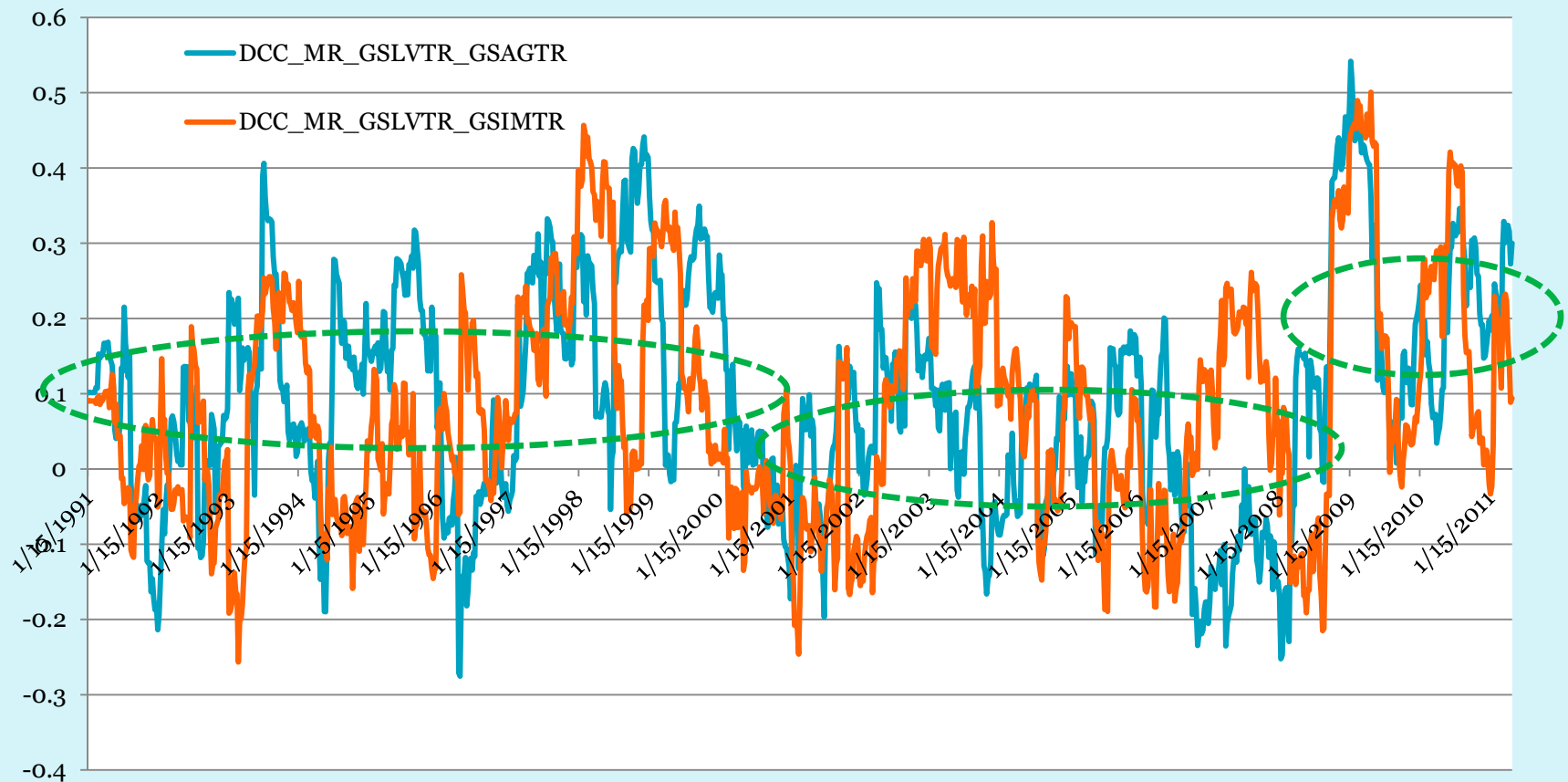
- Same for Cross-Commodity correlations? *Not for Industrial Metals...*



Cross-Commodity Correlations

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- How about Livestock? *Quite the opposite...*



I. This Paper



Thinking about Commodity-Equity Linkages

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○ As the DCC graphs show...

- ✦ Equity-commodity DCC estimates *do* fluctuate substantially over time
 - **This paper:** can we predict those fluctuations?
 - Macroeconomic / physical fundamentals? “Excess” speculation? Both?
- ✦ Extreme-event correlations *do* exist (Shanghai Feb.’07, Lehman Sept.’08, ...)
 - **This paper:** does financial stress increase correlations?
 - **This paper:** how (through what **channel**) does stress affect distributions?

○ Our focus

- ✦ Equity-commodity co-movements
 - Why?

II. Trading Facts

Financialization of Commodity Futures Markets



A. Position Data

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- Data for this presentation: **Public data**
 - CFTC Commitments of Traders (COT) Reports (2000-2010)
 - ✦ Weekly (*Tuesday*) end-of-day positions
 - ✦ **Two broad trader types**
 - “*Commercials*”
 - “*Non-Commercials*”
 - **Limitations**
 - ✦ **Heterogeneity** within two broad trader categories (*CFTC 2009*)
 - Hedge Funds *vs.* other speculators
 - Swap Dealers *vs.* Traditional Commercials
 - ✦ **Aggregated** across all contract maturities
 - **Upside**: *our results can be reproduced by anyone*

What Does the Public Data Show?

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1. *Importance of Financial Traders*

- “Excess” speculation is up, 2000-2010
 - “Excess” ≠ Excessive
 - “Excess” = index of spec activity beyond net hedging demand
- Hedge Funds & Swap Dealers (*incl.* CITs) are up, 2006-2013
 - Contract maturity(ies)?

2. *Heterogeneity within the Broad Categories*

- Good idea to break out Swap Dealers & Hedge Funds (2009)

Generalizing to all GSCI Commodities

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- We would like
 - Position data for all futures contracts in the GSCI index
- Unfortunately
 - Some contracts are non-US → no data (e.g., Gas oil; Brent)
 - Position data for RBOB gasoline are available only after 2006
- Bottom line
 - We have data for **17 U.S. commodity futures markets**
 - ✦ Examples: Energy = WTI crude + Henry-Hub nat'l gas + No.2. heating oil
 - Weights:
 - ✦ Time-varying GSCI weights, scaled to account for “missing” contracts

Gauging Speculative Activity

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- Working's T (1960):

- Goal: measure the extent to which speculative positions exceed the net hedging demand in a given futures market i
- Intuition: long and short hedgers do not trade simultaneously or in the same quantity; speculators satisfy this unmet hedging demand in the marketplace – but there may be more spec activity than that bare minimum.

- Formally:

$$WSIS_i = 1 + \frac{SS_i}{HL_i + HS_i} \text{ if } HS_i \geq HL_i$$

$$WSIS_i = 1 + \frac{SL_i}{HL_i + HS_i} \text{ if } HL_i \geq HS_i$$

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where SS_i is the magnitude of the short positions held in the aggregate by all non-commercial traders; SL_i stands for all non-commercial long positions; and, HS_i stands for all non-commercial long positions and HL_i stands for all long hedge positions.

C. Financialization in Pictures

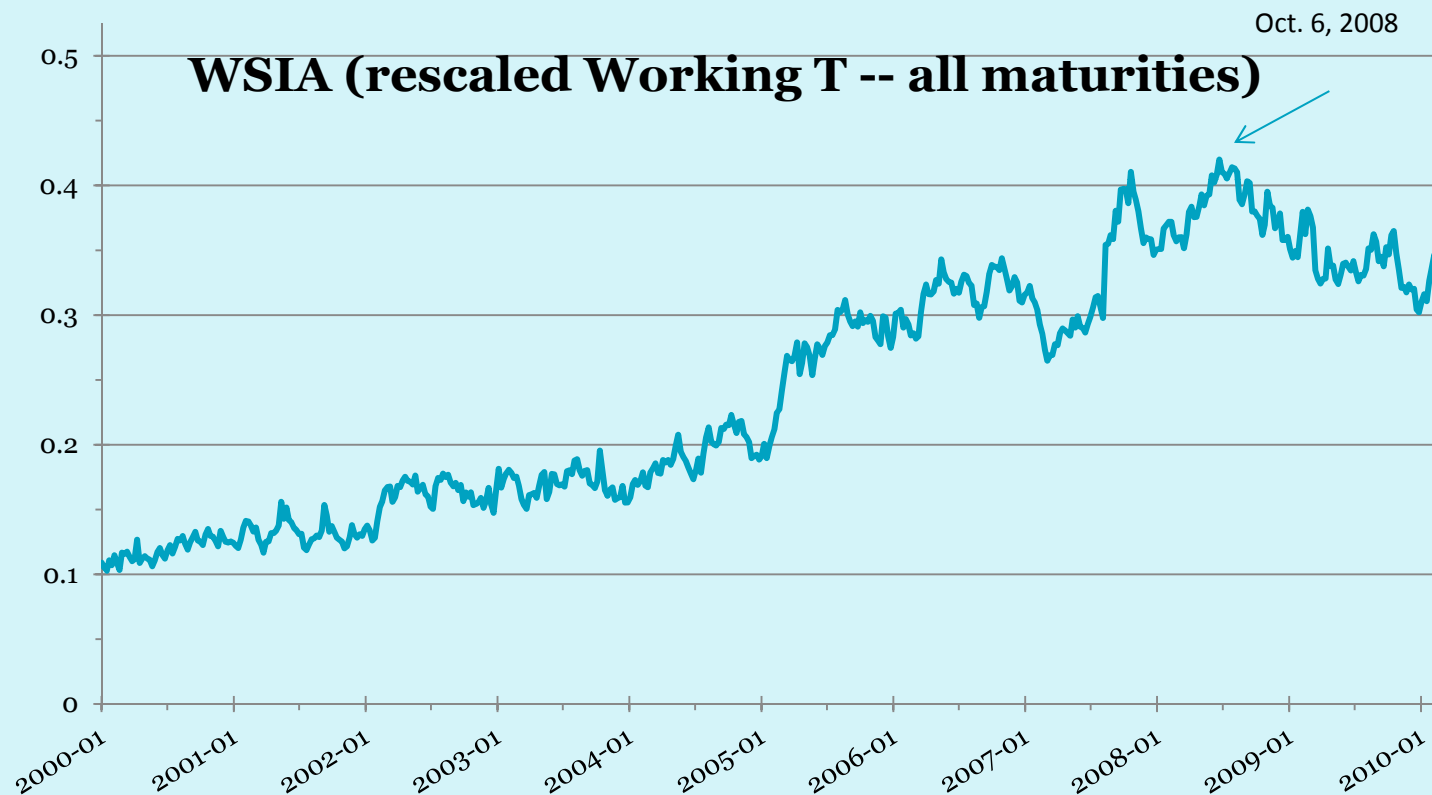
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- Overall speculation is up
 - Averaged from 10-15% “excess” spec before 2003
 - rises to 30-40% after 2005
- Commodity Index Trading
 - Swap Dealer positions account for about 35% of futures OI
 - in a growing market (2006-2013)
- Hedge Funds
 - 25-30% of the open interest after 2006

Spec Activity

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- Working's T, January 2000 to March 2010



III. Main Question



Does Trader Identity Matter?

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- Does the composition of trading activity (*i.e.*, who trades) matter for asset pricing?
 - Theoretical reasons to believe trader identity matters
 - ✦ Models show that less-constrained traders link asset markets
 - e.g., Basak & Croitoru (*JFE* 2006)
 - ✦ During financial stress periods, contagion or retrenchment?
 - E.g., Kyle & Xiong (*JF* 2001), Pavlova & Rigobon (*REStud* 2008)
 - Who is a “candidate” for enhancing linkages?
 - ✦ Traditional “commercial” traders, Long-term hedgers, etc.? → Unlikely
 - ✦ Hedge funds? → More likely
 - Enter/exit markets frequently
 - trade across markets to exploit perceived mis-pricings/opportunities
 - Levered + subject to borrowing limits/wealth effects + value-arb across markets

A. Dependent Variable (*LHS*): *Equity-Commodity Correlations*



Return Correlations

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- Our focus – returns on:
 - Investible passive commodity indices
 - ✦ GSCI (*now S&P GSCI*), DJ-AIG (*now DJ-UBS*)
 - Benchmark passive equity indices
 - ✦ S&P 500 (also, DJIA and MSCI)
- Time period
 - ✦ January 1991 to March 2010
- Prices
 - Tuesday settlement prices (*weekly analysis*)
 - ✦ Similar results at different frequencies (*daily*)

DCC Analysis

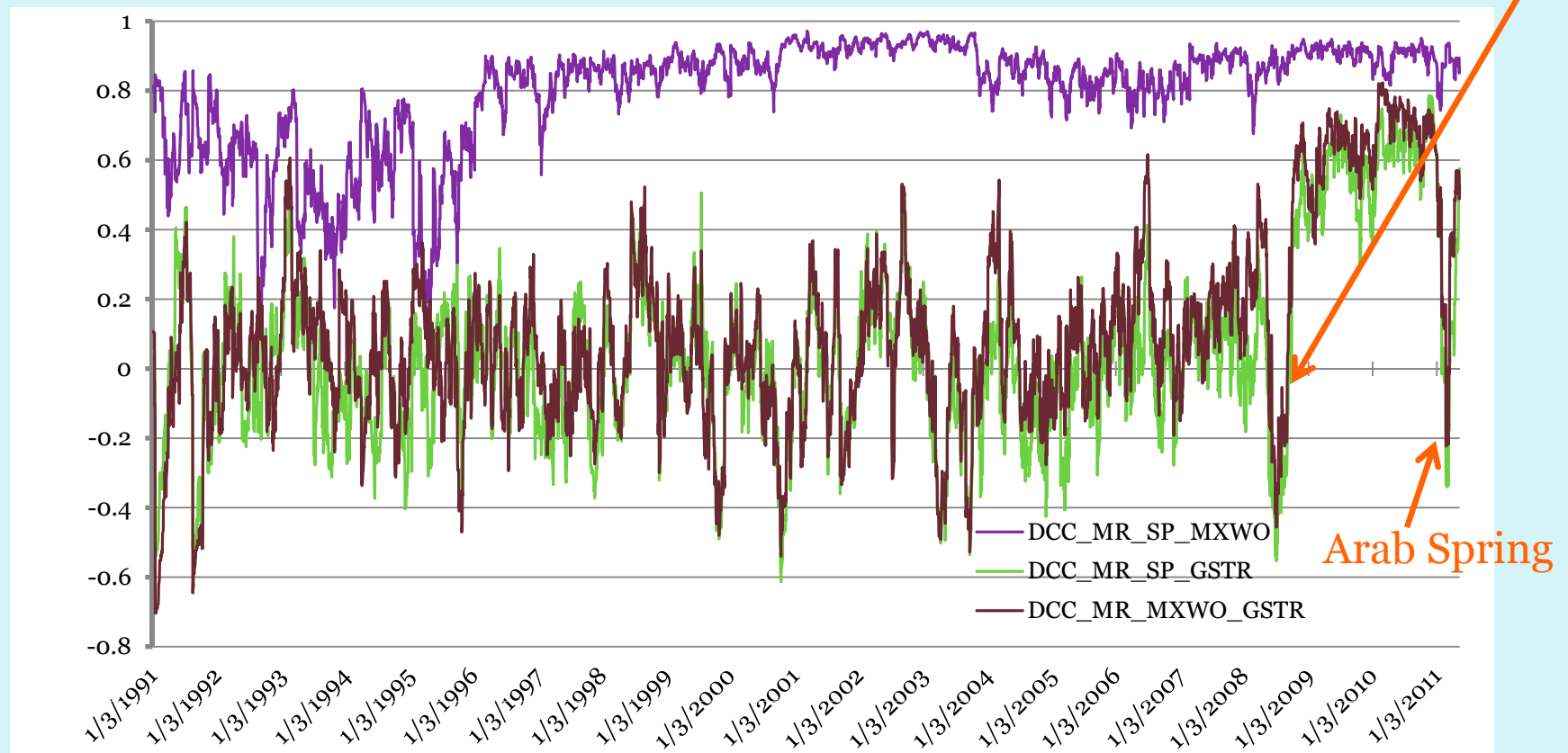
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 - 2-stage estimation:
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 - ✦ Second stage,
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 - Advantages:
 - ✦ Takes into account the time varying nature of the relationship between variables
 - ✦ Accounts for changes in volatility

Correlations between SP500 & GSCI Returns

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- Fig.1B: DCC average $\hat{\rho}$, fluctuate substantially +... **Lehman!**



B. What Predicts Correlations: Trader Positions *or* Fundamentals?



1. Trading

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- We would like
 - Detailed position data for all futures contracts in the GSCI index
- Unfortunately
 - Some of the contracts are non-US → no data (e.g., Gas oil & Brent crude)
 - Position data for RBOB gasoline are available only after 2006
- Bottom line
 - We have trader-level data for 17 contracts
 - ✦ Energy example: WTI crude oil, Henry Hub natural gas, No.2. heating oil, etc.
 - Weights:
 - ✦ time-varying weights from S&P
 - ✦ Rescaling to account for “missing” contracts

2. Economic Fundamentals?

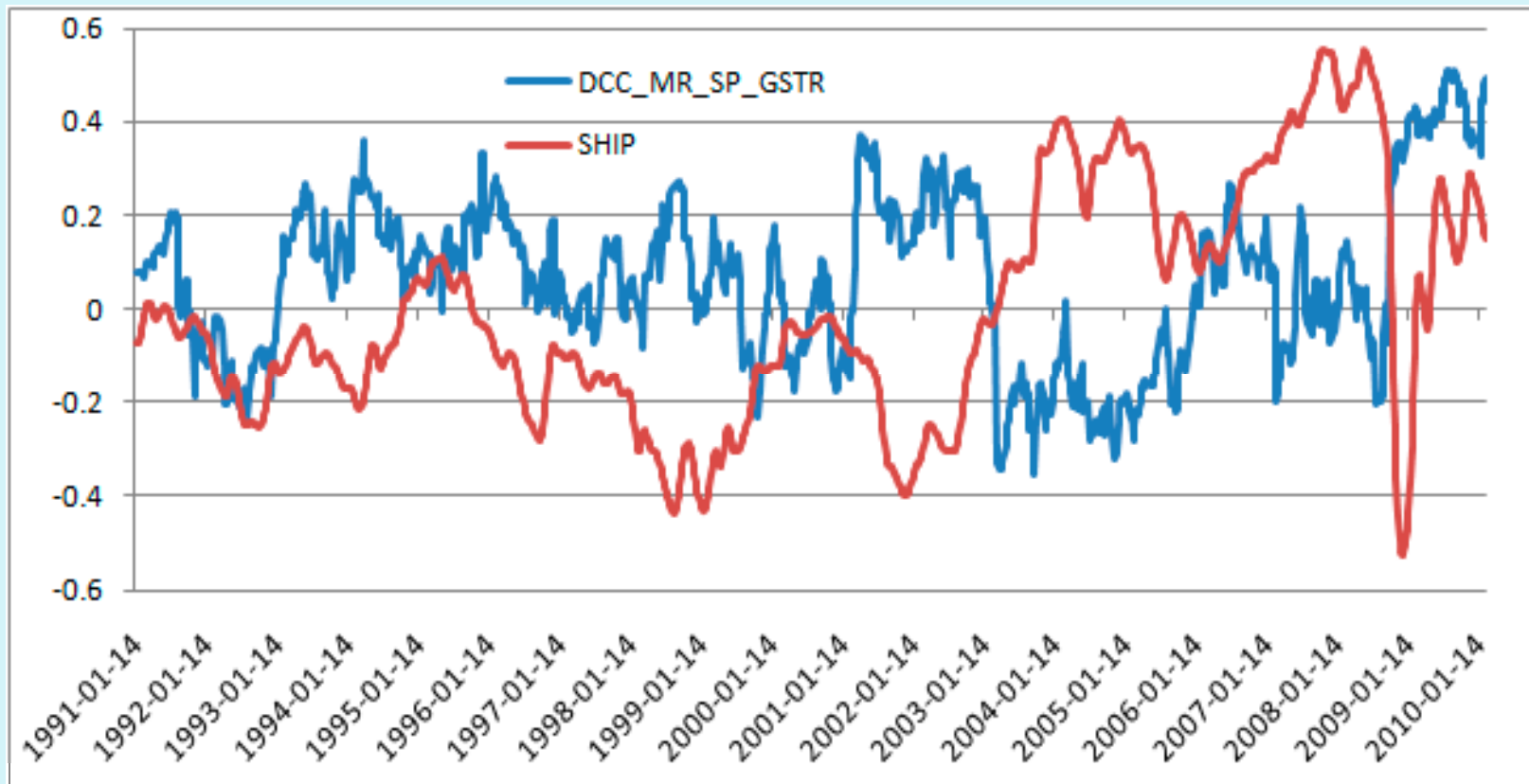
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- Inflation?
- Business cycles / economic climate?
 - They ought to matter
 - Erb & Harvey (*FAJ* 2006), Gorton & Rouwenhorst (*FAJ* 2006)
 - Kilian & Park (*IER* 2009)
 - Appropriate measurement level?
 - ✦ US economic activity?
 - ADS (*Aruoba-Diebold-Scotti, JBES* 2009)
 - *Available at high frequency*
 - ✦ World economy?
 - Shipping freight rates? (*Kilian, AER* 2009)
 - Non-exchange-traded commodity prices? (*Korniotis, FRB* 2009)
 - *Less likely that those price fluctuate with spec activity*

Worldwide Economic Activity & DCC

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- Figure 3: SHIP negatively related with DCC after 1997?



3. Market Stress?

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- **a. Financial Stress?**
 - Financial stress should matter:
 - ✦ Bond-equity returns extreme linkages in G-5 countries
 - Hartmann, Straetmans & de Vries, *REStat* 2004
 - ✦ International equity market correlations increase in bear markets
 - Longin & Solnik, *JF* 2001
 - ✦ Commodity-equity linkages went up in Fall 2008
 - Buyuksahin, Haigh & Robe, *JAI* 2010
 - ✦ Financial shocks are propagated internationally through channels such as
 - bank lending (e.g., van Rijckeghem & Weder, *JIE* 2001)
 - international mutual funds (e.g., Broner *et al*, *JIE* 2006)
 - Our measure: TED Spread
 - ✦ *Robustness*: VIX
- **b. Hedge fund or spec activity or cross-market traders?**
- **a+ b**: Do these effects interact?

C. What Really Matters?

ARDL Regressions



B. Explaining Commodity-Equity DCC

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- Regress the DCC estimate on...
 - ...trader **position data**
 - ✦ Each trader category entered separately
 - Short-dated (≤ 3 months) *vs.* Far-dated (> 3 months) positions
 - ✦ All traders in a category *vs.* only commodity-equity cross-mkt traders
 - ...**real-sector variables**
 - ...**market stress proxies**
 - ✦ **and interaction terms**
- Technical issue
 - Some series are $I(0)$, others $I(1)$; also, endogeneity?
 - **ARDL model**, Pesaran-Shin (1999) approach
 - Lagged values of variables to deal with AC and endogeneity
 - One cointegrating vector → OK

Economic Activity & Market Stress Matter

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	<u>2000-2010</u>	<u>1991-2010</u>	<u>2000-2010</u>	<u>1991-2010</u>
Constant	-0.0425855 (0.1139)	-0.0456055 (0.07643)	-.00925942 (0.05749)	-0.0193913 (0.04863)
ADS	0.136424 (0.1530)	-0.0784245 (0.06634)	0.153715 * (0.08115)	0.00826134 (0.04729)
SHIP	-0.785661 ** (0.3811)	-0.249104 (0.1790)	-0.596757 *** (0.1880)	-0.251052 ** (0.1165)
UMD	0.126140 (0.1070)	0.0924424 (0.07331)	0.0760120 (0.05278)	0.0692592 (0.04678)
TED	0.630212 ** (0.3125)	0.240228 * (0.1410)	0.334082 ** (0.1368)	0.111721 (0.08770)
DUM			0.485022 *** (0.1232)	0.486330 *** (0.1243)

But Speculative Activity Matters, as well!

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	<u>2000- 2010</u>		<u>2000- 2010</u>	
Constant	-3.85024	***	-2.08797	**
	(1.328)		(0.9959)	
ADS	0.103863		0.132858	*
	(0.09492)		(0.07009)	
SHIP	-0.933864	***	-0.693805	***
	(0.2664)		(0.1905)	
UMD	0.0893486		0.0712289	
	(0.06653)		(0.04622)	
TED	6.24366	**	4.27775	**
	(3.120)		(2.102)	
Excess Spec.	3.07302	***	1.64474	**
	(1.048)		(0.8008)	
INT_TED_WSIA	-4.37543	*	-2.96711	*
	(2.261)		(1.533)	
DUM			0.391434	***
			(0.1273)	

Notice the Differential Impact under Stress

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	<u>2000- 2010</u>		<u>2000- 2010</u>	
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VI. Conclusion



Findings

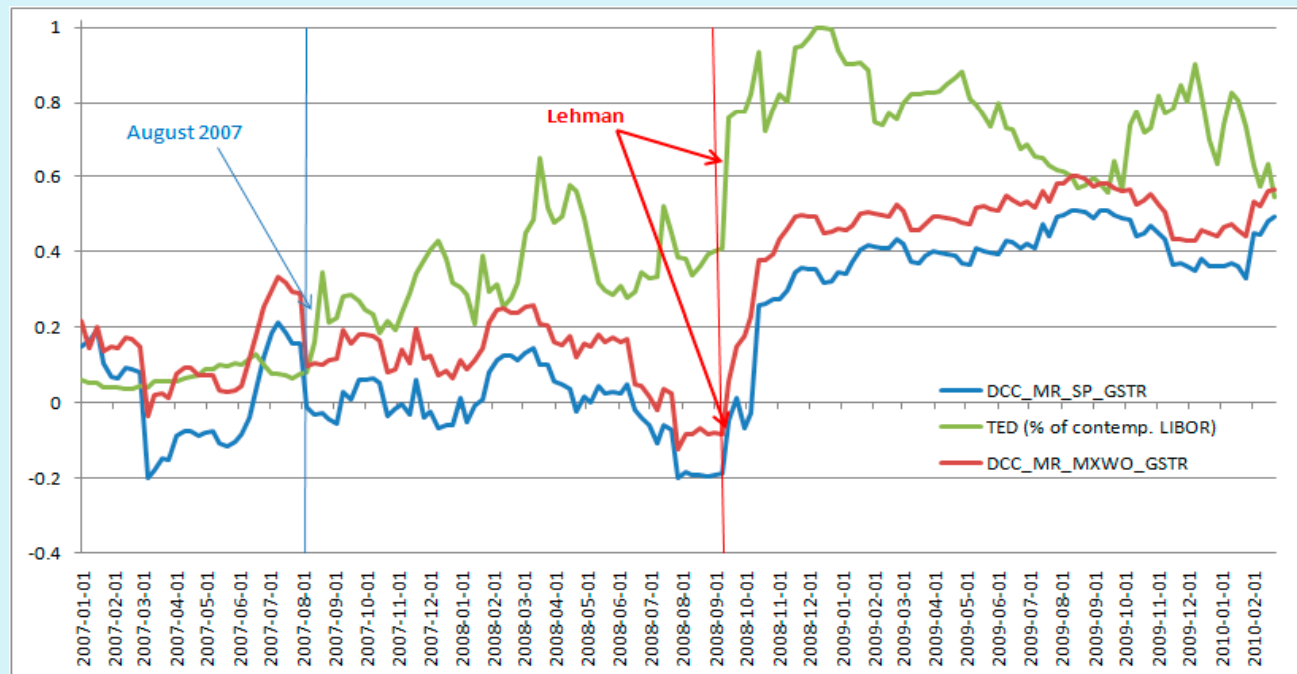
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- **“Co-movements”**
 - ✦ Time variations in correlations, but no obvious trend till crisis
 - ✦ Extreme-events analysis: commodity umbrella leaks
- **“Speculation”** in cross-section of commodity markets
 - ✦ Increase in “excess” speculation
- **Predictive power of spec positions** in commodity markets
 - ✦ Spec activity helps link markets
 - ✦ Market stress matters, too
 - ✦ Interaction – contagion through wealth effects?
- **Information on OI composition should be payoff-relevant**
 - ✦ disaggregation

Further Work

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- Disaggregation
- What has been happening post-Lehman?



- Theory? *What should correlations look like*