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Regulating the Commodity Markets: Data vs Politics

Bahattin Buyuksahin
International Economic Analysis
Bank of Canada

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Regulatory Challenges

- Financial Crisis—precipitated by mortgages
- Commodities
- Public (mis)Perceptions
- Worldwide Markets—Cooperation
  - IOSCO, OECD, IEA, etc.
- Financial/Product Market Overlap
  - SEC, EIA, FERC, Fed, etc.
  - On Exchanges and OTC
- Perspective—futures markets robust

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Dodd-Frank

- Title VII—OTC Derivatives
  - Increase transparency, efficiency
  - Mitigate counterparty risk
  - Mitigate systemic risk
- Requirements
  - Execution on swap execution facilities (SEFs)
  - Central clearing
  - Public reporting
  - CFTC/SEC/Fed-defined universe

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Dodd-Frank (cont.)

- Position limits
  - Prevent excessive speculation
  - Prevent manipulation
  - Ensure market liquidity
  - Ensure price discovery
- Swap dealers
  - Capital requirements
  - Margin requirements
  - CFTC/SEC/Fed-defined universe

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Sources of Commodity Price Changes

- Uncertainty/Risk Management?
- Animal Spirits/Excessive Speculation?
- Traders?
  - OTC swaps
  - Speculators—"Massive Passives"
    - Commodity Index Traders
    - ETFs

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Outline

1. Stylized facts
2. Financialization of commodities
3. Economic Studies
4. Conclusion and next steps

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1. Stylized Facts

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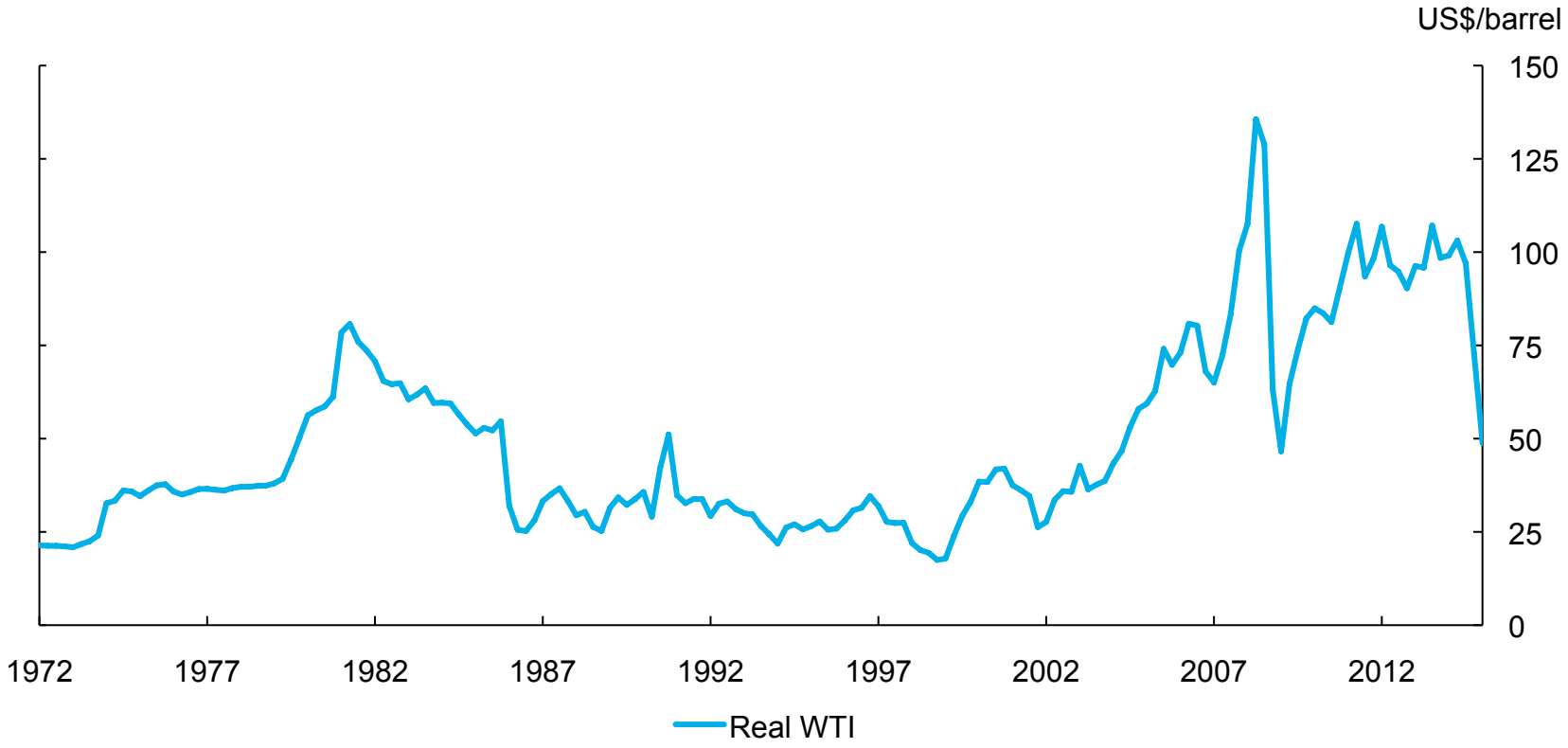
Fact 1: Fluctuating price levels

Real price of WTI
2014 U.S. dollars



Nominal price of WTI deflated using the U.S. GDP deflator.
Sources: U.S. Bureau of Economic Analysis and Bank of Canada

Last observation: 2015Q1

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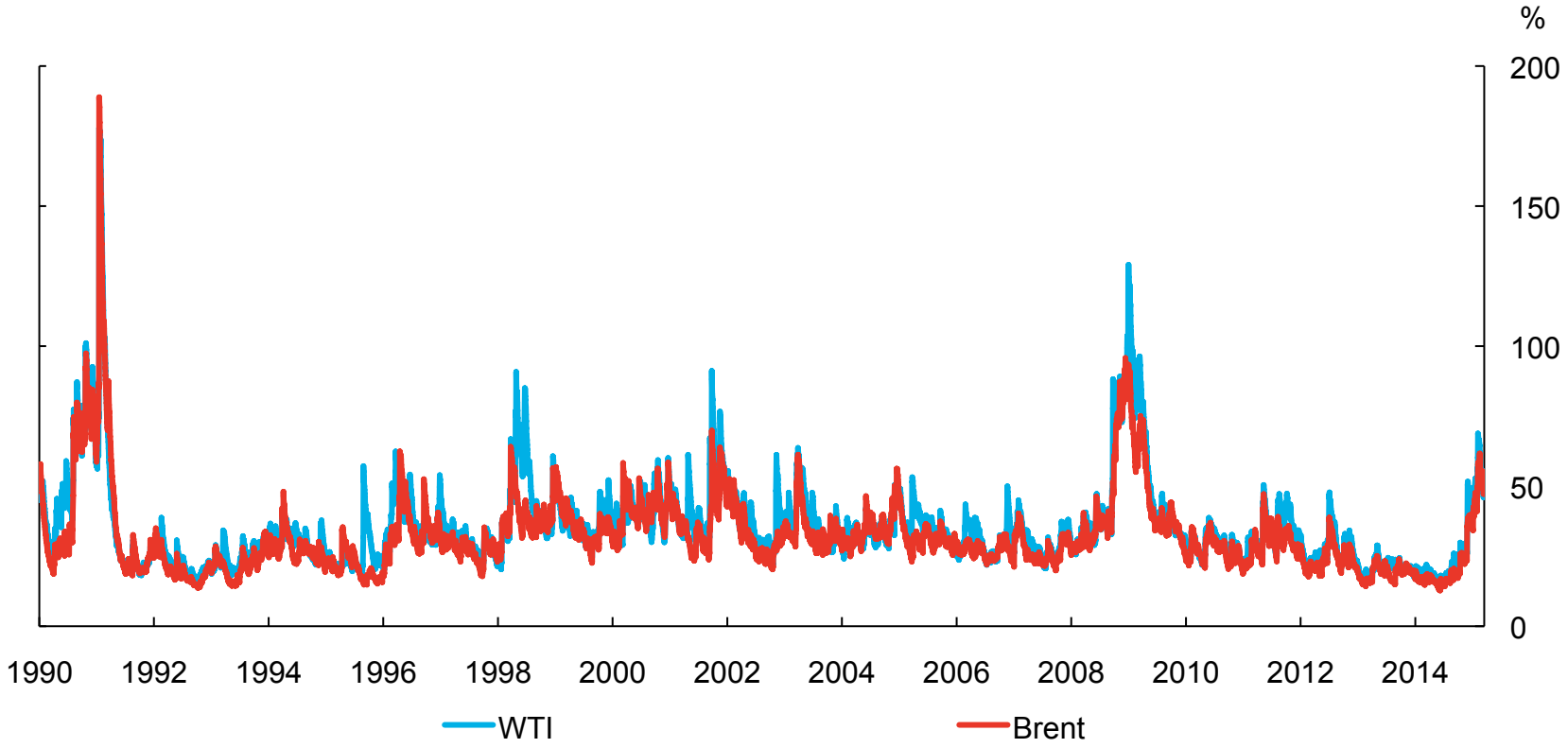
Fact 2: Perception of increased volatility

Volatility in crude oil markets has increased in recent months
Implied volatility GARCH(1,1)



Source: Bank of Canada calculations

Last observation: 17 March 2015

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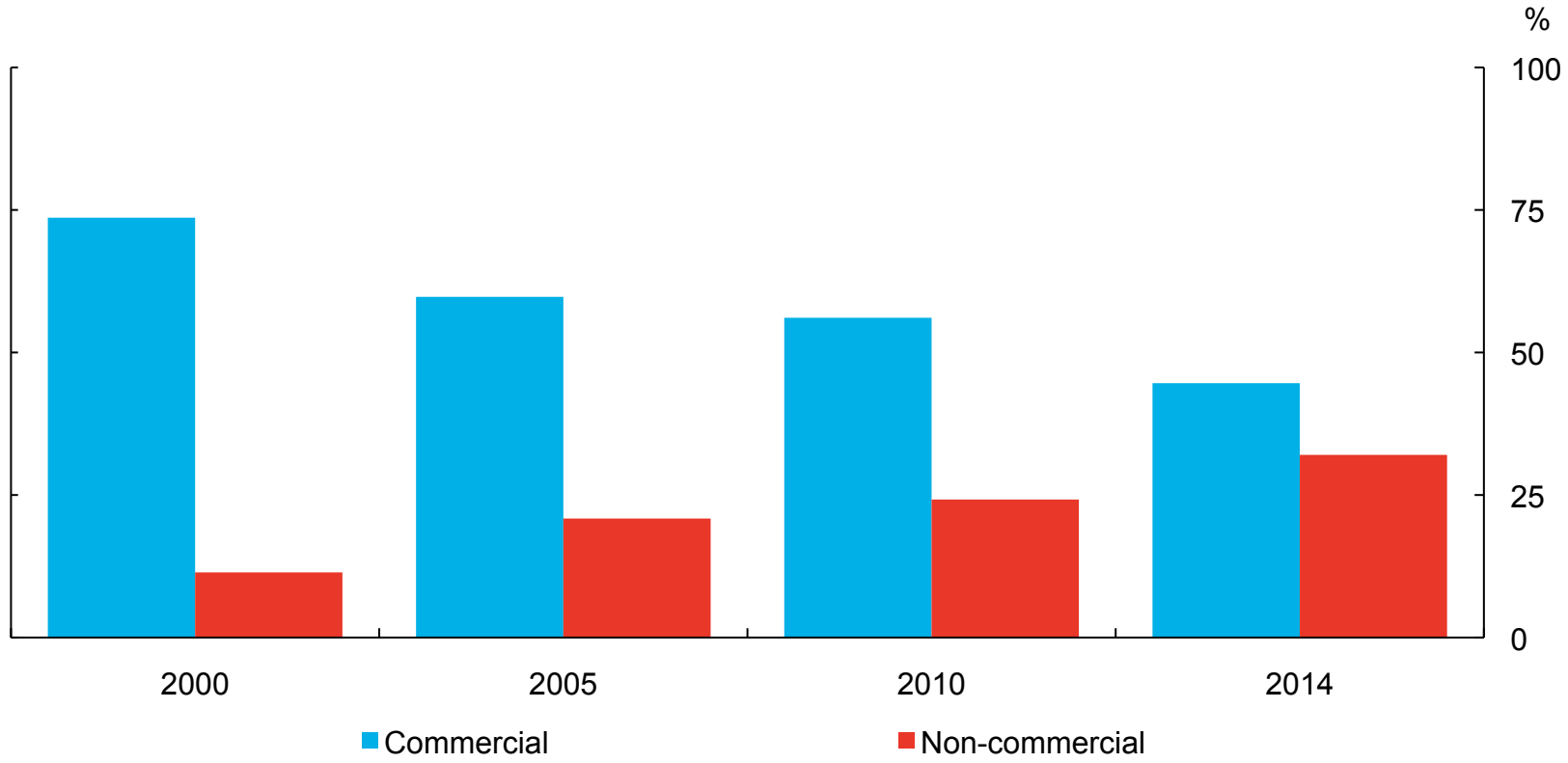
Fact 3: Increased participation of non-commercial traders

Evolution of WTI futures market shares since 2000



Note: Matket share do not add sum to 100 per cent due to non-reportable positions.
Sources: U.S. Commodity Futures Trading Commission and Bank of Canada calculations

Last observation: 2014

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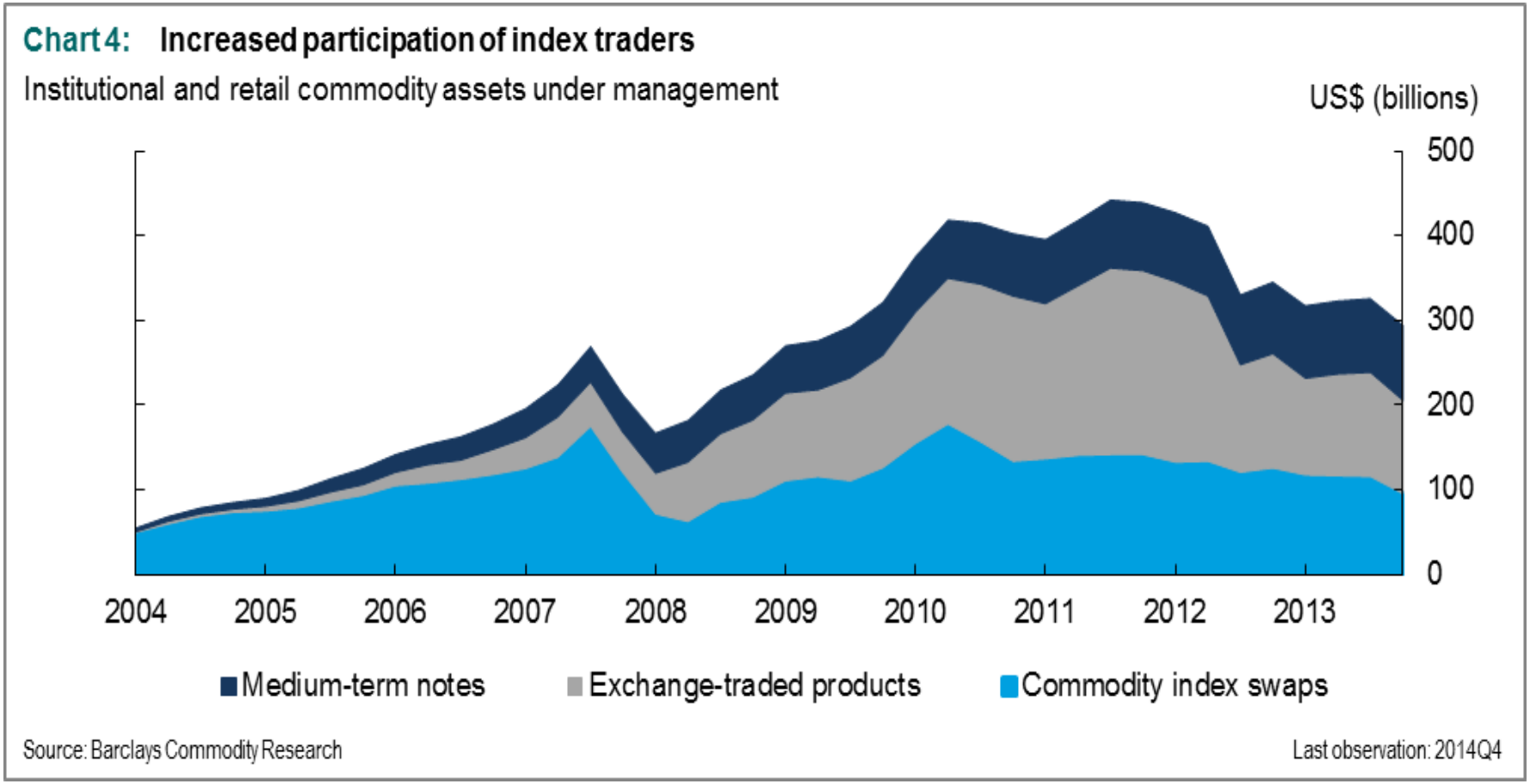
Fact 4: Increased participation of index traders



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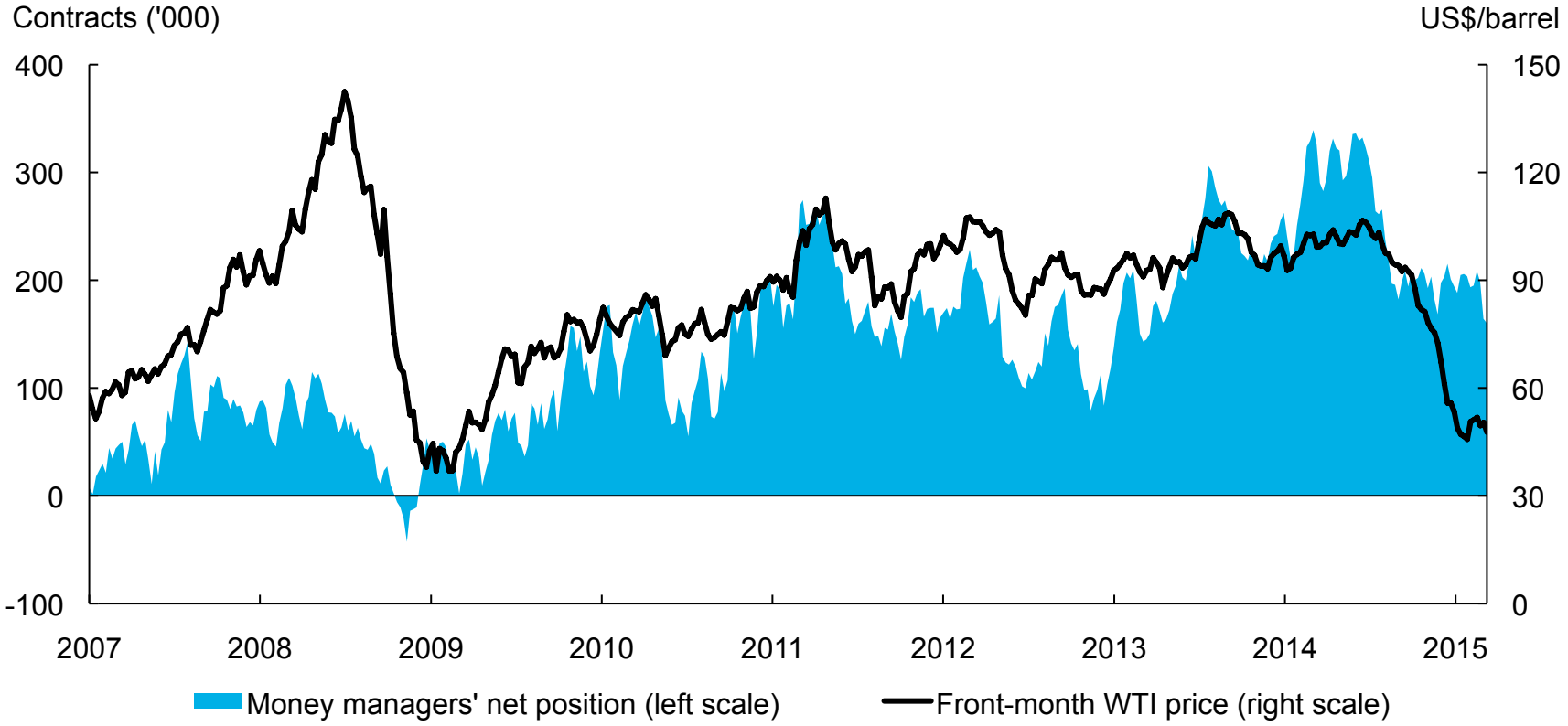
Fact 5: Strong correlation between net money managers' positions and prices

Money managers' net positions and WTI nearby futures price



Sources: U.S. Commodity Futures Trading Commission and NYMEX

Last observation: 10 March 2015

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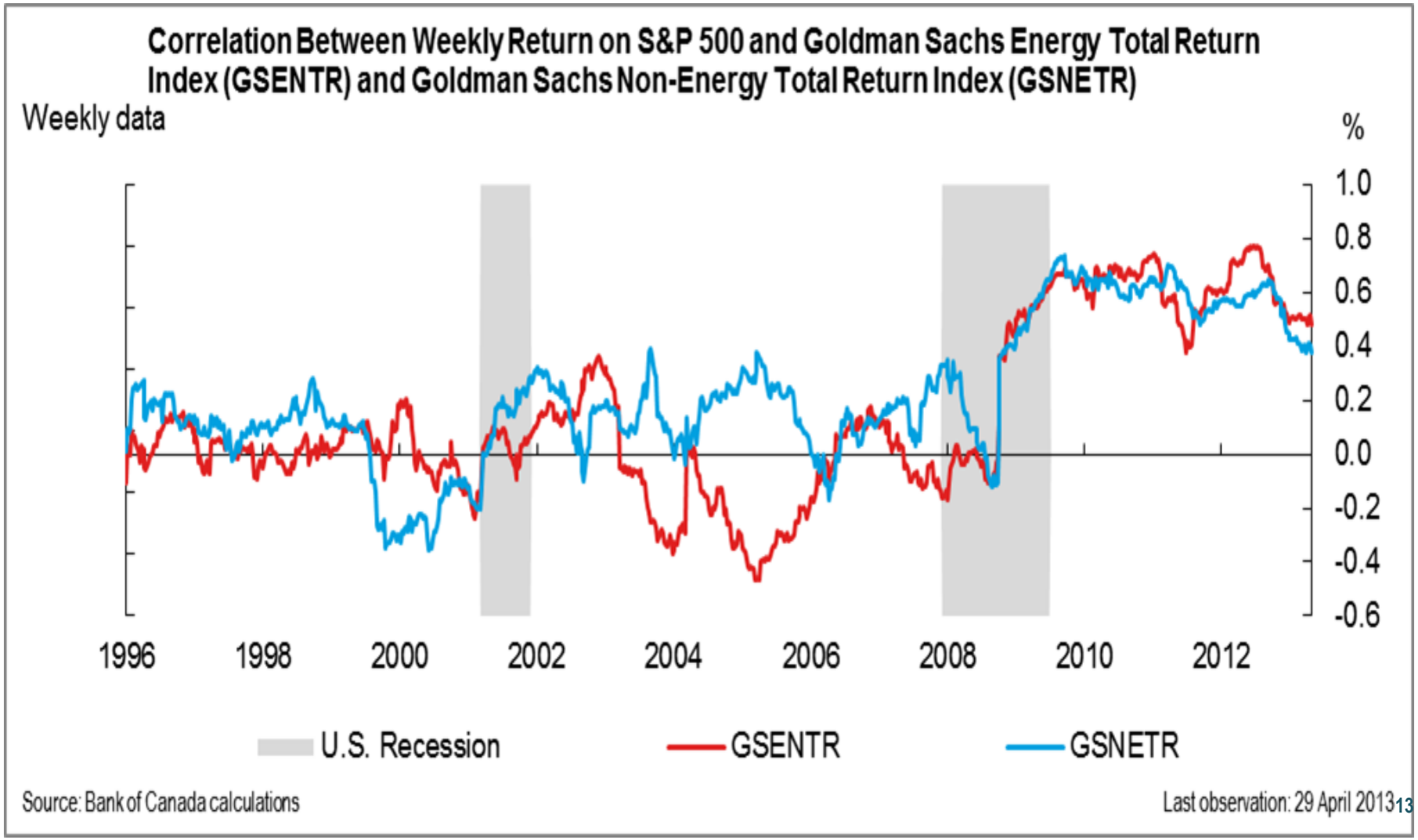
Fact 6: Increased correlation between asset classes



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2. Financialization of Commodities

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Potential benefits and costs of financialization

- Benefits
  - More efficient derivative pricing methods - price discovery generally takes place in derivatives markets (Buyuksahin et al., 2008)
  - Integration of physical crude oil markets (Fattouh, 2010)
  - Reducing the market price of risk (Pirrong, 2011)

- Costs
  - Divergence of prices from “fundamentals”
  - Excessive volatility
  - Erosion of long-run diversification benefits

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2a. Benefits of Financialization

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Economic Studies I: Inter-Commodity Linkages

- "Fundamentals, Trader Activity and Derivative Pricing"
  - Buyuksahin, Haigh, Harris, Overdahl, and Robe
- Focus on Swap Dealer participation
  - From commodity index trading in nearby futures
  - From OTC positions in back-dated futures
- Cointegration of Crude Oil futures prices
  - Result in "better" pricing for hedgers in 1-year and 2-year contracts
- Supports the notion that markets should encourage broad participation

Overview

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- Do ST and LT commodity futures move in sync?
  - Theory: yes (cost of carry relation → stable relation)
  - Empirics: requires long series of backdated futures prices
    - » **We focus on WTI sweet crude oil futures**
- What do we find?
  - ST and MT prices (<9 months) cointegrated since early 1990s
  - LT contracts (>1 year):
    - » Before 2002: not cointegrated with nearby
    - » Since mid-2004: cointegration!
      - + survives crisis
- Why the transformation?
  - Changes in level & structure of market activity? **Yes**
  - Role of "fundamentals"?
    Yes

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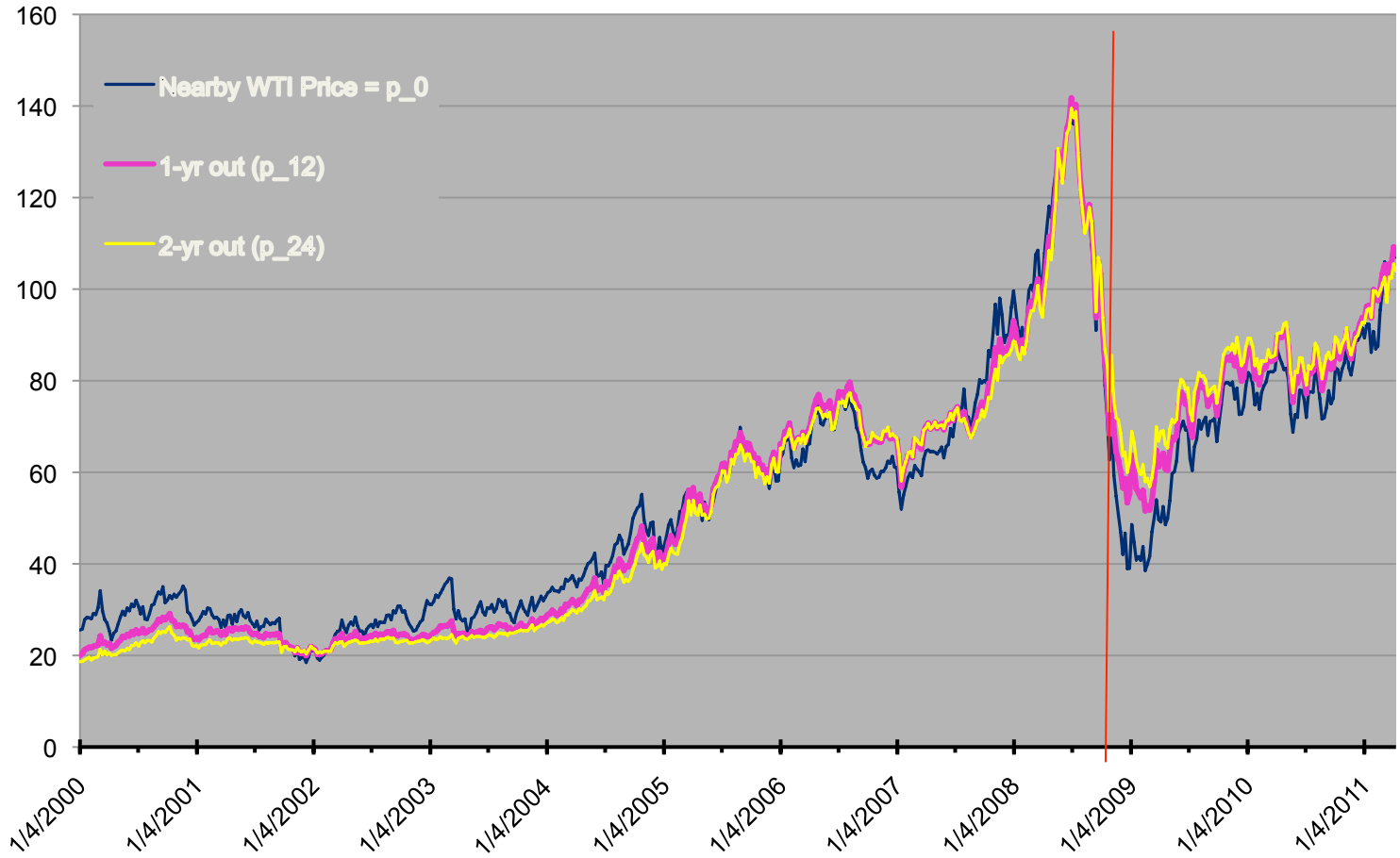
NYMEX Crude Oil Futures (WTI)

Nearby, 1-yr and 2-yr Prices: 2000-2011



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Cointegration – Idea

- Futures prices should be cointegrated (i.e., there ought to be a stable LT relationship between different-maturity futures), simply through the cost-of-carry model:

$$F_t = S_t e^{(r+u-y)t}$$

Where r = Interest rate

u = Storage costs

y = Convenience yield

t = Time to maturity

- **Cointegration** tests for a statistically significant link between futures prices (F_t) at different horizons (t)

Data

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- Our focus:
  - Nearby, 1- and 2-year WTI futures prices ("LT with nearby")
    - Also, check 2 to 9 months futures ("ST or MT with nearby")
- Prices
  - Tuesday settlement prices (weekly analysis)
- Time period
  - Prices for up to 1-year futures: March 1989 to May 2011
  - Prices of 2-year futures: July 1995 to May 2011

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Table 3A: Order of Co-integration

Panel A: Trace tests on order of cointegration

λ_{trace} *test statistic*	H_O:	*critical value (p-value)*
50.93	r = 0	34.10 (0.000)
22.91	r ≤ 1	19.87 (0.020)
4.72	r ≤ 2	8.47 (0.323)

- At most one co-integrating vector
  - Robust to using 1995-2008 *vs.* 1995-2011 data

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Table 3B: LT & ST Parameter Tests

Panel B: Tests for exclusion from the cointegrating vector

	H_O:	$\chi^2_{(1)}$ value (p value)
Nearby	$b_N = 0$	3.115 (0.078)
1 yr contract	$b_1 = 0$	0.969 (0.325)
2 yr contract	$b_2 = 0$	0.468 (0.494)

Panel C: Tests for weak exogeneity

	H_O:	value (p value)
Nearby	$a_N = 0$	0.198 (0.656)
1 yr contract	$a_1 = 0$	6.63 (0.01)
2 yr contract	$a_2 = 0$	6.08 (0.01)

- Cannot reject that the 1-yr and 2-yr prices are not part of the cointegrating relationship (economic reasons to keep them)
- Nearby is weakly exogenous
  - w.r.t. the short-run adjustment to the long-run relation, the 1- and 2-yr prices do all of the adjusting to perturbations in the cointegrating space

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Identifying Changing Cointegration

- Recursive Cointegration Analysis
  - Hansen & Johansen (1993)
  - Highlights changes in LT relationship between the three price series (one co-integrating vector)
  - Steps to recover the "R representation" (ECM)
    - 1. Use full sample to estimate ST parameters (*a*)
    - 2. Keeping ST estimates fixed, re-estimate LT parameters (*b*)
      - Start with a 3 years ("burn-in") period to calculate initial trace
      - Adding one week at a time, recalculate trace; then, repeat

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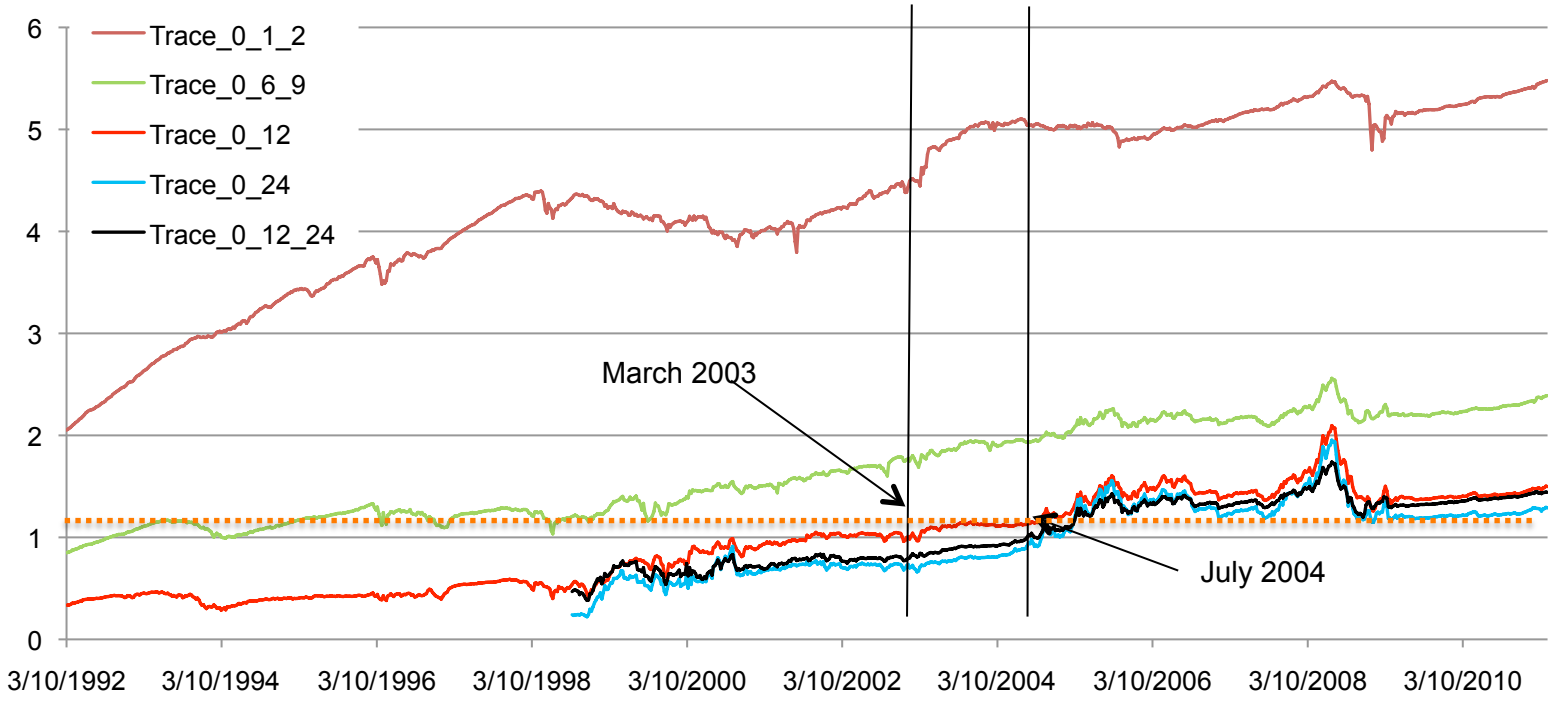
Trace Statistics

- Different for shorter-dated contracts
  - Short-dated contracts cointegrated with nearby much earlier



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Idea #1

Cointegration stems from cost-of-carry relation:

$$F_t = S_t e^{(r+u-y)t}$$

→ Fundamentals may have changed, affecting

- either the stochastic process driving the spot price
  - » Bessembinder *et al*, JF '95
- or the process for the net cost-of-carry
  - » Brenner & Kroner, JFQA '95

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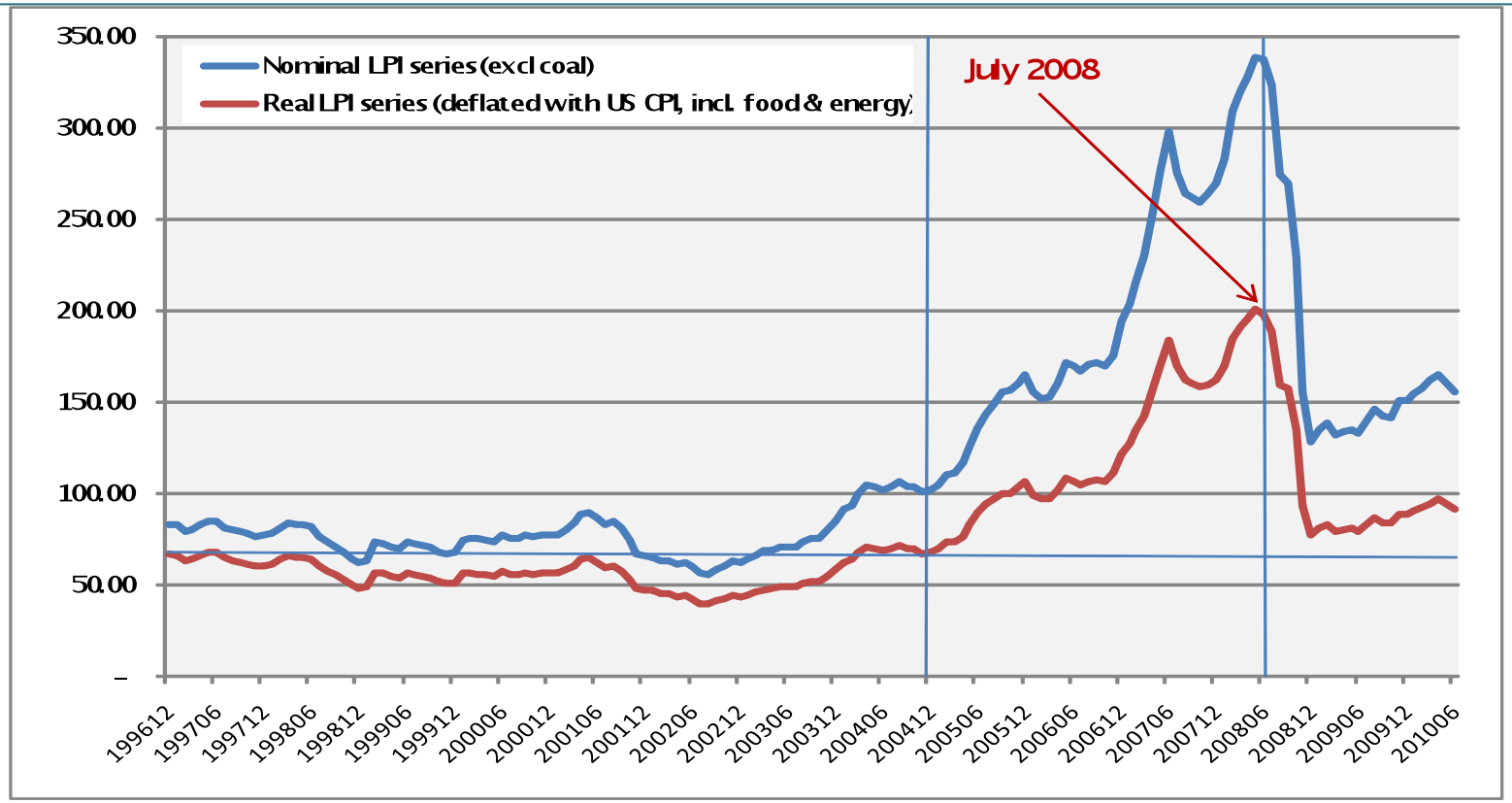
Hyp.#1: Demand Shock for Commodities?



Price index using equally-weighted average return on 8 non-exchange-traded commodities (1990 = 100)

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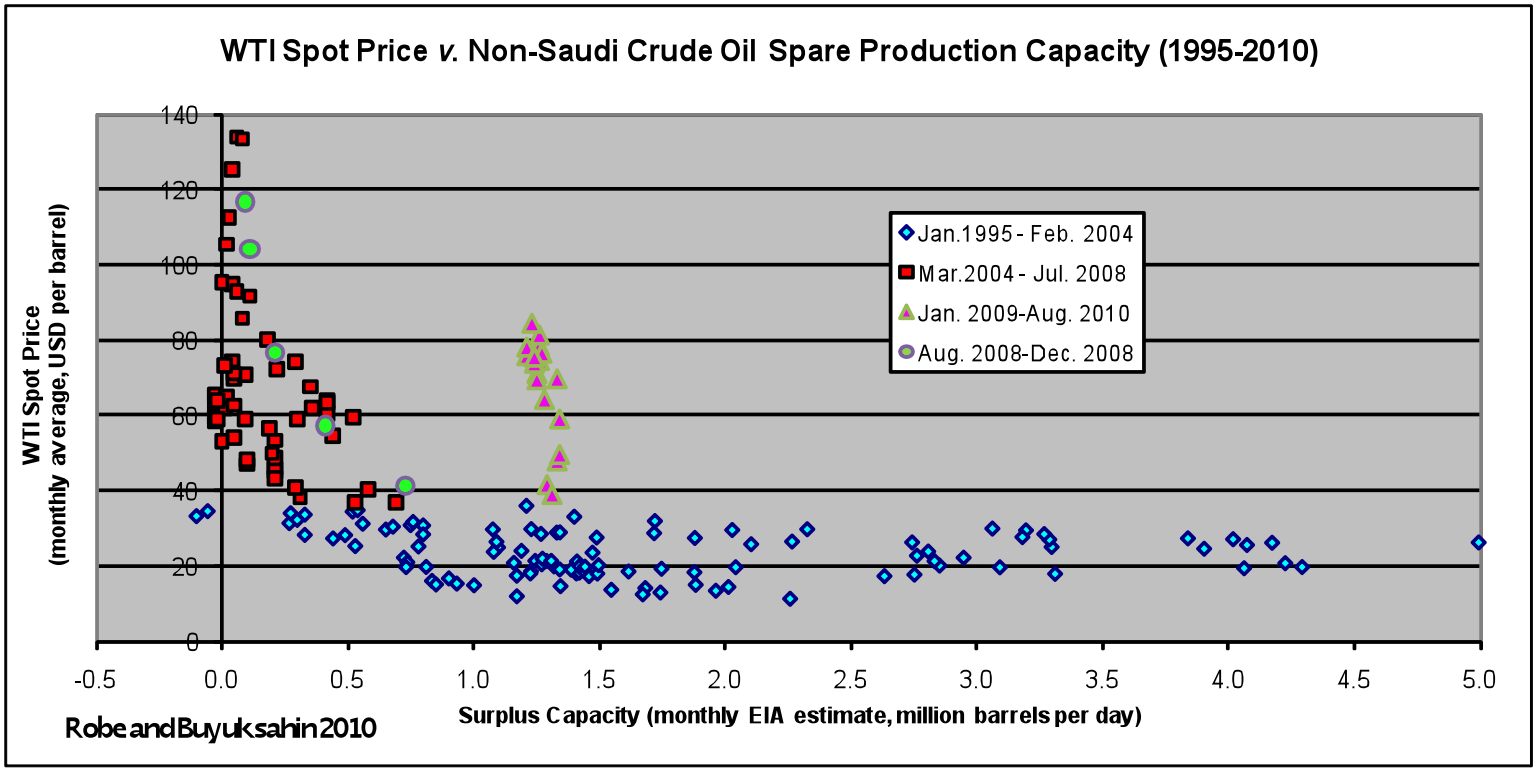
Hyp.#2: Structural Break in Oil Market?



Monthly data on crude oil spot prices and spare production capacity outside Saudi Arabia

(Source: EIA)

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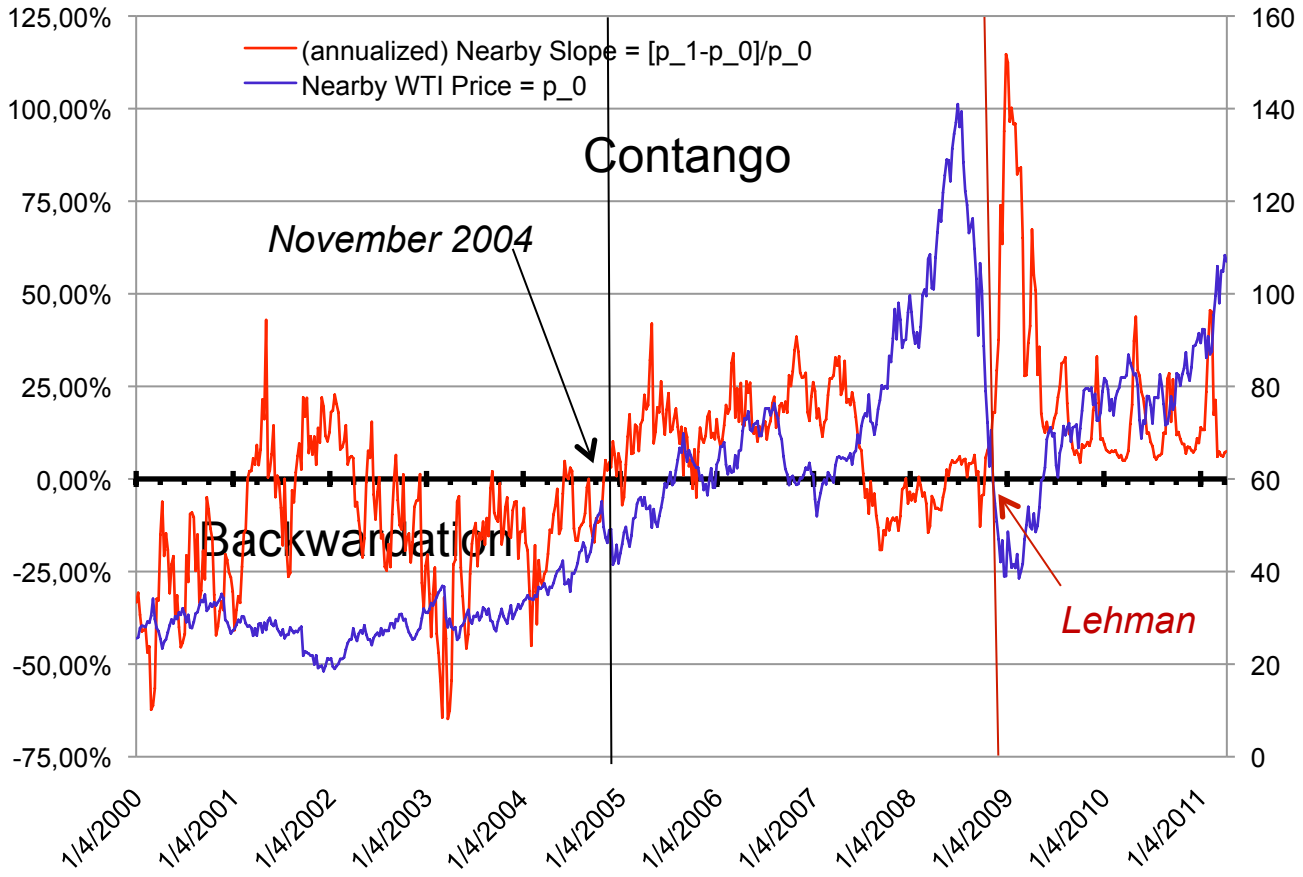
Hyp.#3: Storage?

Net cost of carry: positive after 2004, massively so post-Lehman



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Idea #2

Cointegration requires trading activity that exploits perceived pricing aberrations:

Has arbitraging become easier and/or more prevalent?

- More uninformed traders into the trading stream?
  - "thick market" (Admati & Pfleiderer, 1988; Roll *et al*, 2007)
  - Commodity-index investment flows?
- Arrival of new kinds of traders?
  - Less constrained (Başak & Croitoru, JFE '06)
  - Hedge funds, other financial traders?

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Our Detailed Data: Sub-Categories

- Non-commercials
  - **Hedge Funds** (includes Commodity Pool Operators (CPOs), Commodity Trading Advisors (CTAs), Associated Persons who control customer accounts, and other Managed Money traders)
  - **Floor Brokers & Traders**
  - **Non-Registered Participants** (Traders not registered under the Commodity Exchange Act (CEA) – mostly non MMT financial traders)
- Commercials
  - **"Traditional"**
    - **Producers**
    - **Manufacturers** (refiners, fabricators, etc.)
    - **Dealers** (wholesalers, exporter/importers, marketers, shippers, etc.)
  - **Commodity Swap Dealers** (includes arbitrageurs)

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Research Questions

- Pricing Analysis
  - Are near- and far-month futures prices co-integrated?
  - If so, why?
    - Do fundamentals matter for cointegration?
    - Does trading activity matter for cointegration? If so, whose?

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Explaining Convergence

- Tables 8-9-10: Regress the Trace statistic on…
  - …trader position data
    - Each trader category entered separately
      - Nearby *vs*. 1-yr plus 2-yr
    - Market share *vs*. total number
  - …real-sector variables
  - …controls for exog. changes (e-trading, Dec & June)
- Technical issue
  - Some series are I(0), others I(1); also, endogeneity?

    → Pesaran-Shin (1999) IV approach to cointegration

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Table 9.1: "Financials"

		Model 1 (Market Shares)		Model 2 (Positions)	
		Coefficient	p value	Coefficient	p value
Constant		**0.3944** **	0.0117	**0.5433** ***	0.0003
Spare Capacity		**(0.0434)** **	0.0260	**(0.0465)** **	0.0134
Slope		**3.4561** ***	0.0037	**3.9456** ***	0.0069
TOI (Total Open Interest)		**7.81 E-07** ***	0.0076	**6.95 E-07** **	0.0131
Electronic Trading		**(0.5281)** ***	0.0000	**(0.6465)** ***	0.0000
December		0.1302	0.3488	0.0163	0.9088
June		0.1423	0.1773	0.0264	0.7822
Floor Brokers & Traders	Nearby	(2.0397)	0.1665	-7.09 E-07	0.8713
	(1-year + 2-year)	0.7341	0.8823	1.26 E-06	0.9107
Hedge Funds	Nearby	0.0168	0.9768	-9.12 E-07	0.5030
	(1-year + 2-year)	**2.6162** *	0.0735	2.53 E-06	0.3391
Non-registered participants	Nearby	**3.6755** **	0.0476	**7.44 E-06** **	0.0348
	(1-year + 2-year)	8.2870	0.1371	2.41 E-05	0.1402
Commodity Swap Dealers	Nearby	0.7819	0.2177	1.22 E-06	0.2801
	(1-year + 2-year)	**(3.6009)** **	0.0422	-6.22 E-06	0.1768

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Table 9.2: "Hedgers"

		Model 1 (Market Shares)			Model 2 (Positions)		
		Coefficient		p value	Coefficient		p value
	Constant	**1.2188**	***	0.0008	**0.5134**	***	0.0055
	Spare Capacity	**(0.0348)**	**	0.0212	**(0.0381)**	**	0.0422
	Slope	**4.9582**	***	0.0001	**4.2750**	***	0.0060
	TOI (Total Open Interest)	**7.04 E-07**	***	0.0004	**8.17 E-07**	***	0.0004
	Electronic Trading	**(0.3683)**	***	0.0005	**(0.4727)**	***	0.0003
	December	**0.2855**	**	0.0253	0.1091		0.5299
	June	0.1021		0.2018	(0.0186)		0.8269
Manufacturers	Nearby	**(1.9859)**	*	0.0560	-3.17 E-06		0.3653
	(1-year + 2-year)	2.4473		0.3285	8.03 E-08		0.9900
Producers	Nearby	1.1362		0.4592	8.85 E-06		0.1563
	(1-year + 2-year)	**(22.5346)**	**	0.0455	**-7.59 E-05**	*	0.1041
Commercial Dealers	Nearby	**(1.4558)**	***	0.0097	-5.76 E-07		0.6550
	(1-year + 2-year)	**(3.7662)**	*	0.0786	7.31 E-08		0.9857
Commodity Swap Dealers	Nearby	0.2253		0.6172	**2.24 E-06**	*	0.0841
	(1-year + 2-year)	(1.6968)		0.2249	7.74 E-07		0.7899

Market Structure

- Participants
  - Change in the relative importance of (non) financial traders
  - Different types of traders behave very differently
  - Direction of net positions often varies with maturity
    - Commodity swap dealers are often short in LT contracts
- Pricing and Hedging
  - Market for 1+ year contracts is now much larger than the total market in 2000
  - Prices up to 2 years are now co-integrated with shorter-term contracts
    - Growth of financial trading helps explains this positive change
    - Hedging ability is improved

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Explaining Cointegration

- Fundamentals matter
  - Spare capacity & Slope
  - Demand for all industrial commodities
- Trading activity matters as well
  - Commodity swap dealers in nearby contracts
    - Not further-out positions
  - Financial traders in nearby and backdated contracts
    - Hedge funds *(MMT)*, others *(NRP)*

2b. Cost of Financialization

Divergence of prices from “fundamentals”
Excessive volatility
Erosion of long-run diversification benefits

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Do Speculators Drive Crude Oil Prices?

A simple question

- Is speculative activity destabilizing markets?
  - Is speculative activity moving prices?

Theory: Stabilizing Speculation

- **Profitable speculation must involve buying when the price is low and selling when the price is high (Friedman, 1953)**
- **Speculators fill hedgers' demand-supply imbalances and provide liquidity to the market (Keynes, 1923)**
- **Speculative activity reduces cost of hedging (Hirshleifer, 1990 and 1991)**

Theory: Destabilizing Speculation

- Shleifer and Summers (1990) note that herding can result from investors reacting to common signals or overreacting to recent news.
- Long et al. (1990) show, rational speculators trading via positive feedback strategies can increase volatility and destabilise prices.

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Economics Studies II: Role of Financial Players

- More investment money in commodity futures markets
  - Thousands of hedge funds, commodity index funds, etc.
  - Assets under Management (AUM): exceeded
    $400bn in 2011, inflows = $350bn in 10 years
- What could this development mean for…
  - Energy Price Levels? Buyuksahin and Harris (2011)
  - Oil Market Volatility? Buyuksahin, Brunetti and Harris (2011, 2011)
  - Cross-Market Linkages? Buyuksahin and Robe (2010, 2011)

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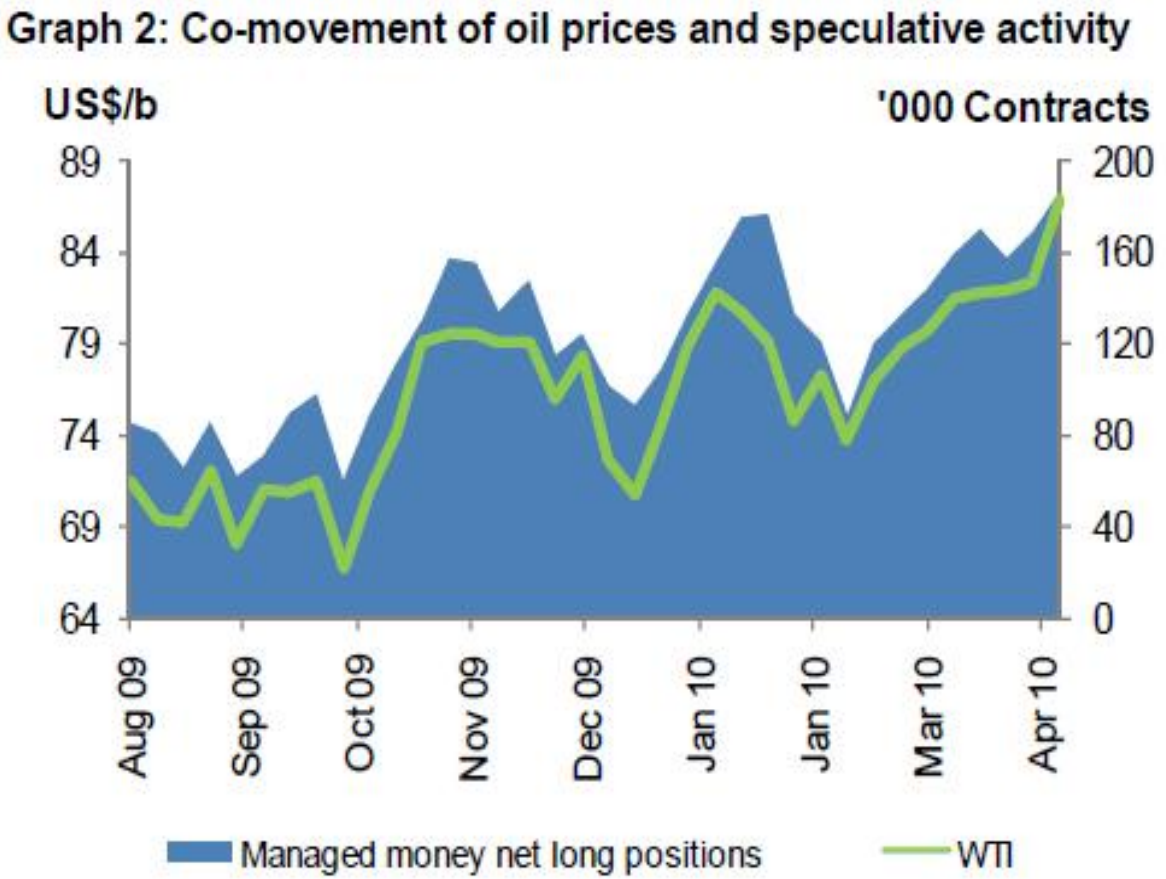
Nice Data – Show us it matters!



2010 OPEC "observation":

Strong positive correlation between net hedge fund positions and crude oil prices

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Data and Findings

- For each category we consider:
  - Level of Net Futures Position
  - Change in Net Futures Position
  - Level of Net Total Position (Futures plus futures equivalent options)
  - Change in Net Total Position
- Trading Activity is measured at
  - Daily and multiple day intervals

➢ What we found:

  - Speculative activity does not Granger-cause prices
  - In general, on the other hand, we find the reverse causality to hold, i.e. position change is Granger caused by price change.

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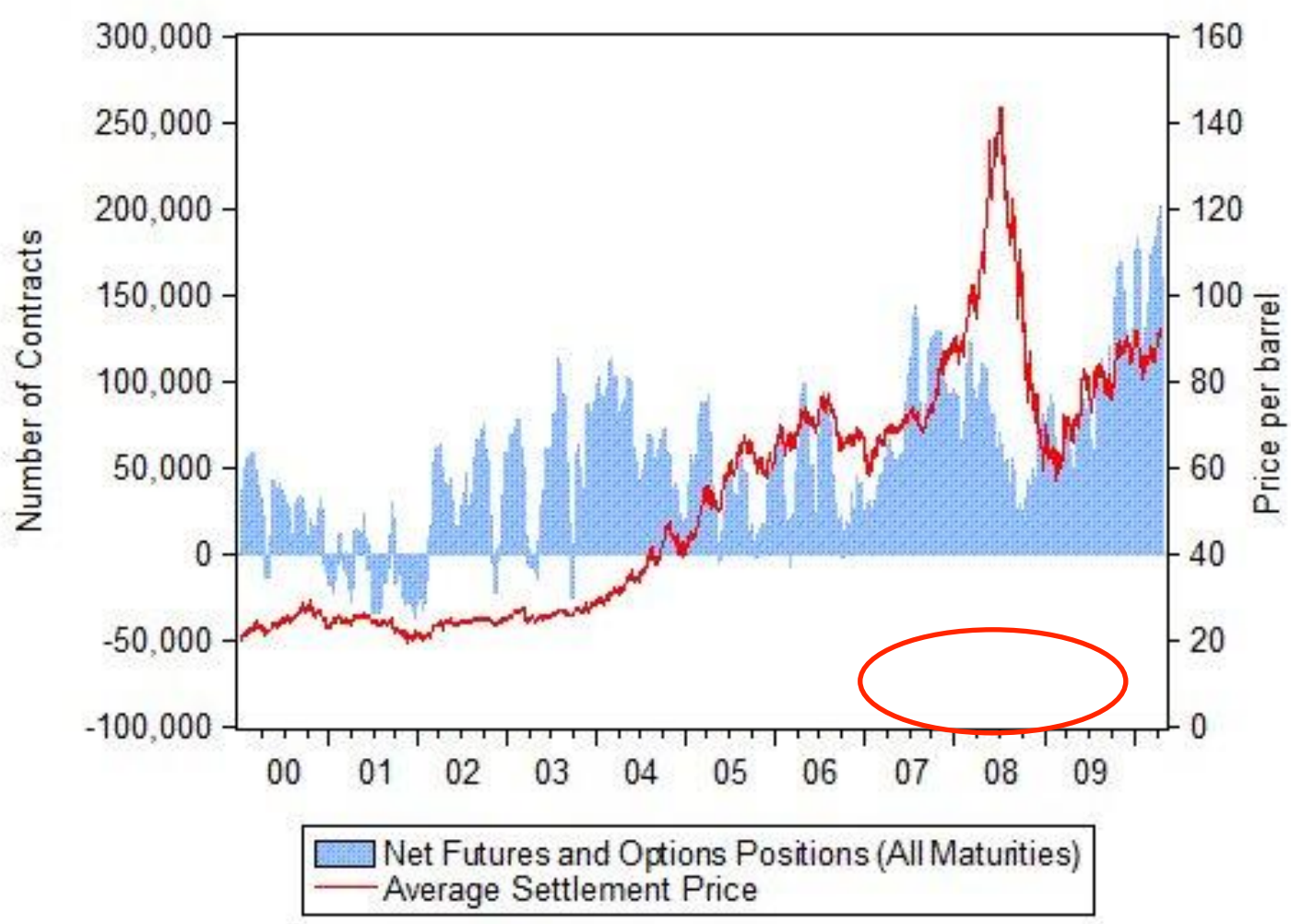

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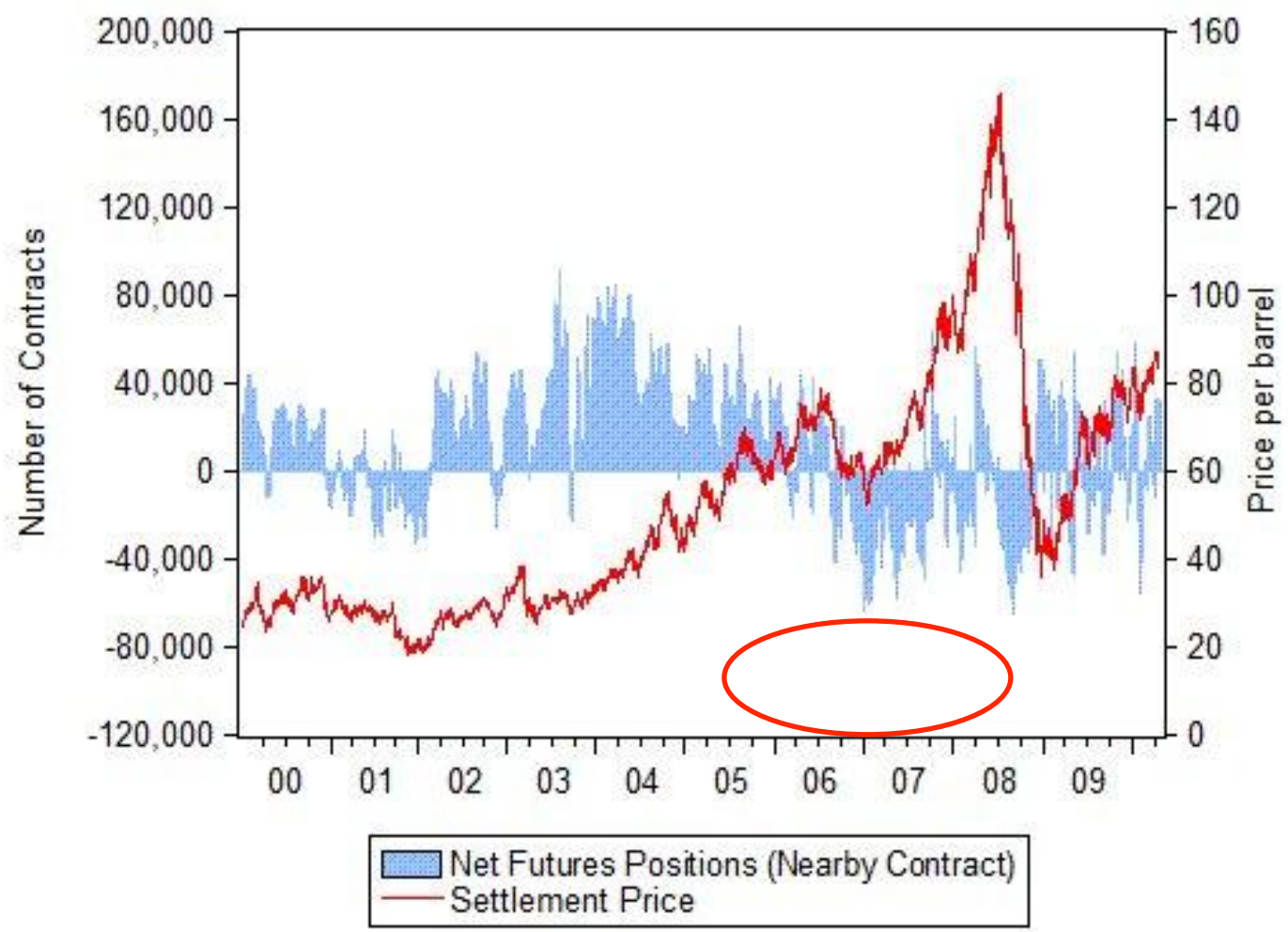

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Multivariate Granger Causality and Contemporaneous Effects Findings

- Multivariate Granger Causality-Empirical Results:
  - Returns are not Granger-caused by positions (including those of swap dealers and hedge funds)
  - Hedge fund activity
    - does not cause any variable in the system
    - is caused by all the variables in the system
    - reacts to market conditions and provides liquidity
    - reduces volatility
  - Swap dealer activity
    - Generally reduces volatility

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Multivariate Granger Causality and Contemporaneous Effects Findings

- Contemporaneous Effects
  - Hedge funds are reacting to market conditions and providing liquidity to the market; i.e. there is a uni-directional causation from change in price to change in MMT's position
  - Interestingly, Swap dealers change in position is preceded by change in prices
  - More transparent information on composition of open interest is needed to have better understanding of role of different market participants on prices and observed high volatility in commodity derivatives markets

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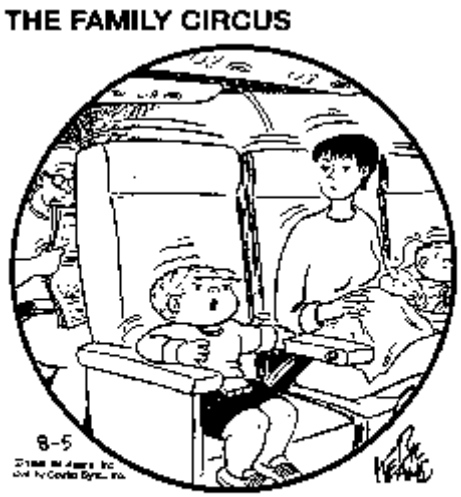
Correlation does not imply causation



"I wish they didn't turn on that seatbelt sign so much! Every time they do, it gets bumpy."

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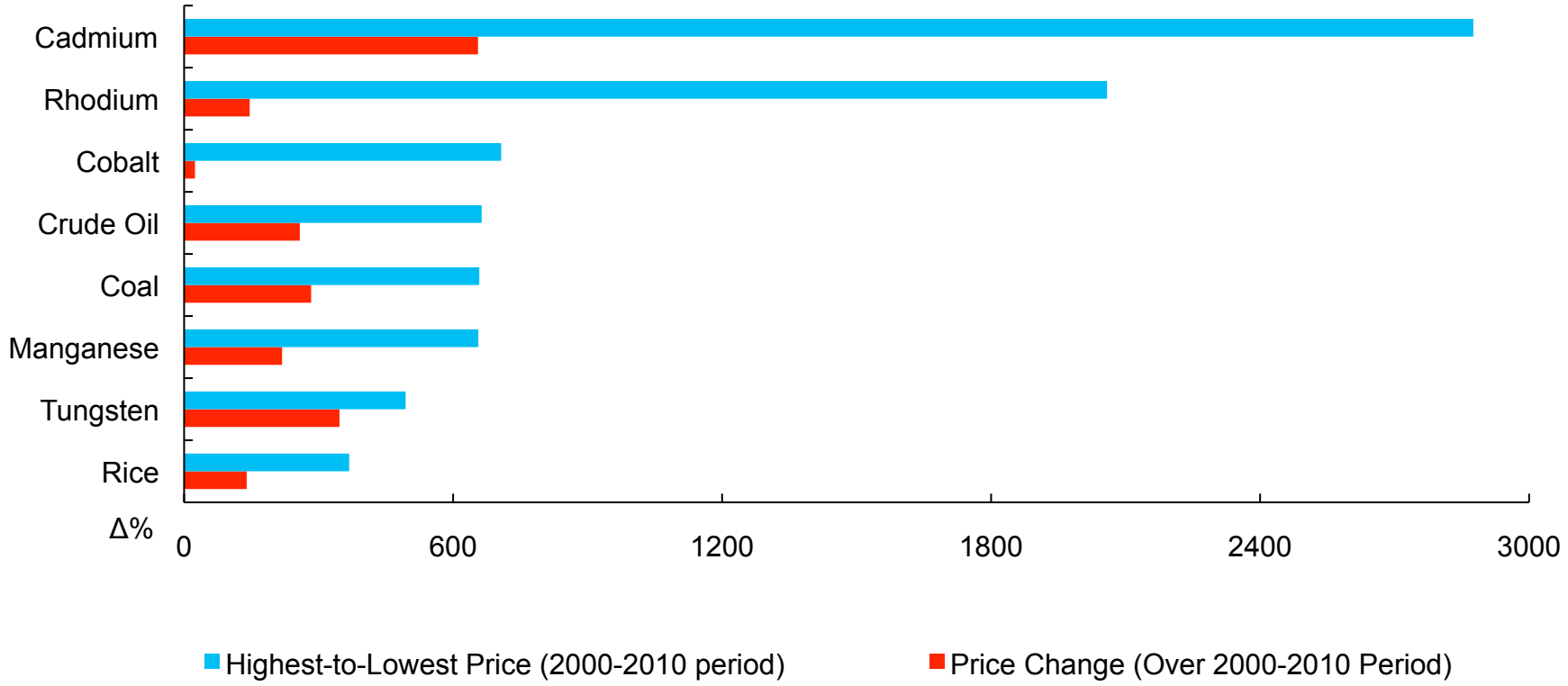
Increase in prices is not unique to exchange-traded commodities

Performance of crude oil and non-exchange-traded commodities



Last observation: 28 December 2010

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Economics Studies III: Role of Financial Players- Markov Switching

- Speculator (hedge fund, swap dealer and arbitrageur) positions have grown in commodity markets this decade
- Concurrently, commodity prices have fluctuated greatly
- Can these trader positions shed light on the probability of continuations/reversals in the market?
- Results:
  - Market fundamentals contribute significantly
    - Crude Oil: Business cycle, credit risk (TED spread), MSCI world index, expected inflation
  - Incremental information from hedge funds, swap dealers and arbitrageurs

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Motivation and Our Approach

- Abreu and Brunnermeier (2002, 2003) model "Syncronization Risk"
- Futures markets reflect these characteristics
  - competitive, rational arbitrageurs
  - complex to determine supply and demand
  - potential for sequential awareness of price deviations from fundamental value
  - both long and short positions expose arbitrageurs to significant holding costs--mark-to-market margins
- Our Approach: Regime switching models with
  - Time varying transition probabilities
  - Conditional on trader positions (changes)

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The Model

➢ Starting point: Simple GARCH

$$y_{i,t} = \mu_i + \sum_{j=1}^{k} \theta_{i,j} X_{i,j,t} + \varepsilon_{i,t}$$

$$\varepsilon_{i,t} = \sigma_{i,t} u_{i,t} \qquad u_{i,t} \sim i.i.d.N(0,1)$$

$$\sigma^2_{i,t} | \Omega_{t-1} = \omega_i + \sum_{j}^{p} \alpha_{i,j} \varepsilon^2_{i,t-j} + \sum_{j}^{q} \beta_{i,j} \sigma^2_{i,t-j}$$

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Regime Switching: Conditional Mean

$$y_{i,t} = \mu_i + \sum_{j=1}^{k} \theta_{i,j} X_{i,j,t} + \varepsilon_{i,t}$$

$$\mu_i = \mu_{i,1} S_t + \mu_{i,0}(1 - S_t)$$

$$S_t \in \{0, 1\} \quad \forall t$$

$$Pr(S_t = 0 | S_{t-1} = 0) = p_{00}$$

$$Pr(S_t = 1 | S_{t-1} = 1) = p_{11}$$

where 0 indicates a bear market and
1 indicates a bull market

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Regime Switching: Conditional Variance

$$\sigma^2_{i,t}(S_t, S_{t-1}, ..., S_0) = \omega_i(S_t) + \sum_j^p \alpha_{i,j}(S_{t-j})\varepsilon^2_{i,t-j} + \sum_j^q \beta_{i,j}(S_{t-j})\sigma^2_{i,t-j}(S_{t-1}, ..., S_0)$$

$$\sigma^2_{i,t}(a, b) = \omega_i(S_t = a) + \alpha_i[\varepsilon^2_{i,t-1}(S_{t-1} = b)] + \beta_i\sigma^2_{i,t-1}(S_{t-1} = b)]$$

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Regime Switching: Transition Probabilities

$$Pr(S_t = 0 | S_{t-1} = 0) = p_{00} = \Phi(Z'_{t-1}\varsigma)$$

$$Pr(S_t = 1 | S_{t-1} = 1) = p_{11} = \Phi(Z'_{t-1}\upsilon)$$

- **where 0 indicates bear market and 1 indicates bull market**
- **Z's are either the standardized daily closing net futures positions (Positions) or position changes (Changes)**

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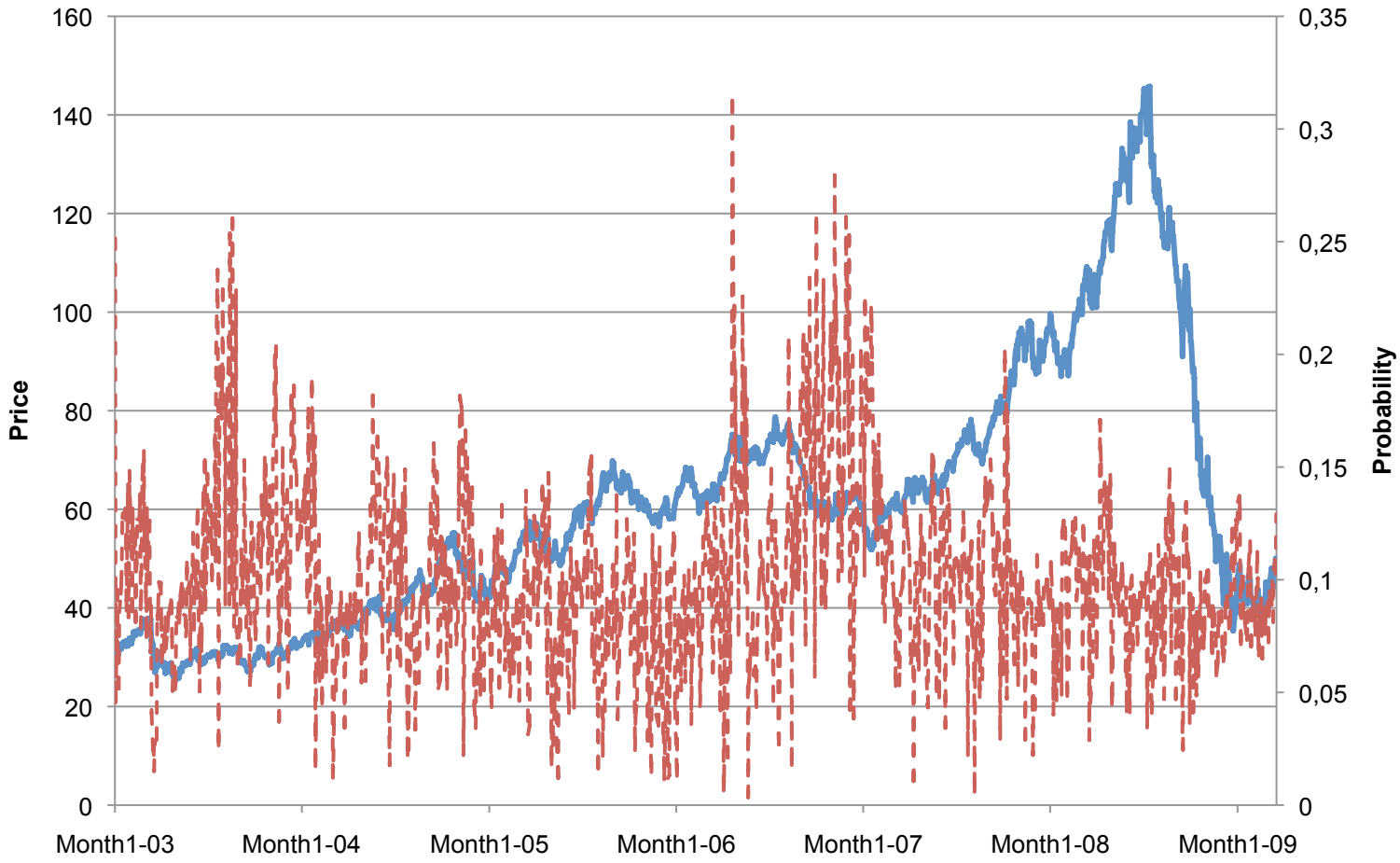
Crude Oil P(1,0): Explanatory Variable: Hedge Fund Position Levels



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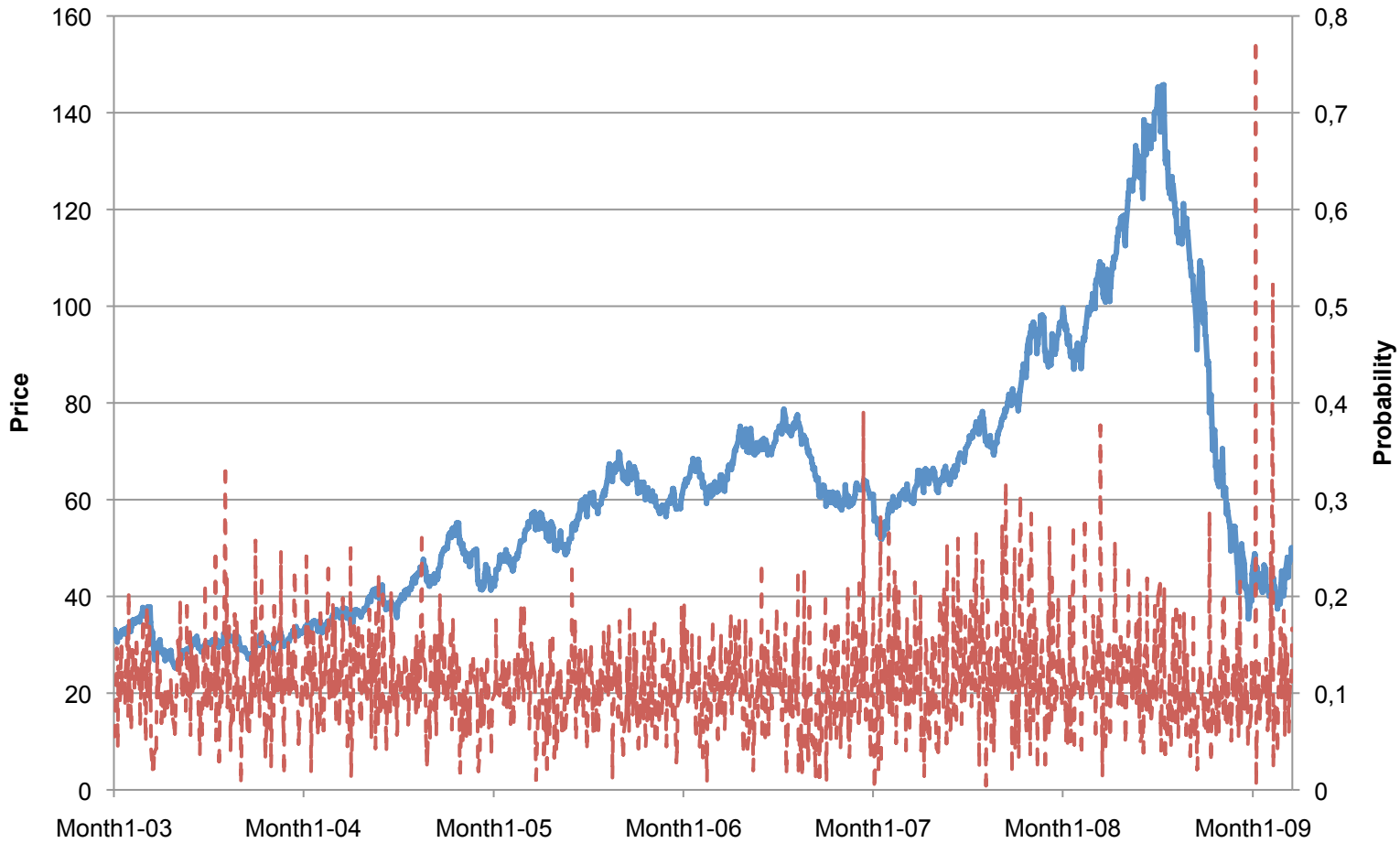
Crude Oil P(0,1): Explanatory Variable: Hedge Fund Position Changes



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Parameters	Model(1,1)	Positions	Changes	Positions	Changes
Bear Market Mean Return (μ_0)	-1.292*** (0.242)	-1.312*** (0.260)	-1.252*** (0.172)	-1.339*** (0.300)	-1.276*** (0.234)
Bull Market Mean Return (μ_1)	0.565*** (0.186)	0.541*** (0.166)	0.627*** (0.117)	0.552*** (0.185)	0.557*** (0.164)
ω	0.000 (0.002)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.003)
γ	18.96*** (3.231)	18.966*** (3.239)	21.800*** (3.962)	18.966*** (4.009)	18.966*** (2.802)
α	0.055*** (0.014)	0.056*** (0.014)	0.057*** (0.014)	0.054*** (0.015)	0.056*** (0.013)
β	0.939*** (0.018)	0.938*** (0.016)	0.935*** (0.017)	0.939*** (0.017)	0.937*** (0.010)
P_{00}-Constant	0.266 (0.269)	0.409 (0.320)	0.208 (0.173)	0.456 (0.459)	0.106 (0.070)
P_{00} $Z_{t-1} \geq 0$		-0.363*** (0.083)	0.374 (0.379)	-0.328 (0.237)	0.106 -0.474
P_{00} $Z_{t-1} < 0$		0.022 (0.042)	-0.068 (0.314)	0.305 (0.365)	-0.382* (0.213)
P_{11}-Constant	1.066*** (0.240)	1.319*** (0.253)	1.239*** (0.220)	1.074*** (0.207)	1.066*** (0.153)
P_{11} $Z_{t-1} \geq 0$		-0.332* (0.200)	-0.227 (0.199)	-0.037 (0.109)	-0.141 (0.172)
P_{11} $Z_{t-1} < 0$		0.165** (0.064)	0.372* (0.211)	-0.023 (0.018)	-0.174 (0.234)
θ	-0.128*** (0.038)	-0.126*** (0.036)	-0.136*** (0.032)	-0.127*** (0.043)	-0.128*** (0.018)
AIC LogLikelihood	6860.72 -3421.36	6855.23 -3414.62	6857.14 -3415.57	6858.37 -3416.18	6857.67 -3415.84

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Main Findings:

- **The model identifies 2 regimes: Low Volatility Bull and High Volatility Bear markets**
  - **Table 3**
  - **γ represents the ratio of bear market volatility to bull market volatility**
- **Volatility is highly persistent**
  - **α+β close to 1.0**
- **Hedge Fund Positions add incremental value**
  - **Significant coefficients**
  - **Lower AIC, Higher Log-Likelihood**
- **Swap Dealer Positions not so much**

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Caveats

- **Transition Probabilities are somewhat low**
  - **No normative standard**
- **Incremental information may be related to fundamental information**
  - **hedge fund positions simply reflect fundamentals**
- **Explore this possibility**
  - **Table 6: Positions are related to fundamental factors!**
  - **Table 7: Transition probabilities controlling for fundamental factors**

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Trader Positions & Fundamentals

	Positions	Changes	Positions	Changes
Panel A: Crude Oil				
	Hedge Funds		Swap Dealers	
AutoRegressive Component	0.942***	-0.061***	0.940***	0.455***
	(0.009)	(0.024)	(0.051)	(0.023)
ADS—Business Cycle	961.5***	425.9	-652.6	-176.9
	(364.3)	(330.9)	(458.4)	(259.5)
TED Spread	-629.8*	-511.9*	962.7	-269.6
	(380.2)	(309.8)	(755.2)	(368.6)
MSCI Equity Index	-139.8	154.4	255.9	180.2
	(241.2)	(181.75)	(231.8)	(125.4)
Expected Inflation	-4663***	-1835**	3768**	-703.5
	(1175)	(923.4)	(1598)	(727.7)
Adjusted-R^2	92.25%	1.11%	92.14%	21.07%

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Transition Probabilities, Fundamentals & Positions

	Levels		Changes		Levels		Changes	
	P_{01}	P_{10}	P_{01}	P_{10}	P_{01}	P_{10}	P_{01}	P_{10}
	i=Hedge Fund Positions				*i*=Swap Dealer Positions			
AR	0.613***	0.643***	0.143***	0.423***	0.472***	0.422***	0.372***	0.457***
	(0.022)	(0.024)	(0.043)	(0.023)	(0.025)	(0.027)	(0.028)	(0.027)
Trader *i*	1.1e-6***	3.2e-7***	-3.4e-7	-5.0e-6***	1.4e-7***	-5.5e-8	8.3e-8	6.5e-7**
	(1.4e-7)	(8.4e-8)	(6.5e-7)	(4.0e-7)	(5.3e-7)	(1.7e-7)	(1.8e-7)	(2.9e-7)
ADS	0.004***	-0.001	0.003	-0.009***	0.002**	-0.006**	0.003**	-0.006**
	(0.001)	(0.001)	(0.003)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)
TED Spread	-0.002*	0.003***	0.002	-0.001	0.001	-3.8e-4	-4.6e-4	-0.002
	(0.001)	(0.001)	(0.003)	(0.004)	(0.001)	(0.003)	(0.002)	(0.003)
MSCI Equity Exp. Infl.	0.218***	-0.221***	0.165	-0.746***	0.262***	-0.598***	0.067	-0.743***
	(0.056)	(0.051)	(0.116)	(0.155)	(0.054)	(0.159)	(0.075)	(0.145)
	-1.748***	0.108	-1.316*	2.103**	-0.392	1.694*	-1.149***	1.273
	(0.382)	(0.438)	(0.673)	(0.949)	(0.322)	(0.987)	(0.422)	(0.947)
R^2	49.52%	42.97%	2.78%	34.59%	24.09%	19.05%	15.61%	23.34%

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Main Findings

- **Crude Oil transition probabilities depend on fundamentals:**
  - **Business Cycle (ADS)**
  - **Expected Inflation**
  - **Credit Risk (TED Spread)**
  - **World stock market (MSCI)**
- **Hedge Fund Positions are incrementally significant**
- **Swap Dealer Positions are too!**
- **Similar results hold for corn and mini-S&P markets**

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Conclusions

- **Hedge fund and arbitrageur positions driven by fundamentals**
  - Swap dealer positions largely invariant to fundamentals
- **Speculative positions have incremental explanatory power beyond fundamentals**
  - Contribute significantly to transition probabilities between low volatility bull markets and high volatility bear markets
- **Further research on similar non-linear dynamics may hold promise for discerning bubble patterns a priori**

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Herding and Speculation in Crude Oil Market

- Herding behaviour might be destabilizing

- But (Buyuksahin et al. 2013a,b)
  - Herding in futures markets is comparable to what we see in the stock market
  - Herding has stabilizing effect

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Economic Studies IV: Herding and Positive feedback trading

- "The Prevalence, Sources and Effects of Herding"

  Buyuksahin, Boyd, Harris, Haigh

  - Test for herding by assessing the degree of correlation across hedge funds and/or FBTs in buying and selling of futures.
  - Also, we test for positive feedback trading by looking at the demand and past performance of futures product.
  - Finally, we test for excess demand and price changes.

- Empirical Findings
  - Overall herding measure for nearby contract is 0.07 for hedge fund and 0.06 for FBTs (for nearby and first deferred it is 0.09 for hedge funds and .07 for FBTs).
  - No indication of positive feedback trading by hedge funds or FBTs.
  - When prices are falling (20 out of 32 markets) , hedge funds may be herding, but they are buying which implies a stabilization effect on prices.

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Causes of Herding and What we do

- Large traders might have greater incentive to herd due to:
  - Perception that other agents might have superior information and infer information about the quality of investment holdings from one another's trade.
  - The basis of performance evaluation between institutions
  - Reaction to the same exogenous shock
- In this paper, we study the trading behavior of two groups of traders (hedge funds and floor brokers) to examine:
  - Herding between hedge funds as well as between FBTs
  - Positive feedback trading across the groups

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Causes of Herding and What we do

- Questions to be addressed in this paper:
  - Does herding occur among hedge funds? If so, does their trading pattern have a stabilizing or destabilizing effect on market prices?
  - Does herding occur among floor brokers? If so, does their trading pattern have a stabilizing or destabilizing effect on market prices?

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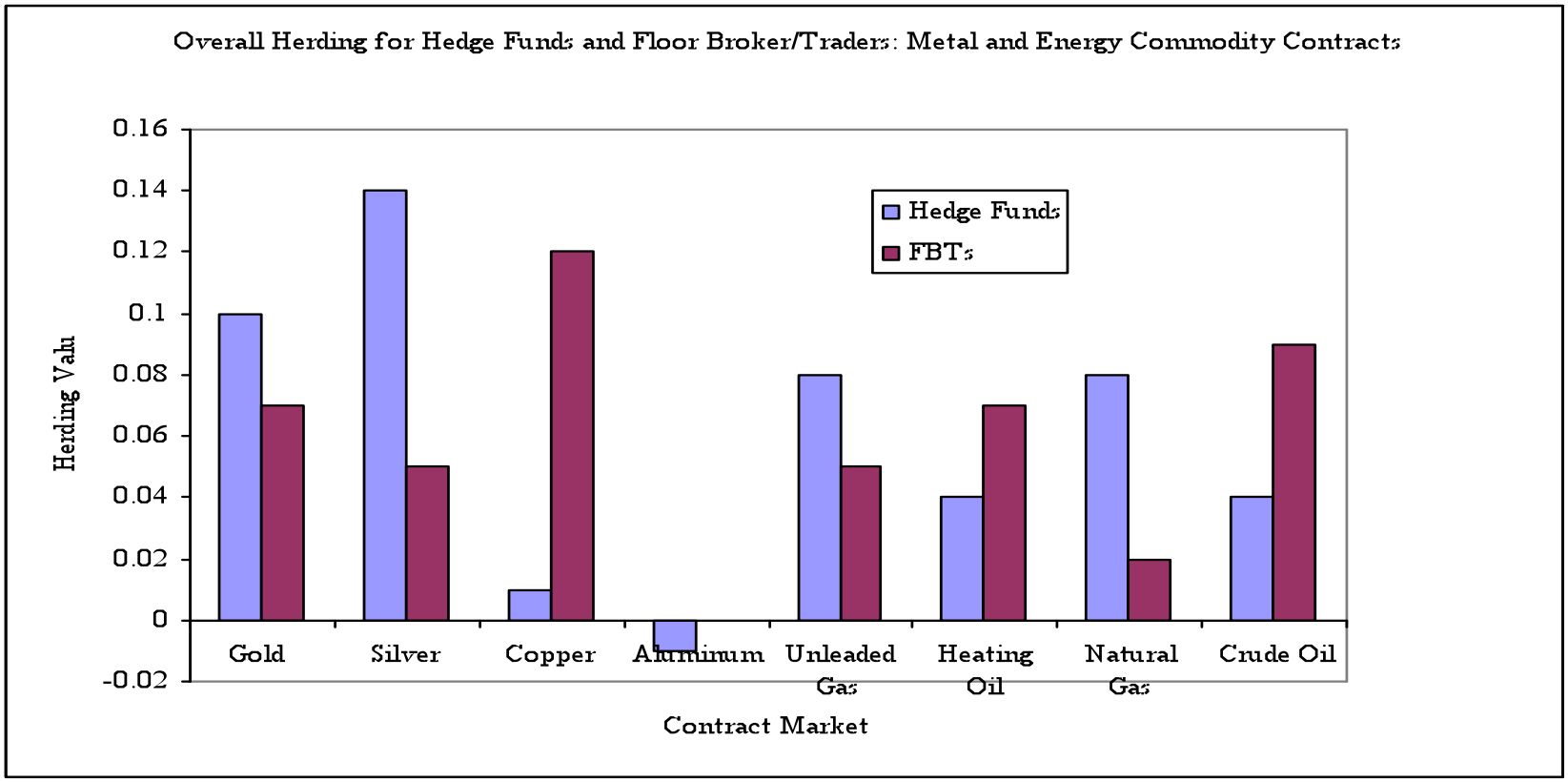
Herding: Empirical Results



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Conclusions

- Larger levels of herding for hedge funds than for FBTs, but both groups have significant levels of herding
- Our herding measure is robust to roll and non-roll periods and indicates that similar trading strategies add to the overall level of herding
- Support for the notion that information takes away incentives to herd with contrarian trading based on limited access to information driving much of the herding in futures markets

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Conclusions, Continued

- The number of traders and floor-based markets are positively associated with herding
- Trading volume and electronic trading are negatively related to herding
- The significant levels of herding by hedge funds serve to stabilize, rather than destabilize, prices in futures markets

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Cross Market Correlations

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Increased correlation between commodities and equities

- Increase in correlation between commodities and other assets due to financialization

- But (Buyuksahin, Robe and Bruno (2013), Buyuksahin and Robe (2013, 2012), Alquist and Coibion (2013))
  - Activities of financial players, commodity prices and other asset prices appear to be increasingly responding to global business conditions
- Temporary prevalence of the common factor (the risk on factor)

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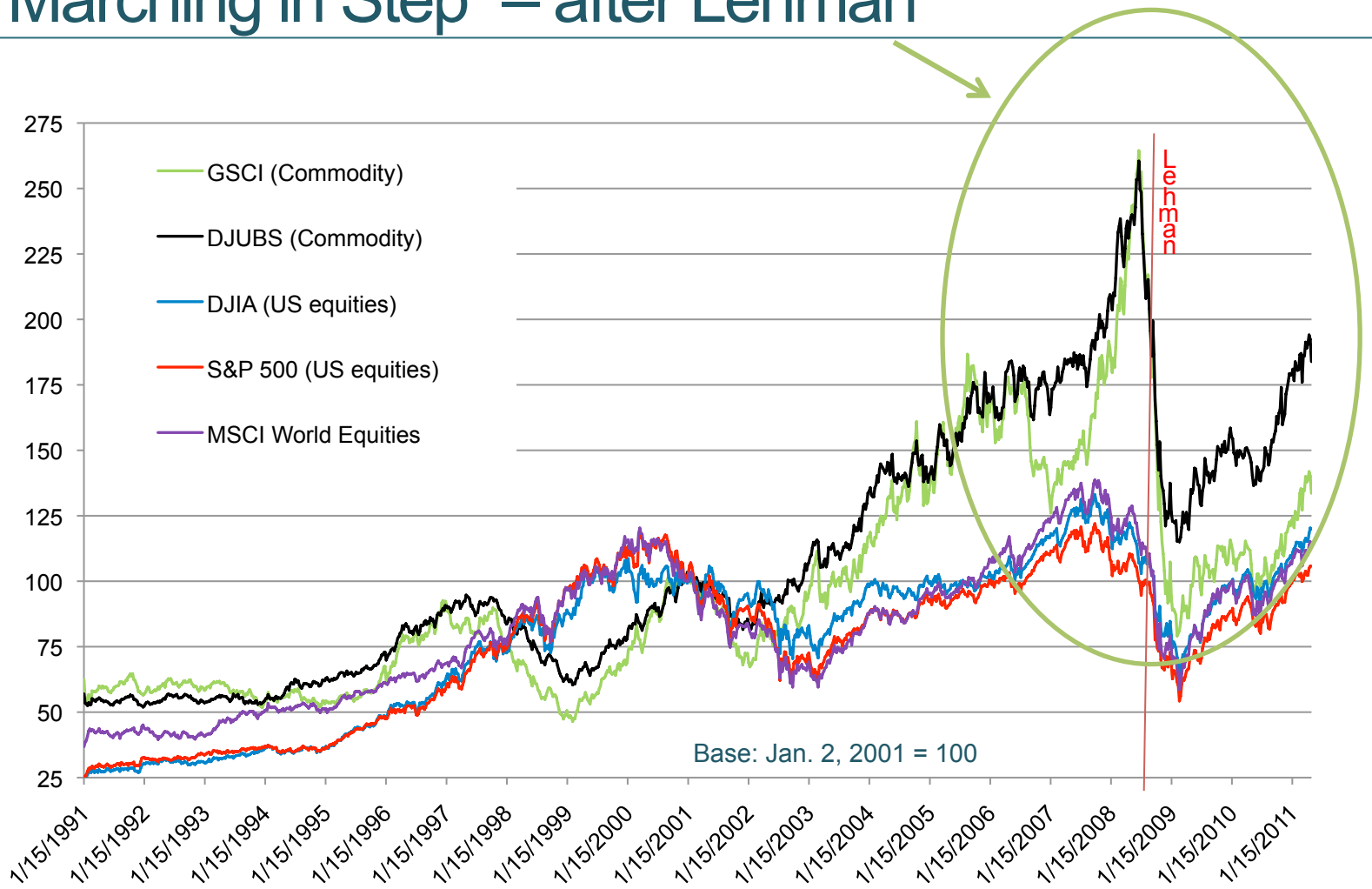
Economics Studies V: Cross-Market Linkages
The "Marching in Step" – after Lehman



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A "Market of One" – Really?

- Büyükşahin, Haigh & Robe (JAI 2010):
  - Not so fast:
    - Let's look at return correlations, not price levels
      - On average, return correlations between passive equity and energy investments were about zero (1991 to August 2008)
      - No secular increase in dynamic conditional correlations (DCC)
  - General result?
    - Yes
      - True at daily, weekly & monthly frequencies
      - True regardless of index choice (GSCI or DJ-UBS; S&P or DJIA)
    - And yet…

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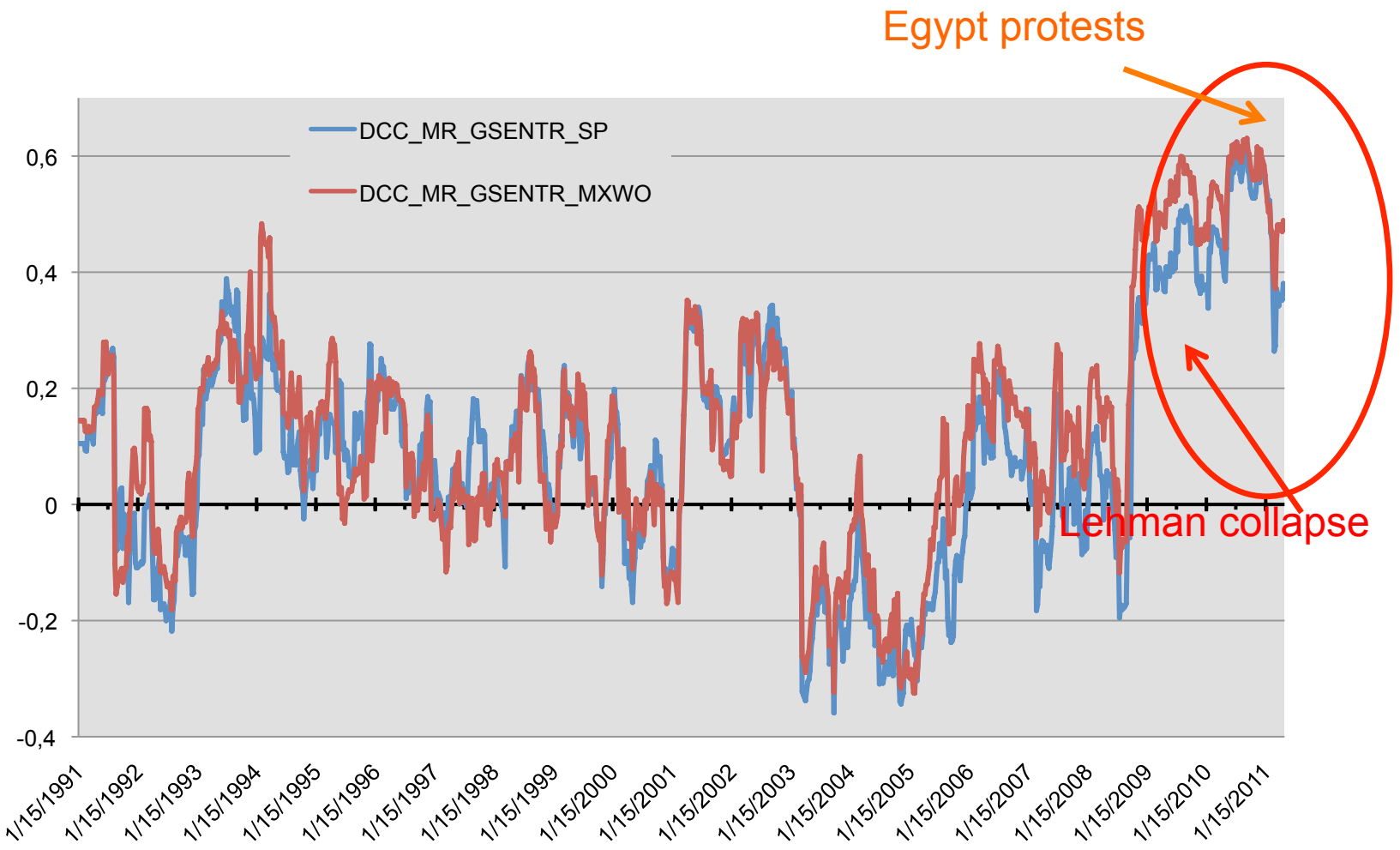
SP500 & GSCI Correlation (DCC), 1991-2011

DCC estimates average close to Ø, fluctuate substantially over time



SP500 & GSCI Correlation (DCC), 1991-2011

Importance of accounting for volatility changes

- *Rolling*

vs.

- *DCC*

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Financialization in Pictures

- Overall speculation is up
  - From about 10% excess spec till 2002
    to 35-50% after 2005
- Commodity Index Trading is Up
  - Swap Dealer positions account for about 35% of futures OI
- Hedge Funds are Up
  - From 5-10% of the futures OI till 2002
    to 25-30% after 2005
- Cross-Market Trading is Up
  - Tripled since 2002
  - Pattern does not follow other hedge funds

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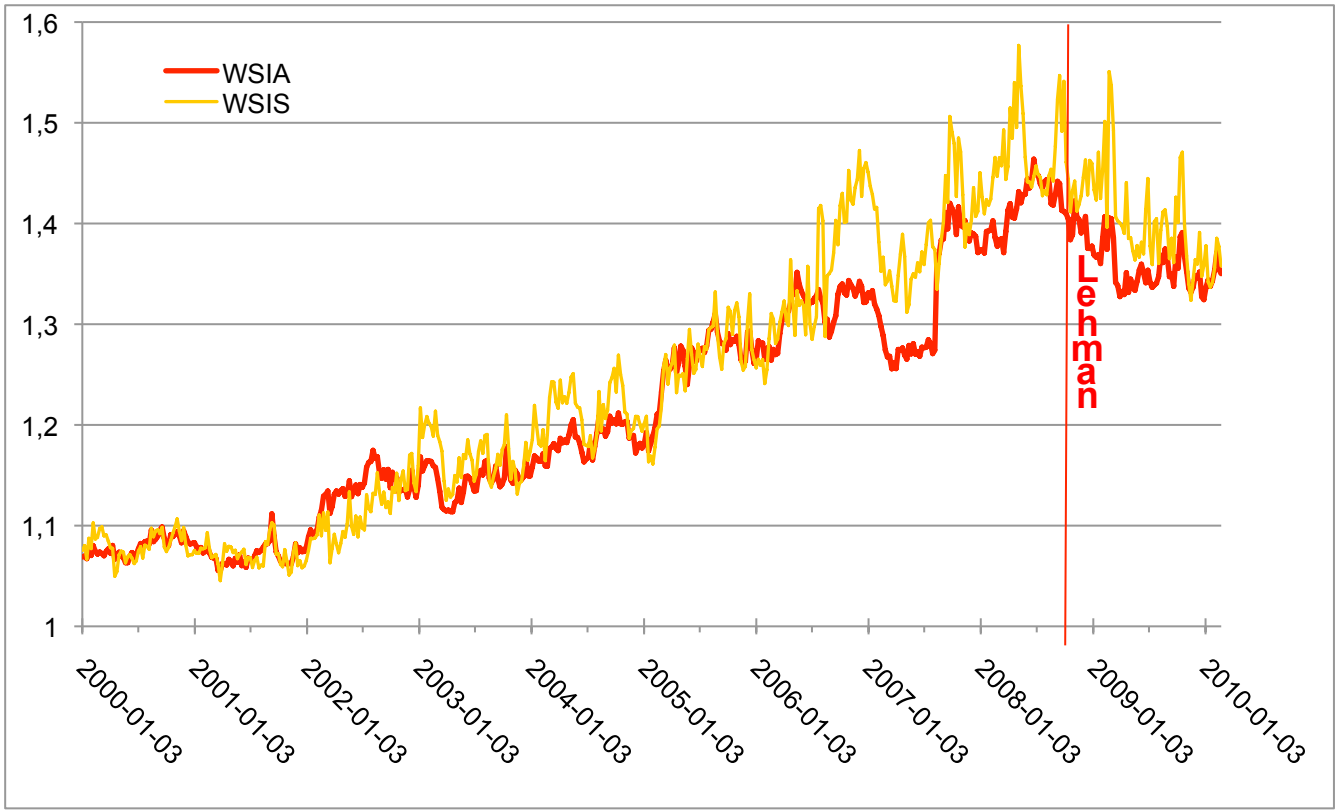
Energy Speculation

Working's *T*, January 2000 to March 2010



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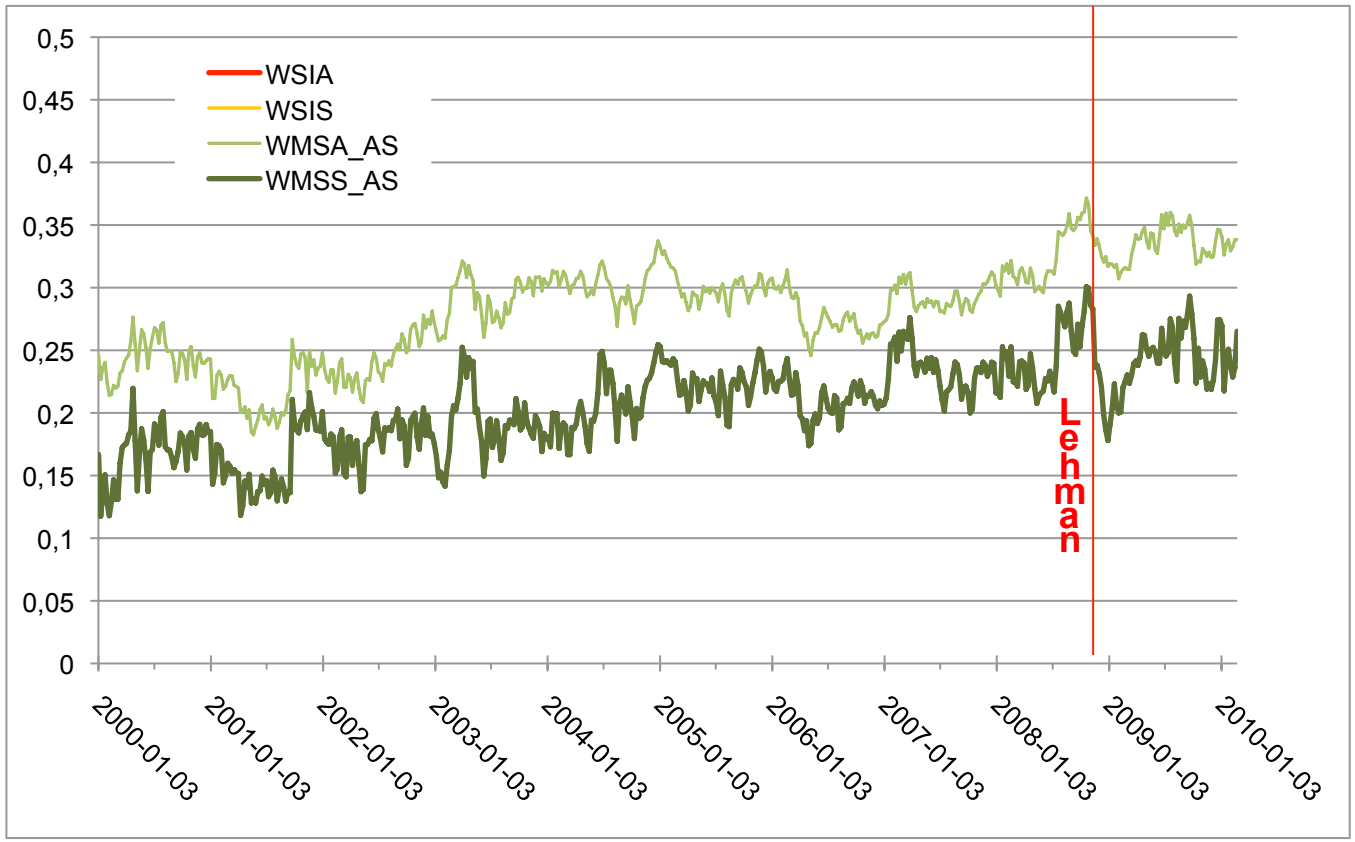
Swap Dealing & Commodity Index Trading

Overall *vs*. Near-dated Swap Dealer Positions (% of OI), 2000-2010



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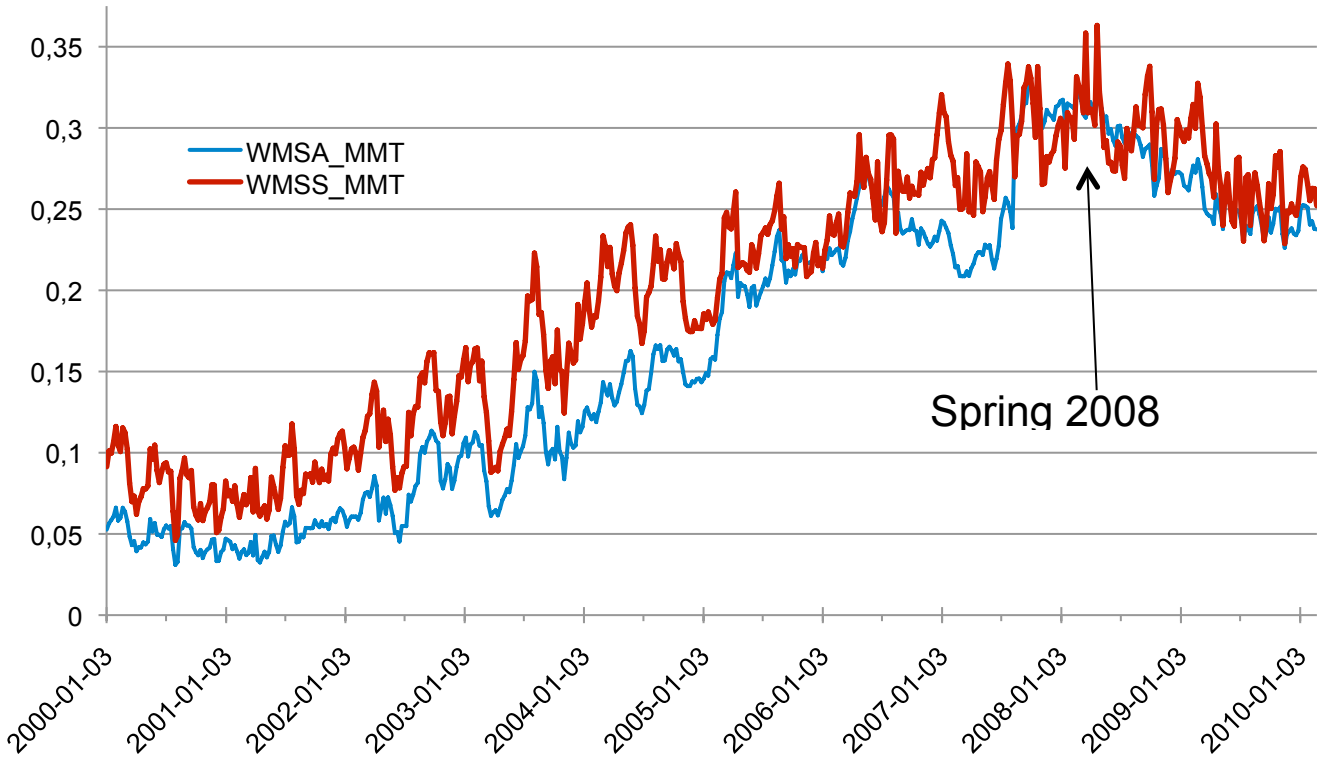
Hedge Funds *and* Cross Traders

Hedge funds' share of Energy Futures Open Interest, 2000 to 2010



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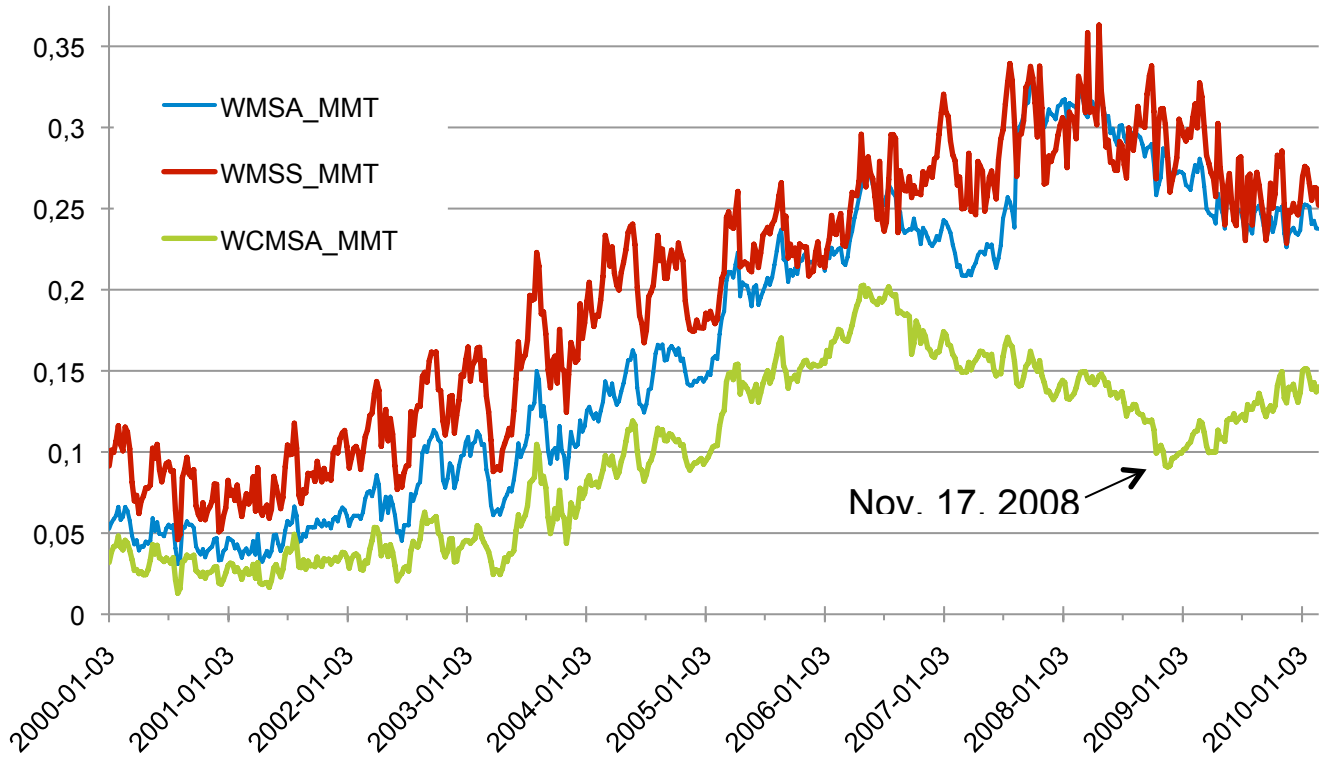
Hedge Funds *and* Cross Traders

- Hedge funds that Trade both Energy and Equity Futures, 2000-2010



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Should It Matter Who Trades?

- Should *trader identity* matter for asset pricing?
  - Theoretical reasons to believe trader identity matters
    - Models show that less-constrained traders link asset markets
    - During financial stress periods, contagion or retrenchment?
  - Who is a "candidate" for enhancing linkages?
    - Traditional commodity users, etc.? → Unlikely
    - Index traders? Only insofar as they provide liquidity
    - Hedge funds? → More likely
      - Seek to exploit perceived mis-pricing
      - Levered/subject to borrowing limits/wealth effects under stress

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Hedge Funds and Stress Interact

Constant	-0.826467	***	-1.96763	***	-2.56901	**	-3.17242	**
	(0.2323)		(0.7290)		(1.057)		(1.273)	
SPARE	0.154870	***	0.135986	***	0.121034	***	0.107117	***
	(0.03576)		(0.03237)		(0.03185)		(0.03093)	
UMD	0.0710231	*	0.0727269	*	0.0579558	*	0.0586289	*
	(0.04025)		(0.03981)		(0.03378)		(0.03274)	
TED	1.77734	***	4.60514	***	1.38053	***	3.39324	**
	(0.5081)		(1.485)		(0.4230)		(1.346)	
WMSS_MMT	**2.37960**	***			**5.22120**	***		
	(0.8664)				(1.523)			
WMSS_AS					0.896538		-0.949729	
					(1.624)		(1.275)	
WMSS_TCOM					2.82919	**	1.07074	
					(1.358)		(0.9123)	
WSIA			1.32955	**			2.21413	***
			(0.5596)				(0.7198)	
INT_TED_MMT	-5.51366	***			-4.30584	***		
	(1.676)				(1.402)			
INT_TED_WSIA			-3.20403	***			-2.37744	**
			(1.064)				(0.9594)	
DUM	0.347098	***	0.350655	***	0.445824	***	0.380342	***
	(0.09457)		(0.09879)		(0.09043)		(0.08412)	
Log likelihood	881.086		871.939		884.97		875.182	

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Cross-Trading Hedge Funds Matter

	2000-2010		2000-2010		2000-2010		2000-2010		2000-2010		2000-2010	
Constant	-0.778333	***	0.210448		-0.971063		-0.783793	***	0.315275		-0.675490	
	(0.2196)		(0.4022)		(0.8296)		(0.2277)		(0.4216)		(0.8831)	
ADS							0.0381775		0.0536956		0.0631063	
							(0.06174)		(0.05042)		(0.04728)	
SPARE	0.178190	***	0.129834	***	0.104834	***	0.179592	***	0.126999	***	0.102546	***
	(0.04215)		(0.03684)		(0.03318)		(0.04372)		(0.03755)		(0.03384)	
UMD	0.0722604		0.0565843		0.0645123	*	0.0715149		0.0540846		0.0602626	*
	(0.04570)		(0.03696)		(0.03534)		(0.04713)		(0.03760)		(0.03580)	
TED	1.37460	***	1.01301	***	3.29099	**	1.46240	***	1.07753	***	3.14341	**
	(0.4684)		(0.3643)		(1.400)		(0.5075)		(0.3831)		(1.427)	
WCMSA_MMT	5.10806	***	3.92980	***			5.13408	***	3.76414	***		
	(1.717)		(1.358)				(1.783)		(1.392)			
WCMSA_AS			-3.73983	**	-2.86410	*			-4.14034	**	-3.40879	**
			(1.543)		(1.567)				(1.629)		(1.653)	
WSIA					1.08753	**					0.946378	*
					(0.5081)						(0.5354)	
INT_TED_CMMTA	-9.82038	***	-6.96981	**			-10.2754	***	-7.13595	**		
	(3.644)		(2.862)				(3.853)		(2.950)			
INT_TED_WSIA					-2.26677	**					-2.11807	**
					(1.005)						(1.028)	
DUM	0.214922	*	0.370933	***	0.431396	***	0.230696	*	0.418018	***	0.496860	***
	(0.1120)		(0.1067)		(0.1017)		(0.1226)		(0.1196)		(0.1197)	
Log likelihood	881.802		885.162		875.116		882.31		885.943		876.387	

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Findings

- "Co-movements"
  - Time variations in correlations, but no upward trend till crisis
  - Extreme-events analysis: commodity umbrella leaks
- "Speculation" in cross-section of energy paper mkts
  - Increase in speculation + hedge fund activity + cross-mkt activity
- Impact of hedge funds in energy markets
  - Hedge fund activity helps link markets
  - Market stress matters, too
  - Interaction – contagion through wealth effects?
- Information on OI composition is payoff-relevant
  - CFTC decision to disaggregate more

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Conclusions

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Many drivers of volatile prices

- Abrupt, visible & physical causes of price changes
  - Technology shock : shale gas revolution in the US – is the same now happening with US onshore oil?
  - Demand shock: unchecked emerging market demand growth under the influence of buoyant economic growth and subsidised prices
  - Policy shock: resource nationalism & impact on investment, oil products spec changes, deepwater regulation, legislation to control derivatives markets and hedging, China's late-2010 restriction on coal-fired power generation potentially boosted oil demand by 300-400 kb/d
  - Geopolitical shocks: 1970s oil shocks, crisis in Libya, what's next? (Iran? Nigeria?)
  - Natural disasters: Hurricanes Katrina & Rita (2005), Japanese earthquake (2011)

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Many drivers of volatile prices

- But longer term trends also play a role
  - Creeping price inelasticity of supply/demand mean that relatively small changes in each can have an exaggerated impact on price
  - Expectations for future fundamentals – uncertainty & data

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Several policy responses to cope with them

Helping ensure more stable markets in future needs:

- Better transparency across both the physical and derivatives markets
- Remove market distortions via price liberalisation & level investment playing field
- Ensure market liquidity & the ability to hedge are retained
- More predictable, harmonised international policies on climate change, fuel qualities, alternative fuels, investment terms
- Promote mutual energy security via interconnections, and diversifying fuel types and sources where it is economically viable
- Finally, widespread encouragement of energy efficiency

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Regulating commodity markets at what cost?

- The possible impact of financialisation and speculation on oil prices has been driving (in part) regulatory agenda by G20.
- However, empirical evidences we presented here suggest that potential benefits > potential costs

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Capital Requirement

- Regulatory measures aimed at increasing cost of hedging or reducing the risk bearing capacity of “speculators" have adverse consequences and should be avoided.
  - Higher capital requirements for swap dealers and major swap participants might as well increase the concentration ratio leaving only large speculators (investment banks) as viable liquidity providers in the commodity derivatives markets, which regulators try to limit in order to reduce systemic risk.

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Clearing requirement

- Clearing requirements for standardised swaps through an intermediary company with sufficient capital, such as clearing houses or central counterparties (CCPs), a measure introduced to eliminate counterparty risk, have also become a target of criticism.
  - Proponents of the requirement argue that central clearing has worked in the futures markets for over a century.
  - Critics counter that the present regulatory reform and regulations may not remove the systemic risk from OTC derivatives but rather shift it from counterparties to central clearing parties.

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Position Limits

- The main objective of the proponents of those hard position limits was to reduce market-share concentration in commodity markets; thereby lowering the volatility. The limit on the concentration of market share is also deemed necessary to reduce systemic risk.
  - Lower liquidity, higher volatility

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Margin Requirements

- The mandatory margin requirements rule may well lead to an increase in the concentration of market share of large speculators while raising price volatility and having no effect on price levels.