Speculation and Equity-Commodity Linkages

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Does It Matters Who Trades?

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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)

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

- Cross-Market Linkages? Our focus today
“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 “Marching in Step” Observers had in Mind

July 1, 2008

Base: Jan. 2, 2001 = 100

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“Marching in Step” since Lehman

Base: Jan. 2, 2001 = 100

- GSCI (Commodity)
- DJUBS (Commodity)
- DJIA (US equities)
- S&P 500 (US equities)
- MSCI World Equities

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A “Market of One” – Really?

Pre-Lehman

- Büyükşahin, 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

- DCC estimates average $\bar{\varnothing}$ – but fluctuate substantially over time

Lehman
Correlation Facts

- 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

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

- **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...

... we’d mis-estimate how much & when correlations change
Without accounting for time-varying volatility...

- Even worse problem with the MSCI World Equity Index
Vs. accounting for time-varying volatility...

- Using DCC, we find no visible trend before Lehman
3. Cross-Commodity Correlations

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

Structural break? If so, it predates financialization

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How about Livestock? *Quite the opposite*...
I. This Paper
Thinking about Commodity-Equity Linkages

○ 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?

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II. Trading Facts

Financialization of Commodity Futures Markets
A. Position Data

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?

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

- 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

• Working’s $T$ (1960):
  o **Goal:** measure the extent to which speculative positions exceed the net hedging demand in a given futures market $i$
  o **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.
  o **Formally:**
    
    $WSIS_i = 1 + \frac{SS_i}{HL_i + HS_i}$ if $HS_i \geq HL_i$
    
    $WSIS_i = 1 + \frac{SL_i}{HL_i + HS_i}$ if $HL_i \geq HS_i$

    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

- 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

- Working’s T, January 2000 to March 2010

WSIA (rescaled Working T -- all maturities)

Oct. 6, 2008

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III. Main Question
Does Trader Identity Matter?

- 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

- **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*)

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Dynamic Conditional Correlation (Engle, 2002)

2-stage estimation:
- First stage,
  - \( n \) univariate GARCH(1,1) estimates are obtained, which produces consistent estimates of time-varying variances (\( Dt \)).
- Second stage,
  - 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 variables
- Accounts for changes in volatility
Correlations between SP500 & GSCI Returns

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

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B. What Predicts Correlations: Trader Positions or Fundamentals?
1. Trading

- 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?

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

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3. Market Stress?

• a. Financial Stress?
  • Financial stress should matter:
    ➢ Bond-equity returns extreme linkages in G-5 countries
      o Hartmann, Straetmans & de Vries, *REStat* 2004
    ➢ International equity market correlations increase in bear markets
      o Longin & Solnik, *JF* 2001
    ➢ Commodity-equity linkages went up in Fall 2008
      o Buyuksahin, Haigh & Robe, *JAI* 2010
    ➢ Financial shocks are propagated internationally through channels such as
      o bank lending (e.g., van Rijckeghem & Weder, *JIE* 2001)
      o 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

- 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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<td>(0.1232)</td>
<td>(0.1243)</td>
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But Speculative Activity Matters, as well!

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<td>-2.08797 **</td>
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<tr>
<td></td>
<td>(1.328)</td>
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<tr>
<td><strong>ADS</strong></td>
<td>0.103863 *</td>
<td>0.132858 *</td>
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<td><strong>TED</strong></td>
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Notice the Differential Impact under Stress

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VI. Conclusion
Findings

• “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

- Disaggregation
- What has been happening post-Lehman?

- Theory? What should correlations look like