The Financialization of Commodity Markets

Ing-haw Cheng, University of Michigan

Wei Xiong, *Princeton University*

Bank of Canada

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Financialization of commodities

- Large inflow of investment capital
  - according to CFTC Report (2008), commodity index investments in total $200B on June 30, 2008
- Commodity futures has become a new asset class for portfolio investors
- Economic mechanisms that affect financial markets and financial investors may also be relevant for commodity markets

The Debate

- Polarized views on whether financial investors have affected commodity prices
  - The bubble view: commodity index investors had caused a gigantic bubble in energy and agricultural commodities in 2007-2008
    - e.g., Masters (2008), US Senate Report (2009), Kennedy (2012)
  - The business-as-usual view: there was no bubble and thus no problem
    - e.g., Krugman (2008), Stoll and Whaley (2010), Irwin and Sanders (2012), Fattouh, Kilian and Mahadeva (2012)
- Rejecting one extreme view does not justify the other
  - The truth might be more nuanced---financialization has transformed commodity markets in subtle ways, some good, some bad
  - Need to analyze specific mechanisms
  - Caution against blank generalization of results from a specific test

Specific Mechanisms

- Excessive focus on speculative storage as the only channel for futures markets speculation to affect commodity markets
  - Spread between futures and spot prices acts as the incentive for speculative storage

Other channels:

- Informational channel
  - Difficult for market participants to separate demand shocks, supply shocks, and financial market shocks
  - High futures prices signal stronger economy, leading to larger commodity demand
  - Futures market trading can affect prices without driving up inventory in short run, need to differentiate genuine demand vs confused demand

- Risk sharing channel
  - Investment inflow to futures markets mitigates hedging pressure, but also brings in their own stress during crises
  - Helps explain the largely increased price volatility during crises
  - Their dual roles make identification challenging

- Financialization might have transformed commodity markets in subtle ways
  - Sharper tests are needed.
  - An opportunity to study general economic forces applicable to financial markets

Road Map

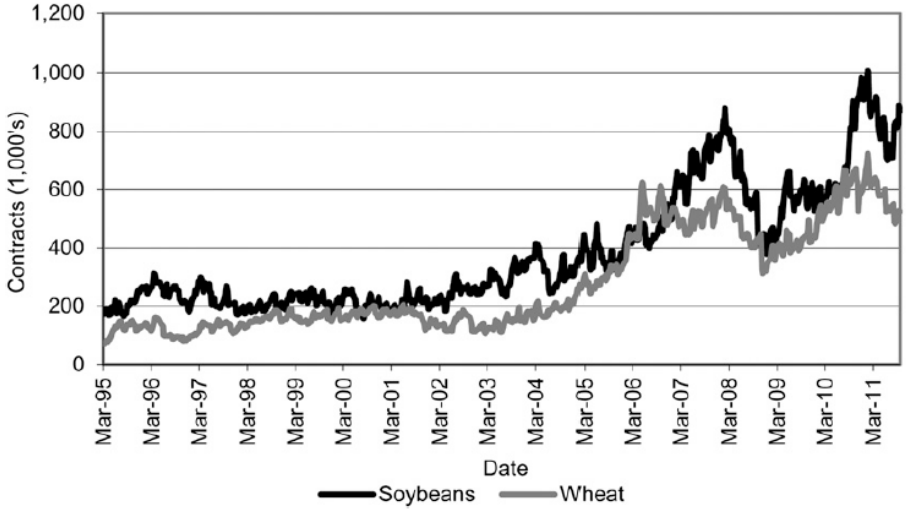
- Basic facts about changes in commodity futures markets in recent years

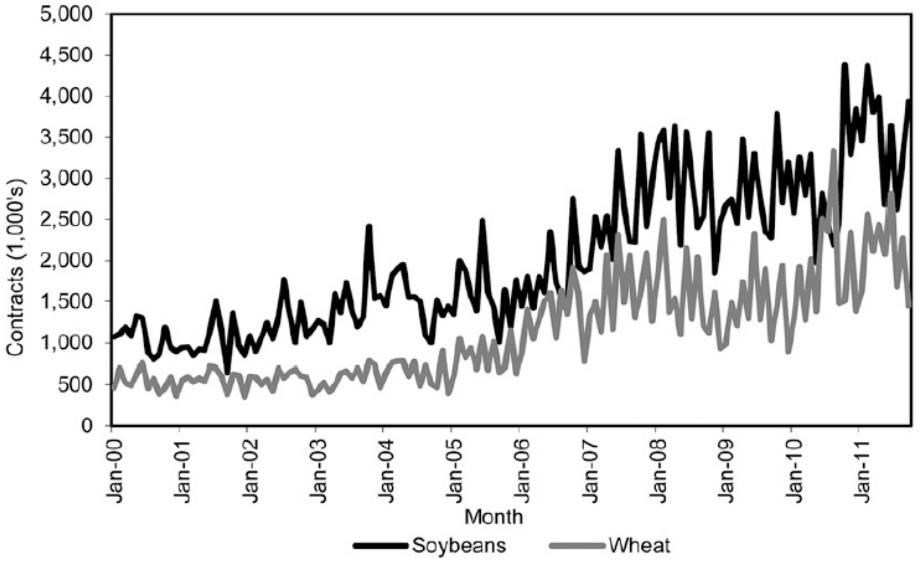
- Economic mechanisms
  - Theory of storage
  - Information discovery
  - Risk sharing

- Will discuss a few focal issues together with the mechanisms
  1. Speculation and commodity inventory
  2. Excessive speculation
  3. Did trading of CITs affect futures prices?

Basic Facts

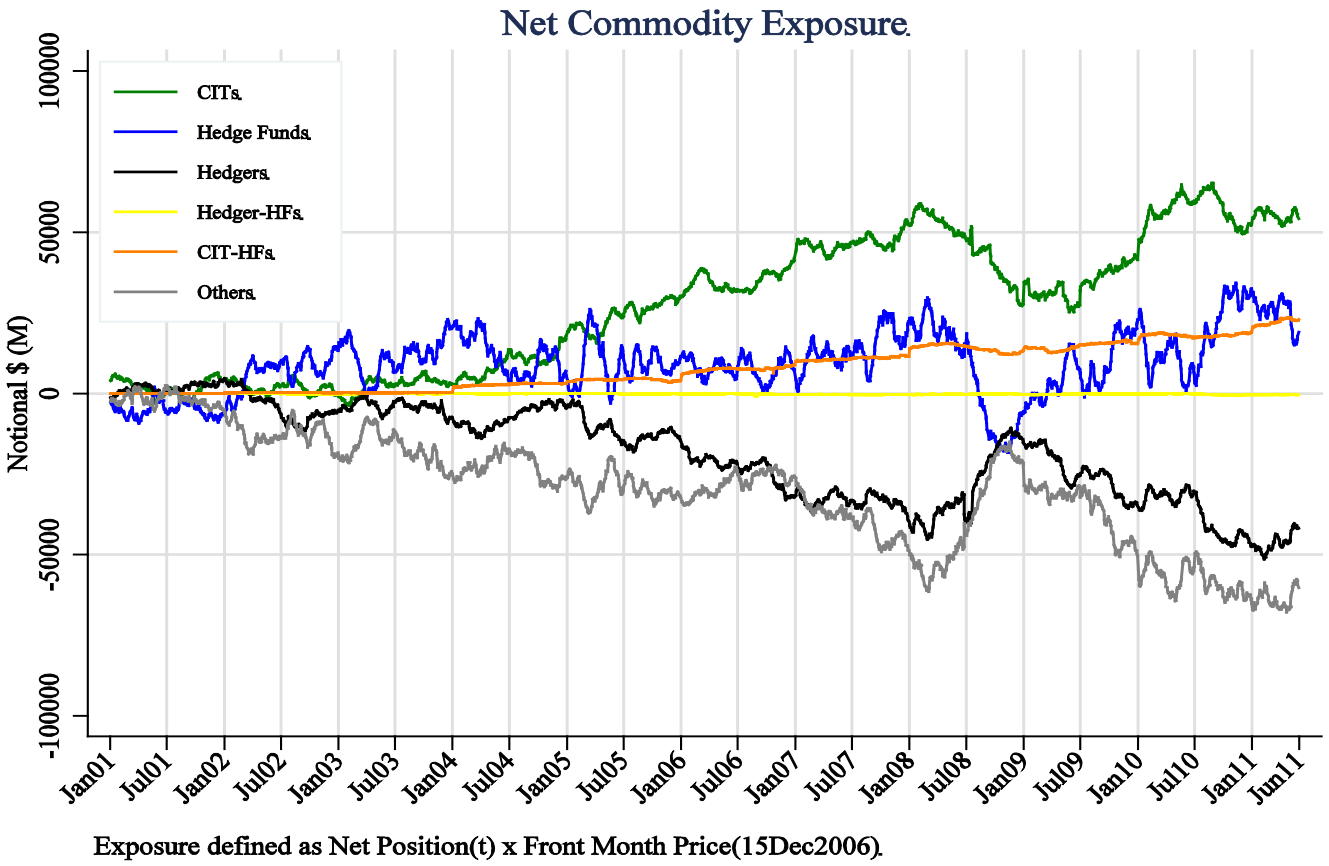
Expansion of Open Interest and Volume





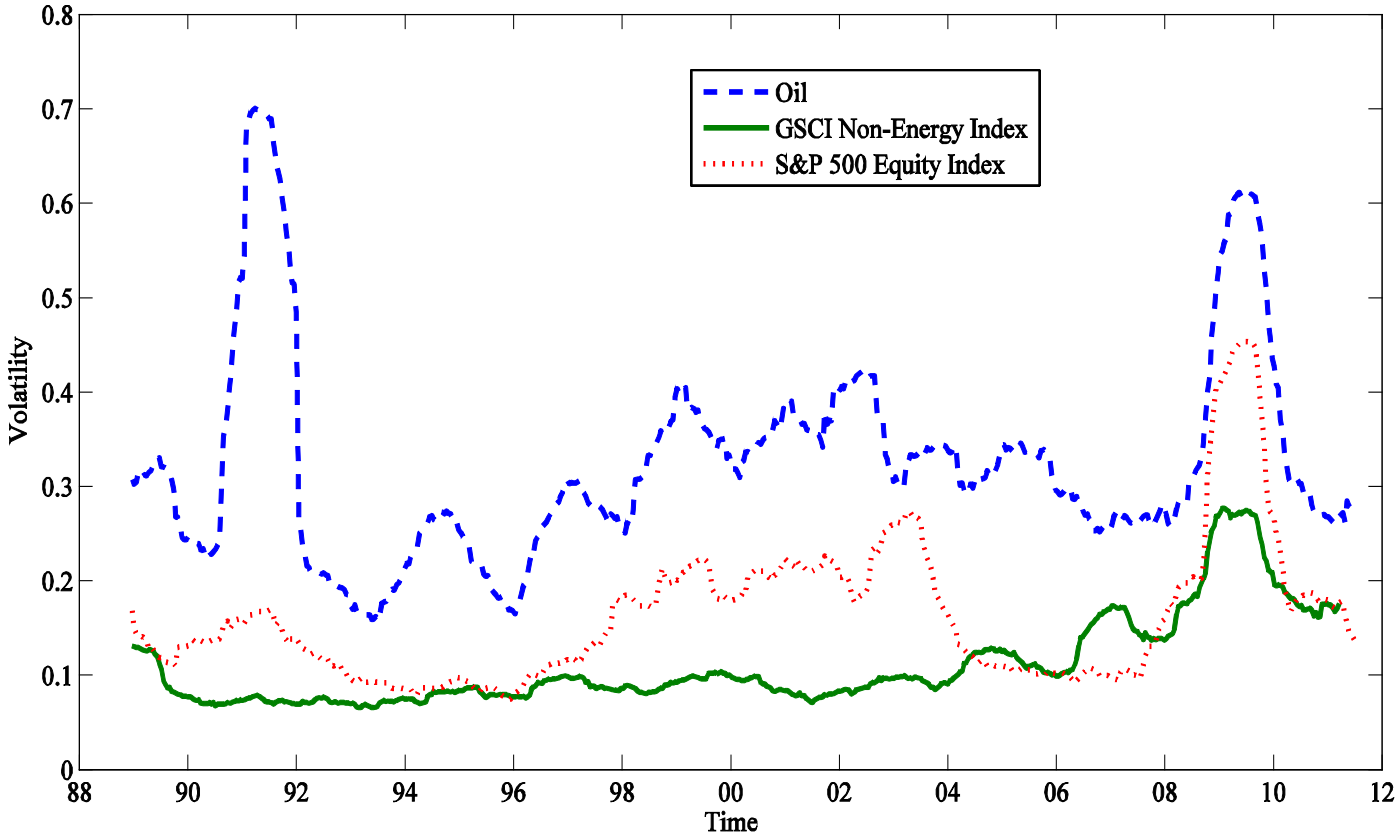
- Source: Irwin and Sanders (2012)

Evolution of Different Groups



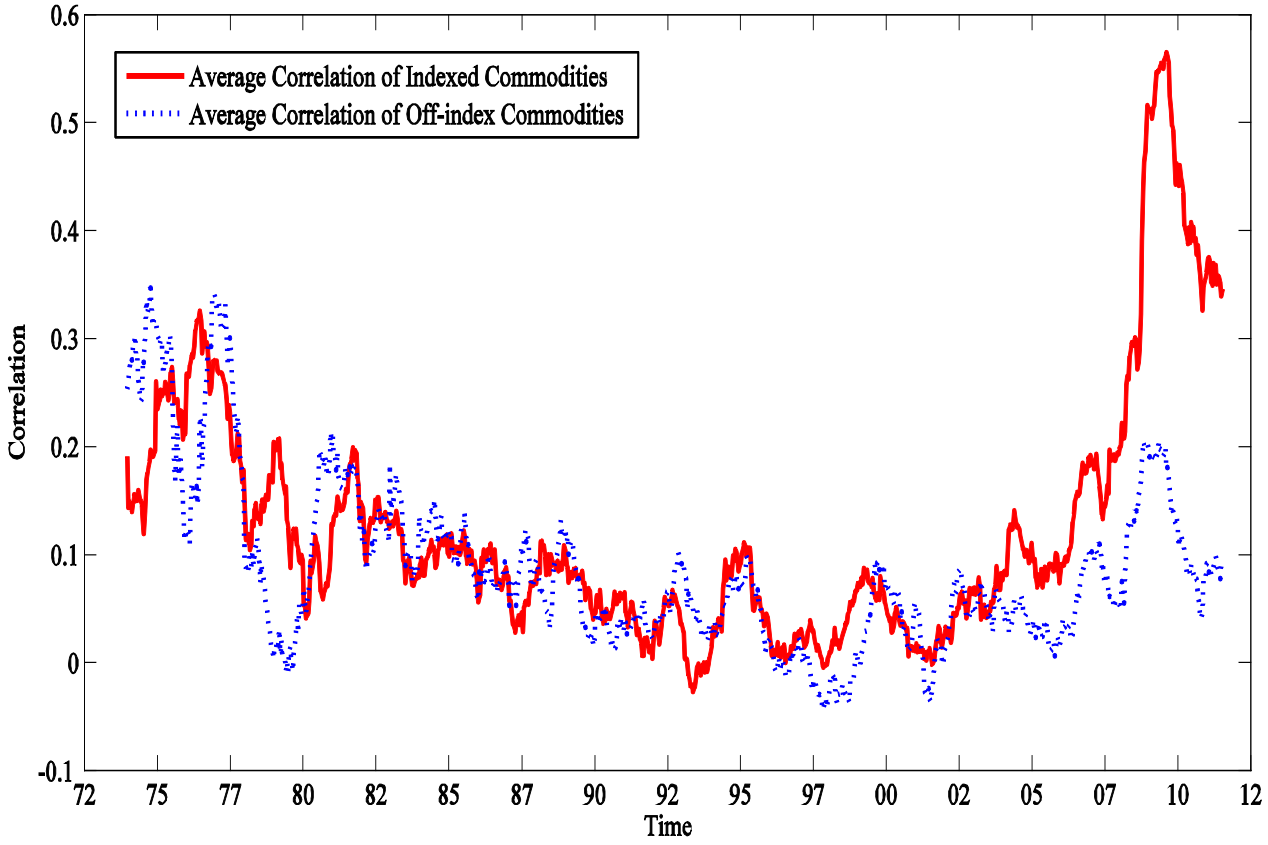
- Source: Cheng, Kirilenko and Xiong (2012)

Commodity Price Volatility



Source: Tang and Xiong (2012)

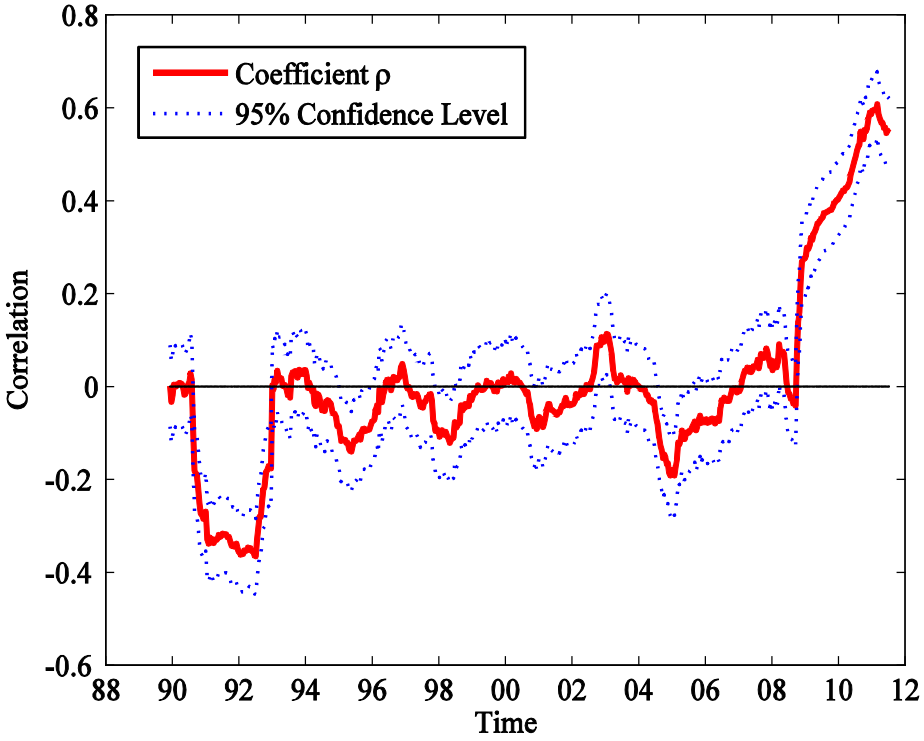
Comovement between Commodities



- Source: Tang and Xiong (2012)

Comovement between Commodities and Stocks

- Tang and Xiong (2012), Büyükşahin and Robe (2011, 2012), Silvennoinen and Thorp (2011)



- Source: Tang and Xiong (2012)

Economic Mechanisms

- Theory of storage
- Information discovery
- Risk sharing

Theory of Storage

- The balance between physical supply and demand is the economic fundamental of commodity markets

- A large strand of the literature focuses on storage
  - e.g., Scheinkman and Schethtman (1983), Williams and Wright (1991), Deaton and Laroque (1992, 1996)
  - Storage saves excess supply and acts as buffer stock for future supply-demand imbalances
  - A non-negativity constraint on inventory
  - Storage leads to positive auto-correlations in price

- Futures markets in theory of storage
  - e.g., Routledge, Seppi and Spatt (2001), Alquist and Kilian (2010)
  - Futures are sideshows
  - Futures-spot price spread as incentive for storage

Speculation by Storage

- Many economists posit that inventory has to rise if speculation distorts prices.
  - The **premise** is that consumers disagree with the traded prices and respond by reducing demand

- Speculation is often defined by anyone buying crude oil not for current consumption, but for future sale or use.

  - Based on this definition, Kilian and Murphy (2013), Juvenal and Petrella (2012), Knittel and Pindyck (2013) find that the WTI price boom in recent years was not accompanied by inventory spike (i.e., intensified speculative activity)

  - This is a specific form of speculation, which ignores informational frictions in reality.

Economic Mechanisms

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Informational Frictions in Commodity Markets

- Participants of commodity markets face incomplete information regarding global supply, demand, and inventory of commodities.
  - Regular reports available from OECD countries, but can be delayed and revised over time
  - Little is available from emerging economies

- Centralized futures markets serve an important platform for information aggregation and price discovery
  - Roll (1984): orange juice futures effectively capture Florida temperature fluctuation
  - Garbade and Silber (1983): commodity futures prices often lead spot prices
  - Hu and Xiong (2013): after mid-2000s, overnight U.S. commodity futures prices positively lead East Asian stock prices

Understanding Commodity Price Boom in 2008

- Hamilton (2009), Kilian (2009), G20 Report
  - Largely increased demand propelled by rapid growth of emerging economies and stagnant supply

- Commodity prices continued to rise in early 2008!
  - WTI rose 40% in 2008 before it peaked in July 2008
  - U.S. were falling into recession in late 2007; S&P 500, FTSE 100, DAX, and Nikkei indices had peaked by October 2007
  - Bear Stearns collapsed in March 2008
  - Growth rate of China was also slowing, it peaked in mid-2007
  - Most emerging economies were driven by exports

- Confusion about emerging economies
  - ECB increased its key interest rate in early 2008, quoting high commodity prices as a key reason
  - Singleton (2012): high dispersion in 1-year ahead oil price forecasts of professional economists

Informational Frictions and Commodity Demand

Sockin and Xiong (2012):

- Basic premise:
  - Both supply and demand shocks are **unobservable** to market participants.
  - Demand is driven by people's expectation of global economic strength
  - Commodity prices are useful signals

Without informational frictions:

- A higher price leads to lower demand
- A supply shock reduces price and boosts demand
- Futures price is a shadow of spot price

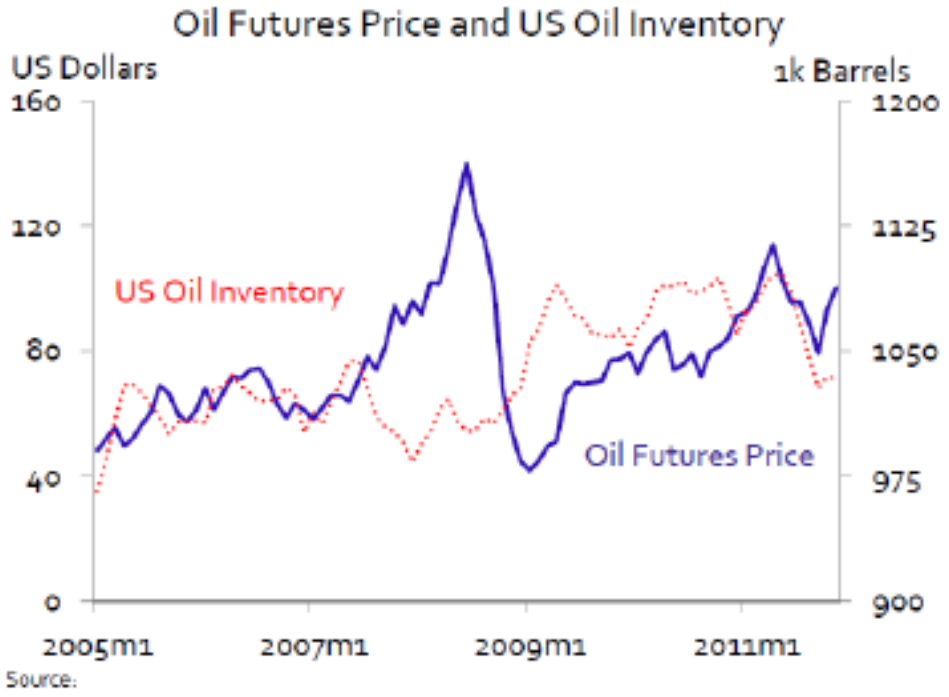
With informational frictions

- A higher price is not just a higher cost of production, but also **a signal for a stronger economy**
  - in net, price elasticity of demand is reduced and can be even positive
- Supply shock has an amplified price effect and an undetermined effect on demand
- Noise from trading in futures market can boost demand and spot price

- Differentiate two types of demand
  - **genuine demand vs confused demand**

Does Inventory Have to Rise with Speculation?

- In the presence of information frictions, consumers' expectations may be affected by futures prices.
  - A speculative effect does not have to show up in high inventory



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Hedging Pressure Theory

Inefficient sharing of commodity price risks

- Keynes (1923) and Hicks (1939)
  - Hedgers are willing to offer premia in futures prices to attract speculators to the long side
- Hirshleifer (1988, 1990)
  - Speculators face fixed cost in participating in a futures market, which endogenously determines the number of speculators and equilibrium risk premium.
  - Fixed participation cost deters consumers (who face risk dispersed across multiple commodities) than producers (with concentrated risks in a single commodity)
- Empirical evidence for hedging pressure
  - Carter, Rausser, and Schmitz (1983) and Bessembinder (1992): positive (negative) futures return conditional on hedgers taking net short (long) futures position; a significant premium for idiosyncratic commodity risk
  - de Roon, Nijman, and Veld (2000): cross-market hedging also leads to hedging pressure

Attractive Returns from Commodity Futures

- Gorton and Rouwenhorst (2006) and Erb and Harvey (2006)
  - Average return comparable to equity, not from spot returns but rather from the structure of futures markets
  - Great benefit of diversification: negative correlation with equity and bond and positive correlation with inflation
  - Establish commodity indices as an alternative investment vehicle

- The high historical futures returns reflect partial segmentation of commodity futures markets, as implied by hedging pressure theory

Integration of Commodity Markets

- The large inflow of index investment after 2004 integrates the previously segmented commodity markets with each other and with outside financial markets

- Tang and Xiong (2012), Büyükşahin and Robe (2011, 2013), and Silvennoinen and Thorp (2011)
  - Largely increased correlations between individual commodities
  - Largely increased correlations between commodities and stocks

- Hamilton and Wu (2013)
  - An affine structural model of commodity futures prices
  - Significant deduction in oil futures risk premia since 2005

Risk Sharing bw Hedgers and Financial Traders

- The two sides have to accommodate each other's need

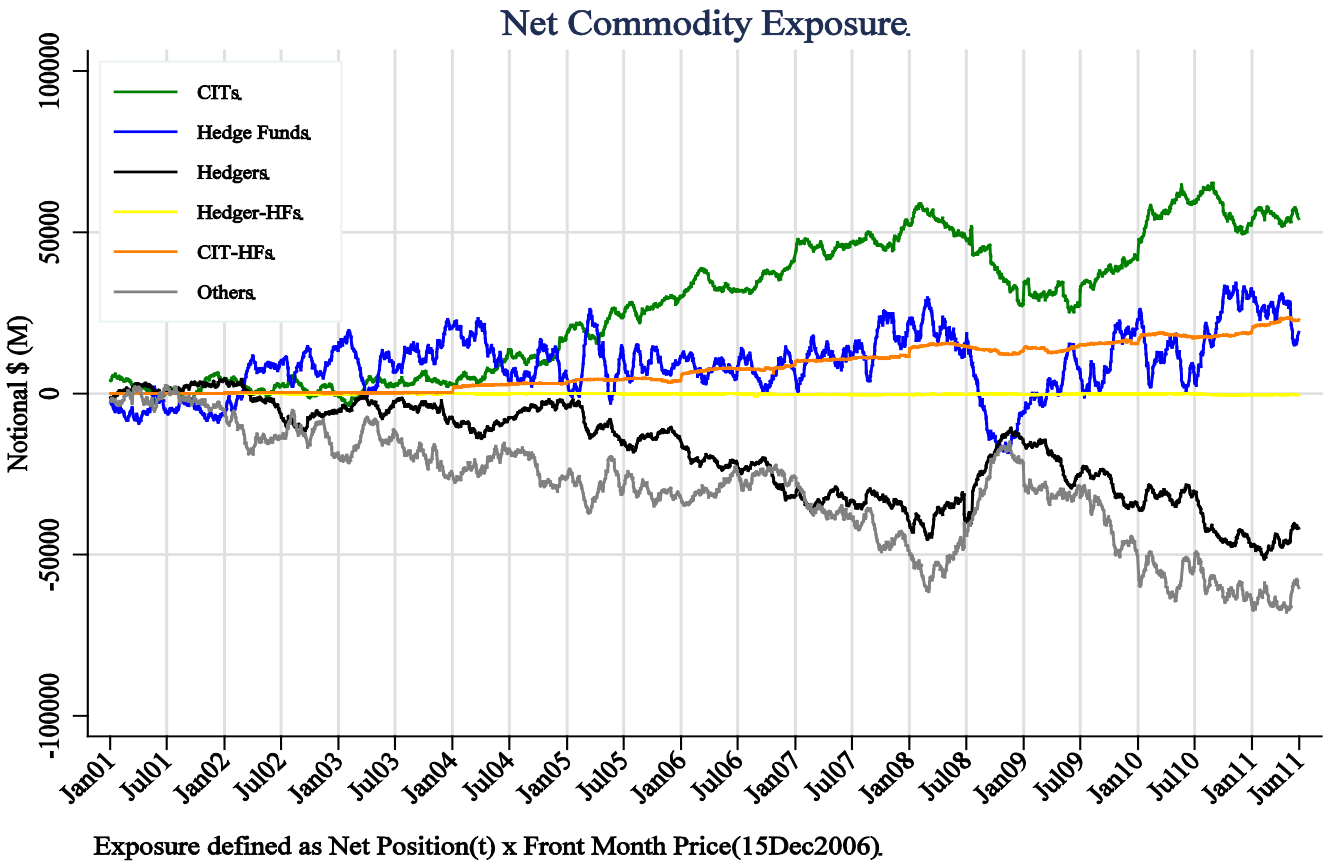
- Financial traders on the long side have limited capacity
  - Etula (2010): commodity risk premium decreases in leverage of the broker-dealer sector
  - Acharya, Lochstoer, and Ramadorai (2012): fraction of futures risk premium attributable to producers' default risk is higher when broker-dealer balance-sheets are shrinking

- When financial traders suffer distresses, risk may be reallocated back to hedgers
  - Cheng, Kirilenko and Xiong (2012)
  - During the recent crisis, VIX shocks hammer financial traders' risk bearing capacity and cause risk to flow back from financial traders to hedgers.

Excessive Speculation

- What is hedging and what is speculation?
  - Hedging is usually defined as trading to mitigate cash flow risk in one's endowed business, and speculation as trading to profit from price movements
- In practice, hedging is measured as trading by commercial hedgers, while speculation as trading by non-hedgers
  - Hedgers can also trade to maximize profits!
  - Speculators may need to hedge their risk
- What is excessive speculation?
  - Market clearing requires that in the net speculators trade on the other side of hedgers.
  - Speculators provide liquidity to hedgers and facilitate information discovery.
  - To define excessive speculation, one has to first measure normal speculation, which is rarely defined.

Evolution of Different Groups



- Source: Cheng, Kirilenko and Xiong (2012)

Working's T

- Working (1960) proposes an index to measure the percentage of speculation in excess of what is minimally necessary to meet short and long hedging demand:

$$T = \begin{cases} 1 + \dfrac{SS}{HL + HS} & if\ HS \geq HL \\ 1 + \dfrac{SL}{HL + HS} & if\ HL \geq HS \end{cases}$$

  - This measure is based on identity of hedgers and speculators rather than specific activity they engage in
  - The notion of "excess" speculation is ambiguous

Do Hedgers Trade Just to Hedge?

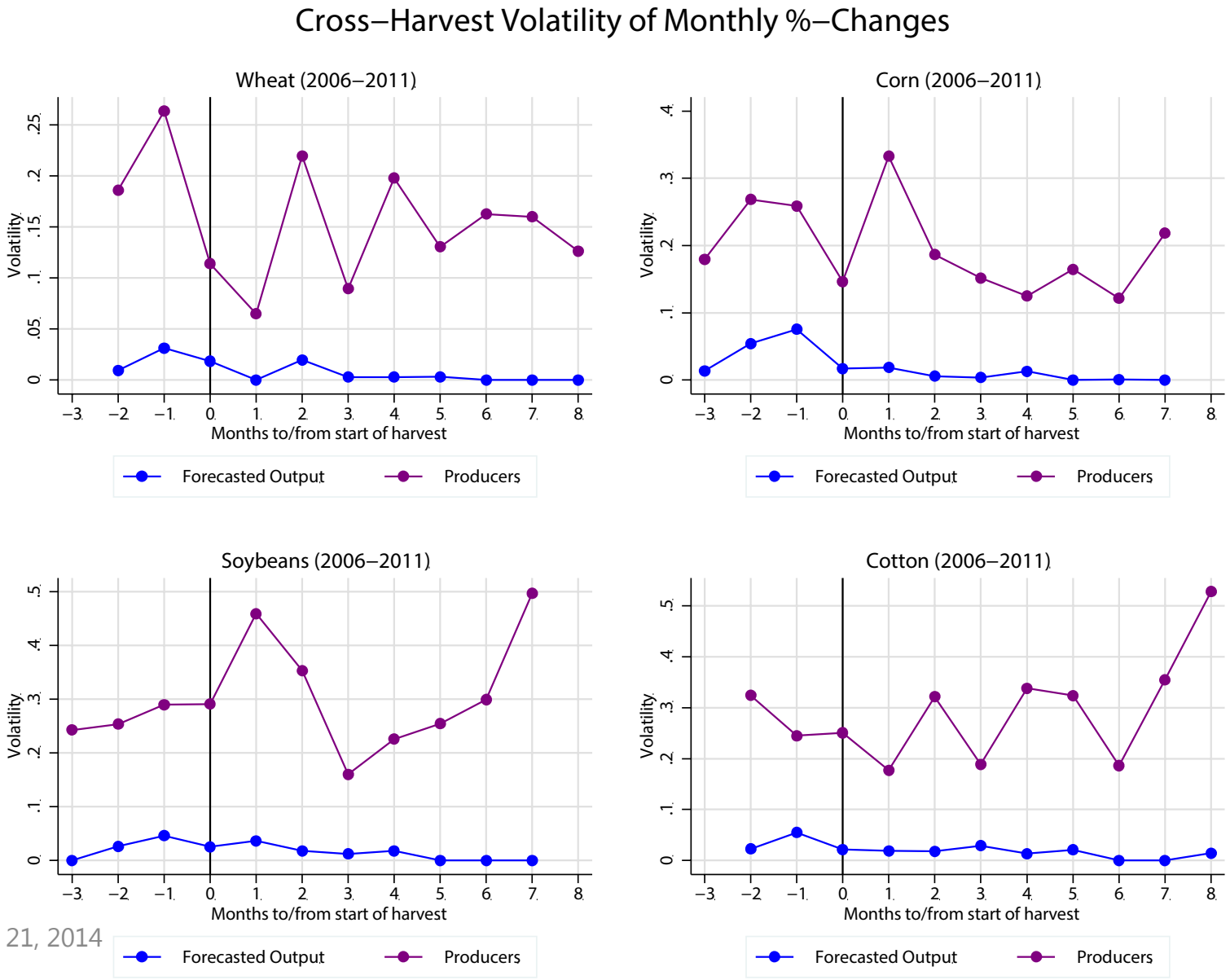
Existing models of hedging (Rolfo 1980, Hirshleifer 1991):

- w/o output uncertainty, a fixed hedging position perfectly hedges price uncertainty
- with output uncertainty, hedgers under-hedge as output is negatively correlated with price, and hedging position fluctuates with expected output

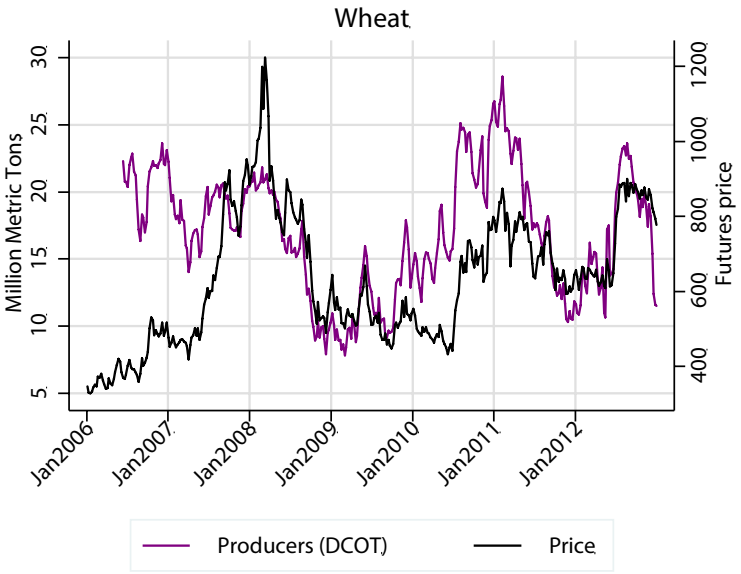
Empirical investigation of Cheng and Xiong (2014):

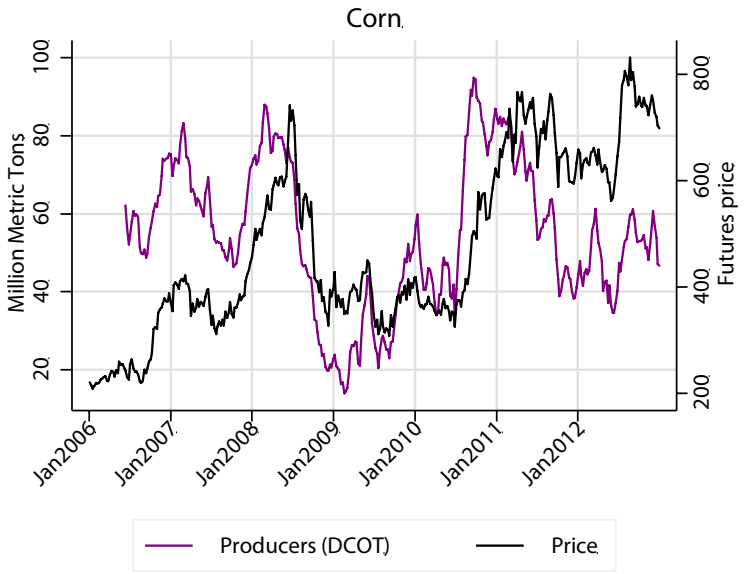
1. How much does output volatility explain hedgers' futures position volatility?
2. Do other factors explain their futures position changes?

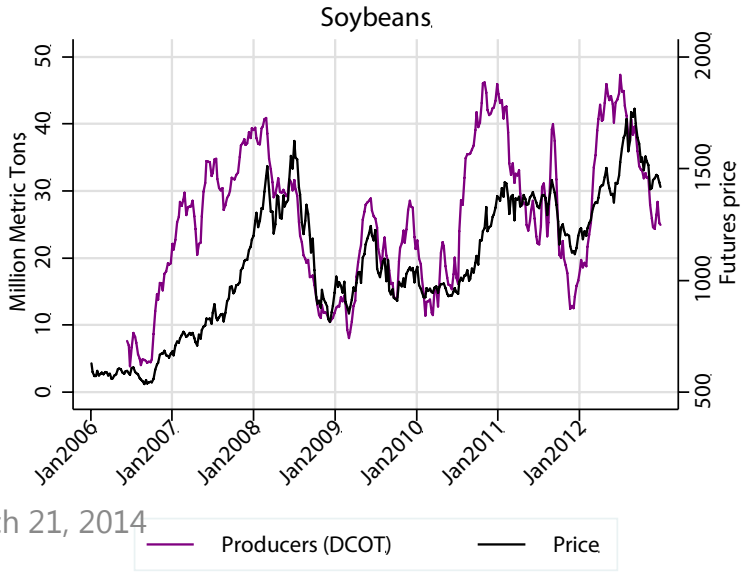
How volatile are monthly futures position changes relative to output expectations?

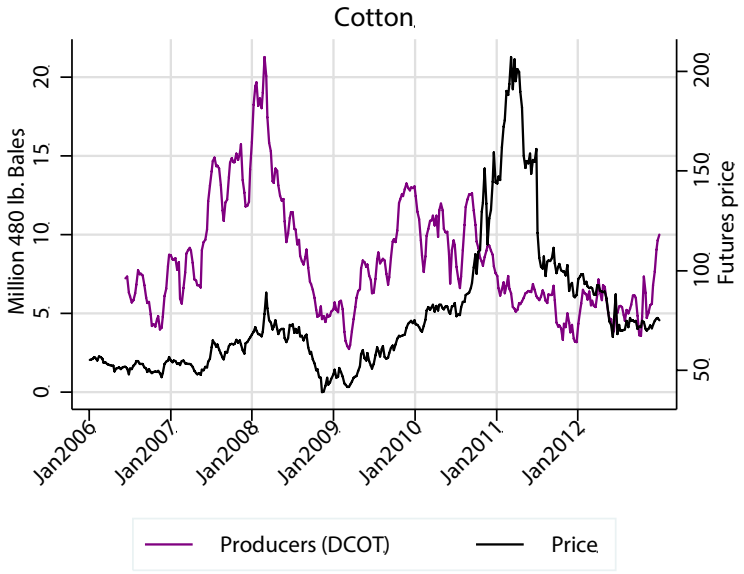


How Do Prices Matter?









Did trading of CITs affect futures prices?

- The Masters hypothesis posits that financial inflow to futures markets drove up oil prices in the 2007-2008 boom.
  - Mechanism not clearly described

- Singleton (2012)
  - Heterogeneous expectations can lead to positive price drift
  - CIT trading predicts higher futures return

- Hamilton and Wu (2012)
  - the long position of CITs fluctuate over time; arbitrageurs with a given supply curve on the short side
  - A larger CIT position implies a lower expected futures return, i.e., a larger CIT position is positively correlated with contemporaneous futures return and predicts lower future return.

- Key predictions:
  - Positive contemporaneous correlation between CIT trading and futures return
  - CIT trading predicts futures return either positively or negatively depending on horizons and specific mechanisms

Data Issues

- Public data reports
  - Weekly Disaggregated Commitment of Traders (DCOT)
    - 4 categories: Producers, Swap Dealers, Managed Money (HF), Other
  - Weekly Supplemental CIT (SCOT)
    - 3 categories: CIT, Non-Commercial, Commercial
    - Agricultural commodities only
  - Aggregation issue: Swap dealers in DCOT are not CITs
    - Could rely only on SCOT, but Non-Commercials are not all hedge funds

- Micro-level LTRS of CFTC underlying public reports
  - Misses swap data (Dodd-Frank reform), subject to netting issue

- Netting problem
  - Positions different lines of business are co-mingled (ex.: Goldman CIT and prop positions), even in LTRS
  - Classifications are often self-reported from traders, one account may have multiple classifications – how to resolve?

- Special call index investment data is low frequency

Inconclusive Evidence

Early work on the price impact of CIT trading focuses on Granger-causality tests

- Reduced form test for whether position changes today predict future returns
- Little evidence of price impact in agricultural commodities using either DCOT-swap dealer positions (Irwin & Sanders JAI 2011) or SCOT-CIT positions (I&S 2011 CJAE, ISM 2009 JAAE, Stoll & Whaley 2009)
- Master's hypothesis: Little evidence of predictive power for energy futures (Brunetti & Buyuksahin 2009, Brunneti, Buyuksahin & Harris 2011, Buyuksahin and Harris 2011) using LTRS swap dealer or hedge fund positions, similarly using special call CIT data (Irwin & Sanders 2012 EE)

More recent work on Master's hypothesis:

- Singleton (2012) finds evidence of positive impact of price impact on oil based on positions imputed from index weights in agricultural commodities
- Hamilton and Wu (2013): Singleton effects are specific to the 2007-2009 recession

Conditional correlations of equity markets and commodity futures

- Potentially driven by hedge funds (Buyuksahin and Robe 2011, 2012, Buyuksahin, Haigh and Robe, 2010)

Inconclusive Evidence

Overall:

1. Agricultural SCOT-CIT positions predict oil returns (Singleton), but only in recent 2007-2009 recession (Hamilton-Wu)

2. Own-commodity SCOT-CIT, DCOT-Swap Dealer positions do not predict own-commodity returns
   - Irwin & Sanders, Brunetti & Buyuksahin, Hamilton-Wu

3. Potentially some effect on conditional correlations from hedge funds, but maybe not
   - Buyuksahin and Robe

What to make of all this?

Limitation of the Tests

- The premise of the aforementioned tests rests on CITs always driving the price.
  - CITs may sometimes trade to accommodate hedgers. Then, the usual simultaneous equation issue may arise.
  - When CITs initiate the trade, there is a positive correlation between price change and CIT position change; when CITs accommodate others, there is a negative correlation
  - Average across these two scenarios, the unconditional correlation is not determined.
  - A sharper test requires isolating trades initiated by CITs.

Conditional Tests

- Cheng, Kirilenko and Xiong (2012)
  - During the crisis (Sep 2008-June 2012), when instrumented by VIX changes, position changes of CITs and hedge funds are positively correlated with futures return
- Henderson, Pearson and Wang (2012)
  - Abnormal returns in two-day windows surrounding launch of commodity-linked notes (CLNs)
  - Effect is increasing in CLN proceeds, not reversed over five days
- Mou (2011)
  - Exploit variation in positions caused by deterministic "index roll." Hedge funds trade to exploit CITs rolling positions from nearby maturity into the next maturity
  - Abnormal returns from HPW (2012) are muted during roll window

Conclusion

- Excessive focus on two polarized views – the bubble view and the business-as-usual view
  - the truth is likely to be more nuanced

- Important to focus on economic mechanisms
  - The same economic mechanisms for financial markets---information aggregation and risk sharing---may also affect commodity markets