The Financialization of Oil Markets
Potential Impacts and Evidence

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Background

- Sharp oil price cycle during 2002-2008 cycle and more recent oil price behaviour polarised debate about drivers of oil prices
  - Fundamentals and expectations about these fundamentals
  - Financialization of oil markets
  - Speculation
  - Manipulation

- Debate been driving (in part) regulatory agenda by G20
Rapid Growth in Open Interest on Crude Oil Futures Exchanges

Average Daily Open Interest in Crude Oil Futures in US Exchange

Source: EIA
Money Managers Net Long in U.S. Oil Futures Market

US Exchange Traded Futures Positions by Money Managers

Source: EIA
Structure of Presentation

• Financialization: What it means?

• The potential impacts of ‘financialization’ and speculation on oil markets

• What does the empirical evidence tell us?

• Financialization and social welfare

• Conclusions
1. Financialization

- Captures increasing exposure to commodities by a wide set of market participants such as hedge funds, pension funds, insurance companies and retail investors

- Exposure through variety of instruments: futures, options, exchange traded funds, index funds, and bespoke products

- Financial innovation provided an easy and a cheap way for various participants to gain exposure to commodities

- Motivation: Commodities as an asset class
  - Return enhancement
  - Portfolio diversification
  - Inflation hedge
  - Hedge against weak US dollar

- Increase in financialization often associated with increase in speculative activity but could also mean greater recourse to market insurance
2. The Potential Impacts on Oil Markets

• Several arguments
  – Influence the oil spot price
  – Increased oil price volatility
  – Higher oil price co-movement with financial assets and other energy and non-energy commodities
  – Affect crude oil futures returns
  – Break inventory-oil price relationship
  – Encourage herding behaviour in oil markets with destabilising consequences

• Is the empirical evidence supportive of these effects?
3.1 Price Level Impacts

Figure 1: Price of Non-Exchange Traded Commodities and Price of Crude Oil

Source: IEA Oil Market Report, March 15, 2011
Investment Inflows into Commodities and Prices

Investment inflows to commodities, (Indices, ETP, MTNs, $bn) and Commodity Price Indices

Source: Barclays Capital, IMF
‘Financialization’, Market Price of Risk

- **Pirrong (2011)**
  - Greater financial market integration reduces market price for risk and increases the level of inventories by reducing cost of hedging
  - Induces an increase in the spot price
  - But stabilizing: higher level for inventories reduces the chance of future price spikes

- **Acharya et al (2010):**
  - Pressure for hedging demand from producers and/or if speculators face capital constraints which limit their ability to take risk results in an increase in cost of hedging and affect optimal inventory decisions
  - Decision to hold/release inventories affects spot prices
  - Find evidence that changes in default risk (proxy for risk aversion) predict Futures returns

- **Etula (2009):**
  - Risk premium depends both on systematic risk and non-marketable risk increasing in level of effective risk aversion
  - Risk-bearing capacity of brokers and dealers
  - Empirical findings: Change in risk bearing capacity of traders predicts quarterly crude oil returns

- **Mou (2010)**
  - Index funds have to roll their entire positions putting pressure on futures prices
  - Profitability of trading strategies to exploit this anomaly increases in index fund investment and decreases in the amount of arbitrage capital
Policy Implications

• Regulatory measures matter:
  – Regulatory measures aimed at increasing cost of hedging or reduce the risk bearing capacity of ‘speculators’ have adverse consequences and should be avoided
  – Etula (2009) concludes: ‘result is central to understanding why restrictions on speculation by market makers may adversely impact the functioning of many derivatives markets’.
  – Some types of regulation are socially beneficial even though they come at a cost: Regulation needed to ensure that oil futures speculation should not involve excessive leverage or opaque instruments

• Many types of regulation: microprudential, market prudential or systemic (issues to be discussed in next session)
3.2 Oil Price Volatility

Price Volatility in Crude Oil and Non-Exchange-Traded Commodities

Source: IEA Oil Market Report, March 15, 2011
3.3 Increased Correlation

- Increased price co-movements between equity, bond and commodity returns
- Increased correlation between exchange rates and oil prices
- Increased price co-movements between non-energy and energy commodities’ returns
- Correlation between index commodities is higher than those for commodities outside index

Source: Tang and Xiong, 2010
Drawbacks

• Evidence not fully supportive (Stoll and Whaley, 2010)
  – Price of index commodities don’t necessarily move together (Oil and Gas)

• Common real macroeconomic shocks driving correlation

• Correlation not stable over time and structural break depends on frequency used (1-day, 1-hour, 5-minute, 10-second, and 1-second frequencies)

• Not clear who is driving these correlations
  – Hedge funds (Büyükşahin and Robe, 2011)
  – High frequency trading activities and algorithm strategies (Bichetti and Maystre, 2012)
  – Index investors (Masters, 2008)

• Why does all this matter? Any welfare consequences?
  – Büyükşahin and Robe (2011): “additional work is needed, if one is to ascertain whether the impact of financialization on cross-correlations represents a welcome improvement in market efficiency or, instead, is a worrisome development”
What about Oil and Gas Prices?

Source: EIA
3.4 Predictability of Crude Oil Futures Returns

• Singleton (2011)
  – Empirical Result: Increases in flows into index funds predict higher subsequent futures returns

• But…. 
  – Based on inaccurate measure of investment flows into index funds
  – Does not imply causation
  – How to interpret such a result?
Index Investment Flows

Comparison of quarterly WTI crude oil net long index positions based on Index Investment Data (IID) and Masters Algorithm Estimates

Irwin and Sanders (2011):

- WTI crude oil futures positions using Masters algorithm overestimated
- Correlation between two series close to zero at quarterly horizon
- Empirical studies that use Masters Algorithm are flawed
- No statistically significant relationship between growth in contracts on one hand and returns, realised volatility and implied volatility on other hand; When relationship found, it is negative

Source: Irwin and Sanders (2011)
Interpretation of Result

- Even if such an evidence holds it is not necessarily supportive of speculation
- Consistent with existence of frictions that limit participation of non-commercial traders in futures markets (Hirshleifer, 1988; 1989)
- Risk premium depends both on systematic factor and residual risk linked to hedging pressure
- Increased hedging pressures \(\Rightarrow\) Increase risk premium
- Increased hedging pressures \(\Rightarrow\) Attract more speculative positions and affect futures prices
- De Roon et al (2000):
  - Market producers hedging positions correlated with commodity futures price changes
  - Consistent with evidence of frictions in futures markets
3.5 Herding Behaviour

• Herding often assumed to be detrimental to the market
  – Prices diverge from their fundamental values; lead to mispricing; impedes hedging; inefficient social outcomes
  – Can be both stabilising or destabilising

• Buyuksahin et al (2009) find evidence of herding in commodities futures
  – Herding in futures markets driven in part by mimicking behaviour and common trading strategies specifically by hedge funds and floor brokers/traders
  – But have stabilising effect on prices

• Evidence has been limited so far to this study: An area in need of further research
3.6 The Inventory-Price Relationship

US Commercial Crude Stocks vs. WTI (1994-2011)

(US $/b)

(million barrels)

Source: OPEC
Broken Relationship

- Often claimed that relationship broken due to entry of speculators/ index investors
- Underlying static framework

- Speculators drive Prices upwards above equilibrium level
- Encourages production and discourages consumption
- Accumulation in Inventories
- Positive relationship between price and inventories
Inventory-Price Relationship Much More Complex

- Relationship between two endogenous problems could be shifting in response to structural changes or changes in expectations

- Pirrong (2008): Commodity storage problem dynamic & should be analysed in dynamic rational expectation model
  - Forward looking agents respond to increase in variance of demand by increasing inventory holdings which requires prices to increase
  - If variance shocks are volatile enough, relationship between inventories and prices becomes unstable

- Dvir and Rogoff (2009):
  - Agents will increase optimal storage in expectation of higher prices in next period
  - Will lead to higher equilibrium price today when storage is positive
  - Impact of growth shock is magnified: increasing demand when it is high in preparation of higher demand in the future
  - Price volatility higher in presence of storage (contrary to the view that storage lean against the wind)

- “Those searching for evidence of speculative excess need look elsewhere than the price-inventory relation.” (Pirrong, 2008); same conclusion reached by Singleton (2011)
3.7 Shocks in a VAR Framework

- Distinguish between various types of shocks (Kilian and Murphy, 2010):
  - Oil supply shock; Oil demand shock; Speculative oil demand shock (Shock to demand for inventories as a result of change in expectations); Residual shock
  - Speculative demand shock played a minor role in oil price rise between 2003-2008; Oil price increase caused by shifts in demand driven by global economic expansion

- Juvenal and Patrella (2011) introduce an additional shock but with questionable identifying restrictions:
  - Financial speculative demand shock reflecting traders’ activity in financial markets
  - Financial speculation shocks the second most important driver of oil prices after oil demand shocks
  - Also accounts for increased correlation between oil & other commodities

- Lombardi and Van Robyas (2011) introduce a financial speculation shock
  - Identification based on oil futures spread and the oil futures price
  - Find that destabilizing financial activity can have an important impact in the short run but limited in the long run
  - Fundamentals (and expected fundamentals) explain about 90% of oil price movements in the short run

- Comparing sign-restriction across VAR papers very difficult task.
4. Welfare Analysis Needed

• Potential negative consequences of financialization
  – ‘Spill over price volatility from outside to commodities markets and also across commodities’ (Tang and Xiong, 2010)
  – Erode the long-run diversification benefits as systematic risk dominates futures return
  – Prone to bubbles as in financial markets

• Potential positive consequences of financialization
  – More efficient derivatives pricing methods through linking futures prices at different maturities (Buyuksahin et al, 2008)
  – Helped physical crude oil markets become more integrated by reducing transaction costs and facilitate arbitrage across geographically distant markets and across crude oil of different quality (Fattouh, 2010)
  – Reduce the market price of risk with stabilising effect on the oil price (Pirrong, 2011)

• Need for studies that evaluate social welfare
5. Conclusion: What Have been Learnt So Far?

• Most evidence from VAR analysis suggests that speculation played a limited role in explaining oil price movements during the 2002-2008 oil price cycle; oil demand shocks (current and expected) can account for the oil price rise.

• Price co-movement analysis adds little to our understanding of drivers of oil prices:
  – What drives this co-movement?
  – Why does it matter?

• Evidence of predictibility of crude oil returns based on traders’ position is mixed at best and is consistent with other explanations based on market frictions.

• The inventory-price relationship should not be used to analyze impact of speculation.
Does not imply that entry of financial players has had no impact on oil price formation

• Change in risk aversion of financial players can have an impact on the spot price

• Changes in risk premia (Hamilton and Wu, 2011)
  – Significant changes as financial investors (index funds) have become natural counterparts to hedgers
  – Risk premia declined post 2005 and become more volatile (even negative in many instances like in 2009)

• Change in term structure of commodity futures markets (Mou, 2010)

• Increase in herding activity

• Increased correlation across various maturities but different explanations
  – Fattouh and Scaramozzino (2011): Shift in the probability distribution of the mean reversion parameter due to change in expectations

• What remains unclear is the social welfare consequences of these changes
Financial Players and Expectations

• How does the entry of financial players affect the formation of expectations?

• Beauty contest games can arise in a difference of opinion framework and heterogeneity of traders (Singleton, 2011; Allen, Morison and Shin, 2006)
  – Market participants form expectations not only in terms of expected fundamentals but also on basis of anticipations of other players’ expectations

• Impact of public information or signals amplified even if do not necessarily reflect large changes in underlying fundamentals
  – Can affect my guess about other players’ guesses

• Market participants tend to focus only on few signals while ignoring others as not possible to coordinate on a large number of signals
  – Inventories, weak dollar, shortages of supply, peak oil

• To what extent these features play out in commodities markets is yet not clear and is need of further research