Do financial investors destabilize oil prices?

by

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The opinions expressed here are personal and not necessarily shared by the ECB or the Eurosystem

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Motivation

• **Oil price** surged with increasing momentum between 2003-2008 before falling in the wake of the financial crisis and the subsequent economic downturn. After that, prices recovered again.

• **Oil price increases** came against the background of surging demand and stagnating supply.
Financialization of oil

- The **financialization** of the oil futures market was also blamed: the number of open futures contracts more than tripled over period 2000 – 2008

- **Did financial activity drive up the price of oil?** Do we need stricter regulations on trading in the oil futures market?
Policy-relevant questions

1. Has financialization distorted the pricing mechanism in futures markets?
2. Does this transmit to spot prices?
3. If so, should commodity futures markets be more regulated?
WHAT’S EXACTLY FINANCIALIZATION?
Why derivatives?

• Futures markets exist to transfer risk of oil price fluctuations

• 2 types of traders
  – Commercial traders may want to hedge against price fluctuations by fixing the price they will pay or receive for delivery in the future
  – Also non-commercial traders enter the futures markets to achieve exposure to oil price risk and make a profit.

• The activity of non-commercial traders is usually defined as speculation
Does financial activity distort pricing?

STABILIZING ACTIVITY
If trading is based on expected fundamentals, activity in the futures markets will make markets more liquid and allow information to be priced in immediately and efficiently.

DESTABILIZING ACTIVITY
Traders may distort efficient pricing in the futures markets only when they take positions that disregard (expected) fundamentals.
The role of index investment

- Recently, banks have popularized commodity investment by marketing index funds
- Index funds trace popular commodity indexes with a passive strategy
  - They just go long and roll over contracts as the delivery date approaches
- Is this putting constantly upward pressure on prices?
Findings on the impact of index funds

- Index investment does not cause changes in futures prices (Stoll and Whaley 2010)
- Index investment does not increase volatility (Irwin and Sanders 2010)
- Increase in commodity correlation due to hedge funds (Büyüksahin and Robe 2010)
- Index funds affect futures prices around roll-over dates (Mou 2010)
- Index investment increased commodity correlation (Tang and Xiong 2010)
- Index investment is affection prices beyond the short term (Singleton 2011)

Is this a data issue?
Our contribution

• We evaluate the importance of financial activity in determining the spot price without explicitly using positions data

• We focus on shock to the futures market not linked to fundamentals
  – deviation from the no-arbitrage condition

• We use a structural VAR model with sign restrictions
  – Fundamental oil supply and demand-side shocks
  – Precautionary demand shock
  – Non-fundamental financial activity shock
THEORETICAL SETUP
Spot and futures prices

- Financial activity in the futures markets only matters if these traders can affect the spot price of oil.
- Linkage between spot and futures market by a no-arbitrage condition (Pindyck 1994)

\[ P_t \left(1 + r_t \right)^\tau = F_{t,t+\tau} \left(1 + \Psi_{t,t+\tau} \right) \]

- Spot oil price
- Futures price; for delivery in \( t+\tau \)
- Risk-free bond rate; Opportunity cost
- Convenience yield; additional benefit from having oil in storage
No-arbitrage condition

- ... or taking logs:

\[ p_t + \tau r_t = f_{t,t+\tau} + \psi_{t,t+\tau}. \]

- Re-writing gives:

\[ f_{t,t+\tau} = p_t - \psi_{t,t+\tau} + \tau r_t. \]

- This condition should hold if markets are efficient and arbitrage opportunities are instantaneously exploited.
Convenience yield

• In turn, the convenience yield is:

$$\psi_{t,t+\tau} = G[p_t, I_t, E(D_{t,t+\tau})]$$

– spot oil price, inventories and expected oil fundamentals (Pindyck 1994)

• It is more beneficial to have oil inventories if
  – Oil spot price is higher
  – The current level of inventories is lower
  – Expected oil demand and supply are tighter
No-arbitrage futures price

- Substituting the expression for the convenience yield gives...

\[ f_{t, t+\tau} = p_t - \psi_{t, t+\tau} + \tau r_t \]

\[ f_{t, t+\tau} = p_t - G[p_t, I_t, E(D_{t, t+\tau})] + \tau r_t \]

- The futures price in the no-arbitrage, efficient markets’ case is **solely dependent on current and expected fundamentals**
Deviations from the no-arbitrage price

- Destabilizing financial activity can distort efficient pricing if traders buy or sell futures based on reasons not related to (expected) fundamentals.

- So the observed futures price can deviate from the no-arbitrage value:

\[
\hat{f}_{t,t+\tau} = f_{t,t+\tau} + \epsilon_t
\]

Observed futures price = no-arbitrage price + DESTAB. FINANCIAL SHOCK derived above which distorts efficient pricing.
The observed futures price

- **Substituting in the no-arbitrage futures price gives**:

\[ f_{t, t+\tau}^o = p_t - G[p_t, I_t, E(D_{t,t+\tau})] + \tau r_t + \epsilon_t^f \]

- **The observed futures price is driven by**:
  - Current and expected **fundamentals**
  - Destabilizing **financial activity shock**
Spot-futures spread

- Rewriting this in terms of the futures–spot spread

\[ s^o_{t,t+\tau} = f^o_{t,t+\tau} - p_t = G(p_t, I_t, E(D_{t,t+\tau})) + \tau r_t + \epsilon^f_t \]

1. The spread is negatively affected by changes in current and expected fundamentals (also incl. stabilizing activity in futures markets) (1)

2. The spread is positively affected by destabilizing financial shocks (2)

   - ...we can use this finding to uniquely identify the fundamental shocks from the non-fundamental financial activity shock in the data
EMPIRICAL RESULTS
Our Structural VAR

• Estimation of an SVAR model for the global oil market:

\[ Y_t = c + A(L)Y_{t-1} + u_t \]

– Global oil production
– Oil spot price
– World economic activity
– Inventories
– 3-month oil futures price
– (Futures-spot spread, defined within the model)

• Monthly data, over 1991M1-2010M2 with 12 lags
Identification

- Disentangle different types of shocks that determine oil prices
  - Fundamental versus non-fundamental shocks
  - Different types of fundamental shocks
- We identify shocks using sign restrictions
- Non-fundamental shock = destabilizing financial activity shock
- Shocks to fundamentals = shocks to (current and expected) supply and demand
### Oil supply shock

- **E.g. supply disruptions**

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**Economic activity shock**

- **E.g. strong growth of emerging economies**

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Oil demand shock

- **E.g. oil-gas substitution shock**

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Destabilizing financial shock

- E.g. index funds?

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Response to fundamentals

- Oil price
- Oil production
- Inventories
- World econ. activity
- Futures-spot spread

Graphs illustrating the response of various economic indicators to different factors.
Response to financial activity

- Some temporary effect on the spot price
- No effect on oil production, inventories or on economic activity
- The spread permanently increases
Variance decomposition

- Fundamentals explain about 90% of oil price movements in the short run
- relevance of destabilizing financial activity is limited.
Historical decomposition

- Financial activity exacerbated gyrations in the oil market
Conclusions

- Financial activity can significantly destabilize spot prices in the short run
- Importance is limited in the long run and the pass-through is incomplete
- Trading according to (expected) oil fundamentals still explains about 90% of oil spot price movements
- Further regulating futures markets may reduce liquidity and risk-absorbing capacity in the oil futures market
- Something to look into: financial stability implications of index investment