Do financial investors destabilize oil prices?

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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**.

spot oil price in USD/barrel
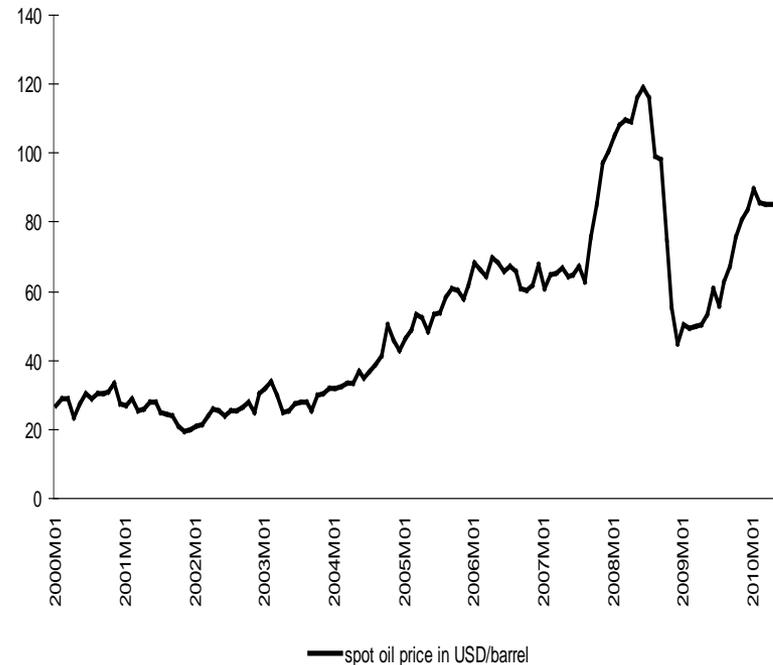
Financialization of oil

- 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?
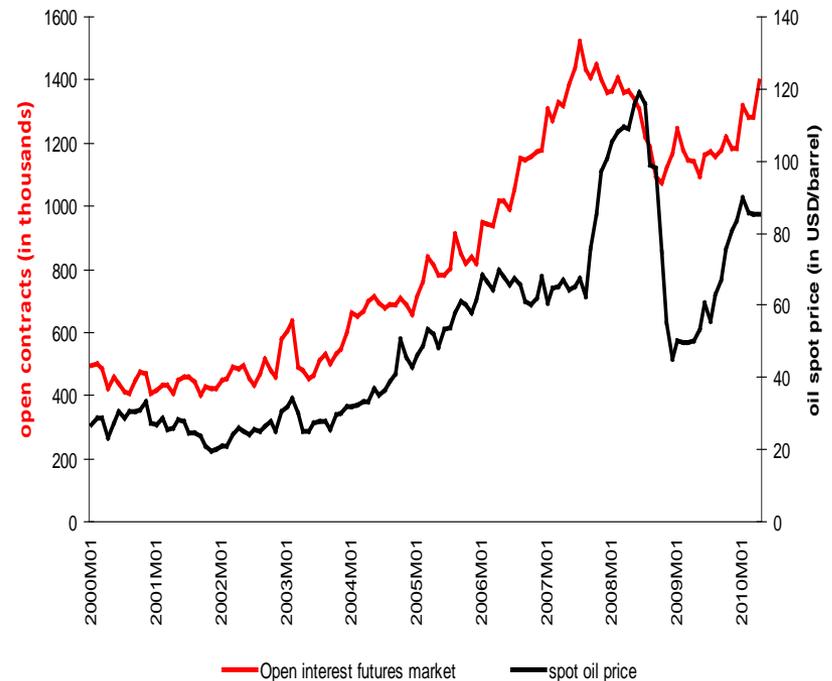
Policy-relevant questions

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 exists 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 <u>more liquid</u> and allow <u>information</u> to be priced in immediately and efficiently

DESTABILIZINGACTIVITY

Traders may <u>distort</u> 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?**
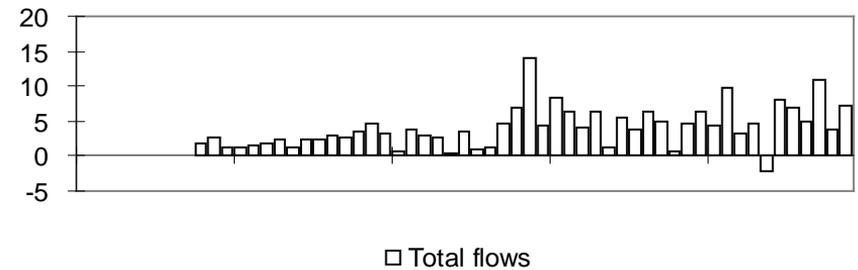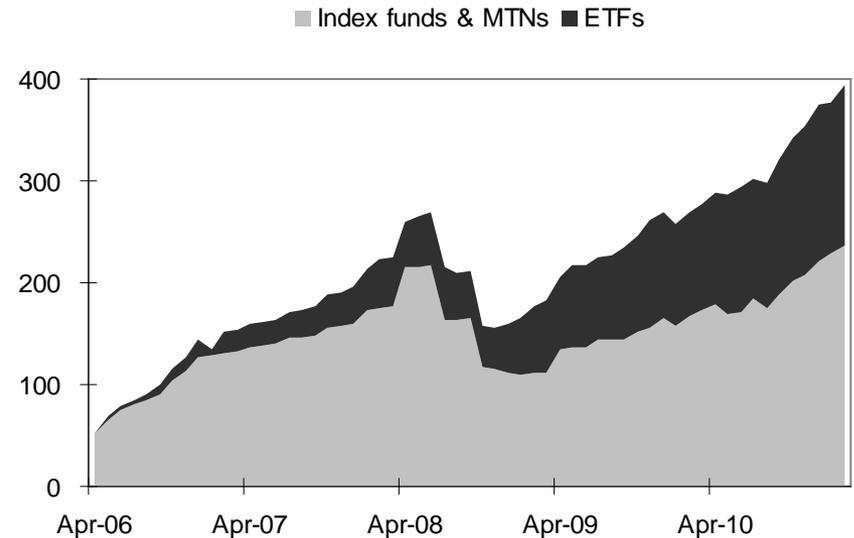
Findings on the impact of index funds

- **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+τ

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…**

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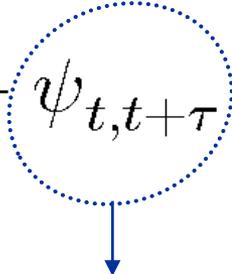
$$f_{t,t+\tau} = p_t - G[p_t, I_t, E(D_{t,t+\tau})] + \tau r_t$$

- **The futures price in the no-arbitrage, efficient markets' case is <u>solely dependent on current and expected fundamentals</u>**

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:**

$$f^{\circ}_{t,t+\tau} = f_{t,t+\tau} + \epsilon^{f}_{t}$$
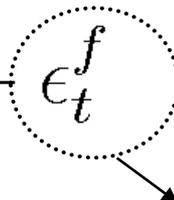
Observed futures price = **no-arbitrage** price + **DESTAB. FINANCIAL SHOCK**

derived above   which distorts efficient pricing

The observed futures price

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

$$f^{o}_{t,t+\tau} = p_t - G[p_t, I_t, E(D_{t,t+\tau})] + \tau r_t + \epsilon^{f}_t$$

- **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**

$$s^{\circ}_{t,t+\tau} = f^{\circ}_{t,t+\tau} - p_t = \underbrace{-G[p_t, I_t, E(D_{t,t+\tau})] + \tau r_t}_{(1)} + \underbrace{\epsilon^f_t}_{(2)}$$

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

- **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**

	Q_{oil}	P_{oil}	Y_{wd}	INV_{oil}	F_{oil}	S_{F-P}
	Oil production	Spot oil price	World econ. activity	Inventories	Oil futures price	Futures - spot spread
Oil supply shock	<0	>0	<0		>0	<0
Oil demand shock driven by economic activity						
Oil-specific demand shock						
Destab. financial shock						

Economic activity shock

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

	Q_{oil}	P_{oil}	Y_{wd}	INV_{oil}	F_{oil}	S_{F-P}
	Oil production	Spot oil price	World econ. activity	Inventories	Oil futures price	Futures - spot spread
Oil supply shock	<0	>0	<0		>0	<0
Oil demand shock driven by economic activity	>0	>0	>0		>0	<0
Oil-specific demand shock						
Destab. financial shock						

Oil demand shock

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

| | Q_{oil} | P_{oil} | Y_{wd} | INV_{oil} | F_{oil} | S_{F-P} |
	Oil production	Spot oil price	World econ. activity	Inventories	Oil futures price	Futures - spot spread
Oil supply shock	<0	>0	<0		>0	<0
Oil demand shock driven by economic activity	>0	>0	>0		>0	<0
Oil-specific demand shock	>0	>0	<0		>0	<0
Destab. financial shock						

Destabilizing financial shock

- **E.g. index funds?**

|	Q_{oil}	P_{oil}	Y_{wd}	INV_{oil}	F_{oil}	S_{F-P}
	Oil production	Spot oil price	World econ. activity	Inventories	Oil futures price	Futures - spot spread
Oil supply shock	<0	>0	<0		>0	<0
Oil demand shock driven by economic activity	>0	>0	>0		>0	<0
Oil-specific demand shock	>0	>0	<0		>0	<0
Destab. financial shock	?	?	?		>0	>0

Response to fundamentals
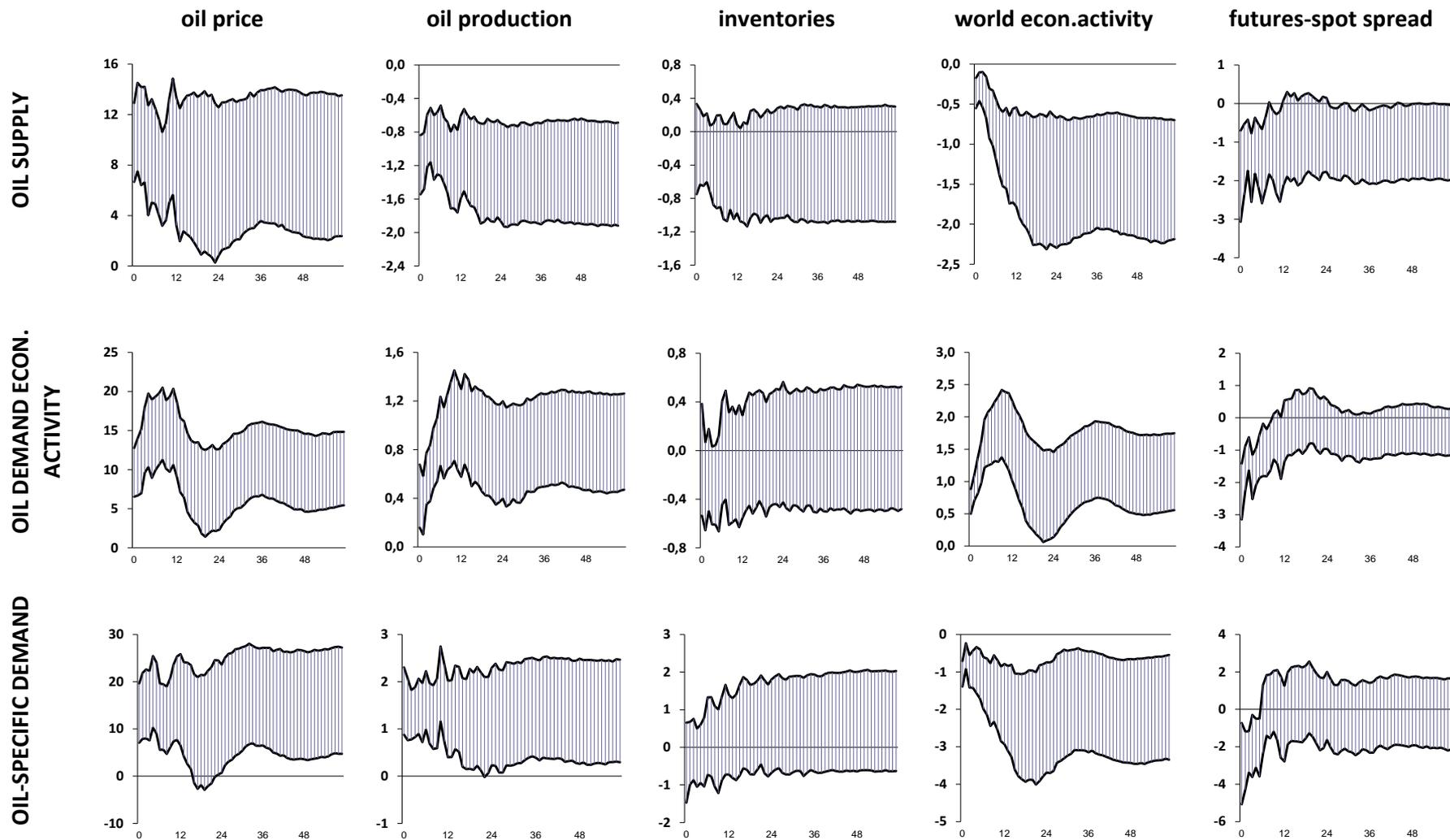
Response to financial activity

oil price · oil production · inventories · world econ.activity · futures-spot spread
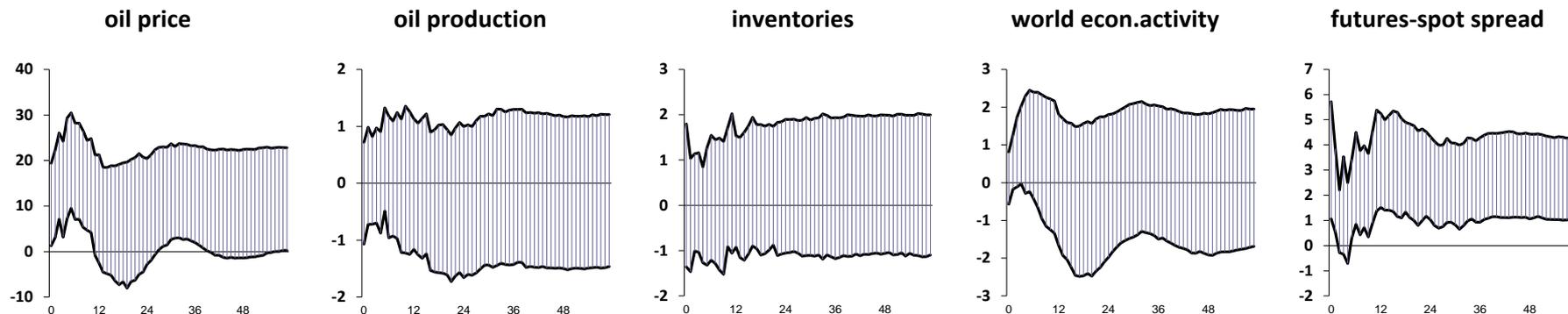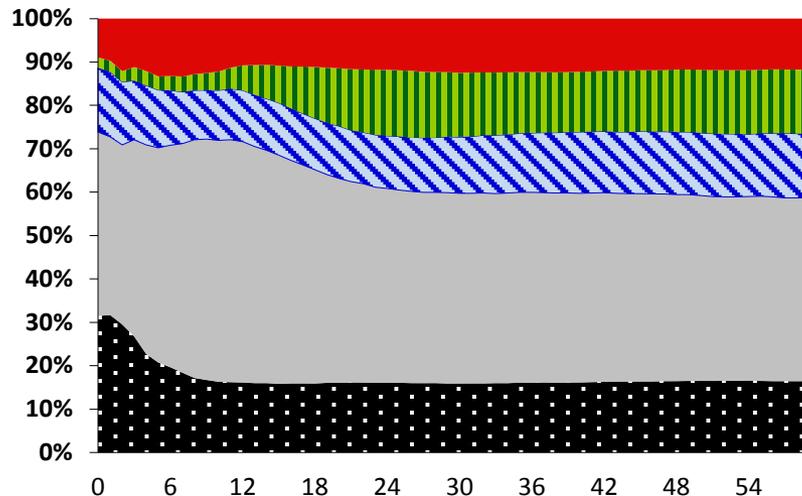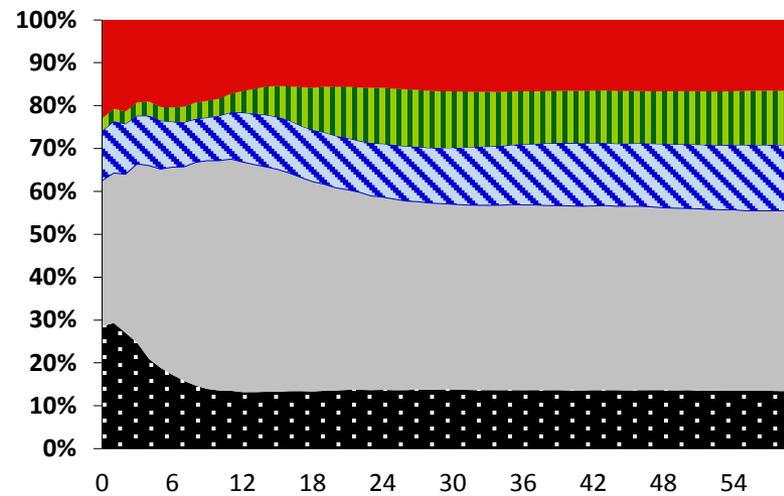
- **Some temporary effect on the spot price**
- **No effect on oil production, inventories or on economic activity**
- **The spread permanently increases**

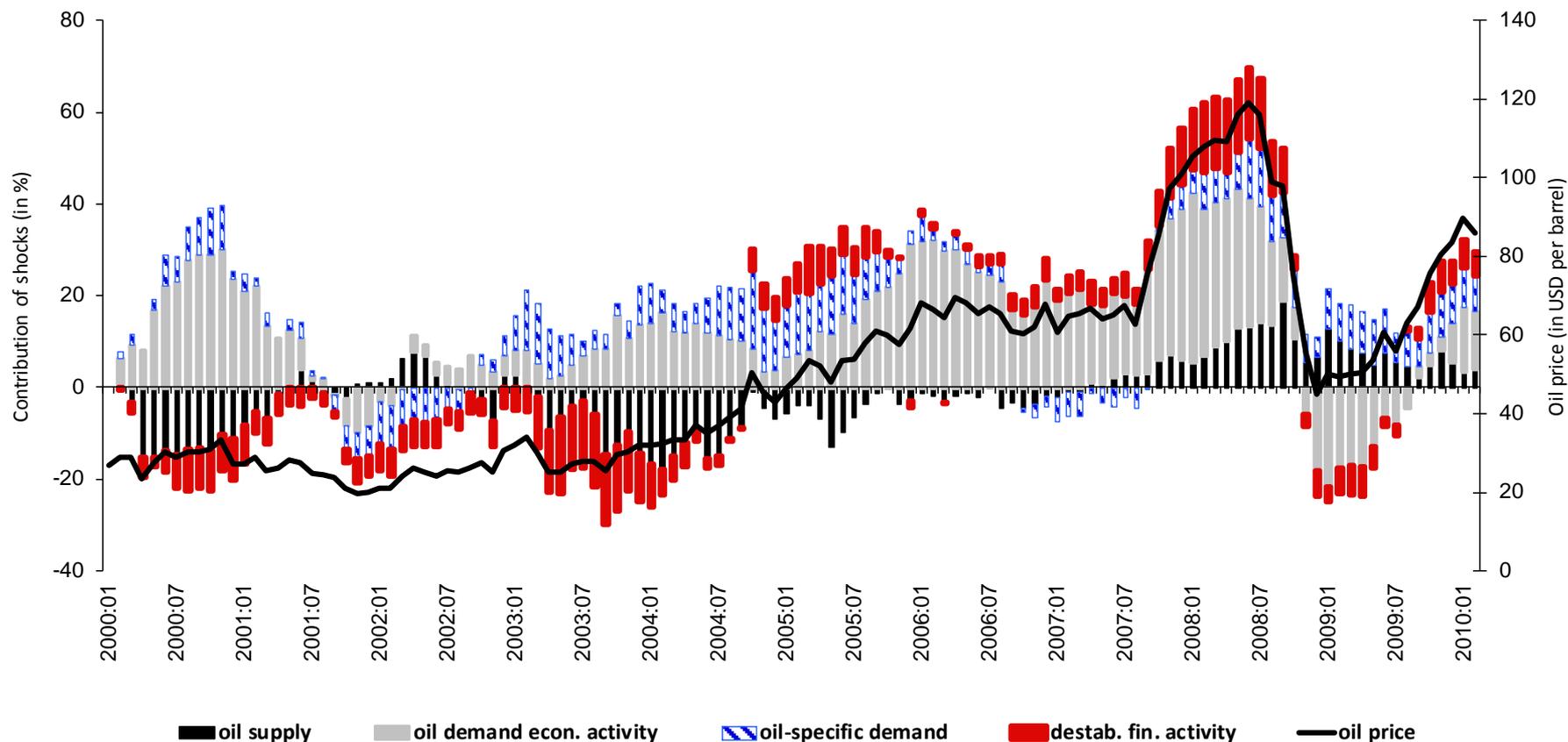# Variance decomposition

Oil spot price

Oil futures price

oil supply   oil demand driven by econ. activity   oil-specific demand   other   destab. fin. activity

- **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