

Do financial investors destabilize oil prices?

by

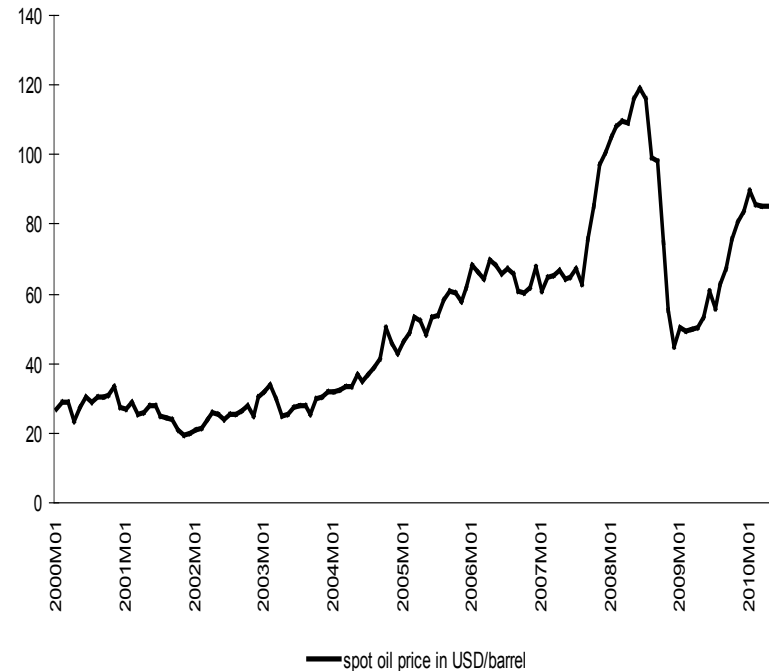
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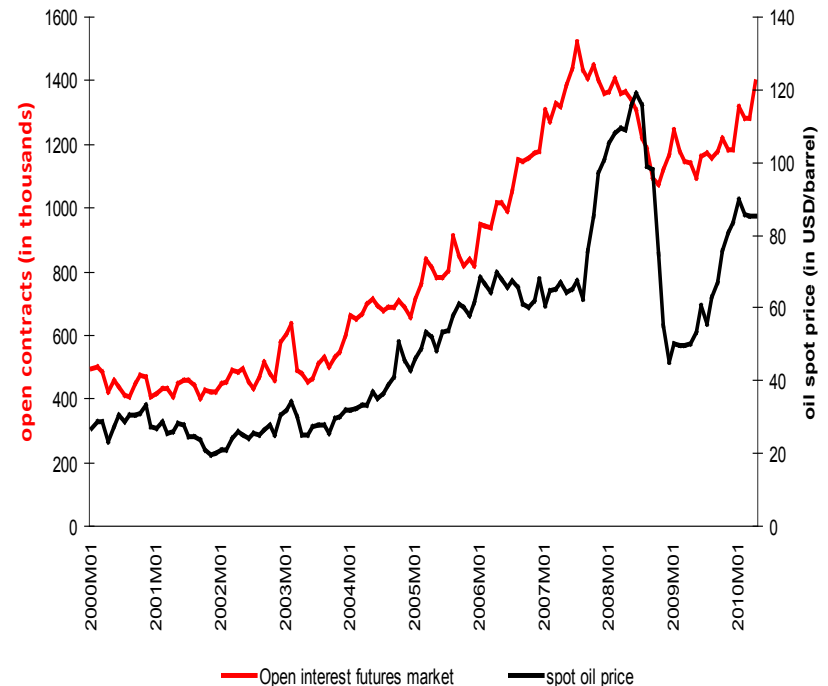
Motivation

- **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?**

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

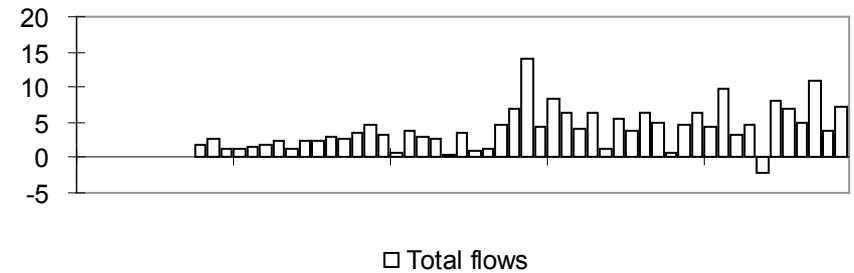
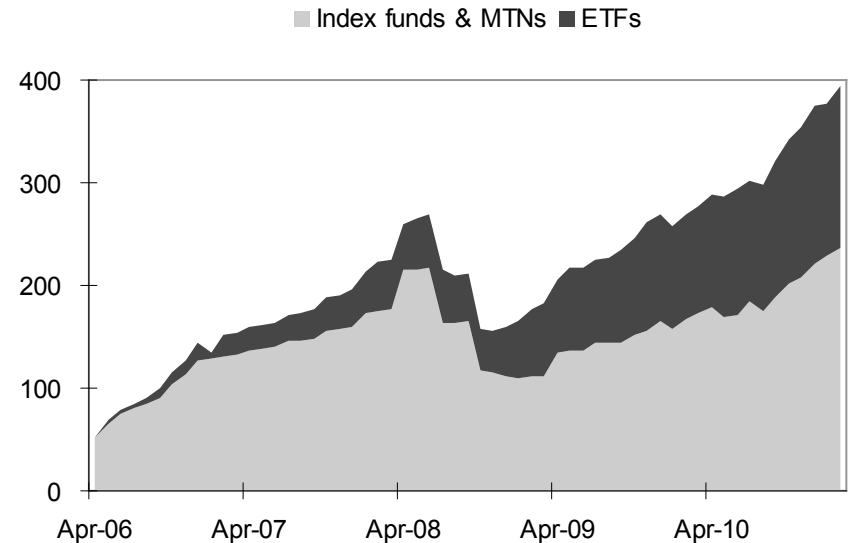
If trading is based on expected fundamentals, activity in the futures markets will make markets more liquid and allow information to be priced in immediately and efficiently

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 affecting 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**
 - **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)

$$P_t (1 + r_t)^\tau = F_{t,t+\tau} (1 + \Psi_{t,t+\tau})$$

Spot oil price

**Risk-free bond rate;
Opportunity cost**

**Futures price;
for delivery in $t+\tau$**

**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

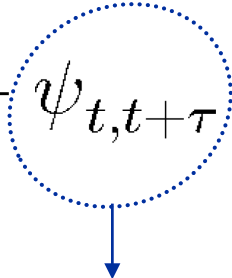
- **In turn, the convenience yield is:**

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

- **spot oil price, inventories and expected oil fundamentals (Pindyck 1994)**
- **It is more beneficial to have oil inventories if**
 - **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...**

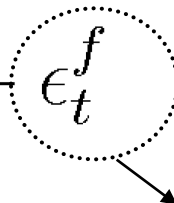
$$f_{t,t+\tau} = p_t - \psi_{t,t+\tau} + \tau r_t$$


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

- **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:**

$$f_{t,t+\tau}^{\circ} = f_{t,t+\tau} + \epsilon_t^f$$


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 :**

$$f_{t,t+\tau}^{\circ} = p_t - G[\underbrace{I_t, E(D_{t,t+\tau})}_{\leftarrow \hspace{10em} \rightarrow}] + \tau r_t + \underbrace{\epsilon_t^f}_{\leftarrow \hspace{1em} \rightarrow}$$

- **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**

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

- 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-nuclear substitution shock

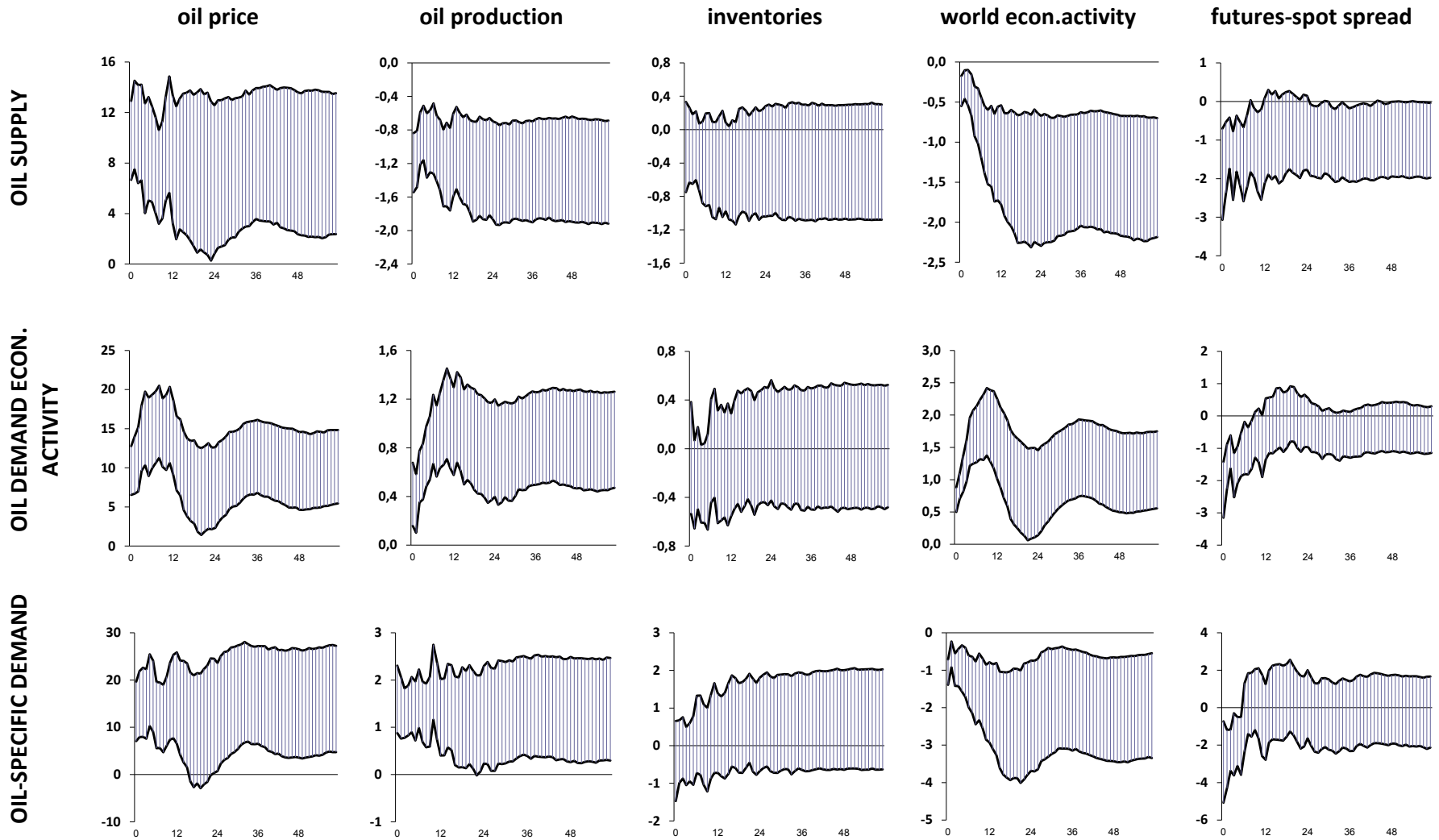
		Q_{oil}	P_{oil}	Y_{wd}	INV_{oil}	F_{oil}	S_{F-P}
		Oil production	Spot oil price	World econ. activity	Inventories	Oil futures price	Futures - spot spread
	Oil supply shock	<0	>0	<0		>0	<0
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	Destab. financial shock						

Destabilizing financial shock

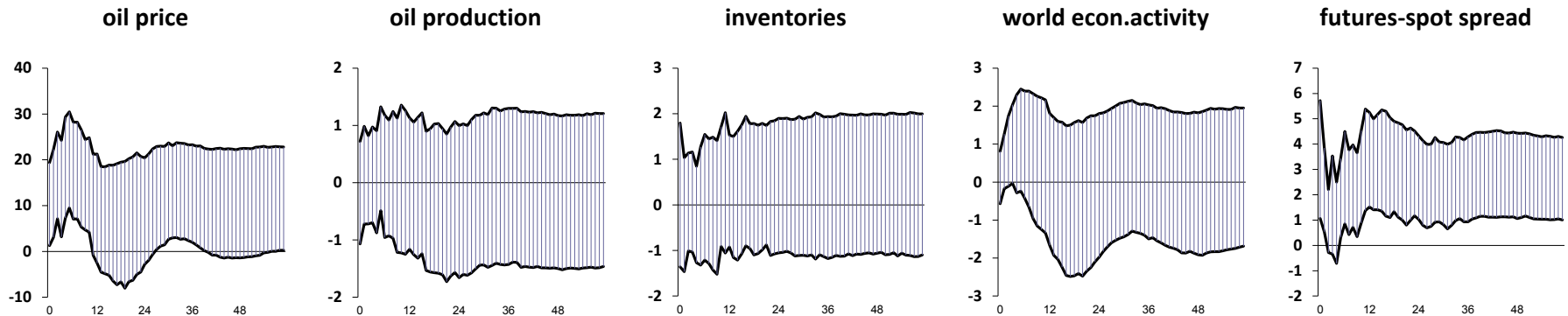
- E.g. index funds?

		Q_{oil}	P_{oil}	Y_{wd}	INV_{oil}	F_{oil}	S_{F-P}
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	Oil-specific demand shock	>0	>0	<0		>0	<0
	Destab. financial shock	?	?	?		>0	>0

Response to fundamentals



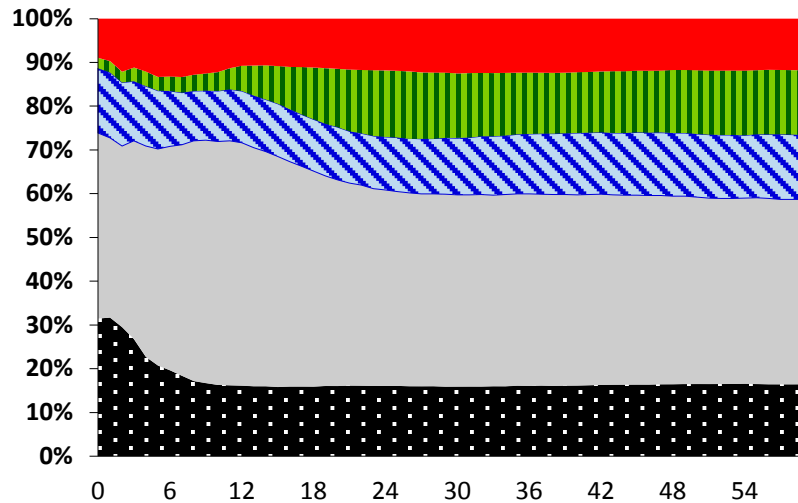
Response to financial activity



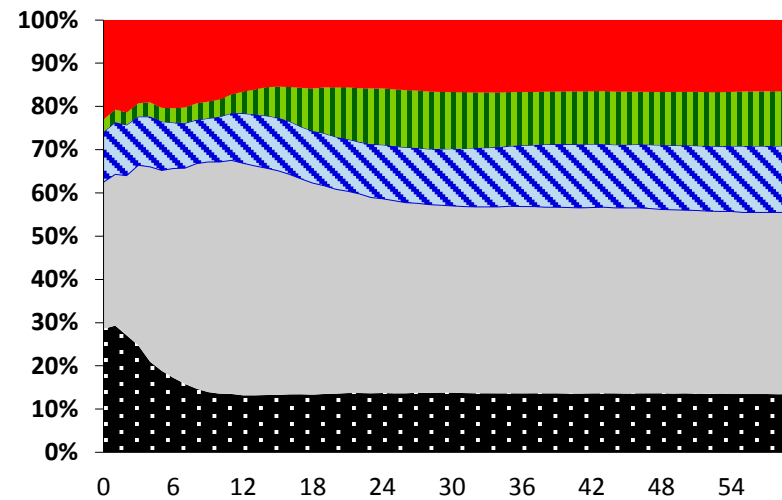
- **Some temporary effect on the spot price**
- **No effect on oil production, inventories or on economic activity**
- **The spread permanently increases**

Variance decomposition

Oil spot price



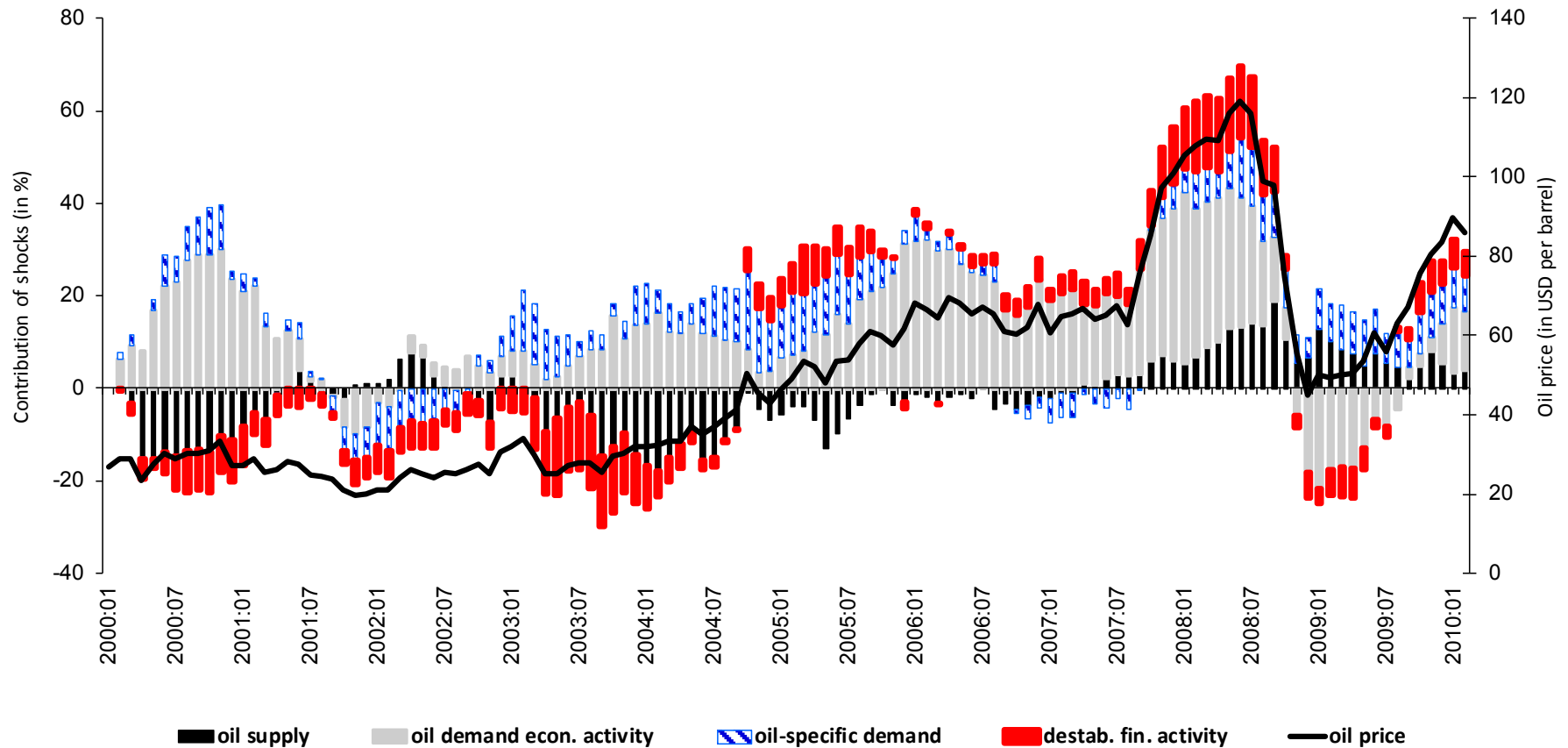
Oil futures price



■ oil supply ■ oil demand driven by econ. activity ■ oil-specific demand ■ other ■ destabil. 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**