What is the welfare social cost of oil price movements?
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Different shocks underlying oil price movements ⇒ Different macro impact (Sadorsky (1999); Hamilton (2003); Edelstein and Kilian (2007); Kilian (2008)).

Effectiveness of economic policies strongly depends on the identification of the major causes of energy prices movements.
Main message

- **Different origin** (fundamental vs. speculative) of oil shocks generates **different impact** on welfare.
- Use of DSGE to model endogenous and structural reaction of different agents. *(theoretical support of monetary policy reaction)*
Different origin (fundamental vs. speculative) of oil shocks generates different impact on welfare.

Use of DSGE to model endogenous and structural reaction of different agents. (theoretical support of monetary policy reaction)

1. Fundamental shocks have reduced impact on welfare compared to speculative shocks.

2. Oil demand shocks have a reduced impact on welfare compared to Oil supply shocks.
4 types of agents:

1. **Households**: supply labor, consume, invest (rent capital to firms).

2. **Firms**:
   - *Intermediate firms*: produce non-oil intermediate goods using labor and capital.
   - *Oil importing firms*: import crude-oil, produce refined-oil intermediate goods and set refined-oil price.
   - *Final good firms*: bundle non-oil and refined-oil intermediate goods to produce consumption, investment and government final goods.

3. **Government**

4. **Central bank**: set monetary policy.
DSGE Model

Consumption and investment (demand side):

\[ q^i_t = \left[ (1 - v^i_t)^{\frac{1}{\eta^i}} (h^i_t)^{\frac{\eta^i-1}{\eta^i}} + v^i_t^{\frac{1}{\eta^i}} ((1 - \Gamma^i_t) o^i_t)^{\frac{\eta^i-1}{\eta^i}} \right]^{\frac{\eta^i}{\eta^i-1}} \]

\[ \Gamma^i_t = \frac{\gamma^i}{2} \left[ \left( \epsilon^o_{t,d} \right)^{-\frac{1}{\gamma^i}} \frac{o^i_t / q^i_t}{o^i_{t-1} / q^i_{t-1}} - 1 \right]^2 \text{ for } i = \{ C, I \} \]
DSGE Model

- Consumption and investment (demand side):

\[
q_{it} = \left[ (1 - v_i) \frac{1}{\eta_i} (h_t^i) \frac{\eta_i - 1}{\eta_i} + v_i \frac{1}{\eta_i} ((1 - \Gamma_t^i) o_t^i) \frac{\eta_i - 1}{\eta_i} \right]^{\frac{\eta_i}{\eta_i - 1}} \\

\Gamma_t^i = \frac{\gamma_i}{2} \left[ \left( \epsilon_{t, O}^{O,d} \right)^{-\frac{1}{\gamma_i}} \frac{o_t^i / q_t^i}{o_{t-1}^i / q_{t-1}^i} - 1 \right]^2 \quad \text{for } i = \{C, I\}
\]

- Oil supply (supply side):

\[
\ln o_t = (1 - \rho_{O,s}) \ln (\bar{o}) + \rho_{O,s} \ln o_{t-1} + \eta_{t, O,s}^O \\
\ln p_{O,t}^* = (1 - \rho_{p_O^*}) \ln (\bar{p}_O^*) + \rho_{p_O^*} \ln p_{O,t-1}^* + \eta_{t}^{p_O^*}
\]
DSGE Model

- Consumption and investment (demand side):
  \[ q^i_t = \left[ (1 - v^i_t)^{1/\eta^i_t} (h^i_t)^{\eta^i_t - 1/\eta^i_t} + v^i_t ((1 - \Gamma^i_t) o^i_t)^{\eta^i_t - 1/\eta^i_t} \right]^{\eta^i_t - 1/\eta^i_t} \]

  \[ \Gamma^i_t = \frac{\gamma^i_t}{2} \left[ (\epsilon_t^{O,d})^{-1/\gamma^i_t} \frac{o^i_t / q^i_t}{o^i_{t-1} / q^i_{t-1}} - 1 \right]^2 \quad \text{for } i = \{C, I\} \]

- Oil supply (supply side):
  \[ \ln o^i_t = (1 - \rho_{O,s}^i) \ln (\bar{o}) + \rho_{O,s}^i \ln o_{t-1} + \eta^O,s_t^i \]
  \[ \ln p^*_O,t = (1 - \rho_{p_o}^i) \ln (\bar{p}_O^*) + \rho_{p_o}^i \ln p^*_O,t_{t-1} + \eta^{p^*_O}_t \]

- Oil price shocks:
  \[ \eta^{p^*_O}_t = \alpha^{phy}_O \left( \alpha^{dde}_O \eta^{O,d}_t - \left( 1 - \alpha^{dde}_O \right) \eta^{O,s}_t \right) + \left( 1 - \alpha^{phy}_O \right) \eta^{O,m}_t \]

  physical (demand or supply) shocks

  market specific shock

Oil price and welfare (by Tovonomy R.) International Association for Energy Economics (2014)
Welfare measure:

\[ W_t = E_t \sum_{k=0}^{\infty} \beta^k U_{t+k}(c_{t+k}, L_{t+k}) \]

where

\[ U_t(\cdots) = e^B_t \left( \ln (c_t - hc_{t-1}) - e^L_t \frac{(L_t)^{1+\psi}}{1 + \psi} \right) \]

Policy function: Second-Order approximation of model’s equilibrium solutions
Results (Welfare impact of oil demand shock)

Oil demand shock impact on Welfare

Oil price and welfare (by Tovonony R.) International Association for Energy Economics (2014)
Results (Welfare impact of oil supply shock)

Oil supply shock impact on Welfare

Welfare change: loss (-), gain (+)

Demand shock weight

Physical shock weight

$10^{-3}$
Results (Welfare impact of oil market-specific shock)

Oil market specific shock impact on Welfare

Welfare change: loss (-), gain (+)

Demand shock weight

Physical shock weight

Oil price and welfare (by Tovonony R.)
International Association for Energy Economics (2014)
DSGE model necessary to model *endogenous and structural* interaction between agents.

Different **impact on welfare** depending on the nature of shocks:

1. Oil-physical (demand/supply) shocks *less harmful* than Oil-market specific shocks.
2. Oil-demand shocks *less harmful* than Oil-supply shocks

**Policy implication**: monetary policy should be adjusted depending on the type of shocks.
!!!!!! Thank you for your attention !!!!!!