Can Energy Subsidies Help Slay Inflation?

Christopher Erceg[✠] Marcin Kolasa[✠] Jesper Linde[✠] Andrea Pescatori[♠]

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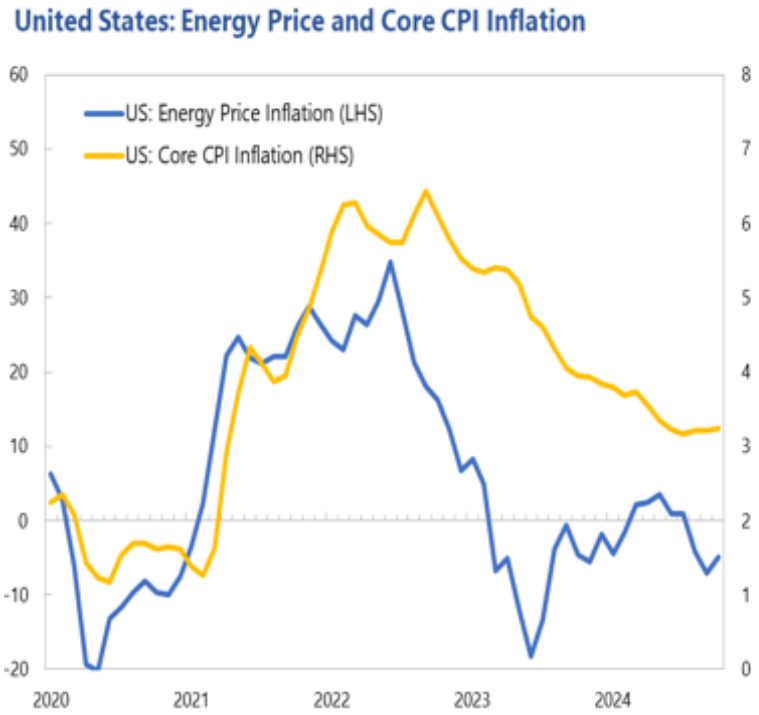
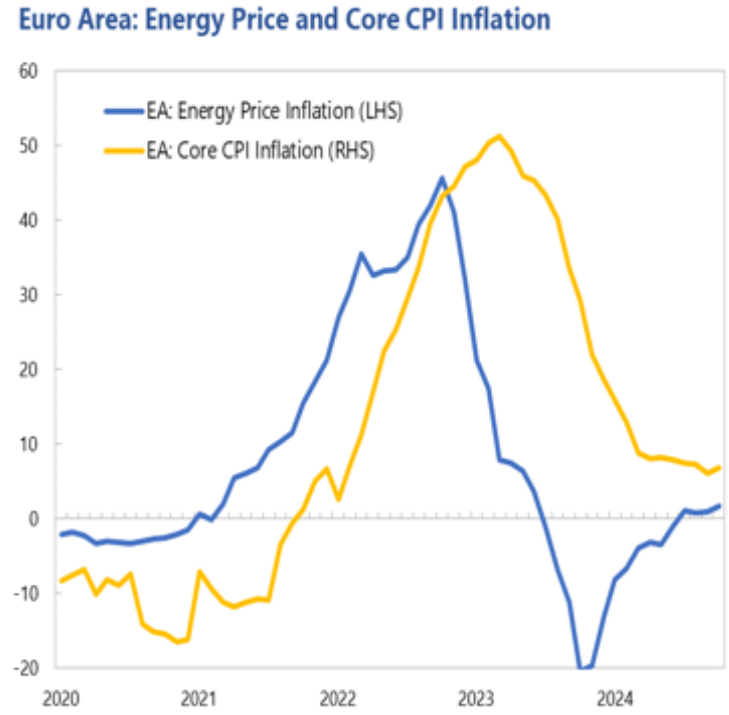
[✠] International Monetary Fund, Monetary and Capital Markets Department

[♠] International Monetary Fund, Research Department

Motivation

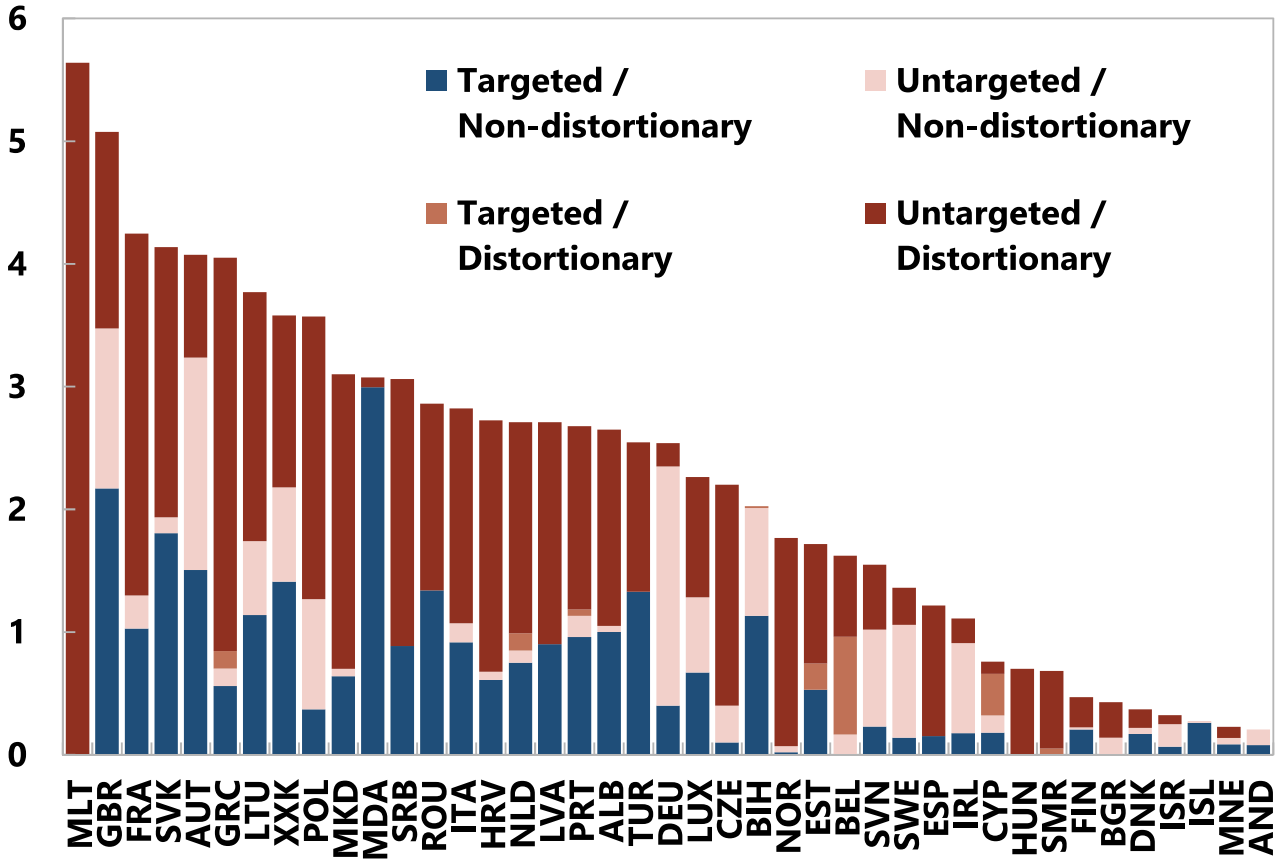
- Sharp increase in energy prices following Russia's invasion of Ukraine
- Major catalyst of high global inflation





Motivation

- Many countries responded by using energy subsidies
- Aim: support vulnerable households and help reduce inflation
- The idea: By reducing headline inflation, subsidies would curb compensatory wage demand and lower core inflation



Notes: Fiscal cost in percent of GDP. Source: Arregui et al. (2022).

What we do

Goal: Study if energy subsidies can reduce inflation by preventing price-wage spiral

- Present empirical evidence on how wages and inflation respond to an oil supply shock in the US and EA
- Develop New Keynesian macroeconomic model to study transmission of energy price shocks and subsidies on inflation
- First consider effects of energy subsidies when implemented globally (closed economy model)
- Then consider a country "acting alone" (small open economy setting)

What we find

- Empirical evidence on transmission of oil prices suggest that wages are partially indexed to headline inflation in EA, but not in the US
- Key insights from model analysis
  - In a closed economy: subsidizing energy consumption = taxing energy use by firms
  - Global consumer energy subsidies are counterproductive - they boost core inflation
  - TANK extension: small scope for consumer energy subsidies to shield vulnerable households, but only if targeted transfers are not available
  - More scope for consumer energy subsidies to work if adopted only by a small group of countries well connected to global energy markets and if wages are heavily indexed to headline inflation

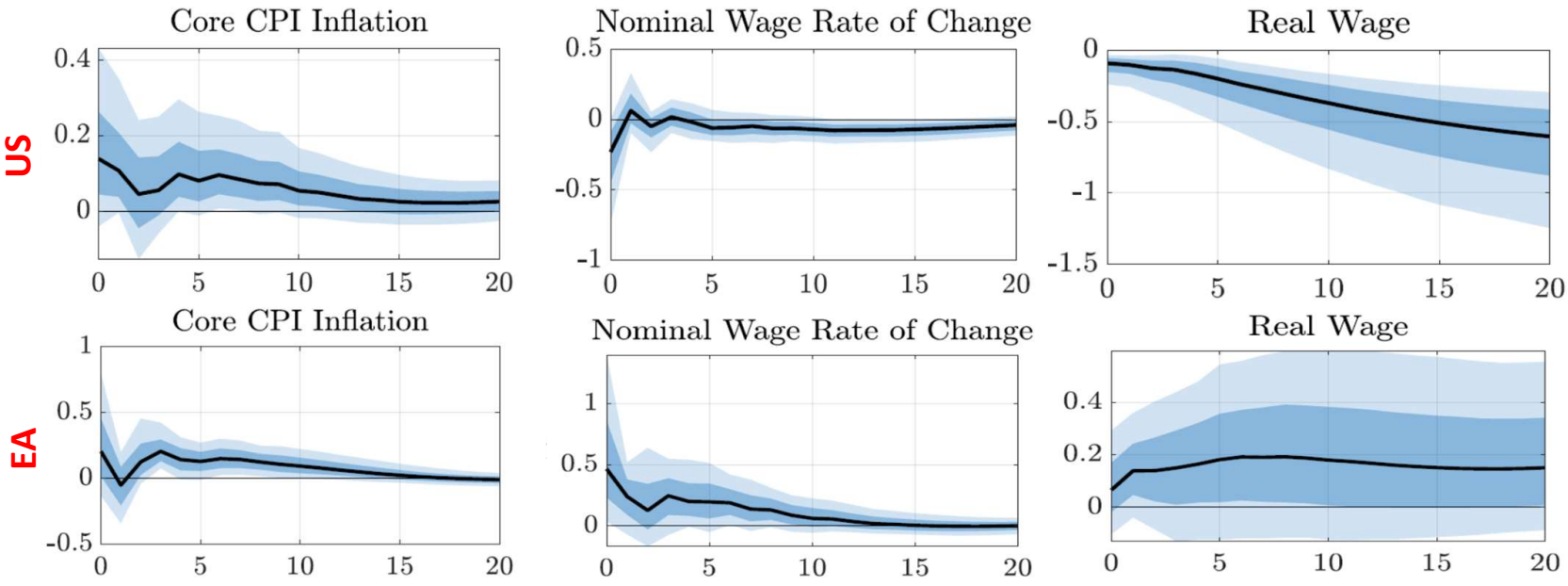
Outline

1. Energy Shocks: Empirical Evidence
2. Theoretical Setup
3. Analytical Results
4. Model Simulations: Closed Economy
5. Redistributive Considerations and Transfers
6. Open Economy Considerations
7. Conclusions

Energy Shocks: Empirical Evidence

Transmission of oil price shocks

Proxy VAR using OPEC announcements from Känzig (2021)



Theoretical Setup

Households

- Standard utility maximization

$$\mathbb{E}_t \sum_{s=0}^{\infty} \beta^s \left(\frac{\left(C_{t+s} - \varkappa C_{t+s-1}\right)^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} - \chi_0 \frac{N_{t+s}\left(h\right)^{1+\chi}}{1+\chi} \right)$$

- Staggered wage setting á la Calvo

- Non-optimized wages indexed to core (producer), headline and steady-state inflation

$$W_t(h) = \Pi_{Y,t-1}^{\iota_y} \Pi_{C,t-1}^{\iota_c} \Pi^{1-\iota_y-\iota_c} W_{t-1}(h)$$

Final goods producers

- Perfectly competitive
- Production function

$$C_t = \left((1-\omega_c)^{\frac{1}{\eta_c}} Y_t^{\frac{\eta_c - 1}{\eta_c}} + \omega_c^{\frac{1}{\eta_c}} O_{C,t}^{\frac{\eta_c - 1}{\eta_c}} \right)^{\frac{\eta_c}{\eta_c - 1}}$$

- Maximize profits

$$P_{C,t} C_t - P_{Y,t} Y_t - (1 - \tau_{C,t}) P_{O,t} O_{C,t}$$

where $\tau_{C,t}$ is energy subsidy to households

Intermediate goods producers

- Monopolistically competitive
- Production function

$$Y_t = \left((1-\omega_y)^{\frac{1}{\eta_y}} V_t^{\frac{\eta_y - 1}{\eta_y}} + \omega_y^{\frac{1}{\eta_y}} O_{Y,t}^{\frac{\eta_y - 1}{\eta_y}} \right)^{\frac{\eta_y}{\eta_y - 1}}$$

  where

$$V_t = K_t^{\alpha} N_t^{1-\alpha}$$

- Period profits

$$P_{Y,t} Y_t - R_{K,t} K_t - W_t N_t - (1 - \tau_{Y,t}) P_{O,t} O_{Y,t}$$

  where $\tau_{Y,t}$ is energy subsidy to firms

- Staggered price setting á la Calvo

Closing the model

- Energy market clearing

$$Y_{O,t} = O_{C,t} + O_{Y,t}$$

  where $Y_{O,t}$ is exogenous energy endowment

- Monetary policy

$$I_t = I + \psi_\pi \left(\Pi_{Y,t} - \Pi\right) + \psi_y \left(\frac{Y_t}{Y_t^{pot}} - 1\right)$$

- Fiscal authority finances subsidies with lump sum taxes

Analytical Results

How do consumer energy subsidies work? ($\varkappa = \iota = \alpha = 0$)

- Headline inflation

$$\pi_t^c = \omega_c \left(\Delta p_t^o - \Delta \tau_t^c\right) + \pi_t^y$$

- IS curve

$$y_t = -\sigma \mathbb{E}_t \sum_{s=0}^{\infty} (i_{t+s} - \pi_{t+s+1}^y) - \omega_c(\sigma - \eta_c)(p_t^o - \tau_t^c)$$

- Energy market clearing

$$y_t^o = y_t - \tilde{\eta}_y \left(p_t^o - w_t^y\right) - \tilde{\eta}_c \left(p_t^o - \tau_t^c\right)$$

- Core inflation

$$\pi_t^y = \beta \mathbb{E}_t \pi_{t+1}^y + \kappa_y \left[\omega_y \left(p_t^o - w_t^y\right) + w_t^y\right]$$

- Wage inflation

$$\begin{aligned}\pi_t^w = {} & \iota_y \pi_t^y + \iota_c \pi_t^c + \beta \mathbb{E}_t \left\{\pi_{t+1}^w - \iota_y \pi_{t+1}^y - \iota_c \pi_{t+1}^c\right\} \\ & + \kappa_w \left[\left(\chi + \frac{1}{\sigma}\right) y_t + \chi \omega_y \eta_y \left(p_t^o - w_t^y\right) + \omega_c \left(1 - \frac{\eta_c}{\sigma}\right) \left(p_t^o - \tau_t^c\right) - w_t^y\right]\end{aligned}$$

Equivalence result

Proposition

Any two sequences of consumer and producer energy subsidies $\{\tau_t^c, \tau_t^y\}_{t=0}^{\infty}$ *and* $\{\mathring{\tau}_t^c, \mathring{\tau}_t^y\}_{t=0}^{\infty}$ *yield identical equlibrium allocations iff* $\frac{1-\tau_t^c}{1-\tau_t^y} = \frac{1-\mathring{\tau}_t^c}{1-\mathring{\tau}_t^y}$ *for all* $t = 0, 1, ...$

Corollary

Subsidizing energy use by households is equivalent to taxing energy use by firms (to first order approximation: at the same rate)

- Key mechanism: endogenous adjustment in pre-subsidy energy price
- Intuition: Both alternative policies lower (increase) effective energy cost for households (firms)
- Key assumptions:
  - Exogenous energy supply
  - Closed economy / segmented energy market
  - Lump sum transfers / taxes available

Consumer energy subsidies are counterproductive to fight inflation

Proposition

Assume that:

- *Energy and non-energy goods are complements in household preferences*
- *Dynamic component of wage indexation relies on core inflation*

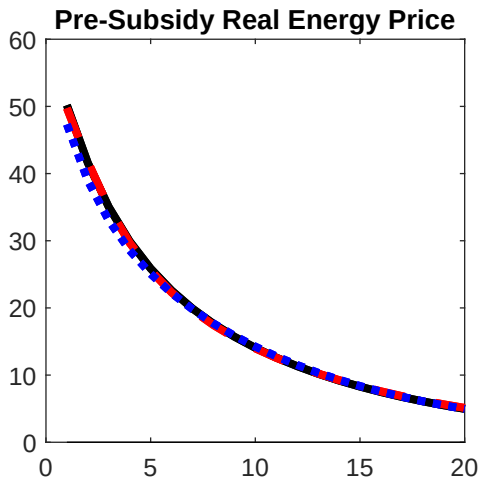
Then, conditional on any response of the output gap, an increase in consumer energy subsidies increases core inflation.

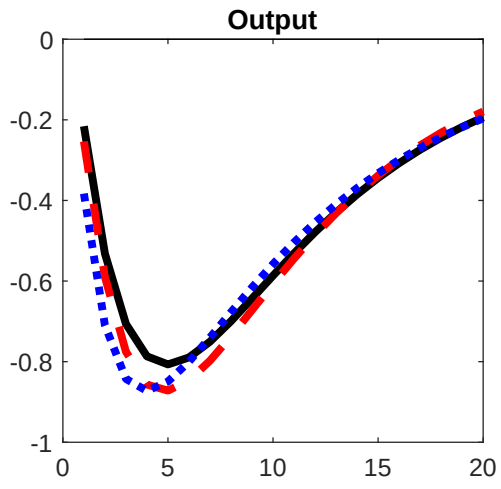
- Key mechanism: subsidies decrease flex-price wage, creating a positive wage gap if wages are sticky

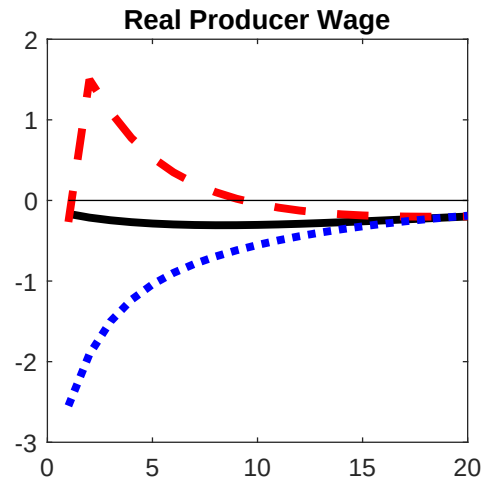
$$\pi_t^y \propto \mathbb{E}_t \sum_{s=0}^{\infty} \beta^s \hat{w}_{t+s}^y$$

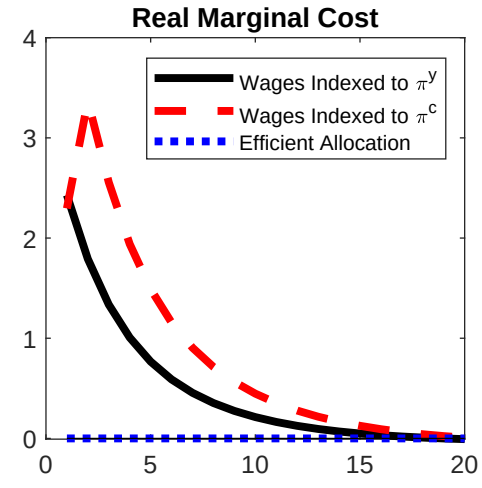
Model Simulations: Closed Economy

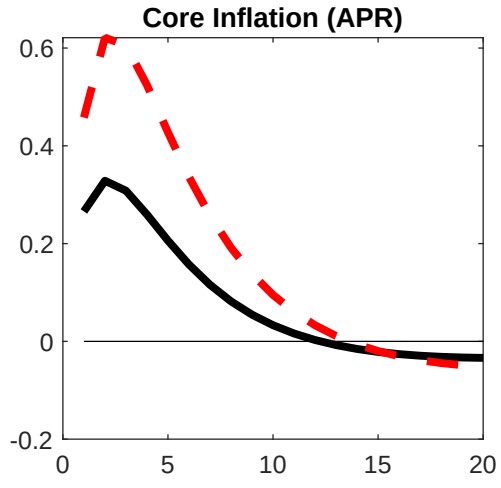
Energy supply shock

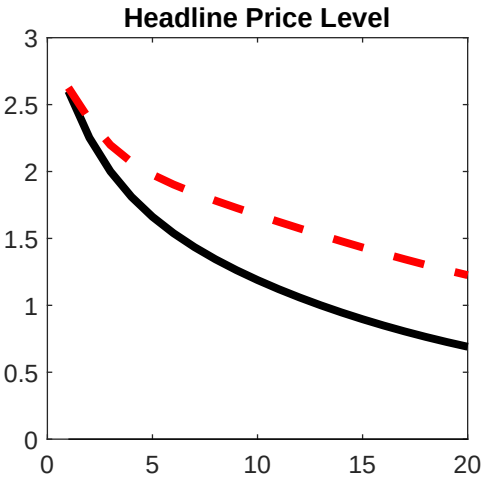




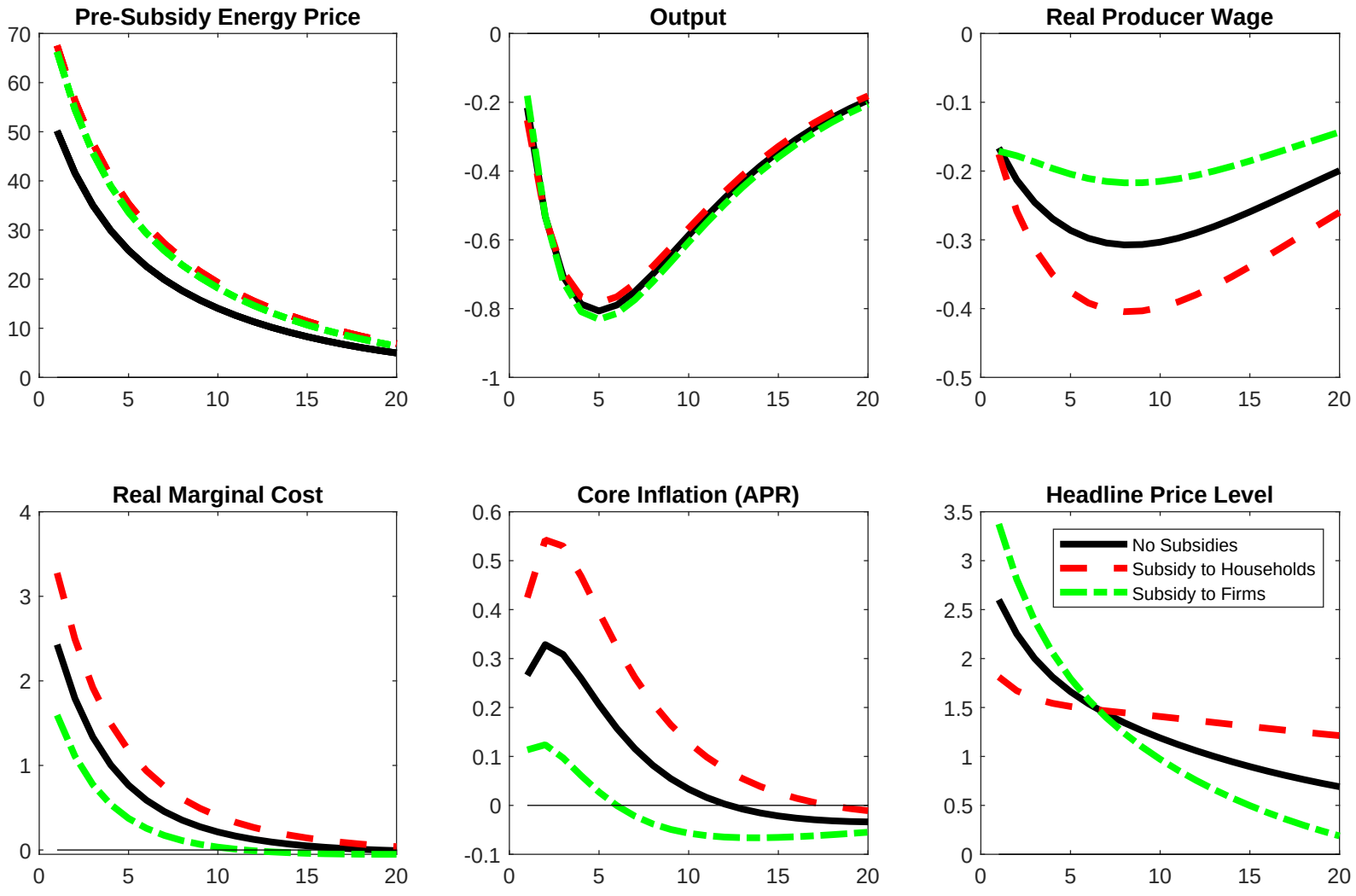




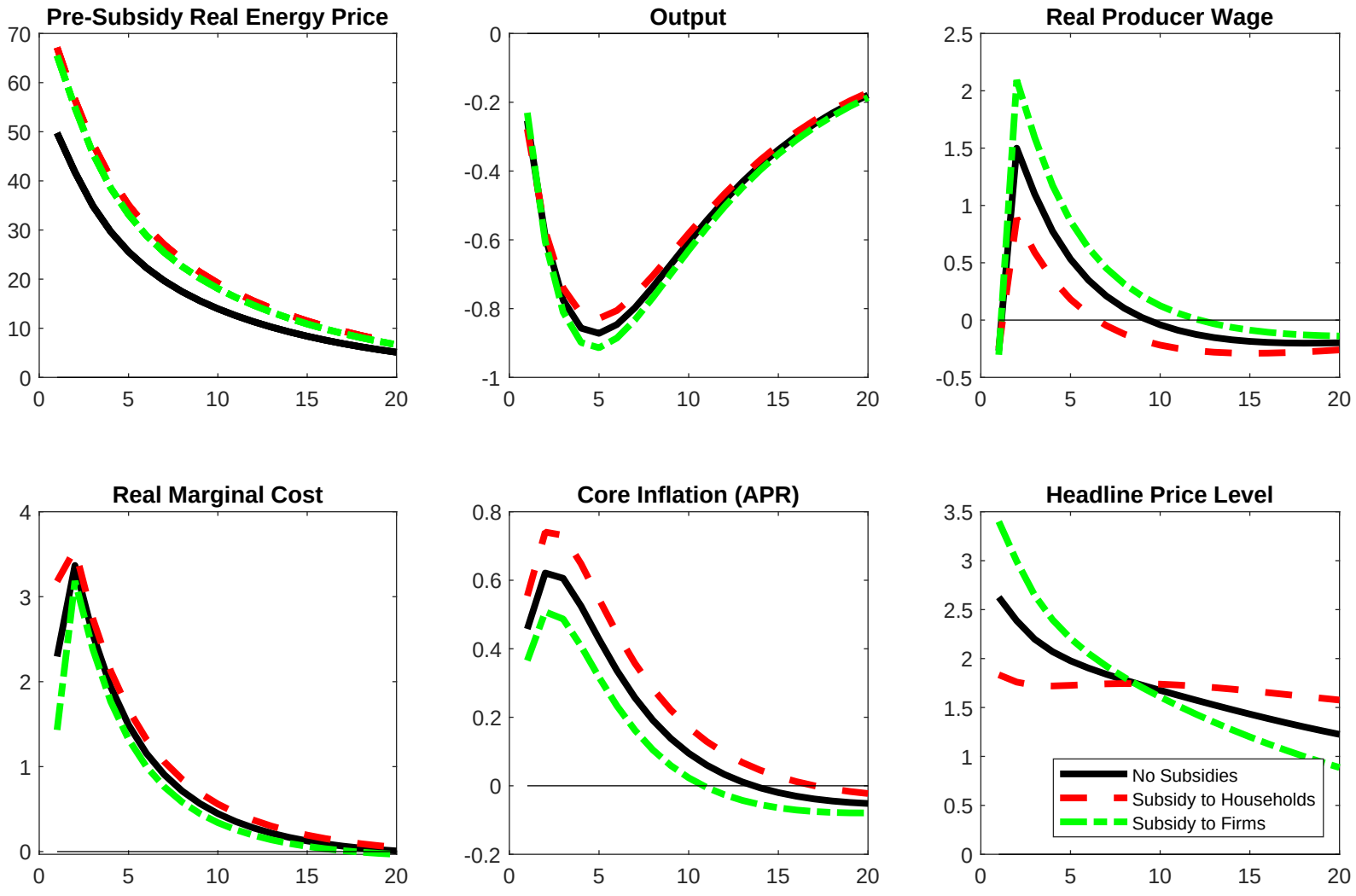




Energy supply shock with energy subsidies, wages indexed to π^y



Energy supply shock with energy subsidies, wages indexed to π^c



Redistributive Considerations and Transfers

TANK Extension

- Introducing hand-to-mouth (Keynesian) households

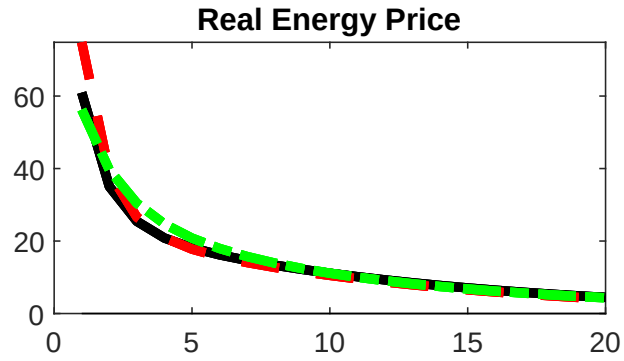
$$P_{C,t}C_t^K = W_t N_t^K - T_t^K$$

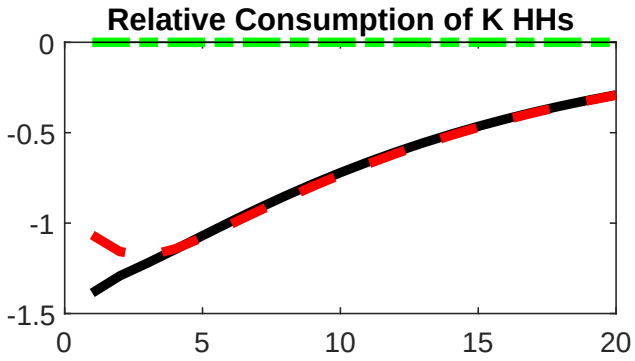
- Transfer rule

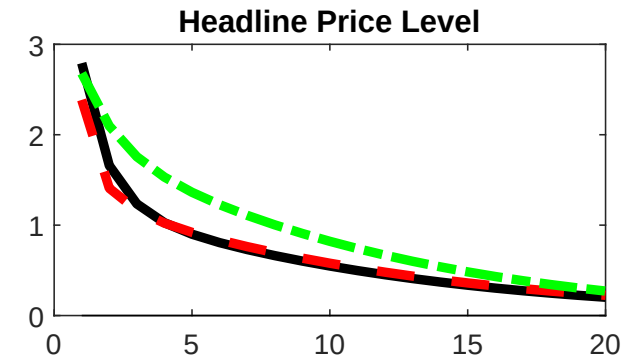
$$\frac{T_t - T}{P_{Y,t}Y} = t_t + \phi \frac{B_{G,t} - B_G}{P_{Y,t}Y}$$

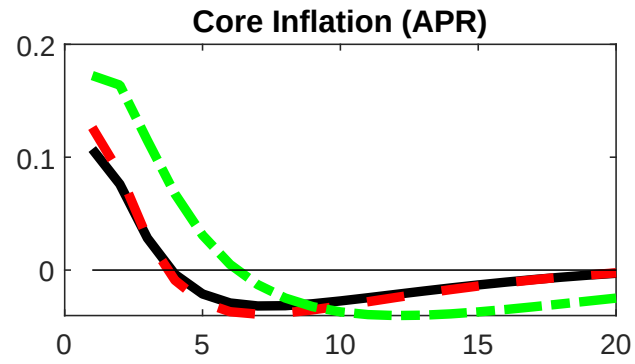
- Share of Keynesian households: 0.4
- Relative consumption of Keynesian households: 0.5

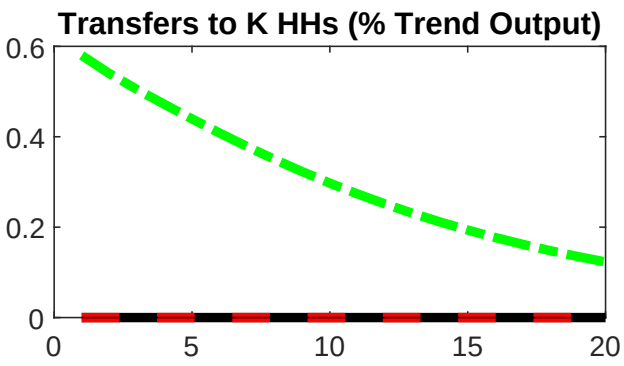
Energy supply shock: optimal subsidies in TANK

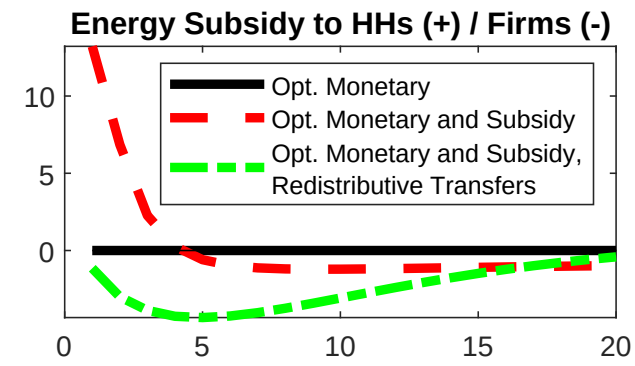












Open Economy Considerations

Open Economy Extension

- Home bias in non-energy goods consumption
- World energy market clearing (here: $\zeta \to 0$)

$$\zeta Y_{O,t} + (1-\zeta) Y^*_{O,t} = \zeta(O_{C,t} + O_{Y,t}) + (1-\zeta)(O^*_{C,t} + O^*_{Y,t})$$

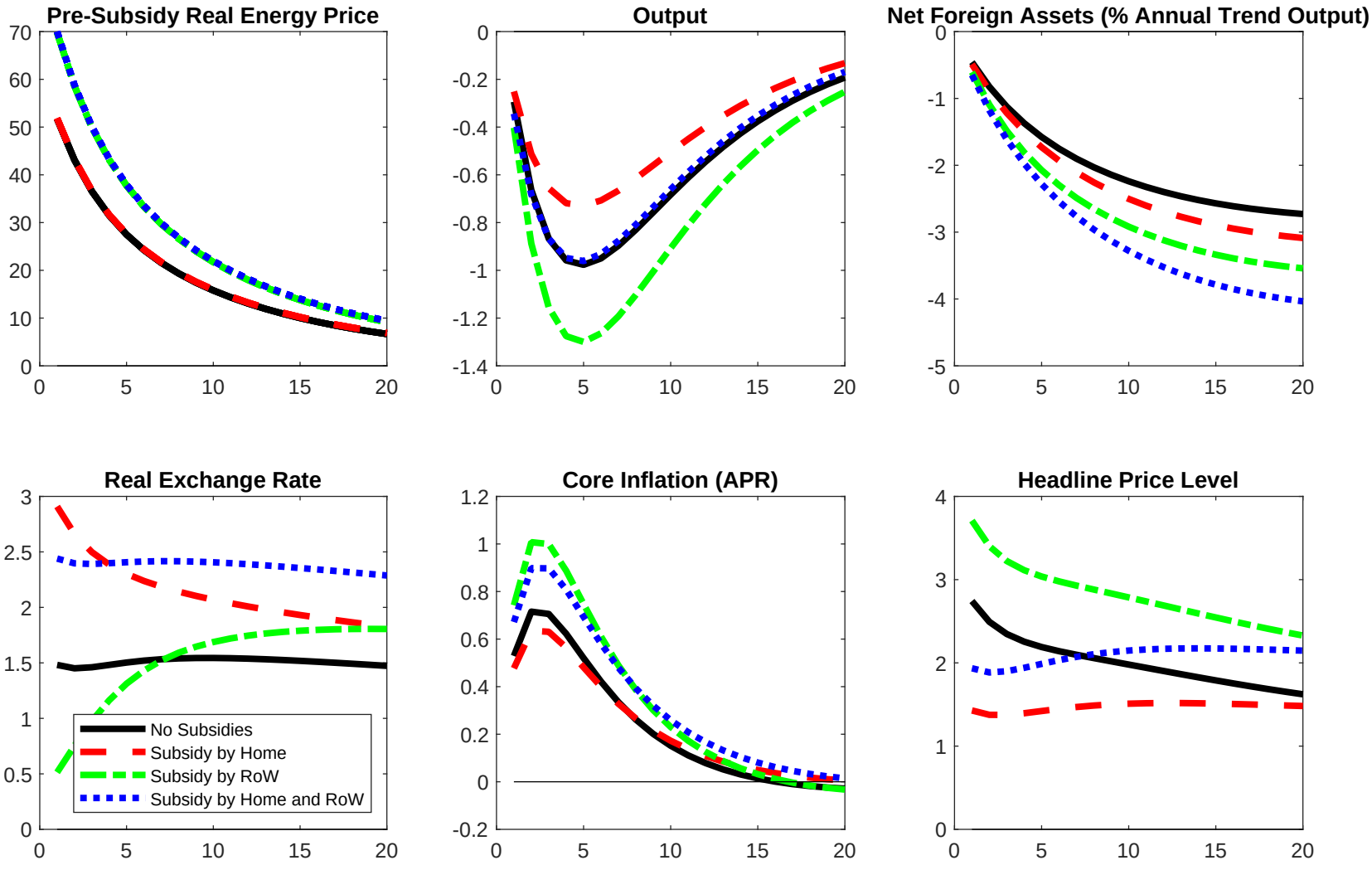
- Net foreign asssets

$$B_t = \underbrace{\varepsilon_t P^*_{M,t} M^*_t - P_{M,t} M_t}_{\text{non-energy trade balance}} + \underbrace{P_{O,t}(Y_{O,t} - O_{Y,t} - O_{C,t})}_{\text{energy trade balance}}$$
$$+ \underbrace{\left((1-\zeta) I_{t-1} + \zeta \frac{\varepsilon_t}{\varepsilon_{t-1}} I^*_{t-1} \right) B_{t-1}}_{\text{gross interest payment on foreign assets}}$$

- UIP condition (Gabaix and Maggiori, 2015)

$$I_t = \mathbb{E}_t \left\{ I^*_t \frac{\varepsilon_{t+1}}{\varepsilon_t} \right\} - \Gamma I_t \frac{B_t}{P_{Y,t}}$$

Energy supply shock with consumer energy subsidies (SOE energy importer, wages indexed to π^c, deep FX markets)



Conclusions

Conclusions

1. Consumer energy subsidies likely to be counterproductive to fight inflation globally and in segmented markets
   - Raise pre-subsidy energy price
   - Effectively shift the burden of adjustment to firms

2. More scope for energy subsidies to consumers in a small open economy
   - Gains limited by exchange rate depreciation
   - High degree of wage indexation to headline inflation and deep FX markets still required
   - Hurt other energy importers if conducted by many open economies