Energy Shocks, Consumption Disparities & The Inflation-Inequality Dilemma

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Outline

Background:

- Energy prices are very volatile
- Extent to which households affected differs
- Periods of high energy prices see rise in direct financial relief to consumers
  - Tax rebates and credits (e.g. 2008 Economic Stimulus Act)
  - Subsidies and direct payments (e.g. COVID-19 Stimulus Checks)
  - Suspension of gas taxes (e.g. Maryland, Georgia)

Research questions:

- Distributional effect of energy shocks on consumption patterns?
- Impact of fiscal interventions targeted at low-income households?

Related literature

Impact of energy shocks: Kilian (2008); Blanchard and Gali (2007); Hoang et al. (2019); Choi et al. (2018); Hooker (1996); Känzig (2021)

Heterogeneous agent literature: Bilbiie (2008, 2017); Debortoli and Galí (2018); Kaplan et al. (2018); Auclert (2019); Broer et al. (2020); Dolado et al. (2021)

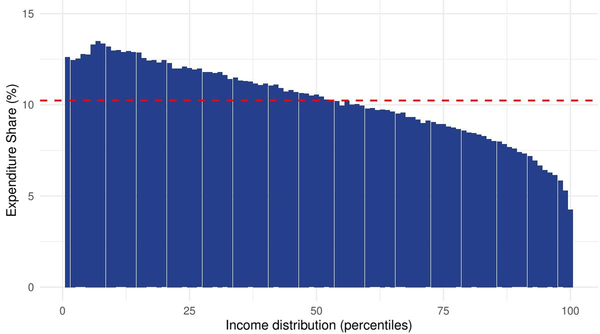
Energy shocks and fiscal policy: Kharroubi and Smets (2014); Kröger et al. (2023); Meyimdjui and Combes (2021); Zhang et al. (2014); Jaravel and Olivi (2019)

Contribution:

- Estimate impact from energy shocks on consumption inequality
- Analyse implications of 'targeted' vs 'untargeted' transfers

Low-income households are more vulnerable to energy shocks

Figure: Energy expenditure shares across income distribution in United States



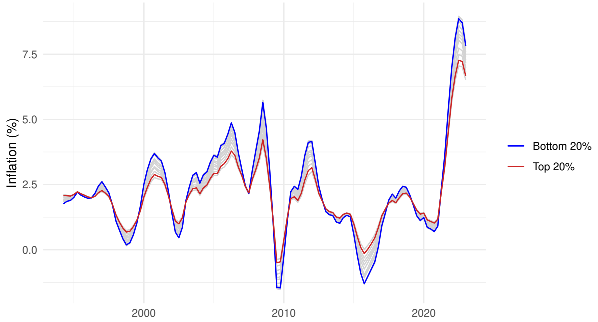
Note: Red-dotted line shows mean expenditure share across entire income distribution for the full sample period (10.23%). Data source: CES.

Household survey data | Expenditure shares over time

Inflation rates between households can differ substantially

Define: $\pi_{it} = \theta^E_{it}\pi^E_t + \theta^F_{it}\pi^F_t + \theta^G_{it}\pi^G_t + \theta^S_{it}\pi^S_t$ with $\theta^x_{it} = \frac{\text{expenditure on } x_{it}}{\text{total expenditure}_{it}}$ for $i = \{1, 10\}$

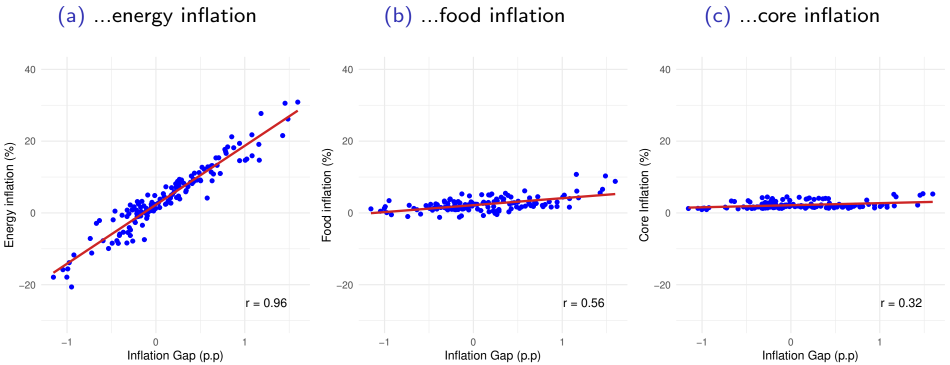
Figure: Inflation rates across low- and high income households



Note: Gray lines show inflation rates across deciles in the income distribution. Data sources: CES, BLS, BEA.

Strong correlation between energy inflation and inflation gap

Figure: Correlations between the inflation gap and...



Note: Full sample period. Inflation gap refers to top/bottom 20% of income earners. Pearson correlation included. Data sources: CES, BLS, BEA.

Methodology

Instrumental variable local projections (Jordà, Schularick, and Taylor, 2015):

- **Stage 1:** Instrument energy prices with OPEC news shocks (Känzig, 2021)

$$\pi_t^E = \alpha_0 + \alpha_1 \mathrm{Shock}_t + \sum_{j=0}^{3} \Gamma' Z_{t-j} + u_t \tag{1}$$

with Z: real growth, unemployment, and world oil production.

- **Stage 2:** Group-Specific Consumption Responses

$$\tilde{c}^g_{t+h} = \alpha^g + \beta^g_h \hat{\pi}^E_t + \gamma^g_h \pi^g_t + \zeta^g_h i^g_t + \sum_{j=1}^{3} \psi^g_{h,j} X^g_{t-j} + \sum_{j=0}^{3} \phi^g_{h,j} W_{t-j} + \epsilon^g_{t+h} \tag{2}$$

with X^g: $\tilde{c}^g, \pi^g, i^g$ and W: unemployment, interest rate.

Sample: 1994Q1–2023Q4.

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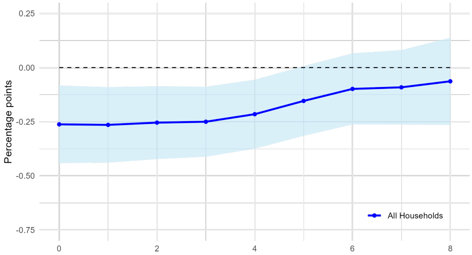
Poor households reduce consumption, while rich households don't

Figure: Response of total consumption to energy shock

(a) All households



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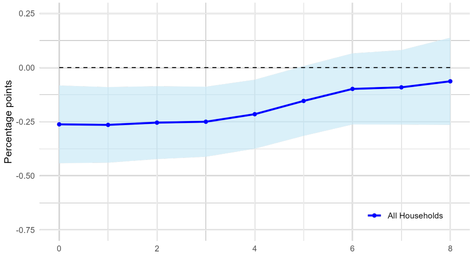
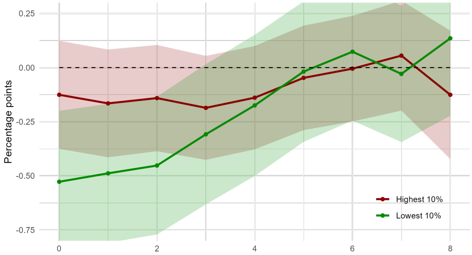


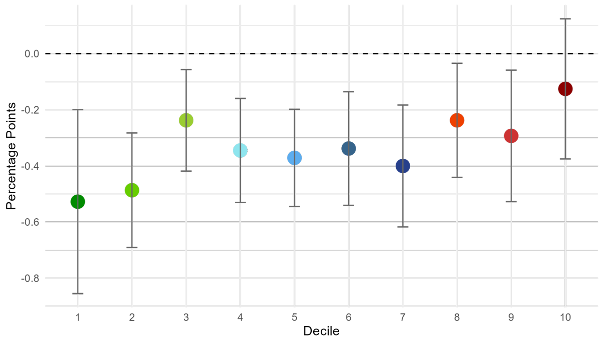
(b) 10% lowest and highest income households



Note: Responses show percentage point deviations from the log-linear trend. Data sources: CES, BLS, BEA, Känzig (2021), FRED.

Beyond extremes: Consumption response declines with income

Figure: Contemporaneous impact of total consumption to energy shock ($h = 0$)



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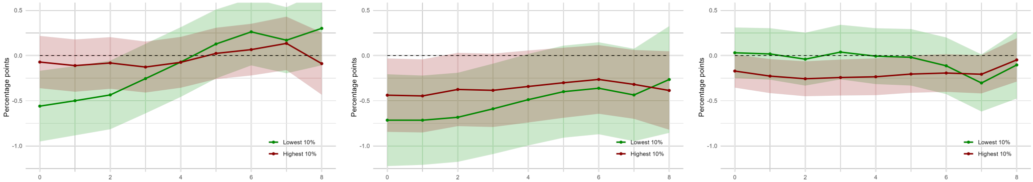
Impact over projection horizon

Not just how much, but what? Adjustments across categories

Figure: Response of consumption components to energy shock

(a) Core goods & services (b) Energy goods (c) Food at home



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Model overview

New Keynesian model with:

- **Two households**: Constrained (λ) and unconstrained ($1 - \lambda$)
- **Two sectors**: ‘Sticky rest’ and ‘less-sticky energy’
- **Non-homothetic preferences**: Heterogeneous consumption baskets

Household heterogeneity

Indirect utility function (Boppart, 2014) with non-homothetic preferences:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{1}{\varepsilon_1} \left[\left(\frac{S_t^k}{P_{Rt}} \right)^{\varepsilon_1} - 1 \right] - \frac{\gamma}{\varepsilon_2} \left[\left(\frac{P_{Et}}{P_{Rt}} \right)^{\varepsilon_2} - 1 \right] \right\}, \qquad k \in \{c, u\} \tag{3}$$

where $0 \leq \varepsilon_1 \leq \varepsilon_2 < 1$, $\gamma > 0$, and S_t^k is total spending

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where $0 \leq \varepsilon_1 \leq \varepsilon_2 < 1$, $\gamma > 0$, and S_t^k is total spending

- **Constrained:**

$$S_t^c = W_t n_t^c + P_t \tau_t^c \tag{4}$$

- **Unconstrained:**

$$S_t^u = W_t n_t^u + P_t \tau_t^u + R_{t-1} B_t - B_{t+1} + \frac{1-\delta}{1-\lambda} P_t D_t \tag{5}$$

Policy design

Monetary policy

$$R_t = \frac{1}{\beta}\left(\frac{\Pi_t}{\bar{\Pi}}\right)^{\phi_\pi}\left(\frac{Y_t}{Y_t^n}\right)^{\phi_y} S(\nu_t) \tag{6}$$

where $\Pi_t = \lambda\Pi_t^c + (1-\lambda)\Pi_t^u$

Fiscal policy

$$\tau_t^c = (1-\tau)\,\delta D_t \tag{7}$$

$$\tau_t^u = \left(1 + \frac{\tau\lambda}{1-\lambda}\right)\delta D_t \tag{8}$$

so that $\lambda\tau_t^c + (1-\lambda)\tau_t^u = \delta D_t$

Calibration

Policy design

Monetary policy

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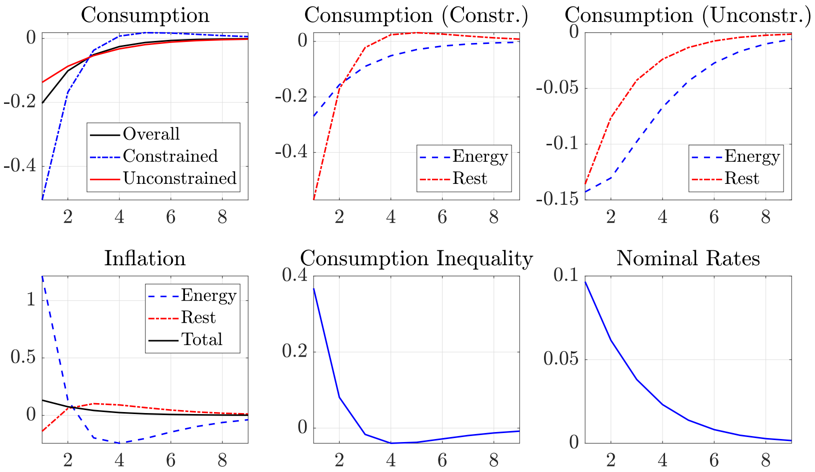
Calibration

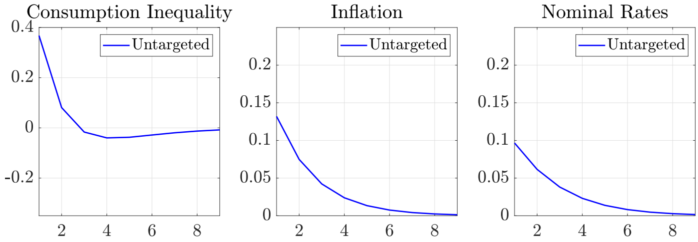
Figure: Negative energy supply shock



Note: IRFs show percentage point deviations from steady state.

'Targeted' transfers: tradeoff between inequality and inflation

Figure: 'Untargeted' fiscal policy vs 'Targeted' fiscal policy



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‘Targeted’ transfers: tradeoff between inequality and inflation

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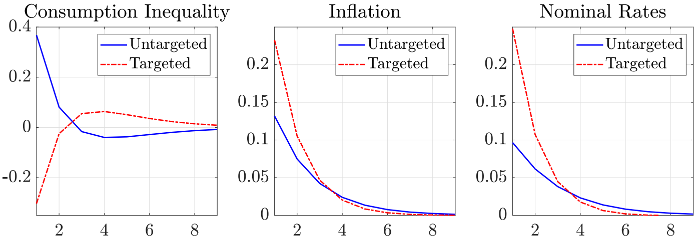

Note: IRFs show percentage point deviations from steady state.

Conclusion

Key results:

- Aggregate consumption falls, while consumption inequality rises after energy shock
- Decline in consumption of low-income households, no impact for high-income households
- Main adjustment via 'core' and energy expenditure
- 'Targeted' transfers reduce consumption inequality, but fuel inflation and interest rates (trade-off)

Next steps:

- Finish calibration using empirical IRFs
- Strengthen fiscal policy analysis

Data: Consumption Expenditure Survey (CES)

- Consumption expenditures from CE-Public Use Microdata (BLS)
- Detailed "Interview survey" with income, expenditure (1000+ categories), savings, debt, hours worked, socioeconomic characteristics, etc.
- 5-7k observations each quarter from 1986-Q1 to 2023-Q1 $\rightarrow$ around 860k obs.
- Rotating panel survey: New households sampled every quarter and each household tracked up to four consecutive quarters
- Aggregate into percentiles and look at sample means each quarter

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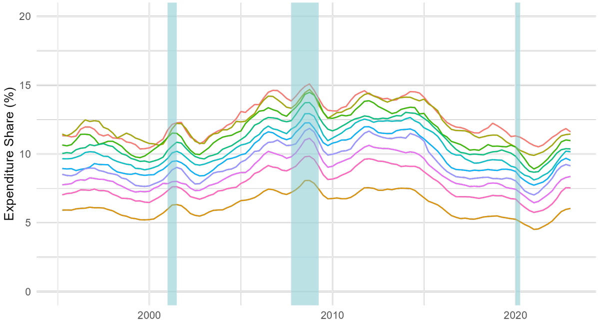
Expenditure shares for energy are generally stable over time

Figure: Energy expenditure shares across income deciles



Data sources: CES, BLS.

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Calibration

Parameter	*Description*	*Value*
Households		
λ	Fraction of constrained households	0.2
γ	Energy share in consumption basket	0.10
ε_1	Non-homotheticity parameter	0.65
ε_2	Non-homotheticity parameter	0.65
β	Discount factor	0.99
ϵ	Elasticity of substitution between core goods	9
Firms		
θ_p^R	Calvo parameter price stickiness, core sector	0.75
θ_p^F	Calvo parameter price stickiness, energy sector	0.25
ρ_{a_F}	Technology shock persistence, energy sector	0.5
Monetary and fiscal policy		
ϕ_π	Taylor-coefficient on inflation	1.5
ϕ_y	Taylor-coefficient on output	0.125
δ	Tax rate on firms' profits	0.266
τ	Fiscal policy rule	1

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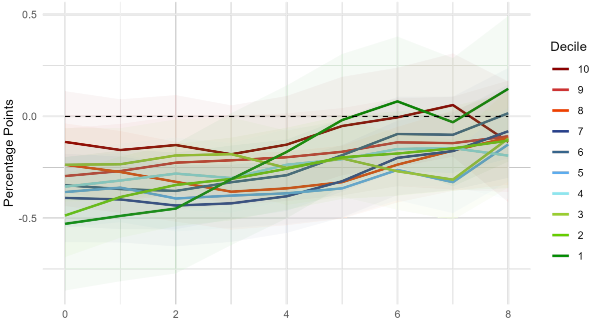
Beyond extremes: Consumption response declines with income

Figure: Response of total consumption to energy shock



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