The distributional effects of oil shocks

Tobias Broer   John Kramer   Kurt Mitman

"Global Challenges and Channels for Fiscal and Monetary Policy", July 2024

- Since 1980s: Business cycles as propagation of shocks
- Since 2010s: Shocks have distributional effects
- 2020s: Large supply shocks and strong monetary responses

Motivation

- Since 1980s: Business cycles as propagation of shocks
- Since 2010s: Shocks have distributional effects
- 2020s: Large supply shocks and strong monetary responses

How do supply shocks and monetary responses affect inequality?

Research question

- What are the distributional effects of oil-price shocks
- ... under observed & counterfactual monetary responses?

This paper

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- ... under observed & counterfactual monetary responses?

Empirical Approach

- Responses to oil-price news by income quantile in Germany
    - of earnings
    - of labor market transitions
- ... under observed monetary policy & counterfactual non-response
    - ... due to sequence of surprises (Sims & Zha 2006)
    - ... due to credible change in policy stance (McKay & Wolf 2024)

Over the last 45 years in Germany, oil-price shocks ...

- reduced activity, increased inflation
- triggered pronounced monetary policy response
- strongly reduced earnings and employment of the income-poor
- had little effect above median income
- affected employment to a large extent via monetary reaction

Literature

Macroeconomic effects of oil shocks

- Zhou (2020), Känzig (2020,23), Bobasu et al (2024)

Distributional incidence of shocks

- Coibion et al (2017), Guvenen et al (2017), D'Acunto et al (2019a,b), Patterson (2018), De Giorgi & Gambetti (2017), Alves et al (2019), Almgren et al (2019), Holm et al (2021), Broer (2024), Chang et al (2024), Ettmeier (2024)

Effects of shocks with counterfactual policies

- Sims and Zha (2006, WP 1996), Bernanke et al (1997), McKay and Wolf (2023,2024)

Outline

1. Data
2. Aggregate effects of oil shocks in Germany
3. Distributional effects of oil shocks in Germany
4. Effect of oil shocks with counterfactual monetary policy

Data

Micro-Data

- German SIAB sample: 2 percent of all individuals in social-insurance system (no public employees, no self-employed)

- "Daily" frequency (aggregated to monthly averages)

- Sample period: 1974-2020

- *Attached* workers (employed or unemployed), 25-60 yoa

- Exclude top coded (~ 6 %)

- Main variables of interest:
  - Employment spells (start and end date)
  - Within-spell average labor earnings

Shocks

1. Oil-price (1974-2020)
   - Price change in window around OPEC announcements (Känzig 2020)
2. Monetary-policy shocks for Germany
   - Bundesbank (1974-1998): Narrative (Cloyne et al 2022)
   - ECB (1999-2020): High-frequency (Almberg et al 2022)

Aggregate effects of oil shocks

Aggregate effects of oil shocks: Local Projection (Jordà 2005)

$$y_{t+h} - y_{t-1} = \alpha_h + \beta_h Oilnews_t + \sum_{i=1}^{l} \gamma_{i,h} X_{t-i} + \varepsilon_{t,h} \quad \forall h \geq 0 \qquad (1)$$

- $Oilnews_t$ negative oil supply news shock (Känzig 2020)
- Scaled to imply $10pp$ rise in world oil price
- X_{t-i}
  - CPI, industrial production
  - real oil price, world oil inventories & production
  - average employed earnings & employment rate (SIAB)

Aggregate effects of oil shocks: Results
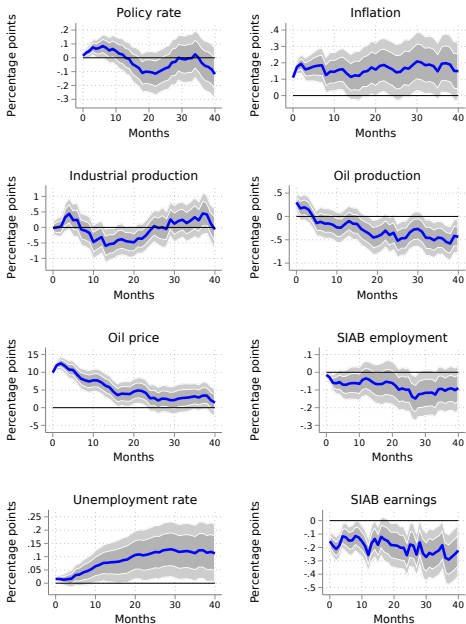
Distributional effects of oil shocks

Distributional effects of oil shocks

- Do oil shocks affect individuals differently
- ... across sectors, occupations, regions, incomes?
- Here: in different deciles of the (permanent-) income distribution

Panel-local projection

$$\Delta y_{i,t+h} = \alpha_h + \sum_{i=2}^{10} \gamma_h^d \mathbb{I}_{d=i} + \left(\delta_h + \sum_{i=2}^{10} \beta_h^d \mathbb{I}_{d=i}\right) Oilnews_t + \sum_{j=1}^{l} \gamma_{j,h} X_{t-j} + \varepsilon_{i,t,h}$$

- Individual-level regressions (vs. Broer et al 2024: decile-averages)
- Decile-specific intercepts γ_h^d (relative to reference decile 1)
- Decile-specific slopes β_h^d (relative to reference decile 1)
- $\Delta y_{i,t+h}$:
  - indicator of employment-transitions $E2E, U2E$
  - pre-tax earnings growth of the employed $\Delta earn_{i,h}$

14
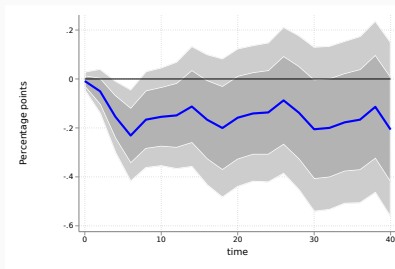
1st-decile IRF (δ_h)

IRF-differences β_h^d for d=2,5,7,10

- Decline in E2E transitions shrinks along income distributions

Back MEEIRF18

Distributional effects: $U2E$ transitions
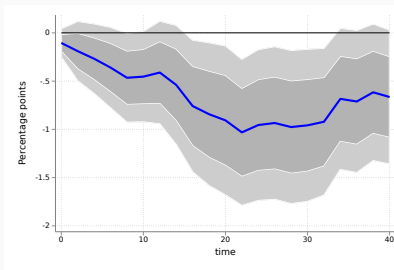
1st-decile IRF (δ_h)
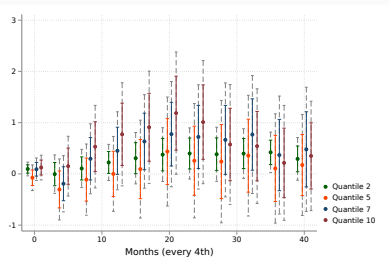
IRF-differences β_h^d for d=2,5,7,10

- After 20 months,1pp fall in U2E at the bottom
- Strongly dampened above median in year 2

Distributional effects: earnings growth of the employed

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IRF-differences β_h^d for d=2,5,7,10
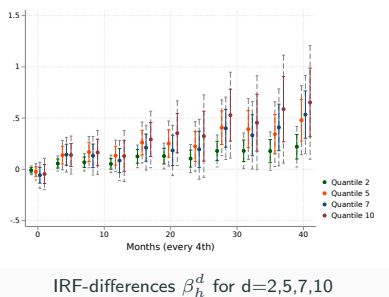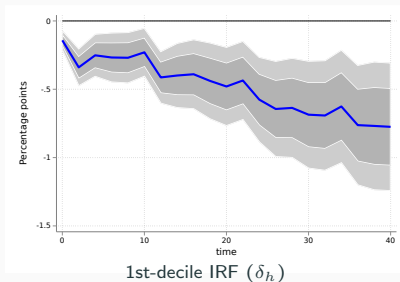
- Significant earnings decline across the distribution in year 1 (40bp)
- Gap opens in year 2,3: decline strongly shrinks along distribution

Summary: Effects of oil shocks in Germany

- Increased inflation and reduced output / employment
- Pronounced monetary response
- Employment & earnings decline concentrated among income-poor

The effects of oil shocks with counterfactual policies

The effects of oil shocks with counterfactual policies

- How does MP reaction change effects of oil shocks?
- Here: How would German economy respond w/o monetary reaction?

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  - ... due to sequence of surprises (Sims & Zha 2006)
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Oil shocks with counterfactual policies I: Sims & Zha (2006)

- Sequence of surprises z_{t+j} that implement 0-response to $oilnews_t$

$$\bar{i}_{t+h} = i_{t+h}|oilnews_t + \sum_{j=0}^{h} i_{t+h}|z_{t+j} = 0, \ h = 0, 1, ..., H$$

- One monetary IRF $i_{t+h}|z_t$ enough
- Here: Use full-sample estimate

Oil shocks with counterfactual policies II: McKay&Wolf (2024)

- Credible change to non-response policy stance in t
- Equivalent to set of period-t shocks $\{z_t^j\}$ s.t. for $h = 0, 1, ..., H$

$$\bar{i}_{t+h} = i_{t+h}|oilnews_t + \sum_j i_{t+h}|z_t^j = 0$$

- Assumptions: $\forall \ h = 1, ..., H, \ j = 1, ..., J$
  - MP-effects only via instrument path $i_{t+h}|z_t^j$
  - Full information about $i_{t+h}|z_t^j$
- Need many, sufficiently different IRFs $i_{t+h}|z_t^j$

Oil shocks with counterfactual policies II: Application

- McKay & Wolf (2024): Choose θ_i to minimise $\sum_h (\bar{i}_{t+h})^2$, for

$$\bar{i}_{t+h} = i_{t+h}^{oil} + \theta_{RR}\ i_{t+h}|z_t^{RR} + \theta_{GK}\ i_{t+h}|z_t^{GK}$$

  - z_t^{RR} Romer and Romer (2004)
  - z_t^{GK} Gertler and Karadi (2015)
- Here: Use
  - z_t^{CL} Cloyne et al (2022): narrative identification,1974-1998
  - z_t^{AL} Almberg et al (2022): high-frequ. identification, 1999-2017
- Maintained assumption:Constant response to $\{i_{t+h}|z_t\}_h$ $1974 - 2020$

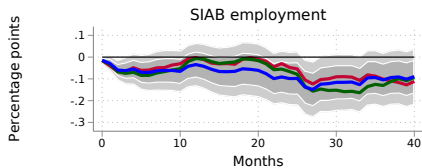## Aggregate effects of monetary shocks

- Local-projection IV (Jordà 2005): instrument i_t with MP shocks z_t
- Two separate first-stage regressions

$$i_t = a + bz_t + \sum_{i=1}^{l} d_{i,h} X_{t-i} + \epsilon_{t,h} \tag{2}$$

- 1974–1998: z_t from Cloyne et al (2022)
- 1999-2017: z_t from Almberg et al (2022)
- X_{t-i}: as before
- Gives fitted values $\hat{i}_t$ `TS `$\hat{i}_t$

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- Second-stage regression

$$\widetilde{\Delta y_{t+h}} = a_h + \beta_h \hat{i}_t + \varepsilon_{t,h},$$

  - $\widetilde{\Delta y_s}$ residual from regression of Δy_s on $X_{s-i}, \ i = 0, 1, ..., l$
  - Estimated on full sample, or separately for Buba and ECB
  - Shock scaled by 2 st dev (BUBA: 0.33 pp, ECB: 0.05 pp)

Oil IRF
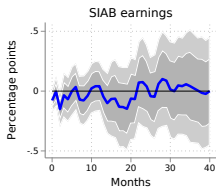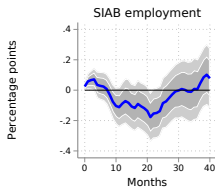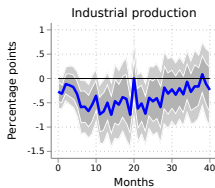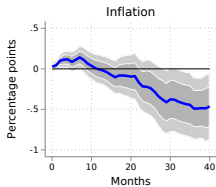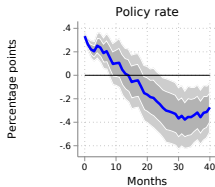
Aggregate effects of monetary shocks: Buba sample

Oil IRF
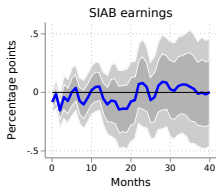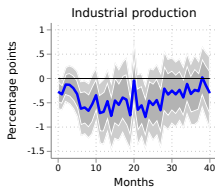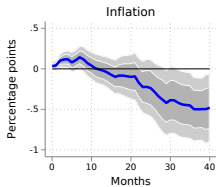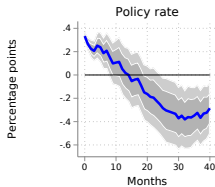
Aggregate effects of monetary shocks: ECB sample
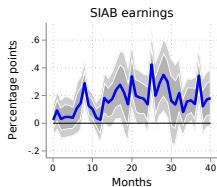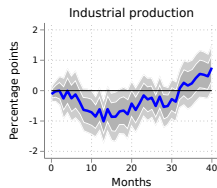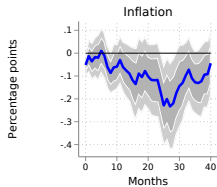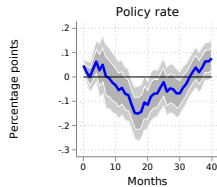
Aggregate effects of oil shocks with counterfactual policies
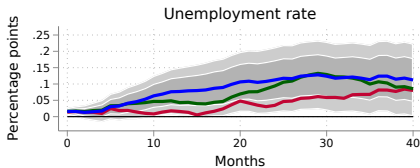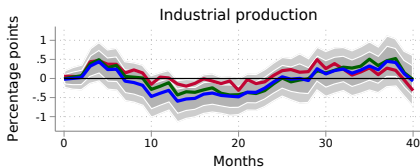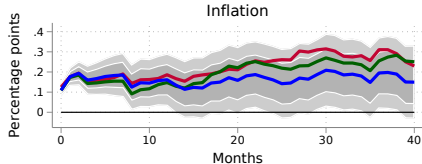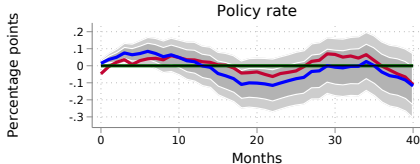
Oil shocks with counterfactual policies: Aggregate effects
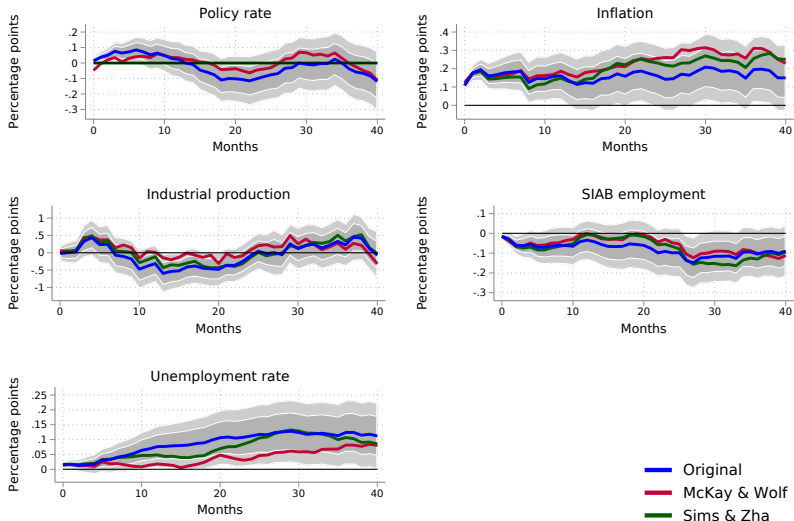
- MP achieved ↓ 10−15 bp inflation for ↑ 10 bp higher UE

Distributional effects of oil shocks with counterfactual policies

- Need: Estimates of distributional effects of monetary-policy shocks
- Simplified estimation, for $d = 1, ..., 10$

$$y_{i,d,t+h} - y_{i,d,t-1} = \alpha_{d,h} + \beta_{d,h}^y w_t + \sum_{i=1}^{l} \gamma_{i,d,h} X_{t-i} + \varepsilon_{i,d,t+h} \qquad (3)$$

where $w_t = \{oilnews_t, \hat{i}_t\}$
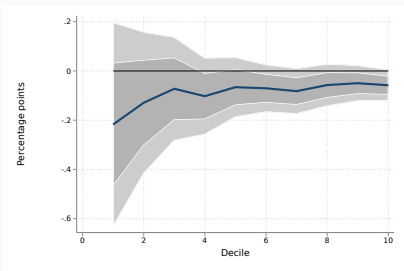
Full sample

Buba sample, Cloyne et al (2022) shocks

ECB sample, Almgren et al (2022) shocks

Full sample

Buba sample, Cloyne et al (2022) shocks

ECB sample, Almgren et al (2022) shocks

- E2E decline stronger in bottom tercile (see also Broer et al 2024)
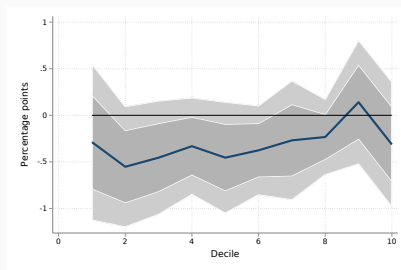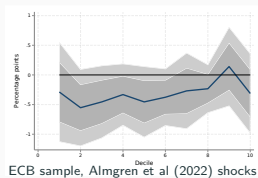- BUBA sample: $\approx$ 10pp oil-price shock; ECB: 1/4 stronger OilEEIRF

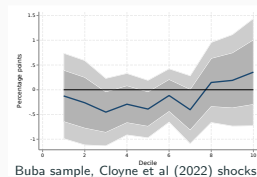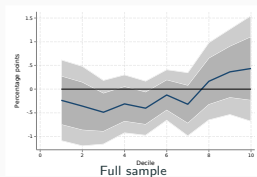# Distributional MP effects at $h = 18$: UE transitions
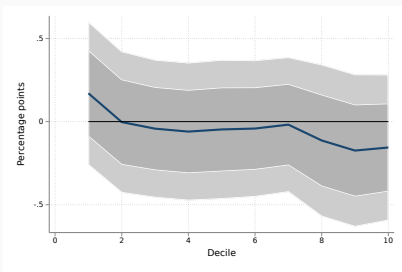

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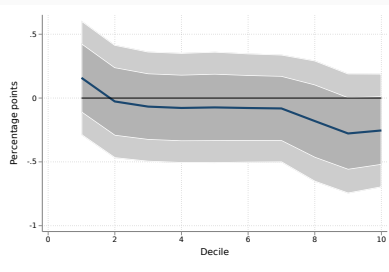

ECB sample, Almgren et al (2022) shocks

- U2E decline, not in top tercile
- 1/5 of 10pp oil-price shock
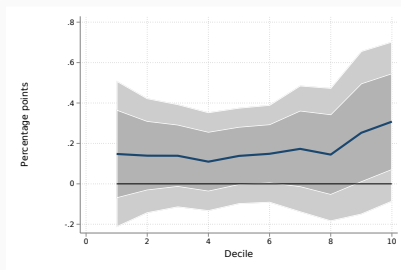
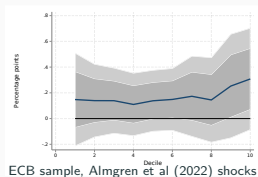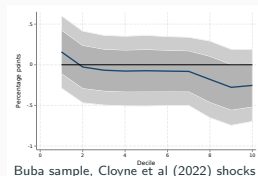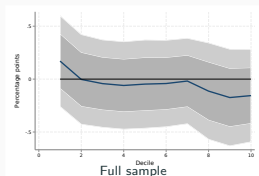# Distributional MP effects at $h = 18$: earnings of employed

Full sample

Buba sample, Cloyne et al (2022) shocks
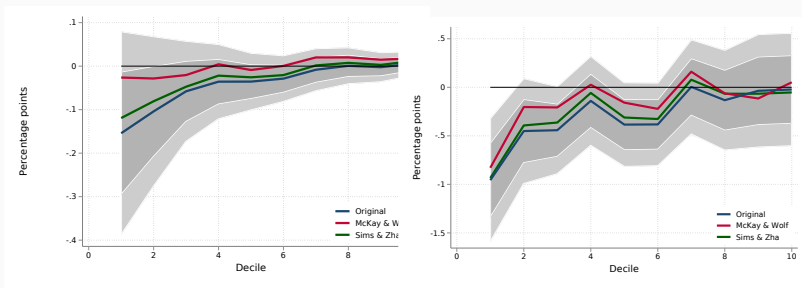

ECB sample, Almgren et al (2022) shocks

Full sample

Buba sample, Cloyne et al (2022) shocks
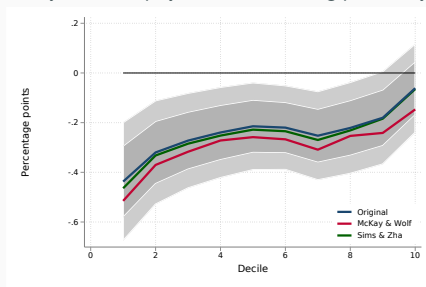

ECB sample, Almgren et al (2022) shocks

- Earnings of employed not much affected by Buba MP
- ECB sample: homogeneous and positive (selection?) effect

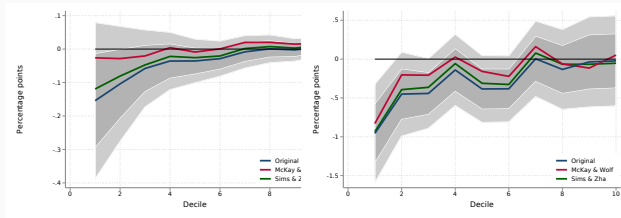# Distributional effects of oil shocks with counterfactual policies

Employment probability of the employed

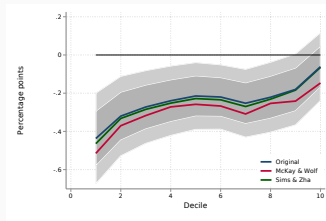Job-finding probability of the unemployed

Earnings growth of the employed

Distributional effects of oil shocks with counterfactual policies

Employment probability of the employed

Job-finding probability of the unemployed

Earnings growth of the employed

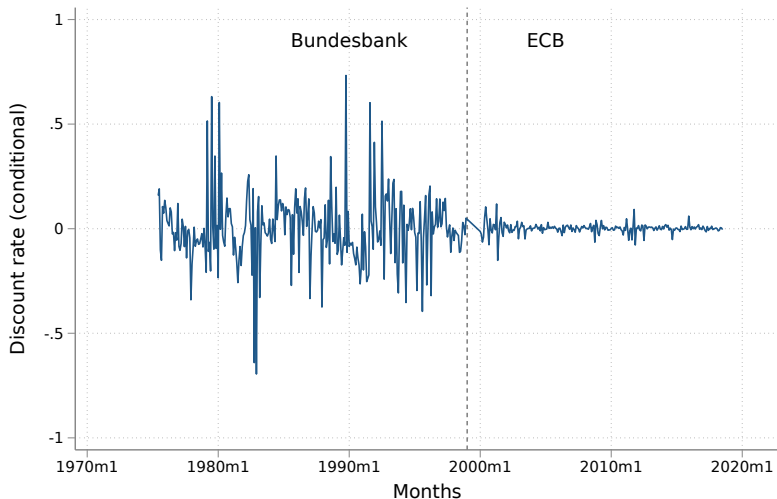- MP accounted for substantial part of employment decline

Summary and future research

Summary

- Oil shocks raise inflation and lower output / employment
- Employment & earnings decline concentrated among income-poor
- MP response caused substantial output and inflation decline
- ... and much of the employment fall among the poor

Future research

- Other dimensions of heterogeneity: Sectors, occupations, regions
  Sectors
- Other supply shocks
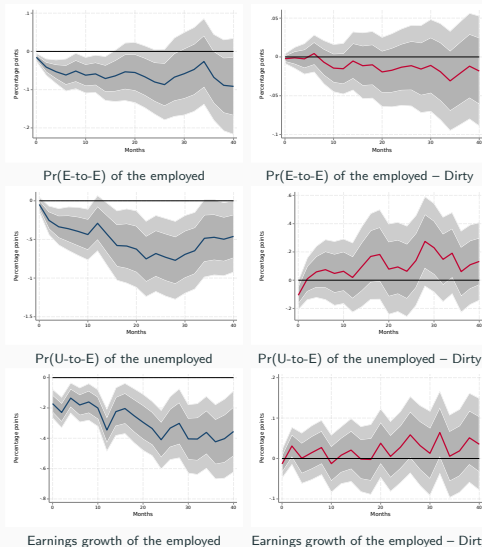- Same-sample monetary shocks in McKay and Wolf (2024)

Time series of policy shocks: fitted values $\hat{\hat{i}}_t$
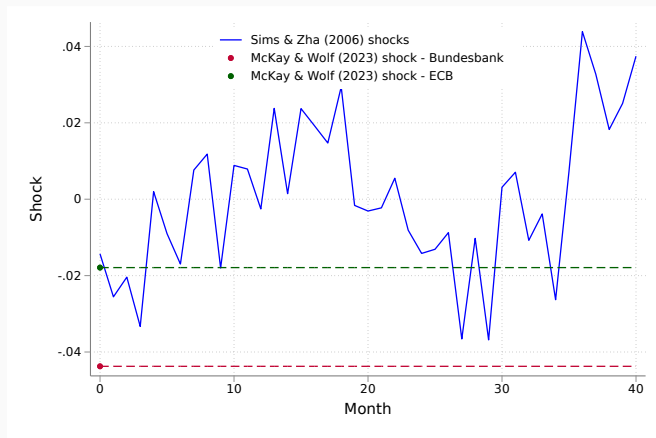
Distributional effects of oil shocks: dirty vs clean sectors

Pr(E-to-E) of the employed

Pr(E-to-E) of the employed – Dirty

Pr(U-to-E) of the unemployed

Pr(U-to-E) of the unemployed – Dirty

Earnings growth of the employed

Earnings growth of the employed – Dirty

Back to Concl

Counterfactual shocks

- $\theta_{CL} = -0.043bp$ (0.26× st dev), $\theta_{AL} = -0.018bp$ (0.72× st dev)

Back Agg Counterf   Back Distr counterf