# The Labor Demand and Labor Supply Channels of Monetary Policy

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Federal Reserve Bank of Chicago

# What we do

- Study response of labor market flows to identified monetary policy shocks
  - Look at flows across labor market states + job-to-job transitions
  - Proxy SVAR with HFI monetary policy shocks à la Gertler and Karadi (2015)
  - But apply methodology from Bauer and Swanson (2022) & use Chair speeches
- Focus on the role of supply-driven labor market flows:
  - Flows between unemployment and nonparticipation
  - Quits to non-employment
- Finding: contractionary monetary policy shock increases labor supply
  - Labor supply response attenuates overall decline in employment
  - Consistent with income effect

# What we do, cont'd

- Contractionary monetary policy shock increases labor supply... but by how much?

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- Contractionary monetary policy shock increases labor supply... but by how much?
- Quantify contribution of supply flows to overall response of labor market stocks
  - à la Shimer (2012), Elsby, Hobijn, and Sahin (2015)
- Response of employment twice as large holding labor supply flows fixed
  - Even larger supply response for lower-skill workers
- Rationalize with simple model of labor market frictions and participation:
  - Substitution effect: drop in job-finding rate decreases search
  - Income effect: rise in marginal utility of consumption increases search

  Income effect must be sufficiently strong to be consistent with estimates
- Consistent w/ stronger supply response of lower-skill workers

# Why we do it

- Conventional wisdom: monetary policy affects employment through labor demand
  - Little role (if any!) for labor supply
- Sticky-wage NK models abstract from labor supply response to monetary policy
  - Sticky wages + neoclassical labor market clearing $\Rightarrow$ labor is demand-determined
  - See, e.g., Broer, Hansen, Krusell, and Öberg (2020)
- This paper: causal estimates revealing important role of labor supply
- Labor supply margin appears especially important for low-skill workers
- Can rationalize findings with labor frictions + income effect on labor supply

# Related Literature

- **Labor market flows:** Davis, Faberman, and Haltiwanger (2006), Elsby, Michaels, and Solon (2009), Shimer (2012), Elsby, Hobijn, and Şahin (2015), Hobijn and Şahin (2021)
- **Labor response to monetary policy:** White (2018), Broer, Kramer, and Mitman (2021), Faia et al (2022), Cantore et al (2023)
- **HFI and Monetary VARs:** Stock and Watson (2012), Gertler and Karadi (2015), Bauer and Swanson (2023a, 2023b)
- **NK transmission mechanism:** Christian, Eichenbaum, and Evans (2005), Broer et al (2020), Auclert, Bardoczy, and Rognlie (2021)
- **Participation under frictional labor markets:** Krusell et al (2017), Cairo, Fujita, and Morales-Jimenez (2022), Alves and Violante (2023)

# Labor market flows

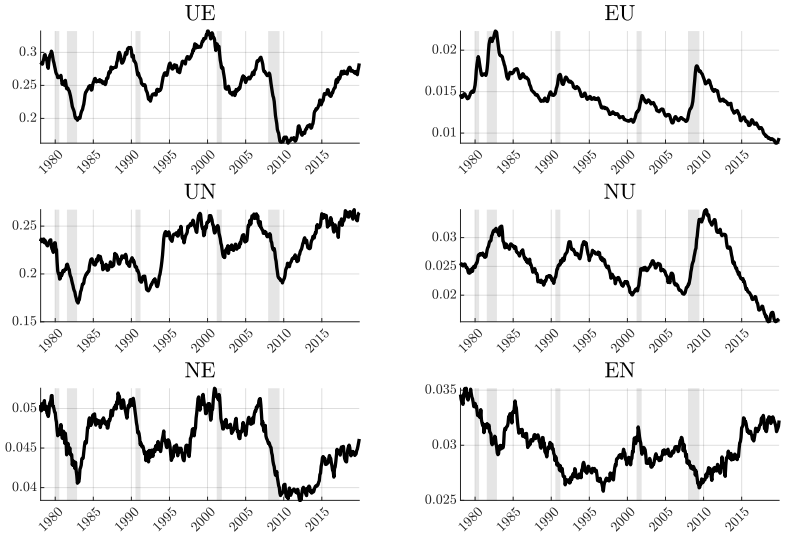
# Labor market flows

- Time series data on labor market flows from merged CPS monthly basics
- Three states: employment (E), unemployment (U), nonparticipation (N)
  - (Also consider job-to-job transitions, i.e., E to E)
- Interpret dynamics of labor market stocks through flows:

$$\begin{bmatrix} E \\ U \\ N \end{bmatrix}_{t+1} = \begin{bmatrix} 1 - p_{EU} - p_{EN} & p_{UE} & p_{NE} \\ p_{EU} & 1 - p_{UE} - p_{UN} & p_{NU} \\ p_{EN} & p_{UN} & 1 - p_{NE} - p_{NU} \end{bmatrix}_{t+1} \begin{bmatrix} E \\ U \\ N \end{bmatrix}_{t}.$$

- Useful for understanding how economic activity shapes dynamics of stocks
- Here: study response of supply-driven labor flows to monetary policy shock
  - Decision to search from non-employment, e.g. UN and NU
  - Quits to unemployment or nonparticipation (how?)

# Time Series of Labor Market Flows




Lots of work on studying unconditional variation in labor market flows— except EN!

# Understanding flows from employment to nonparticipation

- Previous work: EU flows dominated by layoffs (see Elsby et al. 2009, Ahn, 2023)
- This paper: EN flows broadly accounted for by quits ▸ Decomposing EU and EN flows
- Regardless of destination (U or N),
  1. Quits are procyclical
  2. Layoffs are countercyclical
- The cyclicality of EU/EN flows determined by composition of quits/layoffs
- On average, quit rate to U+N $\approx$ layoff rate to U+N
- Implication: Quit rate from JOLTS $\neq$ J2J rate

**Quits to non-employment are important!**

▸ Times Series of Decomposed EU and EN

# Econometric Framework

# Estimating the Effects of Monetary Policy

- Begin with reduced-form VAR:

$$Y_t = \alpha + B(L)Y_{t-1} + u_t, \tag{1}$$

- Six monthly variables for baseline specification: two-year Treasury yield, unemployment rate, participation rate, log CPI, log IP, excess bond premium
- Assume structural shocks:

$$u_t = S\varepsilon_t, \tag{2}$$

  where the first structural shock is a "monetary policy shock", $\varepsilon_t^{mp}$
- First column of $S$, denoted $s_1$, describes the impact effect of the structural monetary policy shock $\varepsilon_t^{mp}$ on $u_t$ and $Y_t$.
- Use an external instrument $z_t$ to identify $s_1$

# External Instrument

- External instrument $z_t$ needs to satisfy:

$$\mathbb{E}\left\{z_t \varepsilon_t^{mp}\right\} \neq 0 \qquad \text{(relevance)}$$

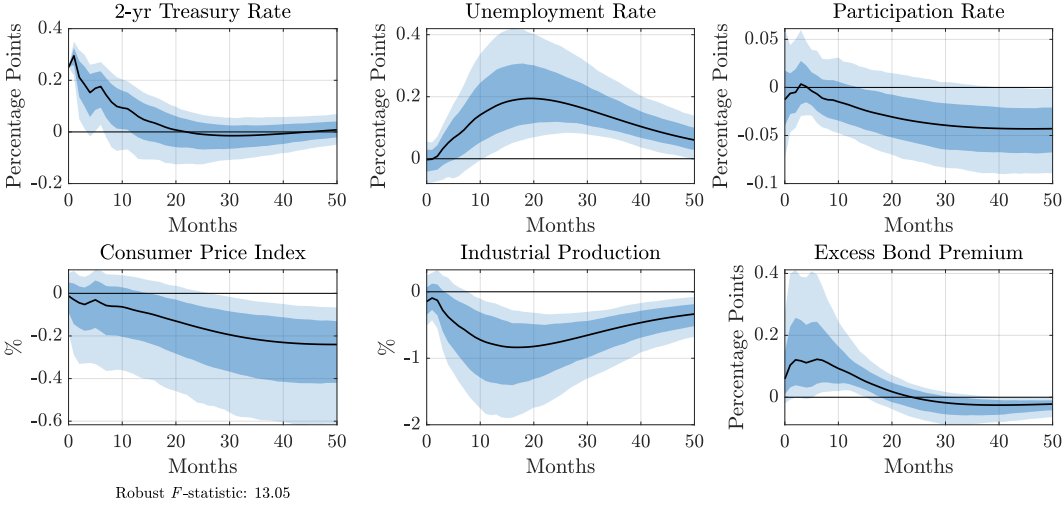
$$\mathbb{E}\left\{z_t \varepsilon_t^{-mp}\right\} = 0 \qquad \text{(exogeneity)}$$

- Use HFI changes in interest rate futures as external instrument in VAR
  - e.g., Stock and Watson (2012), Gertler & Karadi (2014)
- Implement methodology from Bauer & Swanson (2023):

  High-frequency interest rate changes around FOMC announcements *and* Fed Chair speeches, orthogonalized with respect to recent macro/financial news
- Both speeches and orthogonalizing **necessary** for accurate estimates of flow IRFs

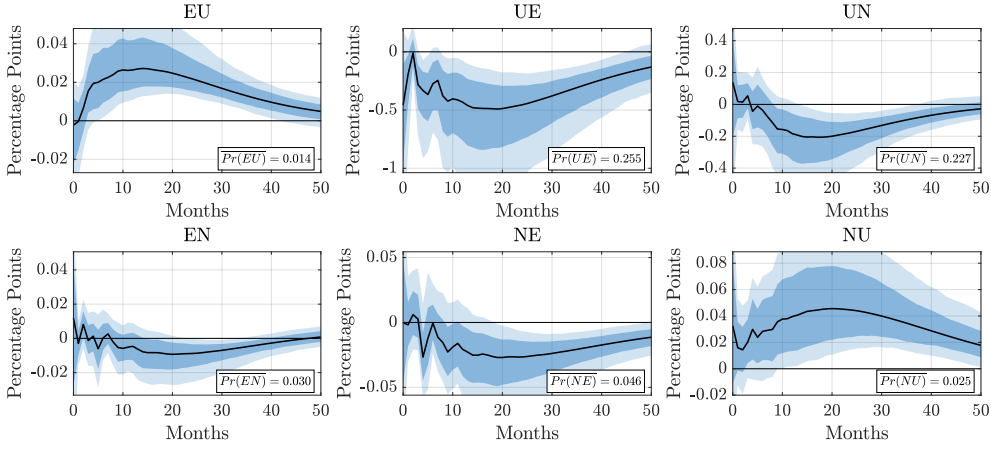
# Estimates

# IRFs from Baseline VAR




- Monthly data, 1978:M2–2019:M12
- Dark and light shaded regions report 68% and 90% confidence intervals

# Response of Labor Market Flows




Robust $F$-statistic from Baseline VAR: 13.05

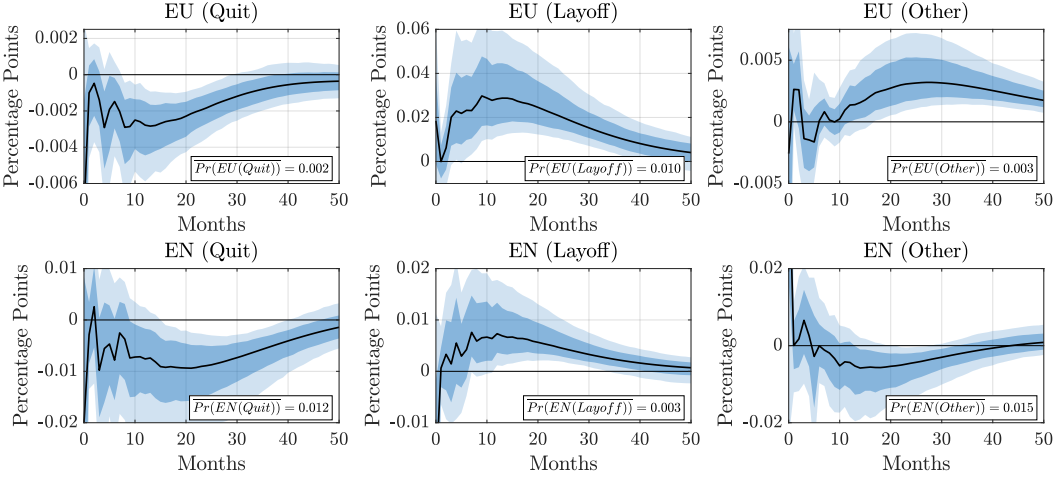
- pEU ↑ & pUE ↓ ⇒ Consistent with decline in labor demand
- pNU ↑, pUN ↓, & pEN ↓ ⇒ Consistent with increase in labor supply

# Response of Labor Market Flows: Robustness and Extensions

After contractionary monetary policy shock:

1. Layoffs increase & quits decline
2. Increase in intensive margins of search
3. Cyclical composition plays minor role in shaping response of aggregate flows
4. Shift in composition of U does not drive behavior of UN flows
5. No evidence of response of job-to-job flows

# Robustness and Extensions (1): Quits vs Layoffs




Robust $F$-statistic from Baseline VAR: 13.05

Following a contractionary monetary policy shock

- Heightened layoffs drive increase in overall EU flows
- Lower quits drive fall in overall EN flows

# Robustness and Extensions

After contractionary monetary policy shock:

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2. Increase in intensive margins of search from non-employment
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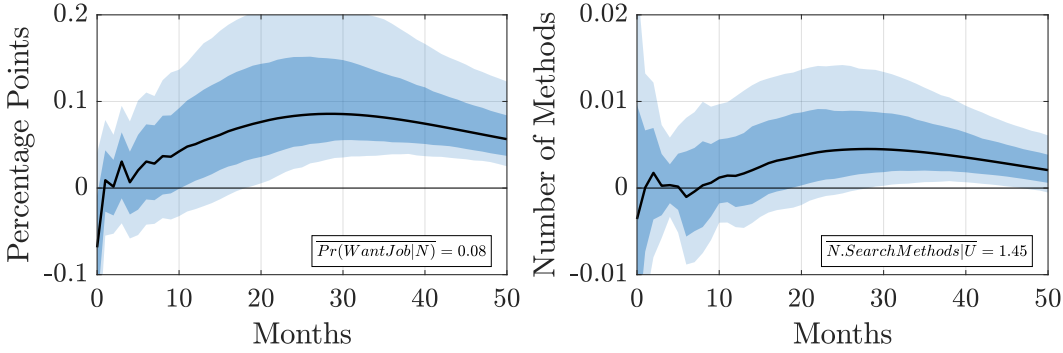
# Robustness and Extensions (2): Intensive Margins of Labor Supply

Intensive margins of search consistent with behavior of NU/UN flows:

- For N: share that want a job
- For U: number of search methods

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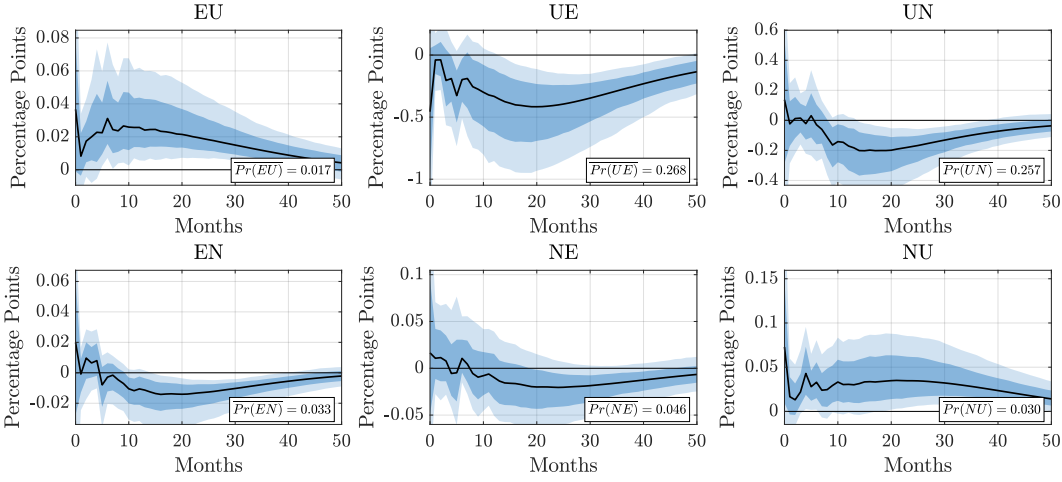
# Robustness and Extensions (3): Fixed-composition flows




- Composition-adjusted flows by ex-ante characteristics, à la Elsby et al. (2015)
- Fix shares using bins for age × gender × education

# Robustness and Extensions

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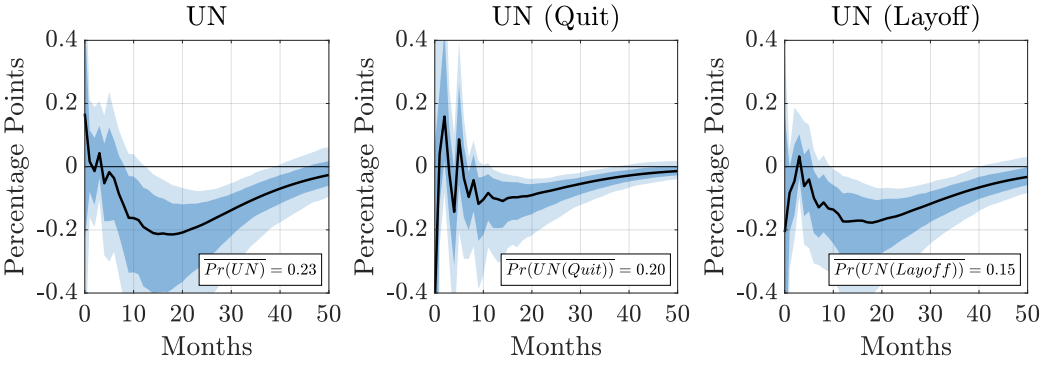
# Robustness and Extensions (4): Composition of Unemployment




Robust $F$-statistic from Baseline VAR: 13.05

Q: Is decline in UN flows driven by a shift in the composition of U towards layoffs?

A: No. Decline in UN flows even conditioning on Quit/Layoff

# Robustness and Extensions

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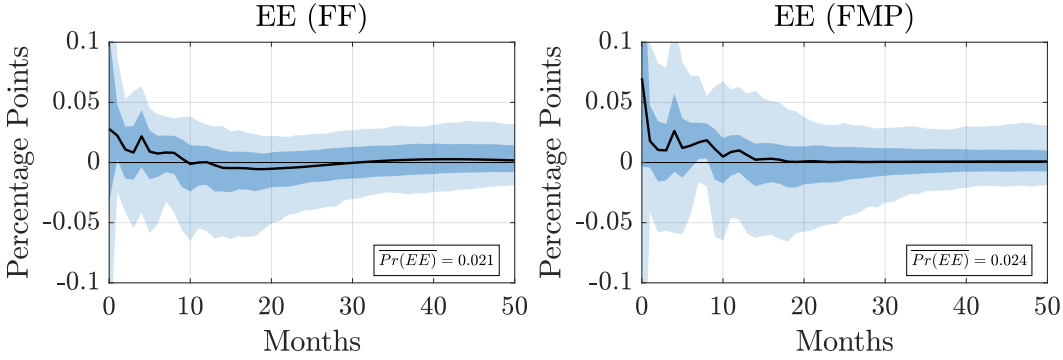
# Robustness and Extensions: Response of J2J Flows (1995-2019)




Robust $F$-statistic from Baseline VAR: 5.44

- Use measures from Fujita, Moscarini, Postel-Vinay (2022)
- No response of EE rate to contractionary MPS
- Cyclicality of EE series from CPS likely muted by workers who "jump ship"

▸ Flows with same sample

# Robustness and Extensions

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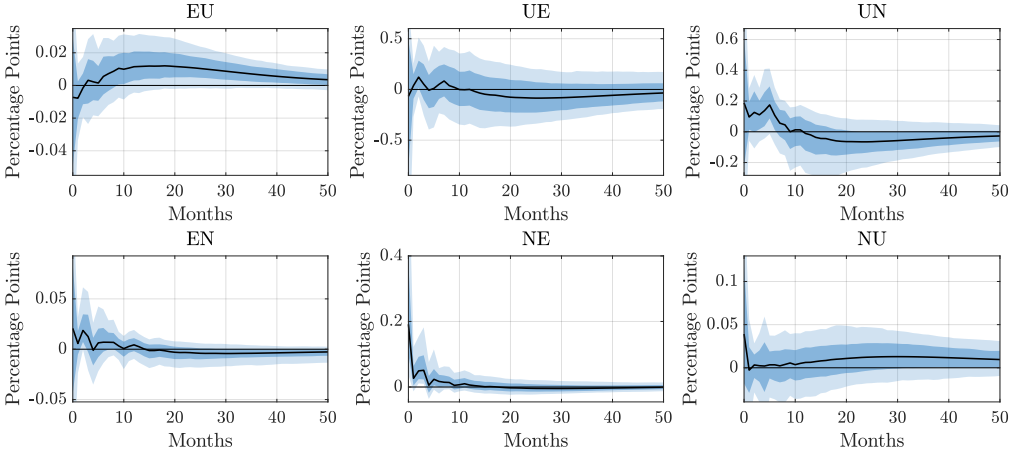
Chair speeches and orthogonalized shocks necessary for recovering baseline estimates

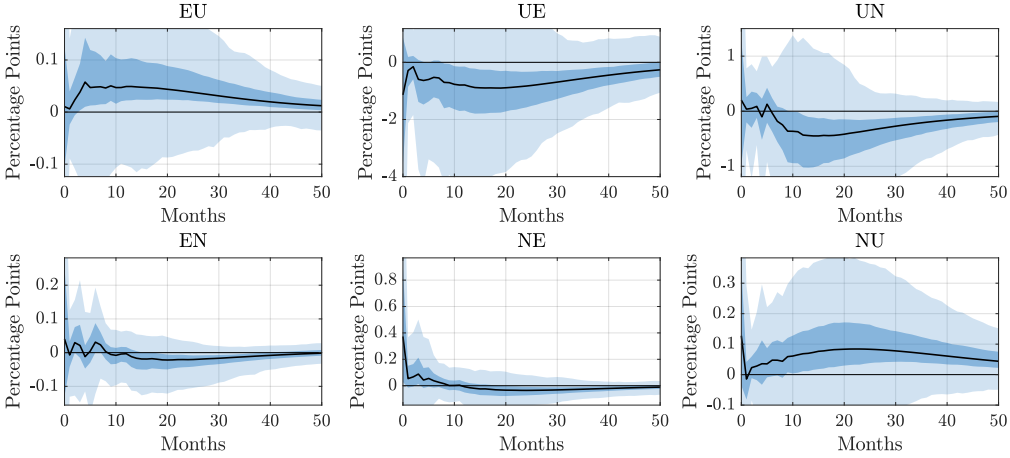
- Biased estimates from non-orthogonalized shocks
- Low F-statistic from orthogonalized shocks FOMC w/o Chair speeches

# Labor Market Flows: No Speeches




- High-frequency shocks from announcements only (e.g. Gertler & Karadi (2015))

# Labor Market Flows: No Speeches (Orthogonalized)




Robust $F$-statistic from Baseline VAR: 0.48

- From announcements only, orthogonalized as in Bauer & Swanson (2022)
- Very low first-stage F-stats (i.e., weak instrument)

# Flow-based accounting for dynamics of labor market stocks

# Flow-based accounting for dynamics of stocks

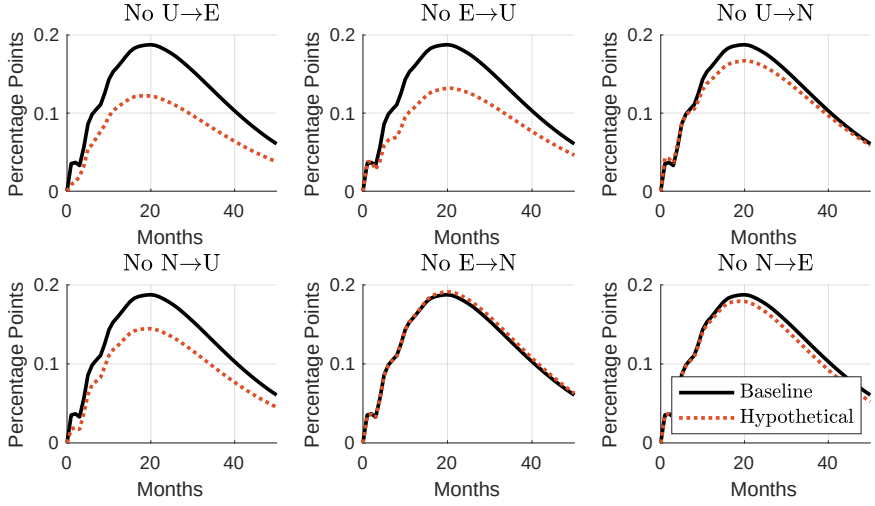
General approach:

- Take IRF's as given, use transition probabilities to construct hypothetical stocks:
- Law of motion for stocks in terms of transition probabilities (i.e., flows):

$$\begin{bmatrix} E \\ U \\ N \end{bmatrix}_{t+1} = \begin{bmatrix} 1 - p_{EU} - p_{EN} & p_{UE} & p_{NE} \\ p_{EU} & 1 - p_{UE} - p_{UN} & p_{NU} \\ p_{EN} & p_{UN} & 1 - p_{NE} - p_{NU} \end{bmatrix}_{t+1} \begin{bmatrix} E \\ U \\ N \end{bmatrix}_{t}.$$

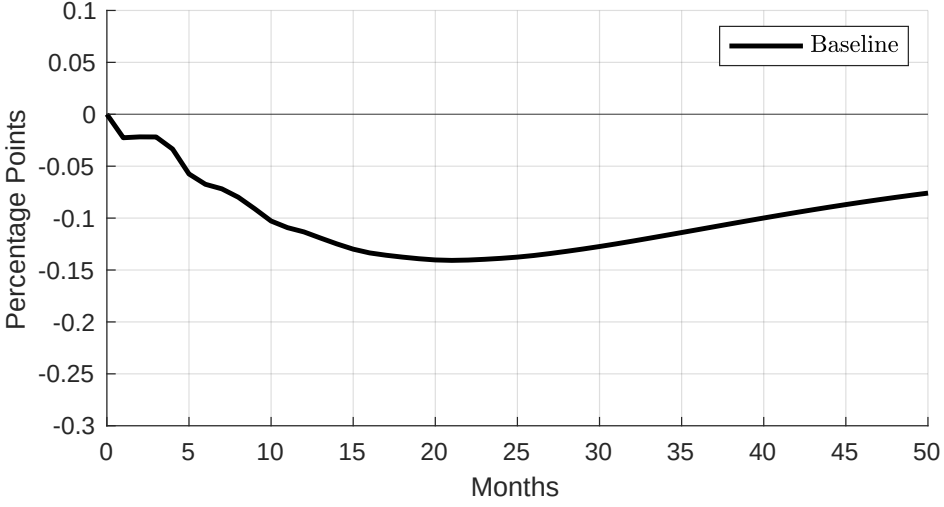
- Assess contribution of flow $p_{XY}$ to stock $Z$ by replacing $\{p_{XY}\}_t$ with "steady-state" value, $\tilde{p}_{XY}$
- Study behavior of resulting hypothetical stock $\check{Z}$ to isolate role of flow $p_{XY}$

# The Ins and Outs of Unemployment




- E→U and U→E roughly equally responsible for rise in unemployment

# Labor Supply Channel of Monetary Policy: Employment



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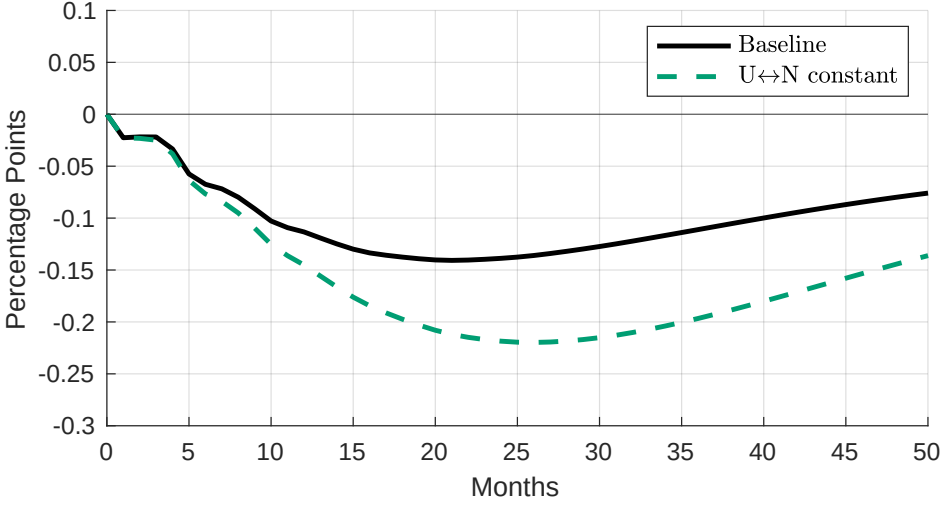
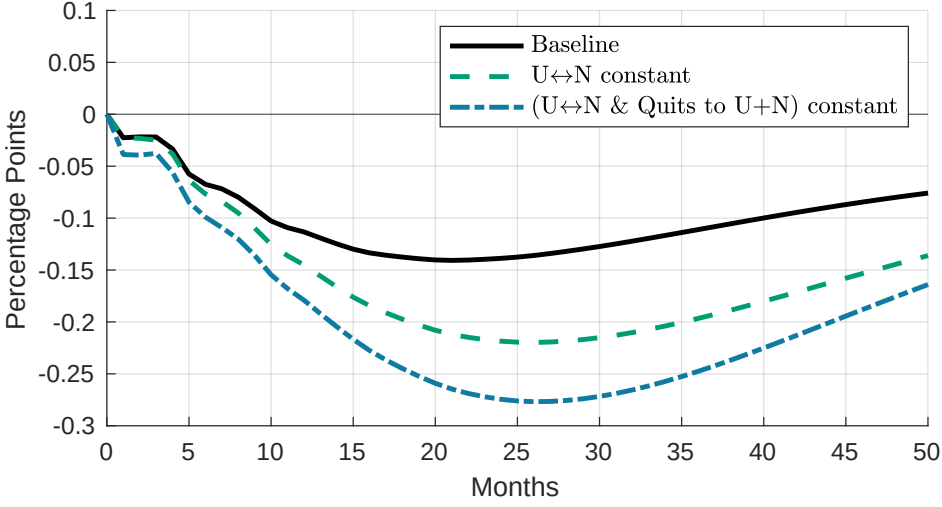
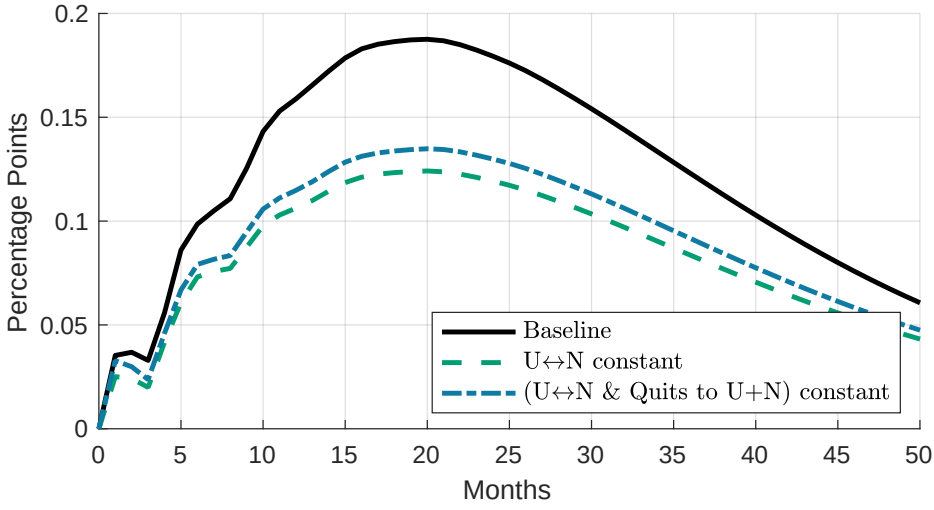


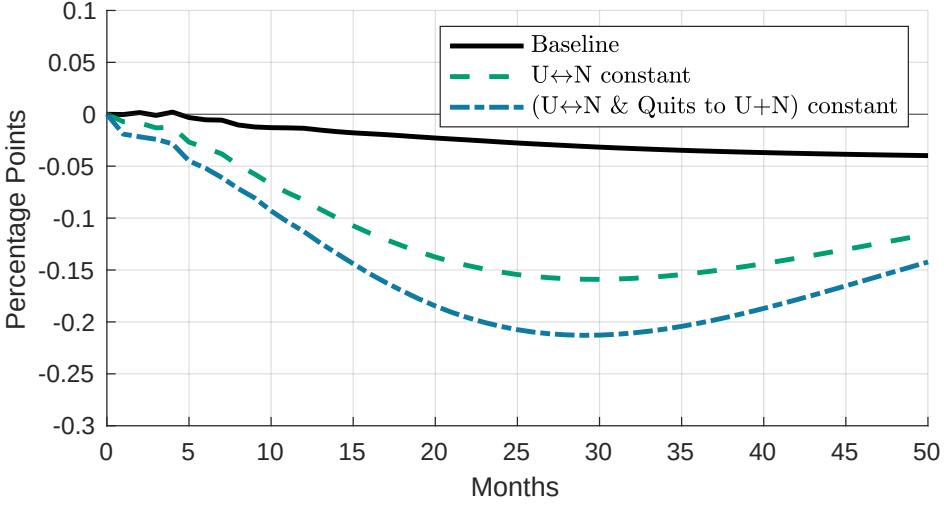
# Labor Supply Channel of Monetary Policy: Employment



# Labor Supply Channel of Monetary Policy: Unemployment



# Labor Supply Channel of Monetary Policy: LFPR

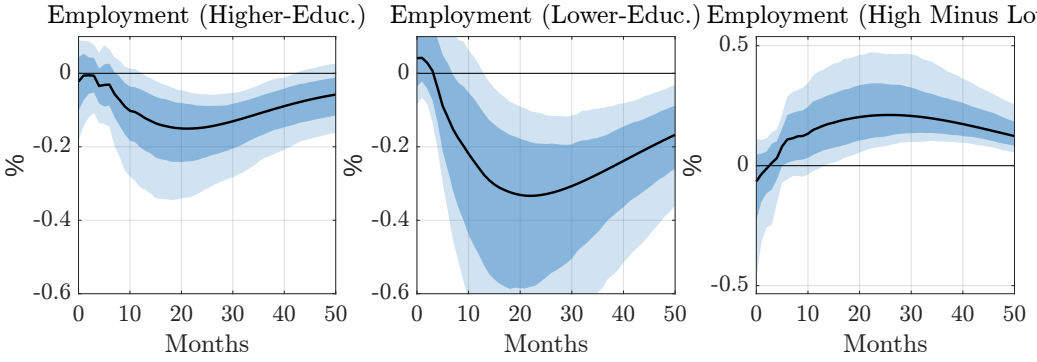


# Interpretation

- Sticky-wage NK model does not allow labor supply response to monetary policy
- Here: labor supply increases in response to contractionary monetary policy shock!
- Quantitatively important: reduces drop in employment by 50%
- Possible interpretation: income effect on labor supply
  - Monetary contraction $\Rightarrow$ smaller budget set
  - Households "feel poorer," take less leisure
- Next: look at low– versus high-educated workers
- Low-educated: greater reduction in labor demand, fewer assets
  - Bigger shocks, less wealth for consumption-smoothing
  - Should expect greater labor supply response

# Heterogeneity

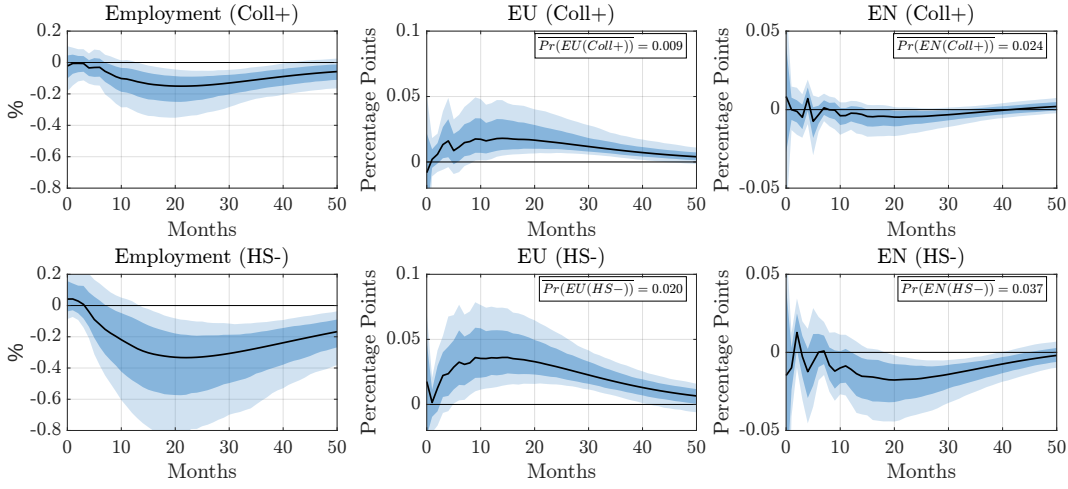
# Heterogeneous Responses to Contractionary Monetary Policy Shock




Larger employment decline for lower-educated workers

▸ Labor market flows, high-skill ▸ Labor market flows, low-skill

# Heterogeneous Responses, cont'd




Robust $F$-statistic from Baseline VAR: 13.05

- Larger employment decline for low-educated driven by larger increase in EU...
- But moderated by larger decrease in EN for low-educated
- Consistent with income effect on labor supply

# Model

# Model

Rationalize estimates of aggregate labor supply flows with simple model

- Labor market frictions + endogenous participation
- Continuous time, infinite horizon
- Worker takes (sticky) wage $w$ and aggr. job-finding rate $\lambda$ as given
- Perfect risk sharing within representative household
- Worker discounts future at constant rate $r$
- Decreasing marginal utility of consumption $\mu$
- Heterogeneous value of leisure $b$
- Active search $s \in \{0, 1\}$ is costly, but increases job-finding rate

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Focus: search response of non-employed to "indirect" effects of monetary policy shock

# Value of unemployment

$$rV_0(b) = \max_{s\in\{0,1\}} \left\{ \frac{b - \psi \cdot \mathbb{I}\{s=1\}}{\mu} + (\alpha \cdot \mathbb{I}\{s=1\} + (1-\alpha)) \cdot \lambda \cdot \left[\max\{V_1(b), V_0(b)\} - V_0(b)\right] \right\}$$

- Let $V_0(b)$ and $V_1(b)$ be the consumption-equivalent values of non-employment and employment
- $V_0(b)$ incorporates
  - Decision to search (nonparticipation vs. unemployment)
  - "Wanting a job" from nonparticipation

# Search threshold

- Search threshold $b^s$ equates cost of search with capital gains:

$$\underbrace{\left(\frac{\psi}{\mu}\right)}_{\text{Cost of search}} = \underbrace{\alpha \cdot \lambda \cdot \left(\frac{w - \frac{b^s - \psi}{\mu}}{r + \delta + \lambda}\right)}_{\text{Additional capital gains from search}}$$

  with job-finding rate $\lambda$ & marginal utility of consumption $\mu$

- Contractionary monetary policy shock: $\lambda \downarrow$ & $\mu \uparrow$
  - Substitution effect: $\lambda \downarrow \Rightarrow b^s \downarrow$ (decreased labor supply)
  - Income effect: $\mu \uparrow \Rightarrow b^s \uparrow$ (increased labor supply)
- Income effect must dominate for the model to be consistent with the data

▸ Value Functions

# Conclusion

# Conclusion

- Sizeable labor supply response to contractionary monetary policy shock
  - Decreases in quits to nonparticipation
  - Greater job-seeking from non-employment
- Both labor demand and supply channels more responsive for lower-educated
- Findings consistent with income effect on labor supply
- Labor supply response attenuates fall in employment by one-half

# Extra slides

# Transition probabilities across labor market states

Table: Average transition properties across labor market states, 1978–2019

| | *To* | | |
|---|---|---|---|
| *From* | E | U | N |
| E | 0.960 | 0.013 | 0.027 |
| U | 0.257 | 0.550 | 0.193 |
| N | 0.040 | 0.028 | 0.932 |

Data from merged monthly CPS.

Table: Cyclical properties of transition probabilities, 1978–2019

| | $p_{EU}$ | $p_{EN}$ | $p_{UE}$ | $p_{UN}$ | $p_{NE}$ | $p_{NU}$ |
|---|---|---|---|---|---|---|
| std(x) | 6.44 | 2.75 | 5.89 | 5.06 | 4.53 | 4.74 |
| corr(x,Y) | −0.775 | 0.373 | 0.749 | 0.424 | 0.258 | −0.574 |

All logged and HP-filtered (smoothing parameter = 1600). "std(x)" denotes standard deviation relative to GDP. "corr(x,Y)" denotes correlation w/ GDP.

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# Decomposing EU and EN Flows, cont'd

Table: Decomposition of EU Flows

| | Total | Quits | Layoffs | Other |
|---|---|---|---|---|
| mean | 0.014 | 0.002 | 0.010 | 0.003 |
| std$(x)$/std$(Y)$ | 5.16 | 8.16 | 7.88 | 6.26 |
| corr$(x, Y)$ | $-0.82$ | 0.61 | $-0.83$ | $-0.11$ |

Table: Decomposition of EN Flows

| | Total | Quits | Layoffs | Other |
|---|---|---|---|---|
| mean | 0.030 | 0.012 | 0.003 | 0.015 |
| std$(x)$/std$(Y)$ | 2.47 | 5.89 | 14.46 | 4.61 |
| corr$(x, Y)$ | 0.49 | 0.53 | $-0.44$ | 0.28 |

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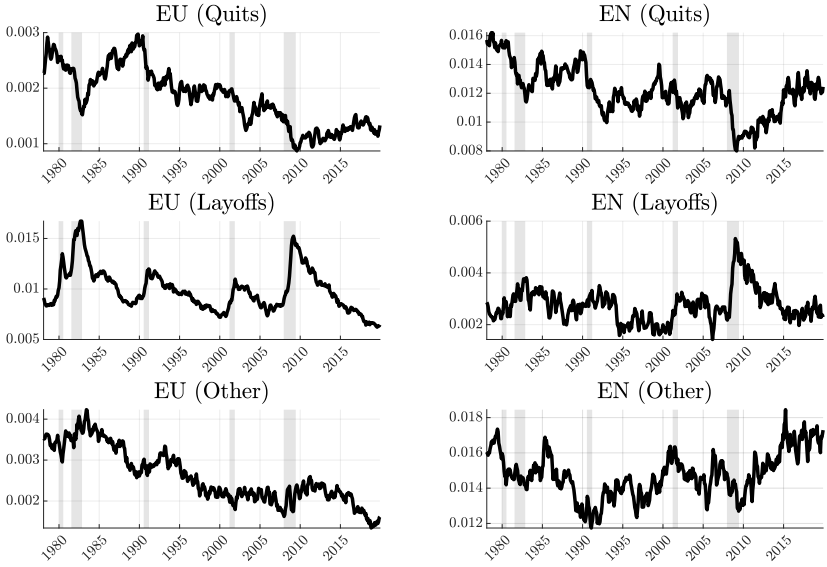
# Decomposition of EU Flows

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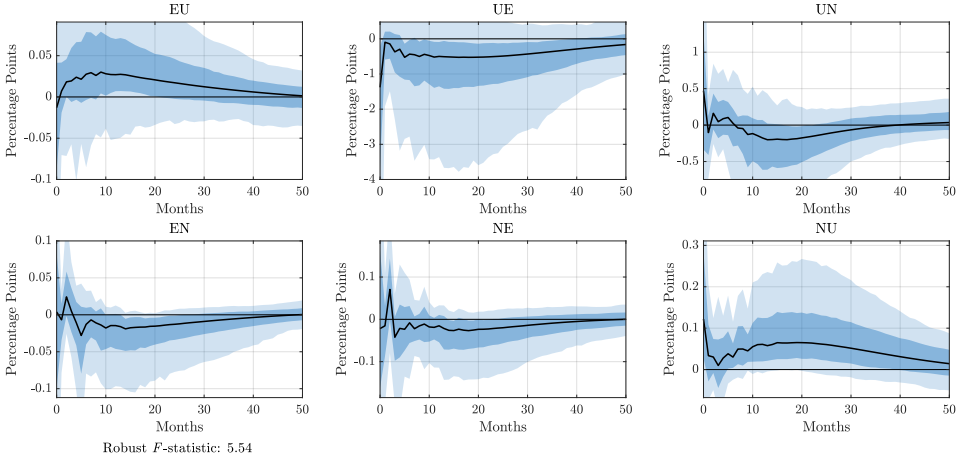
# Labor Market Flows: Short Sample (1995-2019)




- Similar point estimates to full sample (but larger confidence intervals)
- Larger confidence intervals due to sample uncertainty, not weak instrument

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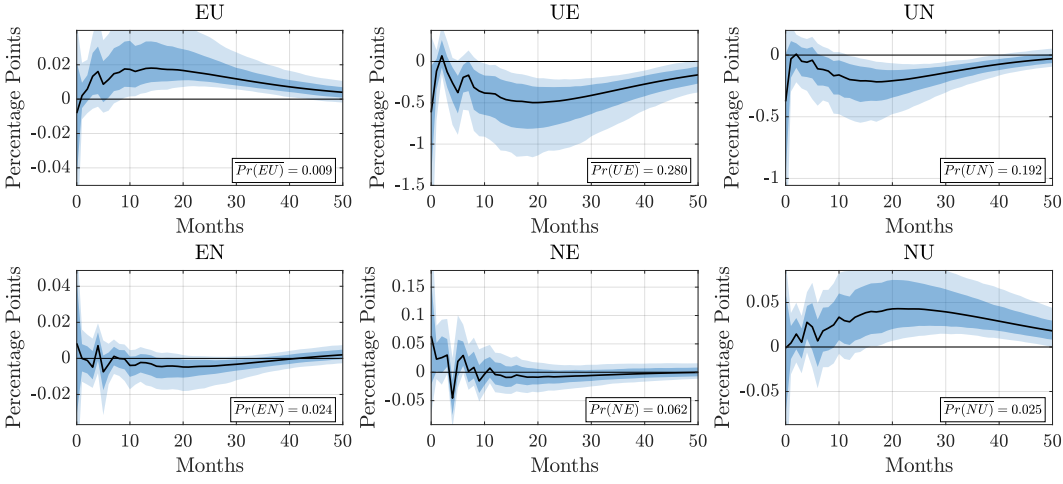
# Labor market flows: Higher-educated




Robust $F$-statistic from Baseline VAR: 13.05

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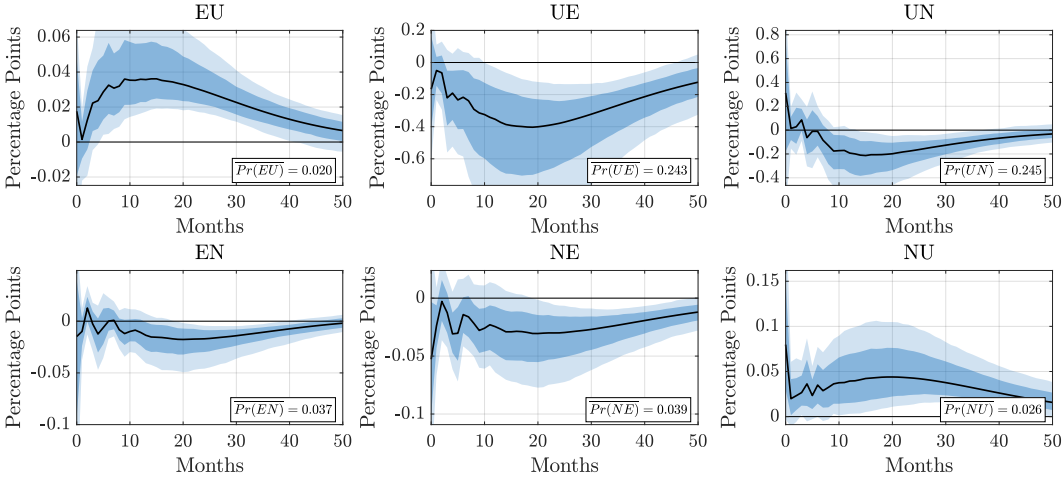
# Labor market flows: Lower-educated




Robust $F$-statistic from Baseline VAR: 13.05

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# Unconditional versus conditional responses

Conditional cyclicality of flows resembles unconditional, but ...

1. Conditional response of EU more persistent
   - Short-lived increase in layoffs at start of recession
   - MPS: more important role for EU in shaping response of unemployment
2. No response of J2J flows to monetary contraction
   - J2J negatively correlated with unemployment, positively correlated with wage growth
   - MPS: no evidence of offer-matching in driving inflation through J2J transitions
3. Conditional responses not driven by cyclical composition
   - Elsby et al (2015): UN$\downarrow$ & NU$\uparrow$ during recession reflects change in composition
   - MPS: IRFs robust to controls for composition $\Rightarrow$ interpretable as behavioral response

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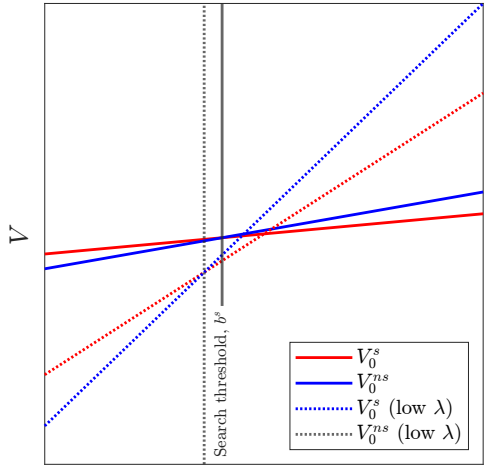
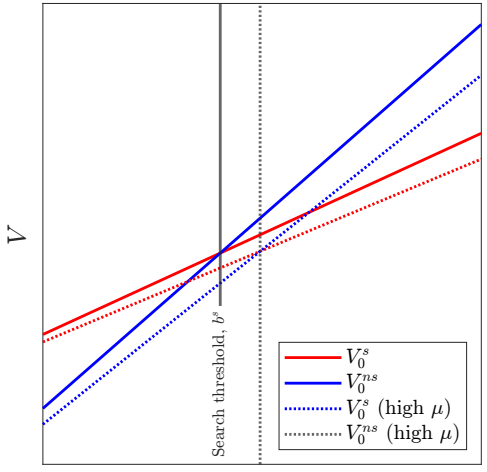
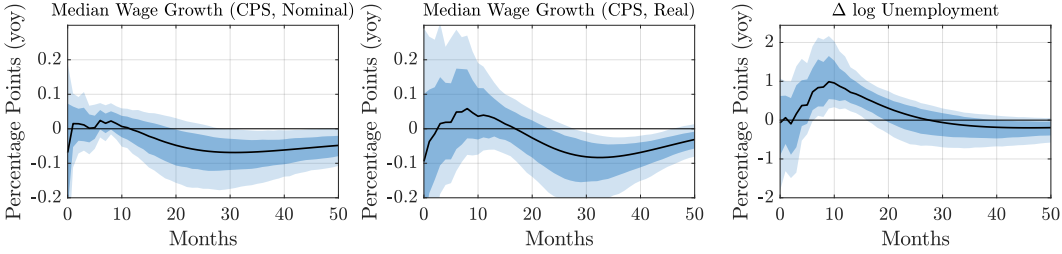
# Model: Comparative Statics



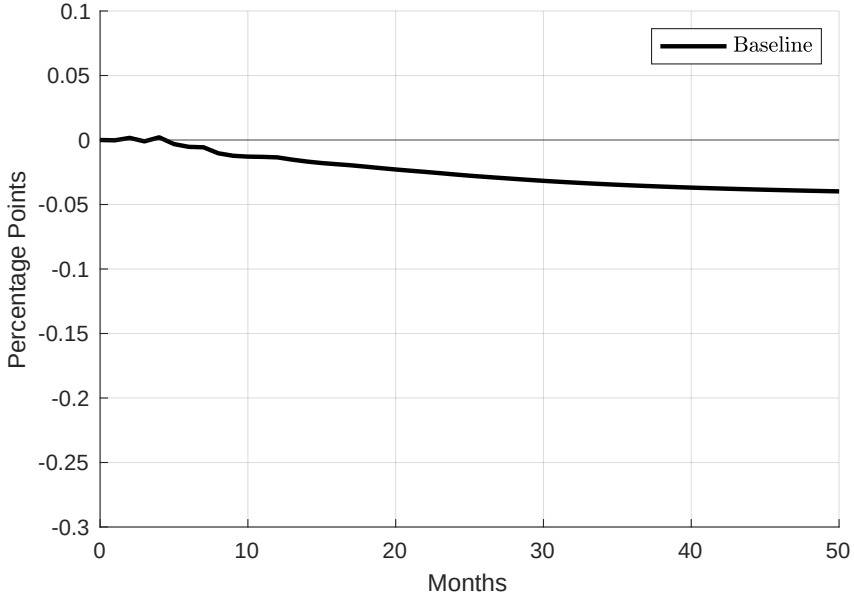

Back

# Response of Wages and Unemployment

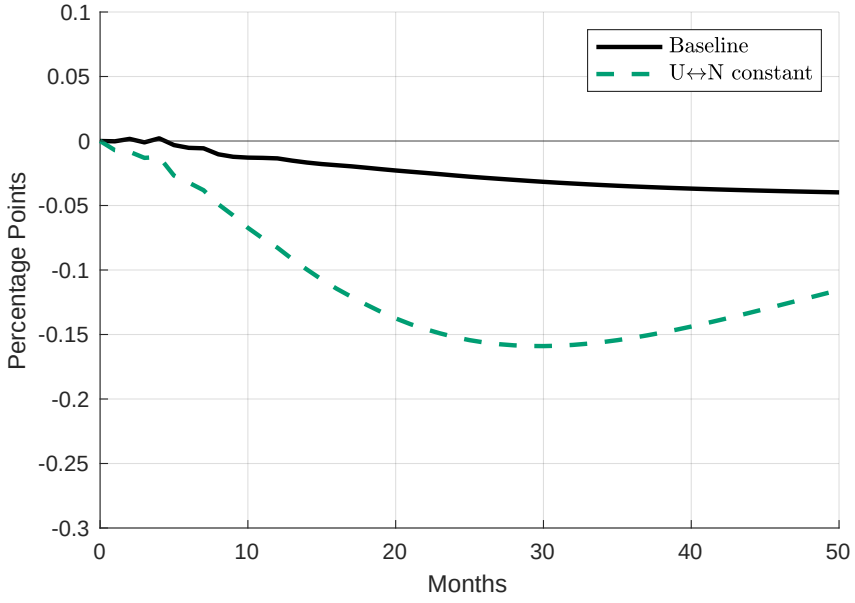



Robust $F$-statistic from Baseline VAR: 13.05

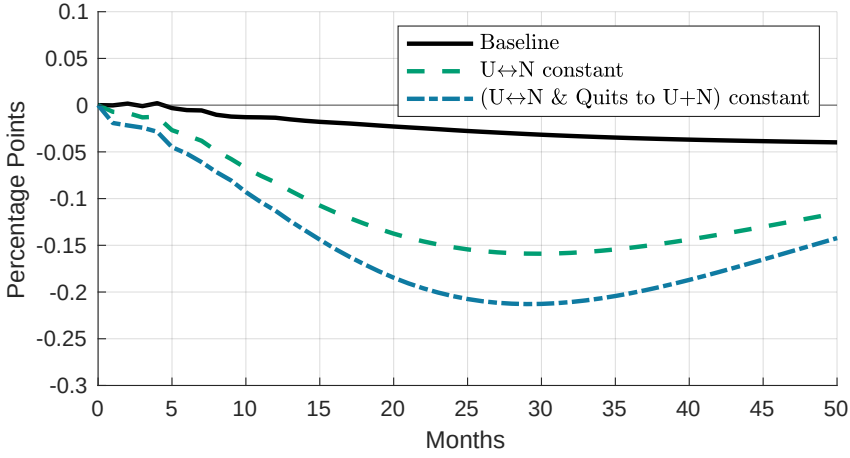
# Participation Response to a Monetary Policy Shock



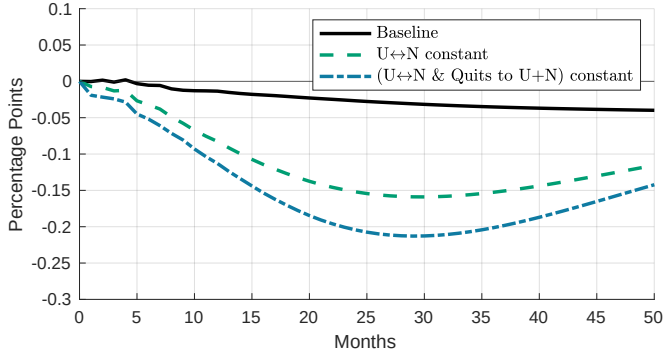
# Participation Response to a Monetary Policy Shock



# Participation Response to a Monetary Policy Shock



# Participation Response to a Monetary Policy Shock




- Labor supply flows = U $\longleftrightarrow$ N flows + quits to non-employment
- Hold labor supply flows fixed $\Rightarrow$ Participation far more procyclical