The Labor Demand and Labor Supply Channels of Monetary Policy

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CEA

What we do

- Study response of labor market flows to identified monetary policy shocks
  - Estimate impulse responses from proxy SVAR with HFI monetary policy surprises à la Gertler and Karadi (2015), Bauer and Swanson (2023)
- Devote particular attention to the response of supply-driven labor market flows:
  - Flows between unemployment and nonparticipation (i.e., UN and NU)
  - Quits to non-employment (i.e., EN quits and EU quits)
- After contractionary monetary policy shock: UN flows $\downarrow$, NU flows $\uparrow$, & Quits to non-employment $\downarrow$
- Apply standard accounting framework: Response of employment twice as large holding supply-driven flows fixed

What we do (II)

- What do IRFs of supply-driven labor flows say about household labor supply response to a monetary policy shock?
  - Change in composition, or broad-based increase in labor supply?
- To address question, we study heterogeneous agent model with labor market frictions and endogenous participation à la Krusell et al (2017)
- Estimate key model parameters to match response of labor market flows to contractionary monetary policy shock
  - Take layoffs, job-finding rates, and interest rates as exogenous (2023)
- Model fit achieved through increase in labor supply across households
- Interpretation: Data consistent with quantitatively important increase in household labor supply in response to an unanticipated monetary tightening

Why we do it

- Conventional wisdom: monetary policy affects employment through labor demand
  - Little role (if any!) for labor supply
- Recent NK models abstract from labor supply response to monetary policy
  - Sticky wages + neoclassical labor market clearing $\Rightarrow$ labor is demand-determined
    - E.g. Gali, Smets, and Wouters (2011), Broer et al (2020), Wolf (2023)
  - NK + search-and-matching $\Rightarrow$ labor supplied inelastically
    - E.g. Gertler, Sala, and Trigari (2008), Christiano, Eichenbaum, and Trabandt (2016)
- This paper: New evidence that decline in employment from a contractionary monetary policy shock significantly attenuated by increase in labor supply
- Implication: Labor supply is relevant for NK framework

Data & methodology

Labor Market Flows

- Time series data on labor market flows from merged CPS monthly basic files
- Three states: employment (E), unemployment (U), nonparticipation (N)
  - We also study job-to-job transitions (i.e., E-to-E)
- Interpret dynamics of labor market stocks through response of flows:

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

- Particular focus on response of supply-driven flows to monetary policy
  - Decision to search from non-employment, e.g. UN and NU
  - Quits to unemployment or nonparticipation

▸ Time Series ▸ Cyclical Properties ▸ New Evidence on Quits to Nonparticipation

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", ε_t^{mp}
- First column of S, denoted s_1, describes the impact effect of the structural monetary policy shock ε_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:

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

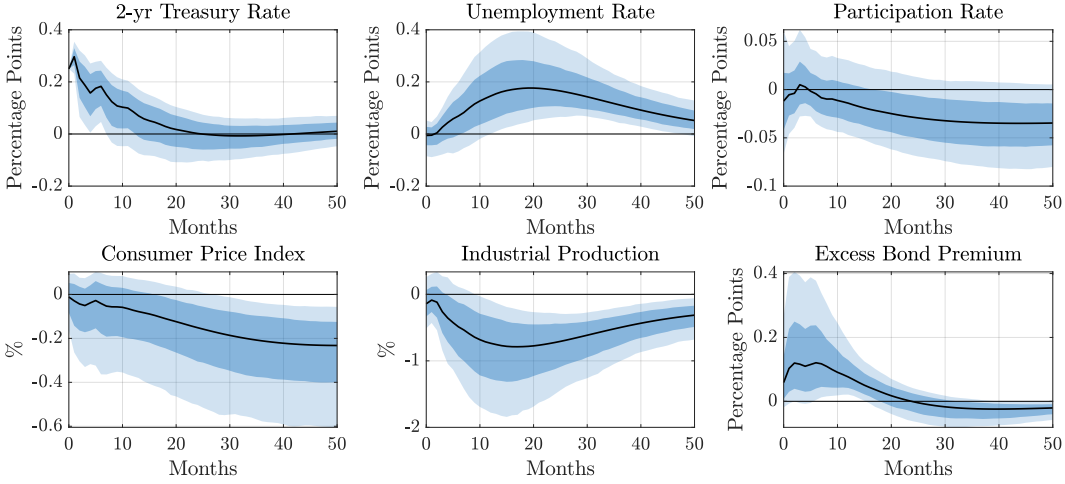
$$\mathbb{E}\left\{z_t \varepsilon_t^{-mp}\right\} = 0 \qquad \text{(exogeneity)}$$

- 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
- Labor market flows added one-by-one to the main VAR

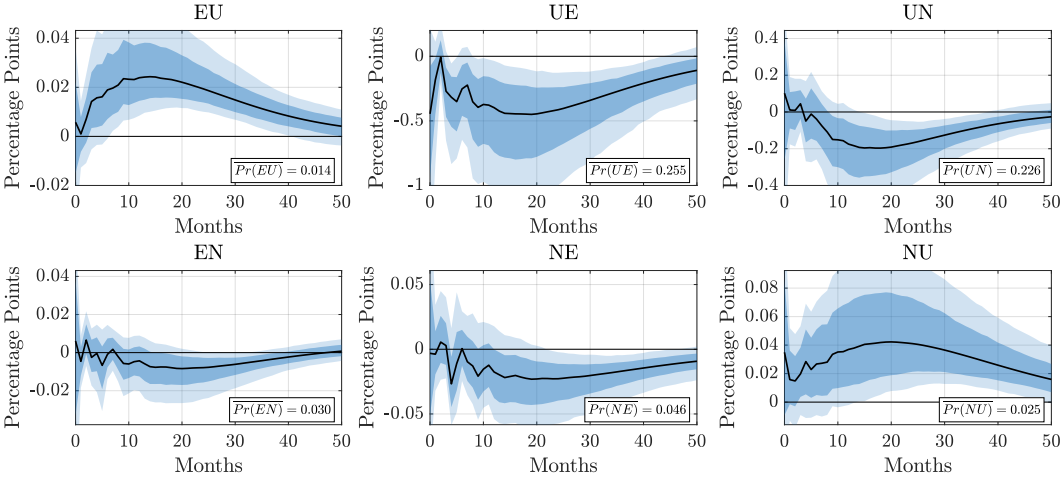
Estimates

Baseline VAR



- Monthly data, 1978:M1–2019: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 narrative of decline in labor demand
- pNU ↑, pUN ↓, & pEN ↓ ⇒ Consistent with increase in labor supply

Additional results

After contractionary monetary policy shock we also find:

1. Layoffs rise, and quits to non-employment fall (see responses of EU & EN)
2. Increase in intensive margins of search from non-employment
3. Cyclical composition plays limited role in shaping response of aggregate flows
4. Larger response of supply-driven flows among lower-skilled
5. Decline in participation driven by labor force exits (through increase in unemployment); attenuated by increase in labor force entry

Chair speeches and orthogonalized shocks necessary for our estimates:

- Biased estimates from non-orthogonalized shocks
- Imprecise estimates from orthogonalized shocks w/o Chair speeches

Next: Quantify contribution of supply-driven flows to decline in employment

Using Flows to Account for Dynamics of Labor Market Stocks

Flow-based accounting for dynamics of stocks

General approach:

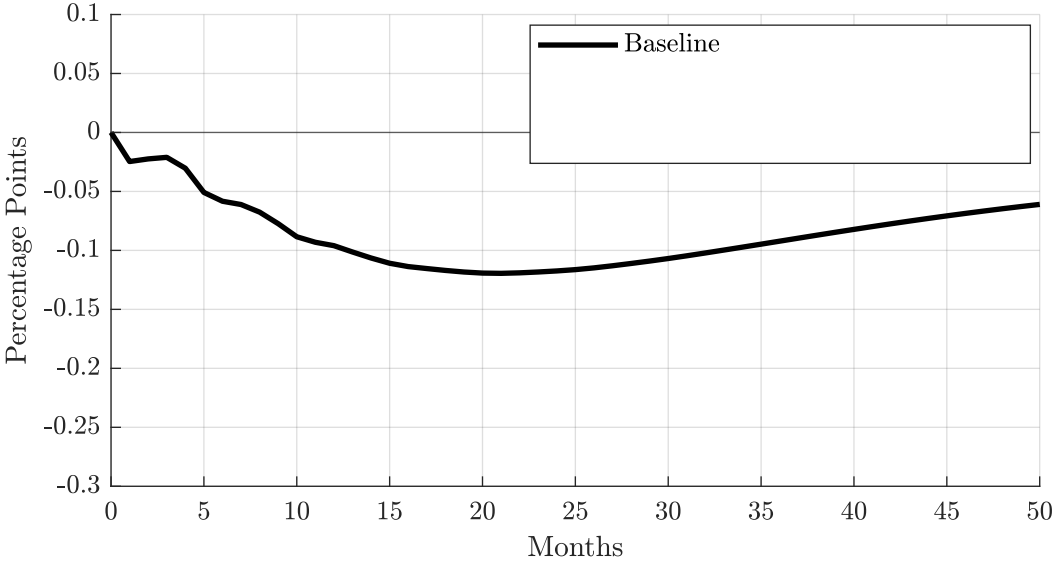
- Take IRF's as given, use transition probabilities to construct hypothetical stocks:
- Law of motion for stocks in terms of transition probabilities (i.e., flows):

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

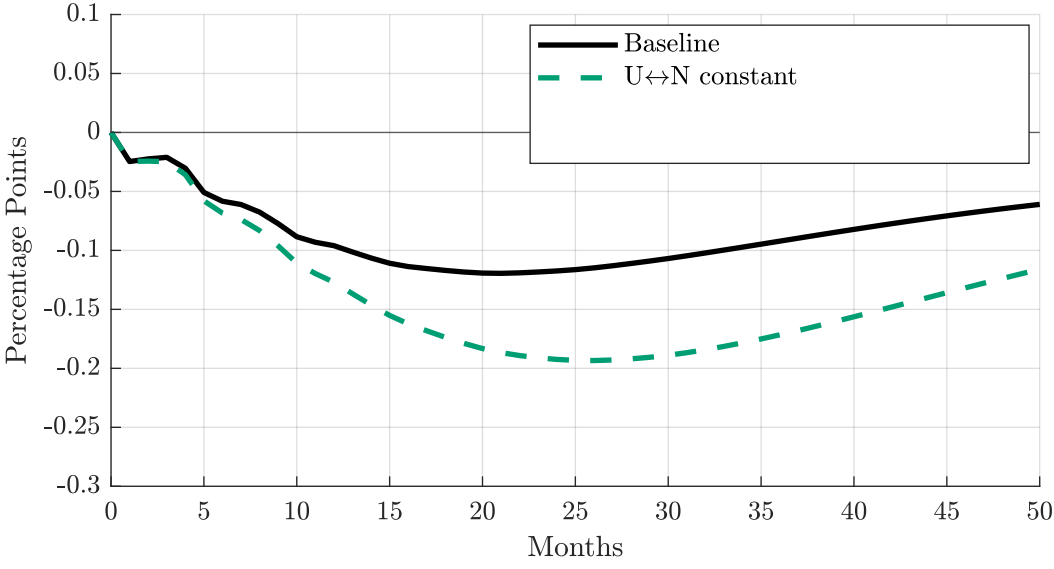
- Assess contribution of flow p_{XY} to stock Z by replacing $\{p_{XY}\}_t$ with steady-state value, $\tilde{p}_{XY}$
- Study behavior of resulting hypothetical stock $\check{Z}$ to isolate role of flow p_{XY}
- Can also study hypothetical stock from "shutting down" multiple flows

▸ In's and Out's of Employment ▸ In's and Out's of Unemployment ▸ In's and Out's of Participation

Decomposing Employment Response to a Monetary Policy Shock



Decomposing Employment Response to a Monetary Policy Shock



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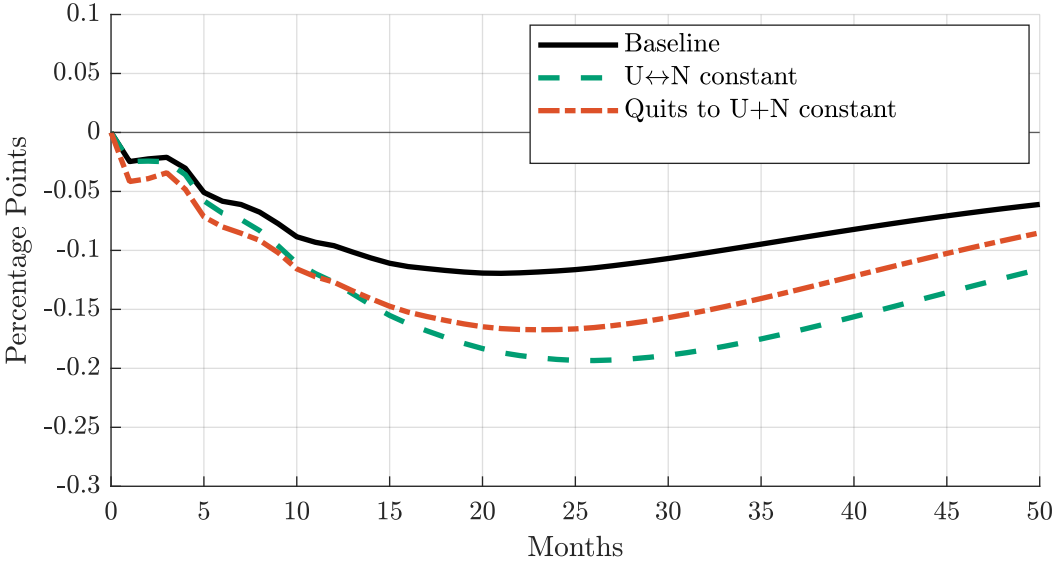

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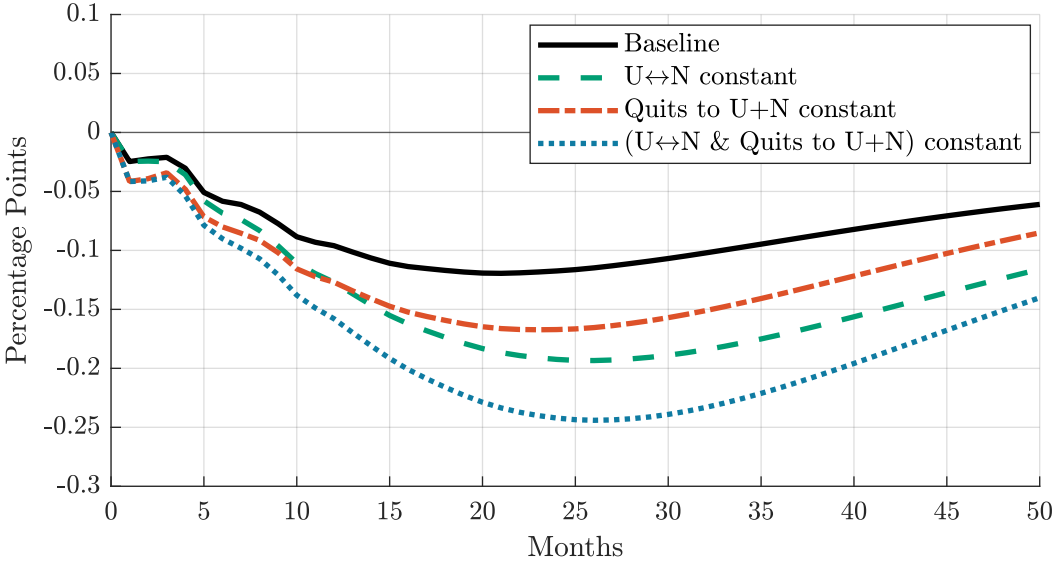

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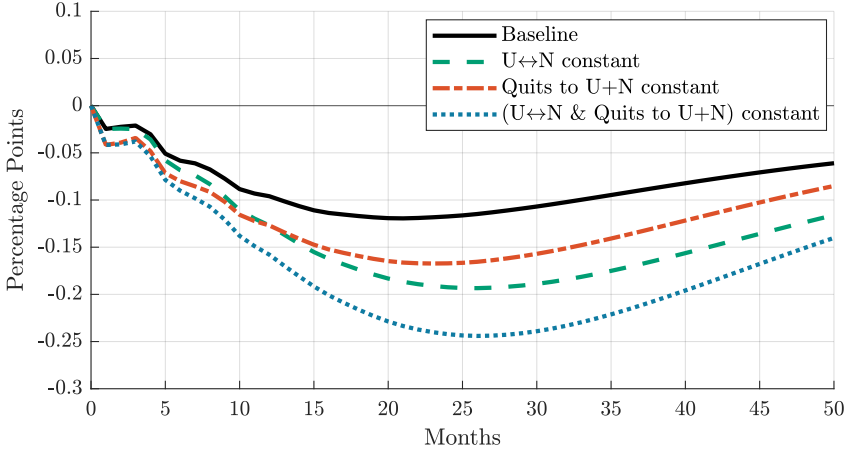


- Holding supply-driven flows fixed ⇒ Employment falls twice as much
- Next: use model to understand role of changes in household labor supply in determining response of supply-driven flows

▸ Controls for composition ▸ Participation ▸ Unemployment

Model

Model

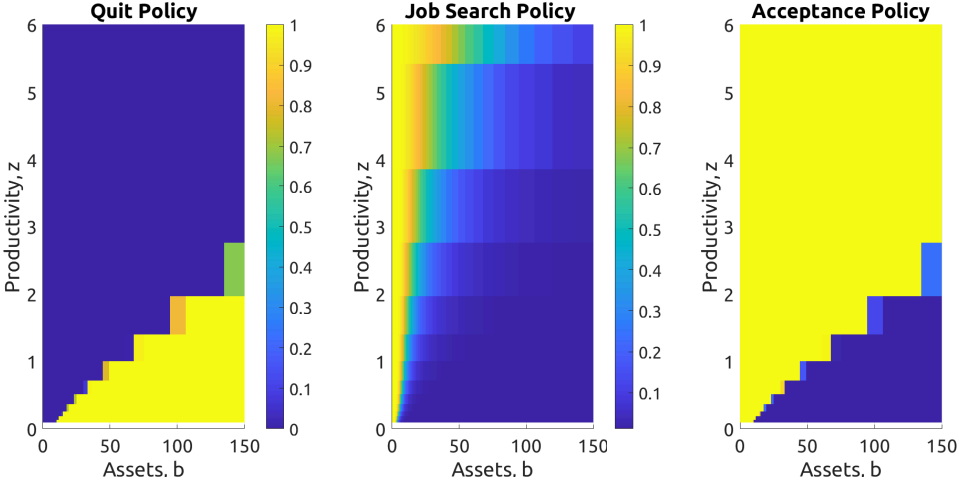
- Want to understand response of supply-driven labor flows in terms of household labor supply response to contractionary monetary policy shock
- Consider heterogenous agent model with labor market frictions + participation
  - E.g., Krusell et al (2017)
- Household adjust consumption/savings and employment policies (endogenous) to variation in policy rates, job-finding probability, and layoffs (exogenous)
  - Interpret model as labor supply block of NK model, à la Alves and Violante (2023)
- Estimate key model parameters to match overall response of labor flows to surprise monetary tightening
- Model fit achieved through broad-based increase in household labor supply

Environment

- Infinitely-lived households value consumption and leisure
- Households are heterogeneous in assets, (stochastic) labor productivity, and labor market status
- Households self-insure against employment risk (job-finding & job-destruction) + changes in labor productivity, subject to borrowing constraint
- In addition to consumption/savings, households choose labor market behavior:
  - Employed receive (fixed) piece wage in labor productivity, choose whether to quit
    - Enjoy less leisure if working
  - Non-employed receive UI (if eligible) + basic income, choose search/acceptance
    - Search increases probability of receiving job offer, but costly in leisure
    - Nonparticipants may receive unwanted job offers

Timing Bellman equations

Labor market policy functions

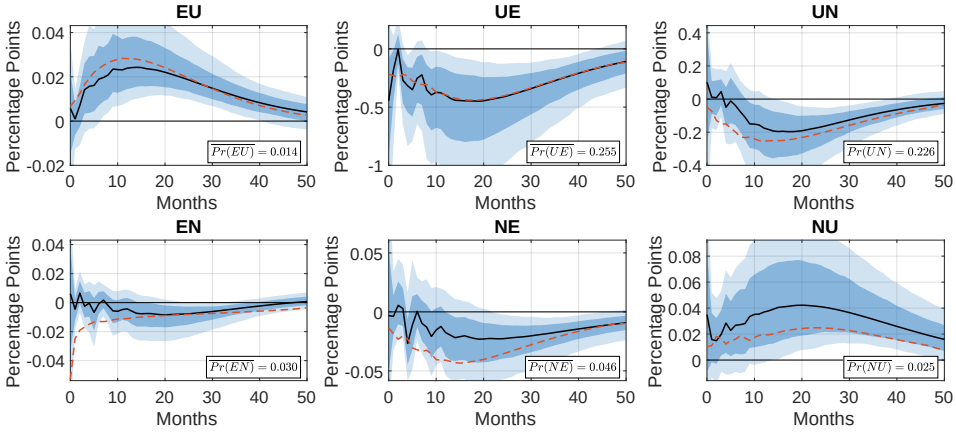


- Substantial variation in attachment to employment across state space
- Assets ↑ & productivity ↓ ⇒ more likely to quit, less likely to search (or accept)

Estimation

- Estimate household response to labor market impact of surprise tightening
- Feed in response of job-finding rates, layoff rates, and real interest rates from contractionary monetary policy shock
- Overall response of labor market flows also determined by endogenous changes in policy functions + distribution of households across labor market states
- Choose model parameters to match response of labor market flows, à la CEE

Model fit



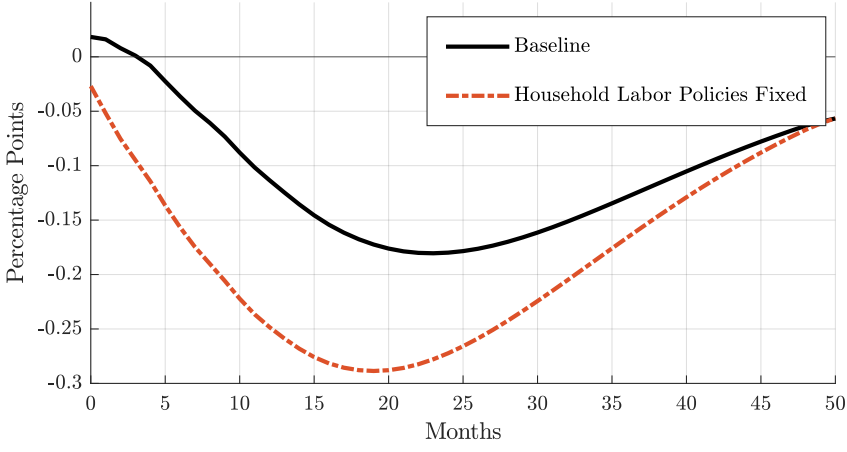
- Labor market flows from model (red lines) largely fall within 90% CI's
- Model fit achieved through change in composition + change in policy functions

▸ Externally calibrated parameters ▸ Internally calibrated parameters

Evaluation

- Ability of model to match response of labor market flows could reflect endogenous changes in composition or household labor supply
- For example, decrease in UN flows could reflect
  - Greater mass of "likely searchers" in non-employment, or
  - Higher propensity to search for employment of all workers
- To assess relative importance of two channels, simulate model holding labor supply policy functions at steady state
  - If changes in labor supply do not matter, employment should be unaffected
- Finding: Employment drops by additional $\approx 60\%$
  - Indicates broad-based increase in labor supply to surprise tightening

Counterfactual response of employment



- Results consistent with broad-based increase in labor supply

Conclusion

Conclusion

- Estimate substantial response of supply-driven labor market flows to contractionary monetary policy shock
- Holding supply-driven flows at steady state, fall in employment doubles
- Use heterogenous agent model with frictional labor markets and participation margin to investigate relationship of household labor supply to labor market flows
- Model fit to labor flows achieved through broad-based increase in labor supply
- Empirical evidence + model findings consistent with important role of labor supply in monetary transmission mechanism

Extra Slides

Transition Probabilities Across Labor Market States

Average Transition Probabilities, 1978–2019

	To		
From	*E*	*U*	*N*
E	0.956	0.014	0.030
U	0.255	0.519	0.226
N	0.046	0.025	0.929

Cyclicality of Labor Market Flows

	p_{EU}	p_{EN}	p_{UE}	p_{UN}	p_{NE}	p_{NU}
mean	0.014	0.030	0.255	0.226	0.046	0.025
std(x)/std(Y)	5.19	2.46	5.69	4.14	3.00	5.22
corr(x, Y)	−0.83	0.49	0.78	0.71	0.65	−0.68

Note: x denotes the variable in each column, Y denotes HP-filtered log real GDP. Standard deviations and correlations in the second and third rows are computed for HP-filtered quarterly averages.

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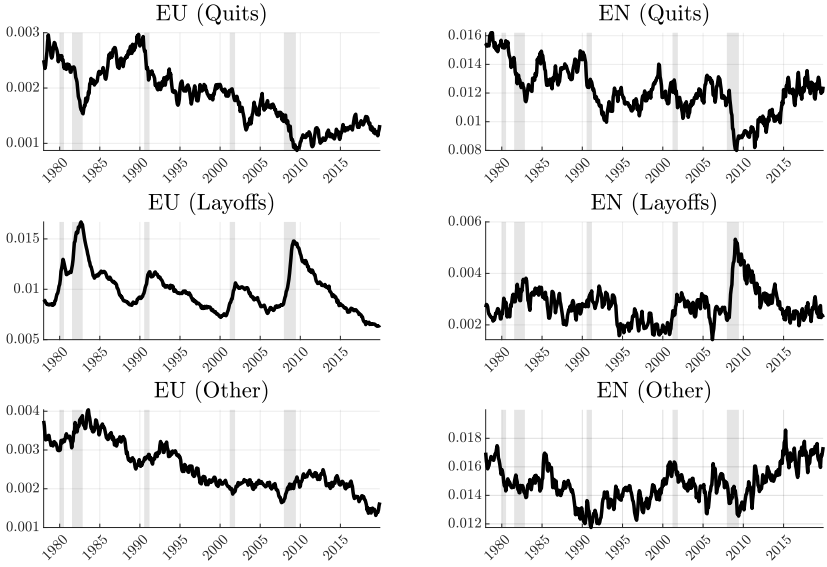
Decomposition of EU Flows



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Relevance of Distinction Between Quits and Layoffs

Post-EU Transition Rates: Quits vs Layoffs

	To		
From	E	U	N
E−U(Quit)	0.454	0.403	0.143
E−U(Fire)	0.362	0.541	0.097

Note: Transition rates are shown for individuals that are in their first month of unemployment following an employment spell, split by reason for unemployment.

Relevance of Distinction Between Quits and Layoffs

Post-EN Report: Quits vs Layoffs

	Average Probability
Want Job | E-N(Quit)	0.224
Want Job | E-N(Fire)	0.528
NE | Want Job	0.154
NE | Do Not Want Job	0.041

Note: The top section shows the probability that individuals want a job, split by the reason for leaving to nonparticipation. The bottom section shows the probabilities of moving to employment, split by whether or not nonparticipants report wanting a job.

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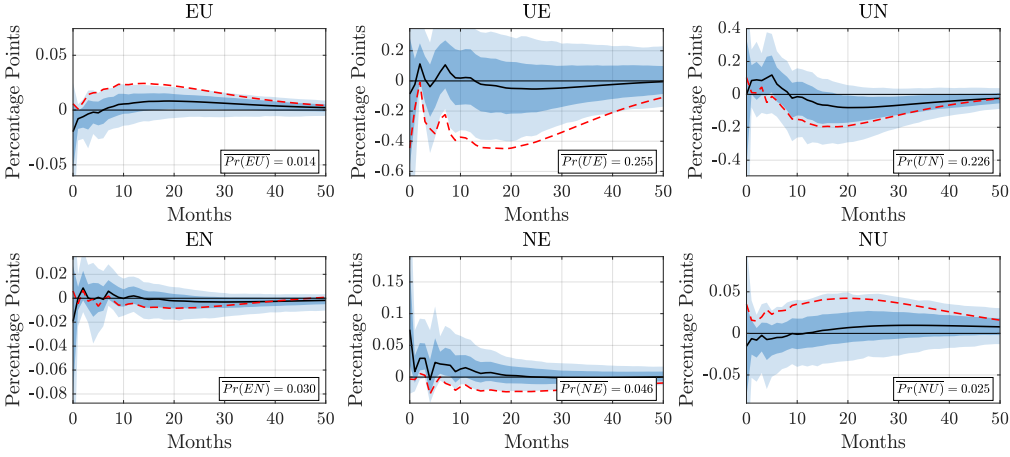
Labor Market Flows: No Speeches (Not Orthogonalized)



Robust F-statistic from Baseline VAR: 9.30

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

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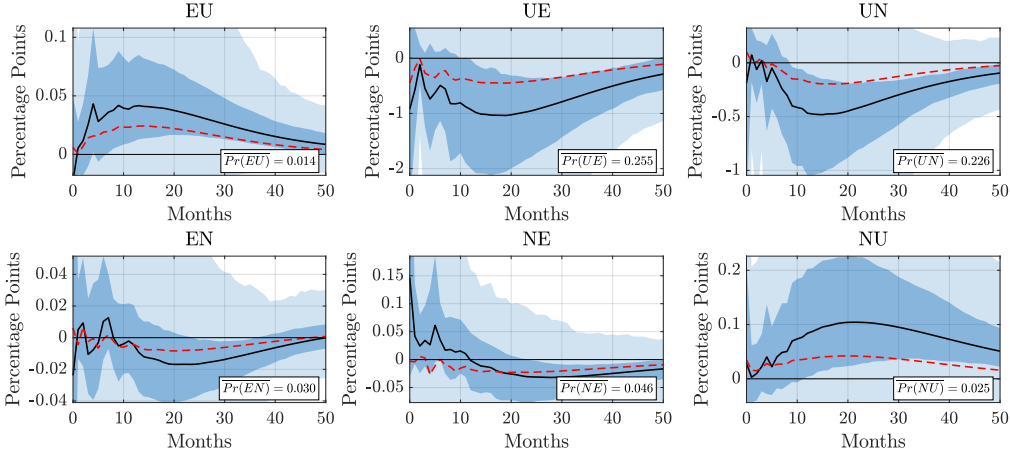
Labor Market Flows: No Speeches (Orthogonalized)



Robust F-statistic from Baseline VAR: 0.48

- From announcements only, orthogonalized as in Bauer & Swanson (2023)
- Very low first-stage F-stats/weak instrument → large confidence intervals

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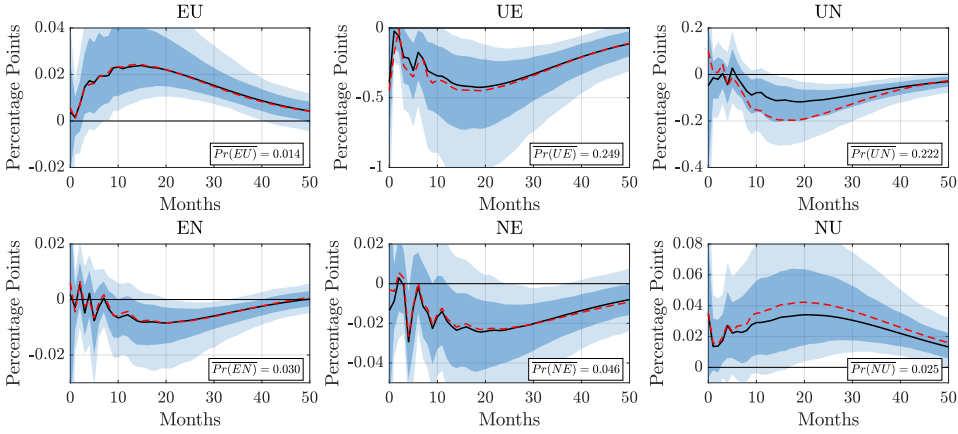
Labor Market Flows: Holding Composition Fixed



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

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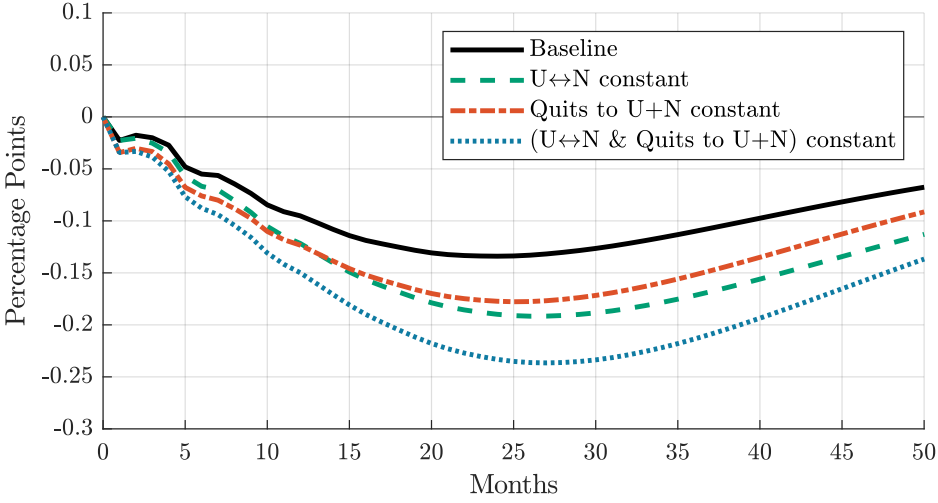
Decomposing Employment Response: Holding Composition Fixed



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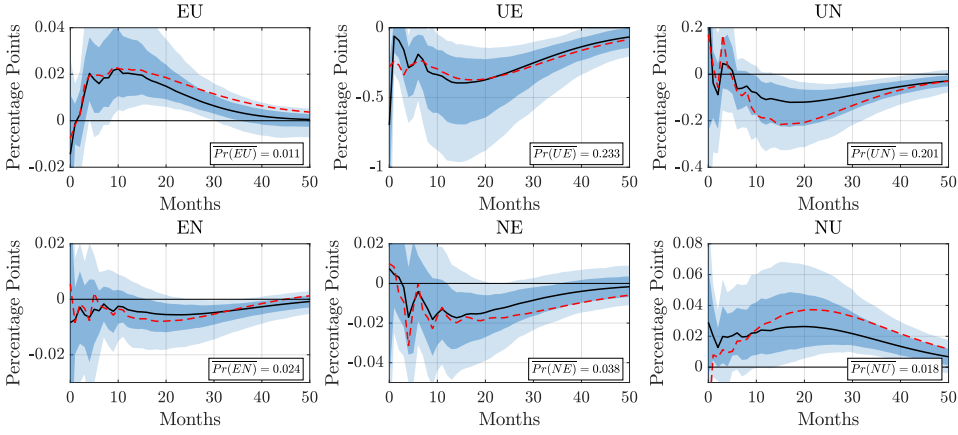
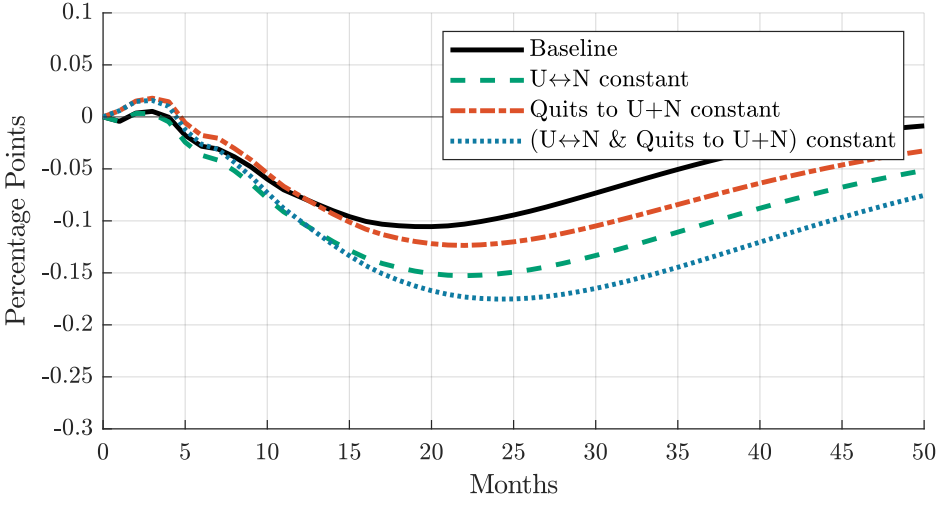
Labor Market Flows: Holding Composition Fixed (Full Controls)



- Composition-adjusted flows by ex-ante characteristics, à la Elsby et al. (2015)
- Fix shares using bins for age × gender × education × reason for unemployment × labor market status one year ago

Decomposing Employment Response: Composition Fixed (Full Controls)



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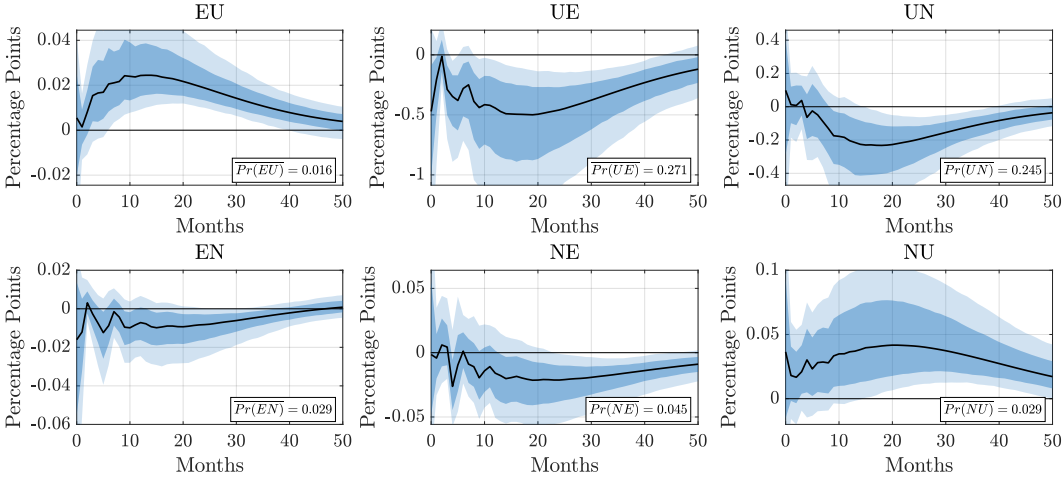
Labor Market Flows: Corrected for Time-Aggregation



Robust F-statistic from Baseline VAR: 13.05

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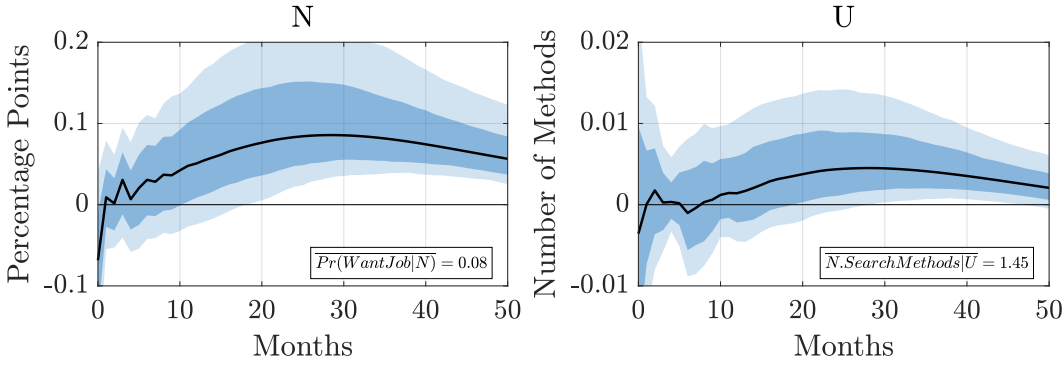
Intensive Margins of Labor Supply

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

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



Robust F-statistic from Baseline VAR: 13.05

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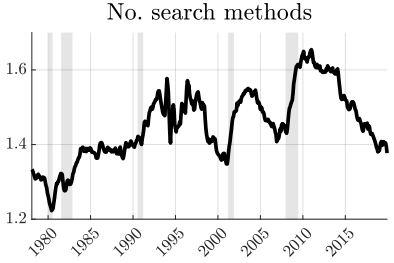
Intensive Margins: Time-Series



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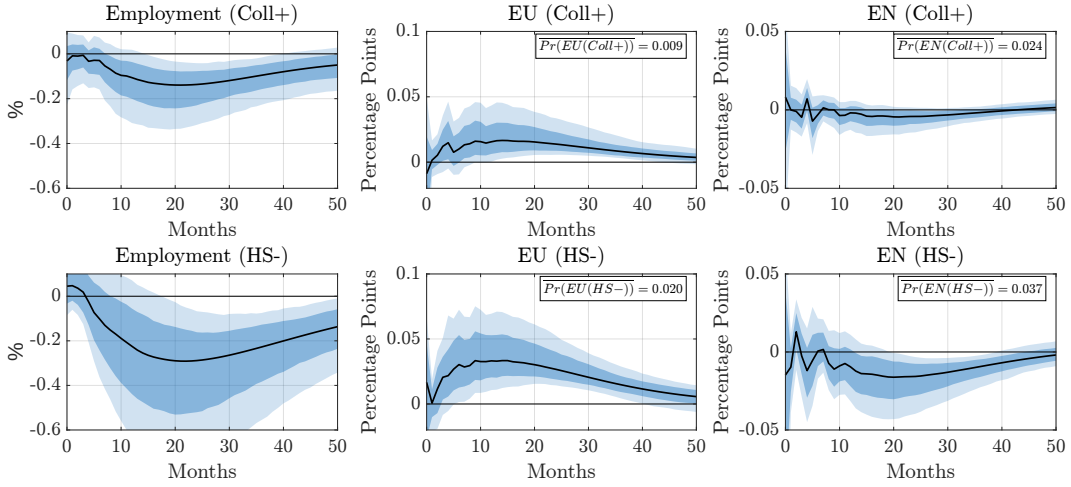
Heterogeneity in Labor Market Responses: Education



Robust F-statistic from Baseline VAR: 13.05

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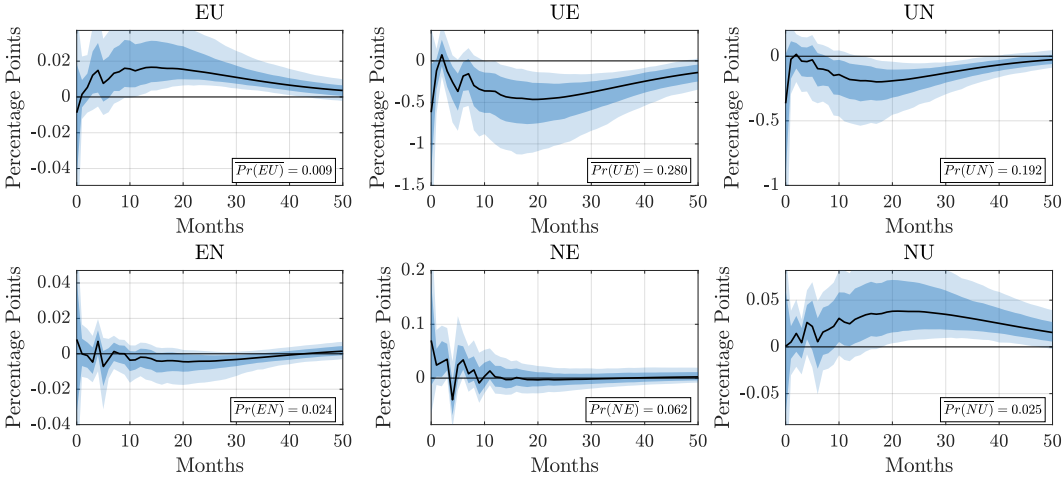
Labor Market Flows: Higher-Educated



Robust F-statistic from Baseline VAR: 13.05

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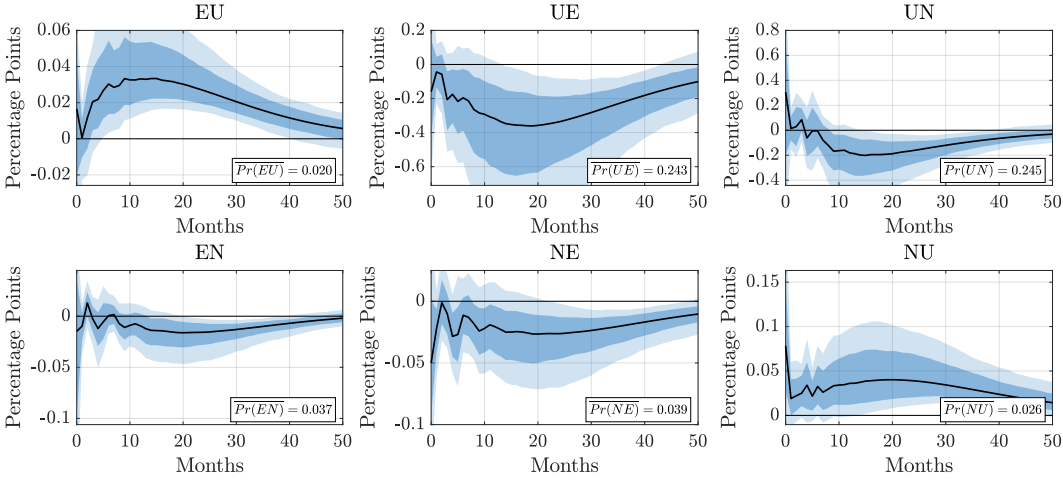
Labor Market Flows: Lower-Educated



Robust F-statistic from Baseline VAR: 13.05

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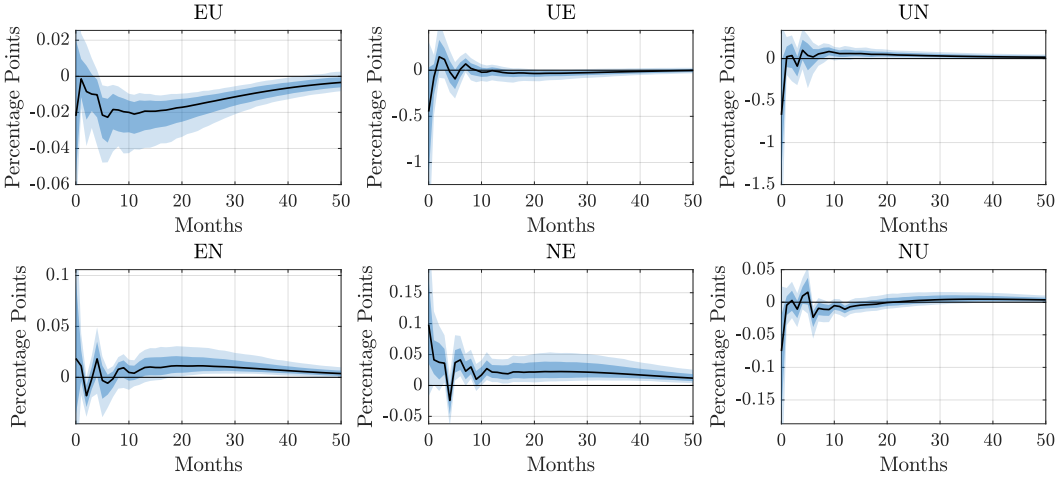
Labor Market Flows: Higher-Educated - Lower-Educated



Robust F-statistic from Baseline VAR: 13.05

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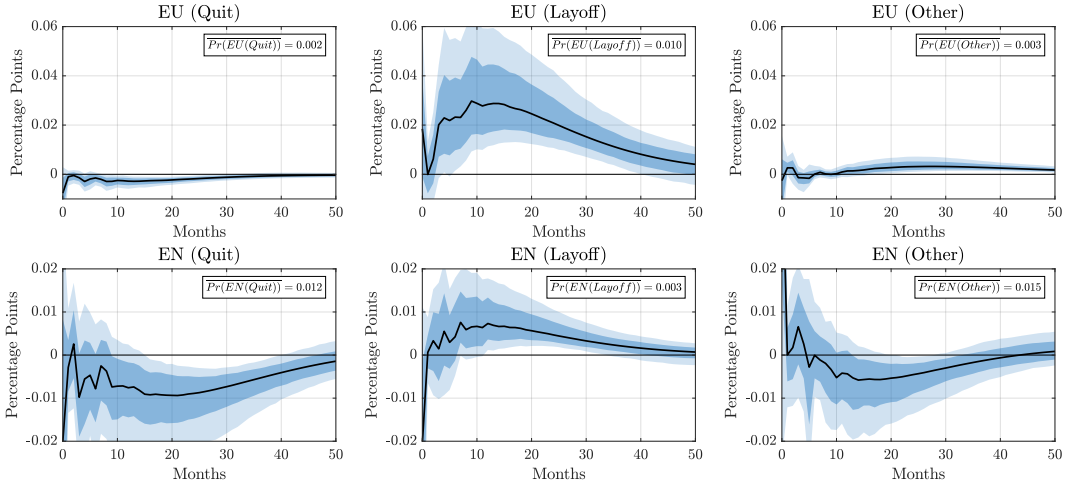
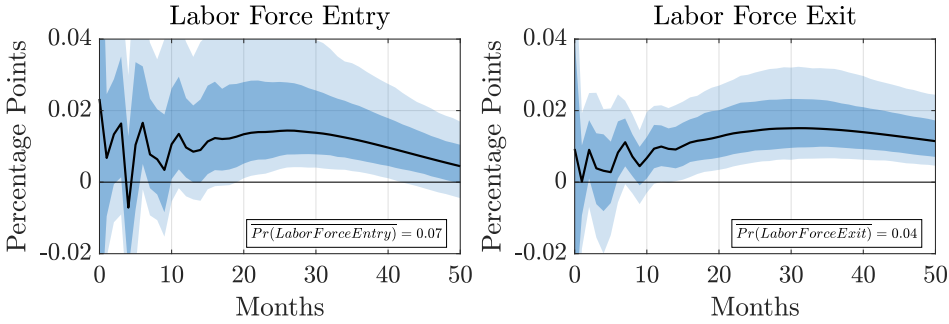
Response of EU & EN Flows: Quits vs Layoffs



Robust F-statistic from Baseline VAR: 13.05

- Heightened layoffs explains increase in EU flows
- Lower quits explains fall in EN flows

Response of exit and entry to surprise monetary contraction



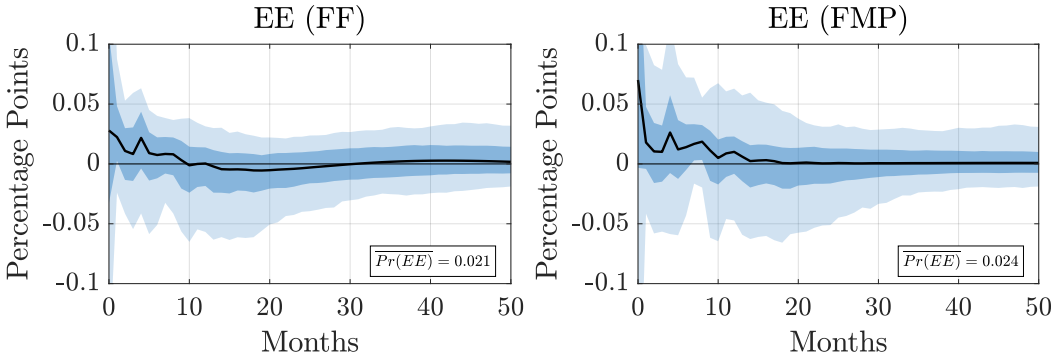
Robust F-statistic from Baseline VAR: 13.05

- Decline in participation comes through exit, offset by entry
- Increase in exits driven by u_t, attenuated by EN_t and UN_t

$$\widehat{\text{Entry}}_t = \omega_e \cdot \widehat{NU}_t + (1 - \omega_e) \cdot \widehat{NE}_t$$

$$\widehat{\text{Exit}}_t = \omega_x \cdot \left(\frac{\widetilde{UN} - \widetilde{EN}}{\widetilde{UN}} \right) \cdot \widehat{u}_t + \omega_x \cdot \widehat{UN}_t + (1 - \omega_x) \cdot \widehat{EN}_t$$

Response of Job-to-Job 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"

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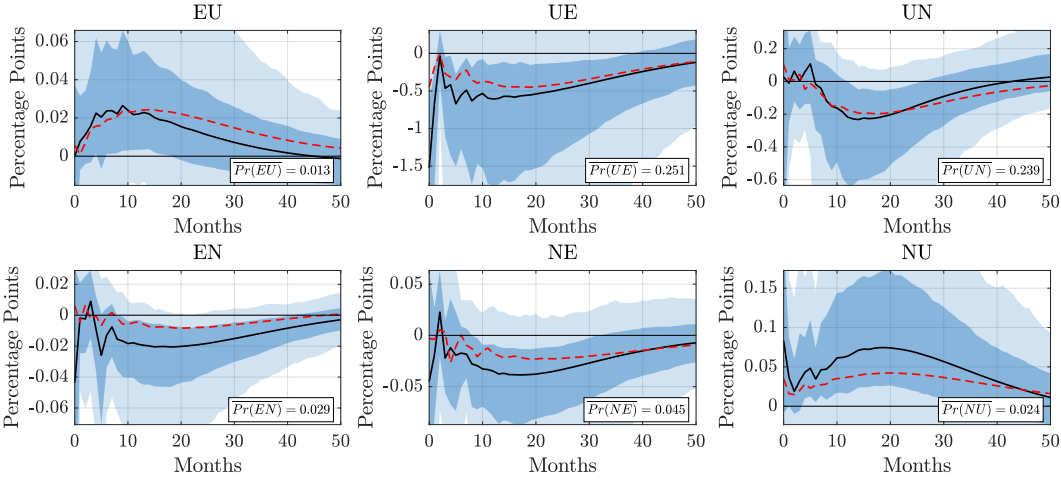
Response of Labor Market Flows (1995-2019)



Robust F-statistic from Baseline VAR: 5.44

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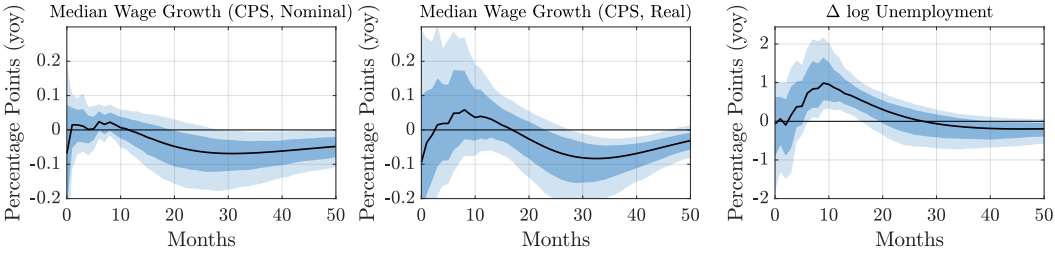
Response of Wages and Unemployment



Robust F-statistic from Baseline VAR: 13.05

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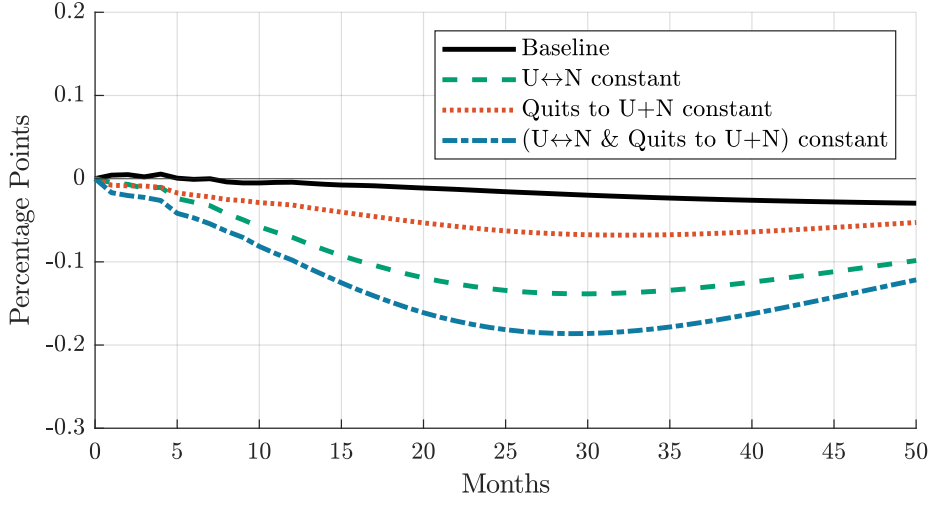
Participation Response to a Monetary Policy Shock



- With response of supply-driven flows fixed ⇒ Participation far more procyclical

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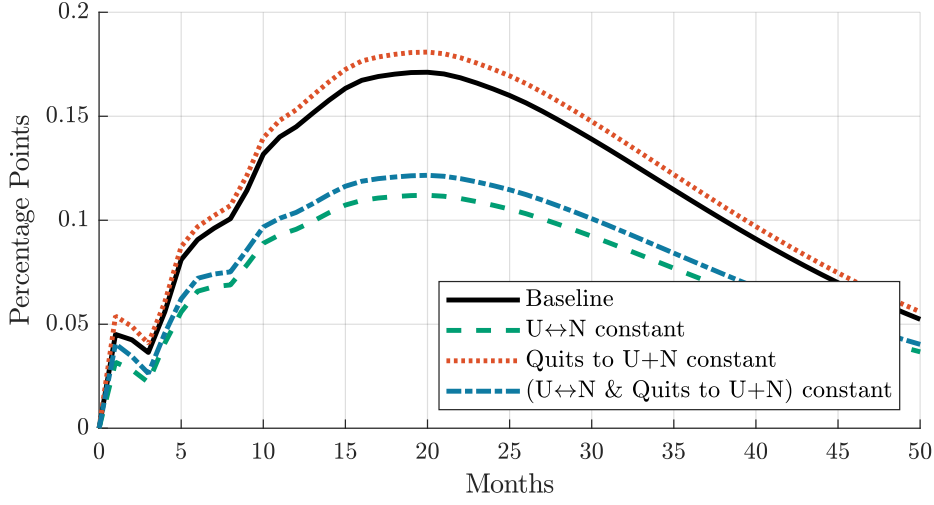
Unemployment Response to a Monetary Policy Shock



- Response of quits not important for unemployment dynamics

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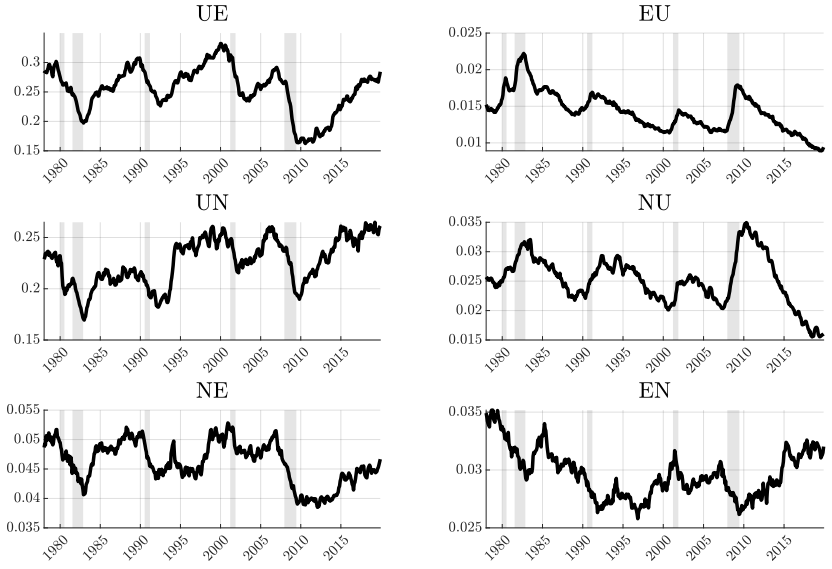
Time Series of Labor Market Flows



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New Decomposition of Flows From Employment to Non-Employment

- Previous work: EU flows dominated by layoffs (Elsby et al. 2009, Ahn, 2023)

	Total	Quits	Layoffs	Other
mean	0.014	0.002	0.010	0.003
std(x)/std(Y)	5.19	8.11	7.39	5.44
corr(x, Y)	−0.83	0.60	−0.85	−0.30

Note: x denotes the variable in each column, Y denotes HP-filtered log real GDP. Standard deviations and correlations are computed for HP-filtered quarterly averages.

- This paper: EN flows show larger role for quits

	Total	Quits	Layoffs	Other
mean	0.030	0.012	0.003	0.015
std(x)/std(Y)	2.46	5.88	14.42	4.80
corr(x, Y)	0.49	0.53	−0.44	0.25

Note: x denotes the variable in each column, Y denotes HP-filtered log real GDP. Standard deviations and correlations are computed for HP-filtered quarterly averages.

Times Series of Decomposed EU and EN | Economic Significance of Quits and Layoffs

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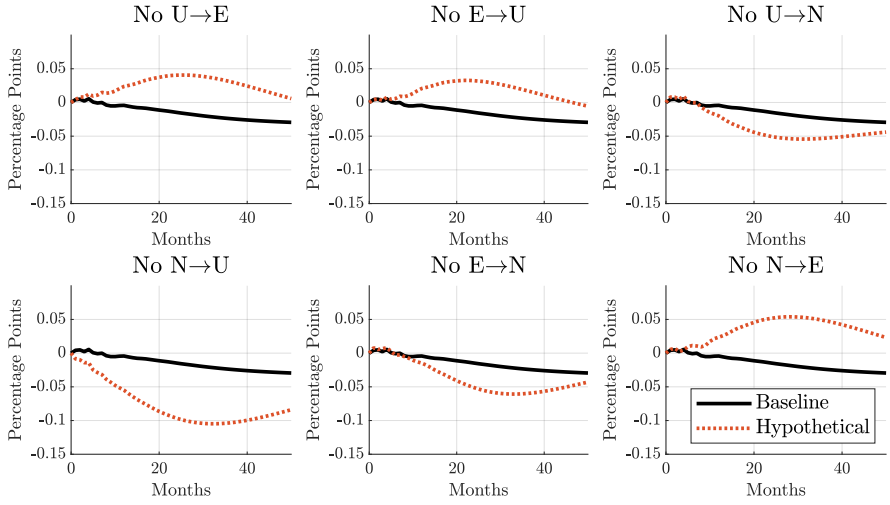
The Ins and Outs of Participation



- E→U and U→E are important for participation cycle

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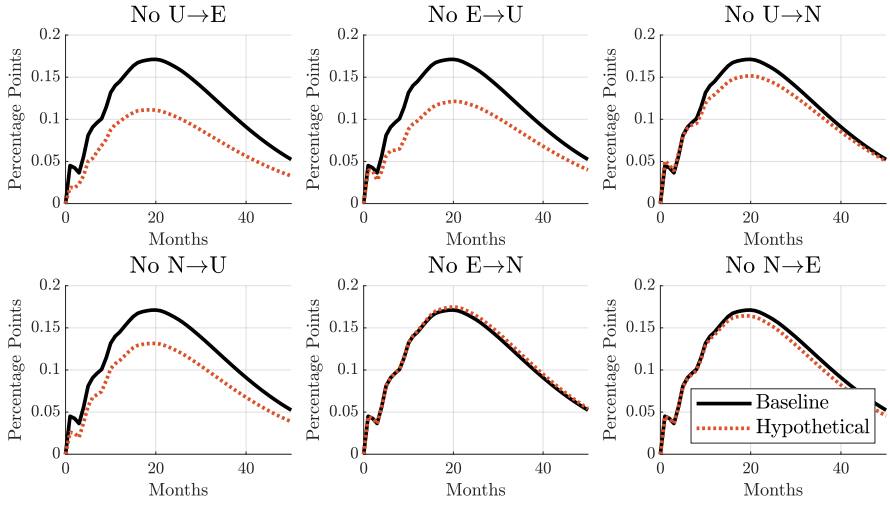
The Ins and Outs of Unemployment



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

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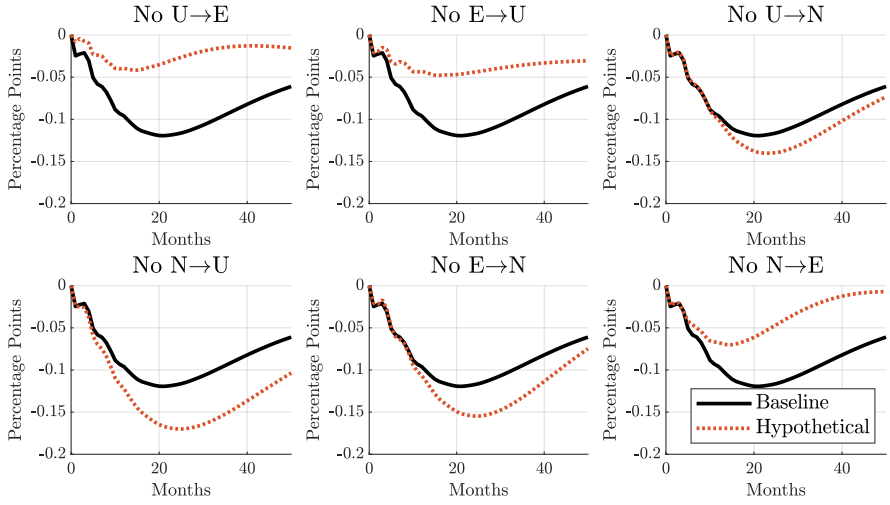
The Ins and Outs of Employment



- N→U more important than U→N for supporting employment

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Timing

Within a period, timing is as follows:

1. Agents make consumption/saving decisions
2. Employed agents decide whether or not to quit their job. Non-employed agents decide whether to search.
3. If employed agents do not quit endogenously, they may separate exogenously (either as a "quit", which is ineligible for UI, or a "layoff", which is eligible for UI)
4. Non-employed agents may receive a job offer. If they do, they can decide whether to accept or reject it

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Value Functions

Let V^E, V^{UI}, and V^N denote the value of employed, UI-eligible non-employed, and UI-ineligible non-employed:

$$V^E(b,z) = \max_{c,b',q} u(c) + \beta \left(q \cdot \mathbb{E}V^N(b',z') + (1-q) \cdot \mathbb{E}V^{NQ}(b',z') \right)$$

subject to

$$c + b' = Rb + wz, \;\; b' \geq 0$$

$$q \in \{0,1\}$$

$$\log z' = \rho_z \log z + \epsilon'_z$$

$$V^{NQ} = \delta^Q V^N + (1-\delta^Q)(\delta^L_t V^{UI} + (1-\delta^L_t)V^E)$$

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Value Functions

Let V^E, V^{UI}, and V^N denote the value of employed, UI-eligible non-employed, and UI-ineligible non-employed:

$$V^{UI}(b,z) = \max_{c,b',s,a} u(c) + (1 - s \cdot \kappa)\psi$$
$$+ \beta \Bigg[(1 + s \cdot \alpha) f \cdot \Big[a \cdot \mathbb{E} V^E(b',z') + (1-a) \cdot \Big(\delta^{UI} \cdot \mathbb{E} V^N(b',z') + (1-\delta^{UI}) \mathbb{E} V^{UI}(b',z') \Big) \Big]$$
$$+ (1 - (1 + s \cdot \alpha) f) \Big(s(1-\delta^{UI}) \cdot \mathbb{E} V^{UI}(b',z') + \Big((1-s) + s\delta^{UI}) \Big) \cdot \mathbb{E} V^N(b',z') \Big) \Bigg]$$

subject to

$$c + b' = Rb + \min\left\{ \phi w z, \bar{UI} \right\}, \; b' \geq 0,$$

$$s, \; a \in \{0,1\}$$

$$\log z' = \rho_z \log z + \epsilon'_z$$

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Value Functions

Let V^E, V^{UI}, and V^N denote the value of employed, UI-eligible non-employed, and UI-ineligible non-employed:

$$
\begin{aligned}
V^N(b,z) = \max_{c,b',s,a} \; & u(c) + (1 - s \cdot \kappa)\psi \\
& + \beta \Big[(1 + s \cdot \alpha) f \cdot \Big[a \cdot \mathbb{E} V^E(b', z') + (1 - a) \cdot \mathbb{E} V^N(b', z') \Big] \\
& + (1 - (1 + s \cdot \alpha) f) \mathbb{E} V^N(b', z') \Big] \\
& \text{subject to} \\
& c + b' = Rb + T, \;\; b' \geq 0 \\
& s, \;\; a \in \{0, 1\} \\
& \log z' = \rho_z \log z + \epsilon'_z
\end{aligned}
$$

Externally calibrated parameters

Parameter	Description	Value	Target
β	Discount factor	0.992	10% Annual
R	Steady state real interest rate	1.00	Standard value
γ	CRRA	2	Standard value
δ^{UI}	Benefit exhaustion	0.1	10% exhaust each month
w	Wage	1	Normalization
α	Efficiency of active search	0.4	UE vs NE|Want Job
ϕ	Replacement rate	0.4	Dept. of Labor
$\bar{UI}$	Maximum UI payments	$\frac{2}{3}\bar{z}$	Dept. of Labor
T	Minimum transfer payment	0.01	Small

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Internally calibrated parameters

Parameter	Description	Value
f	Steady state job-finding probability	0.27
δ_Q	Exogenous quit probability	0.007
δ_Q	Exogenous layoff probability	0.016
ρ_z	Persistence of worker productivity	0.972
σ_z	Standard deviation of worker productivity	0.22
ψ	Leisure cost of employment	0.74
κ	Leisure cost of search	0.39

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