The Labor Demand and Labor Supply Channels of Monetary Policy

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Federal Reserve Bank of Dallas

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- Study response of labor market flows to identified monetary policy shocks
  - Estimate impulse responses from proxy SVAR with HFI monetary policy shocks à la Gertler and Karadi (2015)
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- After contractionary monetary policy shock:
  - Heightened job-search by non-employed: U-to-N rate $\downarrow$ & N-to-U rate $\uparrow$
  - Quit rate to non-employment $\downarrow$
- Apply standard accounting framework: Response of employment twice as large holding supply-driven flows fixed

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- Estimate key model parameters to match response of labor market flows to contractionary monetary policy shock
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- Estimate key model parameters to match response of labor market flows to contractionary monetary policy shock
  - Study by feeding in responses for layoff rate, job-finding rate, interest rate and wages
- Model achieves close fit for aggregate labor market flows
- While also consistent with micro evidence on MPCs and MPEs
- Model implies quantitatively important, broad-based labor supply response: Fix labor supply policy functions at steady-state, employment falls ≈ 70% more

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    - E.g. Gali, Smets, and Wouters (2011), Broer et al (2020), Wolf (2023)
  - NK + search-and-matching $\Rightarrow$ labor supplied inelastically
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- This paper: New evidence that decline in employment from a contractionary monetary policy shock significantly attenuated by increase in labor supply
- Potentially relevant for understanding post-Covid period: large fiscal transfers to households, quits $\uparrow$, labor force participation $\downarrow$, inflation $\uparrow$

Related Literature

Data & Methodology

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- Particular focus on response of supply-driven flows to monetary policy
  - Decision to search from non-employment, e.g. U-to-N and N-to-U
  - Quits to unemployment and nonparticipation (new!)

▸ Time Series ▸ Cyclical Properties

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(x)	0.014	0.002	0.008	0.004
std(x)/std(Y)	5.20	8.11	8.03	5.43
corr(x, Y)	−0.83	0.60	−0.83	−0.54

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.

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- This paper: EN flows show larger role for quits

	Total	Quits	Layoffs	Other
mean(x)	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 ▸ Robustness of EU and EN Decompositions

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

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- 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:

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

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

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  - Use 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
  - Avoids known issues of HFI estimation (e.g., Ramey 2016)
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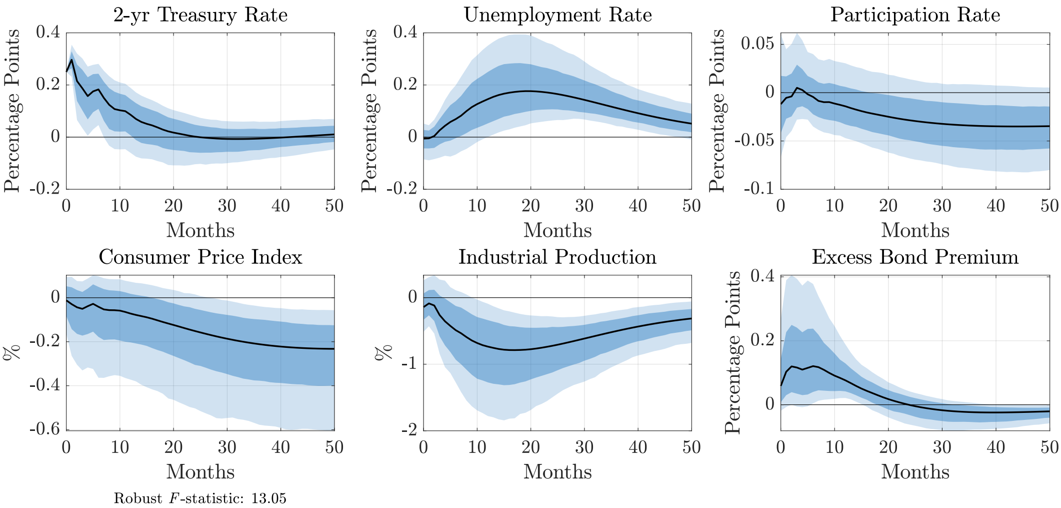
- Labor market flows added one-by-one to the main VAR

Estimates

Baseline VAR



- Monthly data, 1978:M1–2019:M12
- Dark and light shaded regions report **68%** and **90%** confidence intervals

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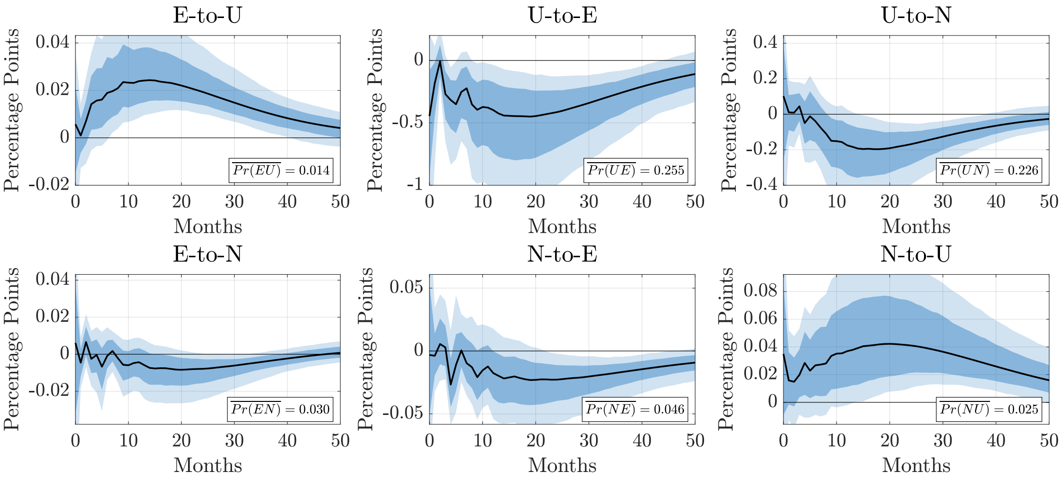

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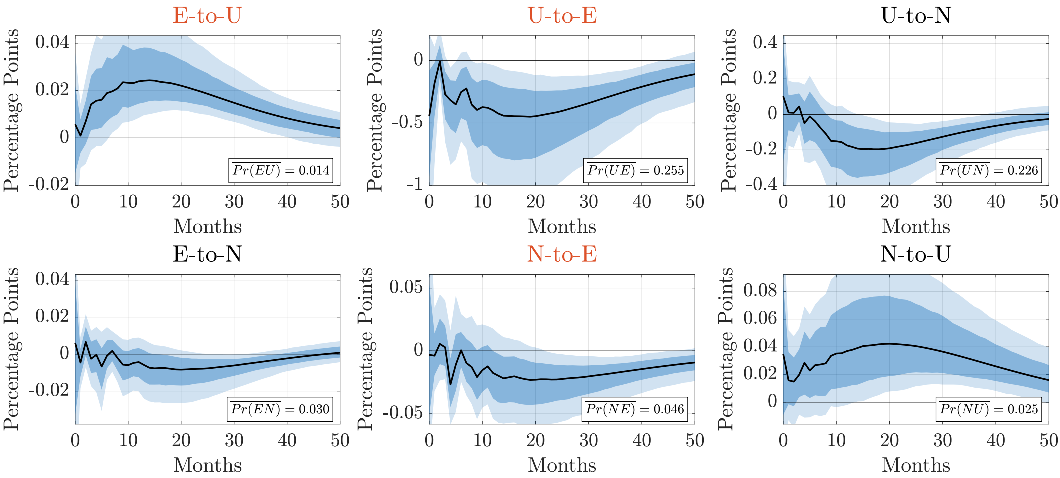

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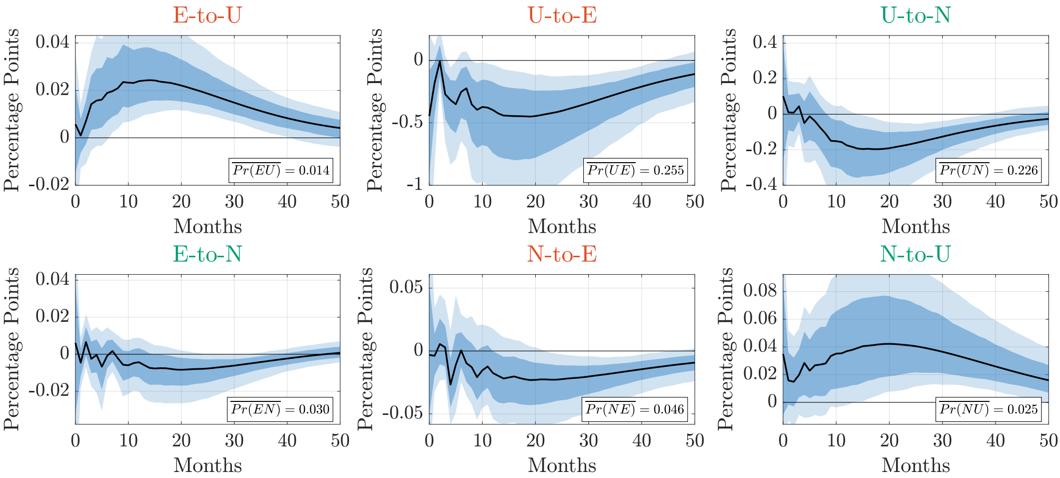

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- pNU ↑, pUN ↓, & pEN ↓ (via quits) ⇒ Consistent with increase in labor supply

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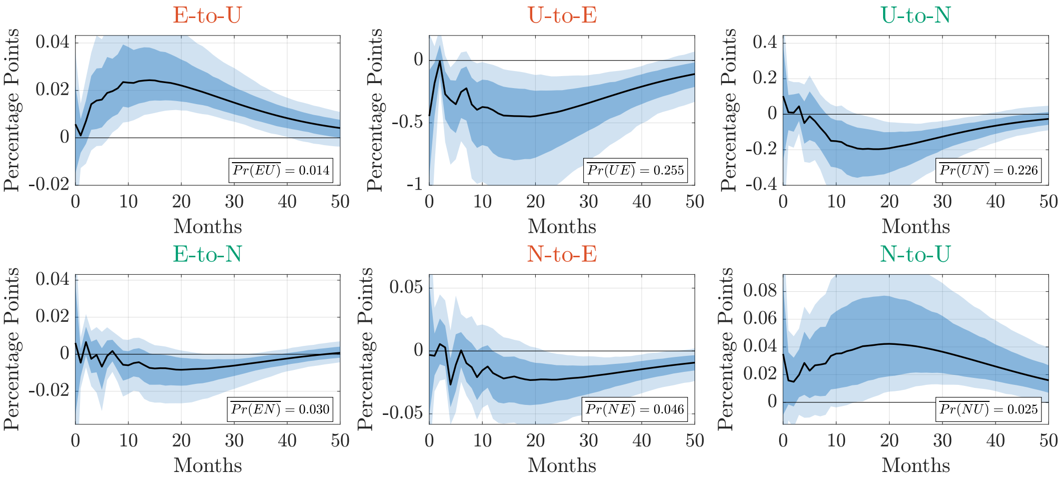

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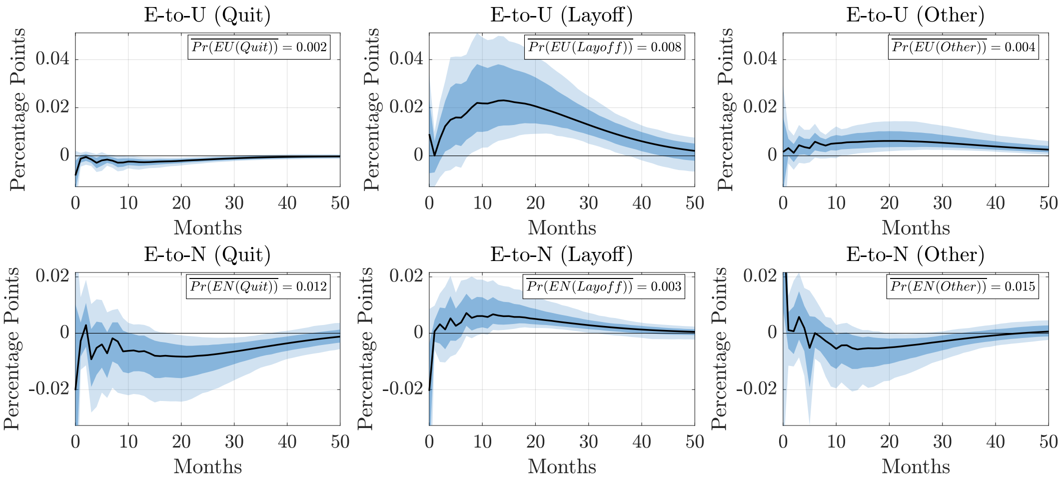
HFI with No Speeches · HFI with No Speeches, Orthogonalized

Response of EU & EN Flows: Quits vs Layoffs



- Increase in layoffs explains rise in EU rate
- Decline in quits explains fall in EN rate

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Using Flows to Account for Dynamics of Labor Market Stocks

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- Difference of hypothetical and actual response of employment reflects role of p_{NU}

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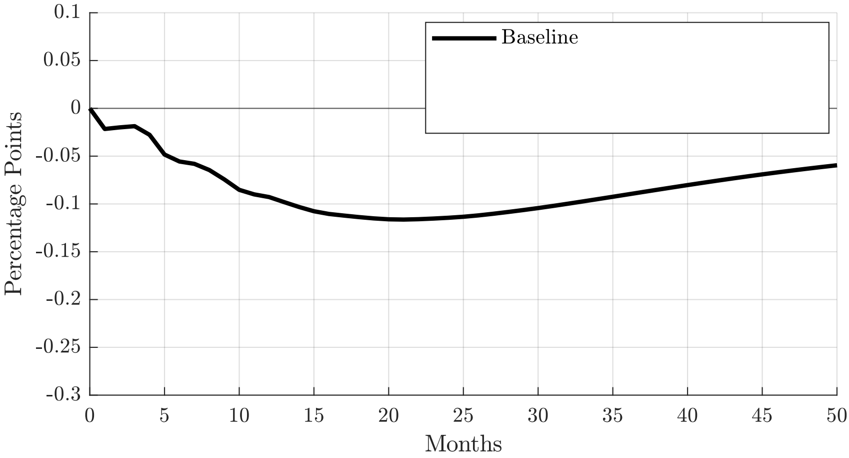
- Repeat for all supply-driven flows, in various combinations

▸ Ins and Outs of Employment ▸ Ins and Outs of Unemployment ▸ Ins and Outs of Participation

Decomposing Employment Response to a Monetary Policy Shock



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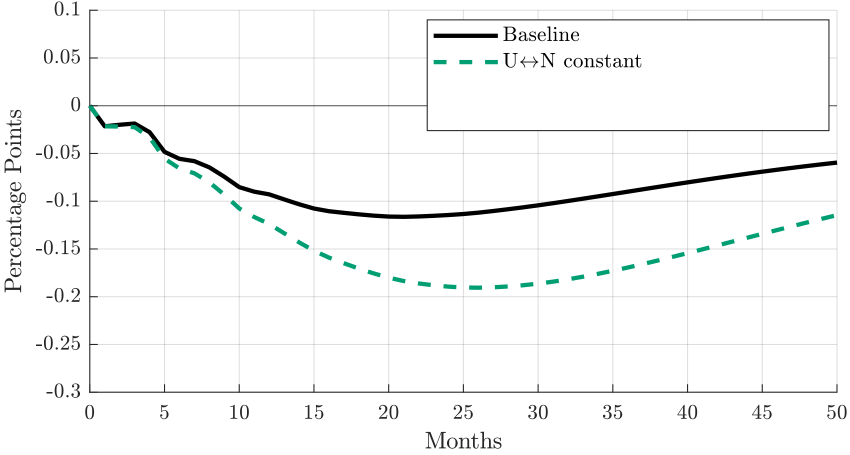

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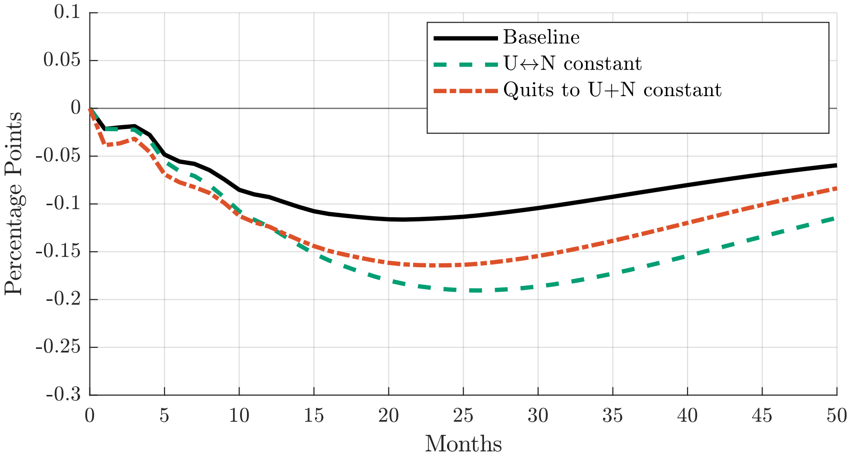

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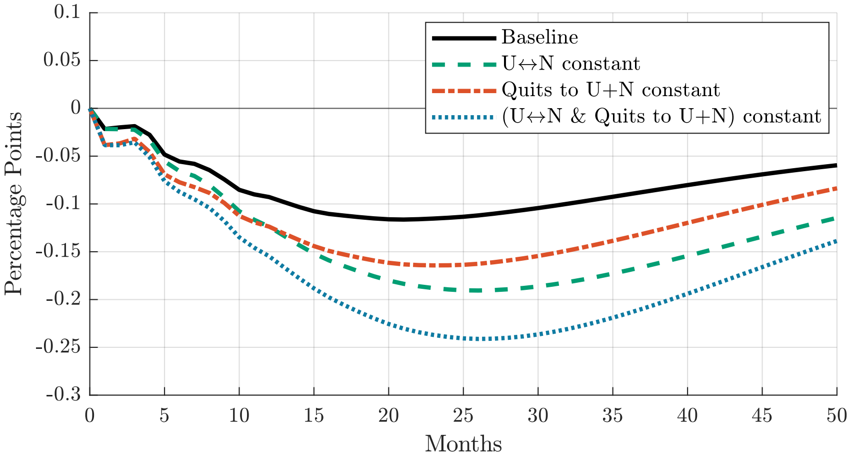

- Holding supply-driven flows fixed ⇒ Employment falls twice as much

▸ Controls for composition ▸ Participation ▸ Unemployment

Model

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- To answer, we study heterogeneous agent model with labor market frictions and endogenous participation à la Krusell et al (2017)
  - Households face employment risk (job-finding/layoff) + shocks to labor productivity
  - Choose consumption/savings and labor supply (quit, search, accept)
  - Employed may quit due to value of leisure
  - Nonemployed face iid search costs each period

Value Functions

Let $V_E(a, z)$, $V_U(a, z, \kappa)$, and $V_N(a, z, \kappa)$ represent the values of being employed, UI-eligible non-employed, and UI-ineligible non-employed:

Defined over

- a = assets
- z = idiosyncratic productivity: $\log z' = \rho_z \log z + \varepsilon_z$, $\varepsilon_z \sim N(0, \sigma_z^2)$
- κ = cost of job search, iid from logistic distribution: mean = μ_κ, scale = σ_κ

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$$V_E(a, z) = \max_{c, a'} \left\{ u(c) + \beta \max\{ \underbrace{\mathbb{E}\, V_N(a', z', \kappa')}_{\text{Quit}}, \underbrace{\mathbb{E}\big[\delta_L V_U(a', z', \kappa') + (1 - \delta_L) V_E(a', z')\big]}_{\text{Do Not Quit}} \} \right\}$$

subject to

$$c + a' = Ra + (1 - \tau) wz + T, \quad a' \geq 0$$

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where

$$\mathcal{V}_U^s(a',z) = f_s \cdot \max\overbrace{\{\mathbb{E}\, V_E(a',z'), \mathbb{E}\, \tilde{V}_U(a',z',\kappa')\}}^{\text{Accept or Reject Job Offer}} + (1-f_s)\,\mathbb{E}\,\tilde{V}_U(a',z',\kappa')$$

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$$\tilde{V}_U(a,z,\kappa) = \delta_{UI} V_N(a,z,\kappa) + (1-\delta_{UI}) V_U(a,z,\kappa).$$

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Timing

Estimation: A Monetary Policy Shock in the Model

- Feed in response of job-finding rate, layoff rate, real interest rates and wages from the data
- Overall response of labor market flows also determined by endogenous changes in policy functions + distribution of households across labor market states

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- Calibrate a number of parameters, $\theta_{EXT} \equiv \{\beta, \gamma, \bar{R}, \delta_{UI}, w, \alpha, \phi, \bar{\phi}, \tau, T\}$
  - Assume $u(c) = \frac{c^{1-\gamma}-1}{1-\gamma}$, $f_{ns} = \alpha f_s$

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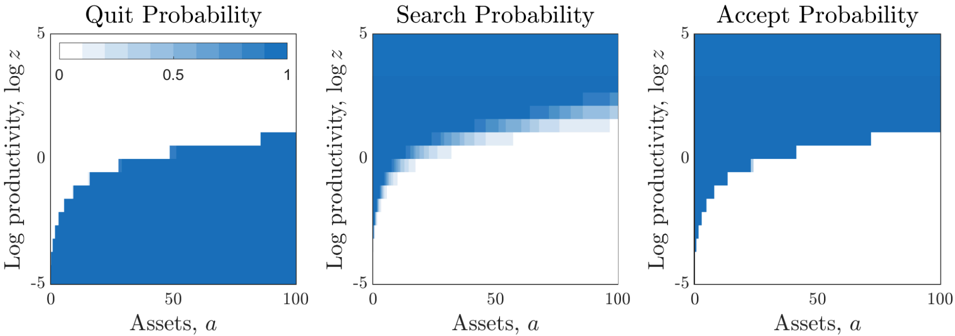
- Estimate remaining parameters to match IRFs of labor market flows
  - À la Christiano, Eichenbaum, Evans (2005) or Auclert, Rognlie, Straub (2020)

$$\theta_{EST} \equiv \{\rho_z, \sigma_z, \mu_\kappa, \sigma_\kappa, \psi, \delta_L, f_s\}$$
$$\hat{J} = \{EU_t, EN_t, UE_t, UN_t, NE_t, NU_t\}_{t=0}^{50}$$
$$\hat{\theta}_{EST} = \arg\min_{\theta_{EST}} (J(\theta_{EST}) - \hat{J})' \Sigma^{-1} (J(\theta_{EST}) - \hat{J})$$

Model parameters

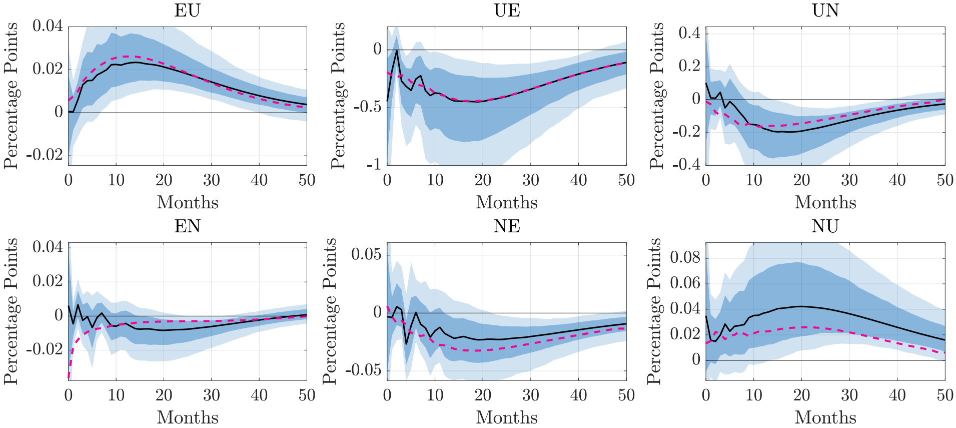
Results: Steady State



1. Model almost exactly fits steady-state transition rates between E, U and N
2. Heterogeneity in labor market attachment (e.g., quit, search, & accept prob's)
3. Model produces quarterly MPC of 7-8%, annual MPE of 2-3%

   In line with (recent) literature

Response of Labor Market Flows: Model vs Data



- Labor market flows from model (magenta lines) largely fall within 68% CI's

Response of Quits and Layoffs | Response of Labor Market Stocks

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- With lower job-finding rates, contractionary shock increases duration (and variance) of non-employment spells
  - Workers require more assets to smooth consumption across non-employment spells ⇒ fewer quits
  - At a given level of assets, lower consumption per period for non-employed ⇒ workers increase active search to escape non-employment
- More modest impact from changes in layoff rate, real wage, and real interest rate

Decomposition of IRFs in model

Evaluating the Role of Labor Supply

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Evaluating the Role of Labor Supply

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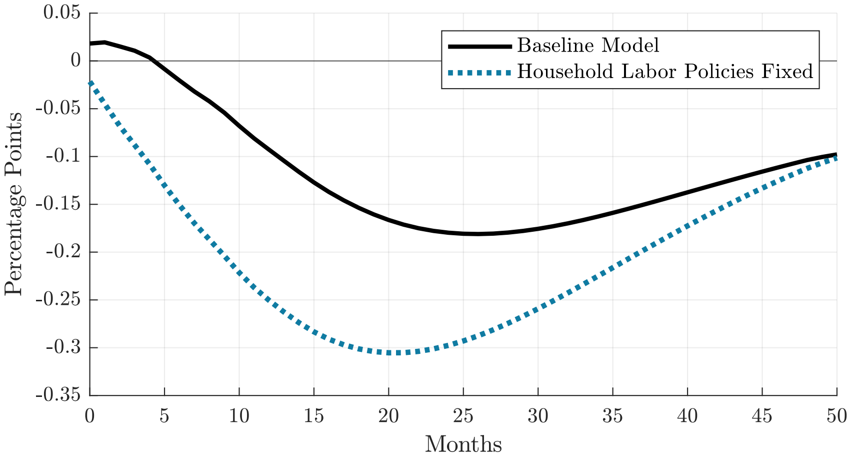
- For example, decrease in UN flows could reflect
  - Greater mass of "likely searchers" in non-employment, or
  - Higher propensity to search for employment of all workers
- To assess relative importance of two channels, simulate model holding labor supply policy functions at steady state
  - If changes in labor supply do not matter, employment should be unaffected

Evaluating the Role of Labor Supply: Employment Response



- Finding: Employment drops by additional $\approx 70\%$
  - Indicates broad-based increase in labor supply to contractionary monetary shock

Conclusion

Conclusion

- New evidence from labor market flows consistent with substantial increase in labor supply to a contractionary monetary policy shock
    - Increase in search activity + decline in quits to non-employment
    - Holding response of supply-driven flows constant, decline in employment doubles
- Interpret findings through estimated heterogenous agent model with frictional labor markets and participation margin
    - Model matches response of labor flows through broad-based increase in labor supply
- Empirical evidence + model findings consistent with important role of labor supply in monetary transmission mechanism
- Ongoing work: study labor supply response to Covid-era transfers (e.g., "Great Resignation") and evaluate role in for subsequent inflation

Thanks!

Cyclical Properties of Labor Market Stocks and Flows

Cyclicality of Labor Market Stocks

	Employment-Population Ratio	Unemployment Rate	Participation Rate
mean(x)	61.14	6.19	65.16
std(x)/std(Y)	0.72	8.25	0.23
corr(x, Y)	0.83	−0.85	0.35

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. The sample is 1978-2019.

Cyclicality of Labor Market Flows

	EU	EN	UE	UN	NE	NU
mean(x)	0.014	0.030	0.255	0.226	0.046	0.025
std(x)/std(Y)	5.20	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 are computed for HP-filtered quarterly averages. The sample is 1978-2019.

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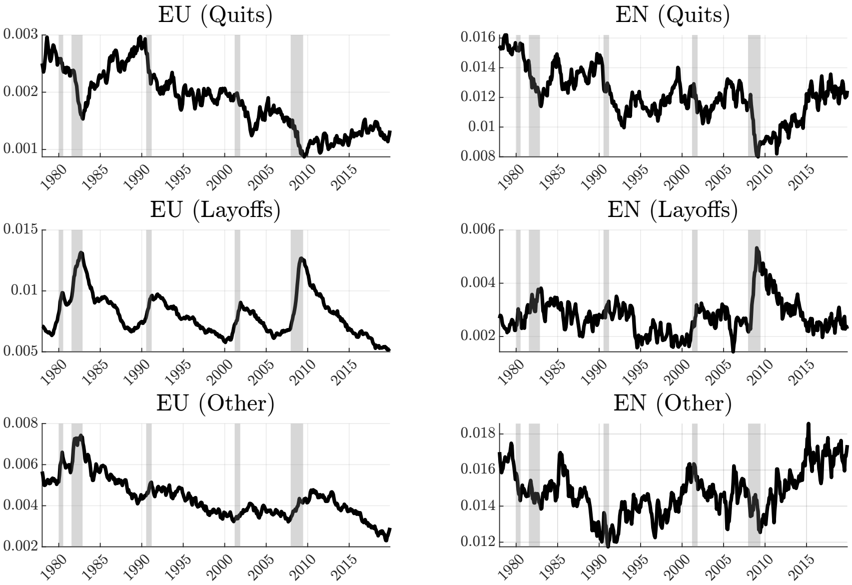
Decomposition of EU Flows



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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)	0.448	0.399	0.153
E – U(Layoff)	0.426	0.468	0.106

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

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Relevance of Distinction Between Quits and Layoffs

	Average Probability
Want Job | E-N(Quit)	0.224
Want Job | E-N(layoff)	0.528
NE |Want Job	0.152
NE | Do Not Want Job	0.039
NU | Want Job	0.177
NU | Do Not Want Job	0.013

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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Robustness of Quit/Layoff Distinction

Sequences of Reasons for U among E-U-U Individuals

Sample period	Pr(Quit |Layoff)	Pr(Layoff |Quit)
pre-Redesign	0.039	0.208
post-Redesign	0.007	0.026

Note: The first row shows the probability of individuals switching their reason for unemployment from layoff to quit (in the first column), or from quit to layoff (in the second column), prior to the 1994 CPS redesign. The second row shows the same, but for the period following the redesign.

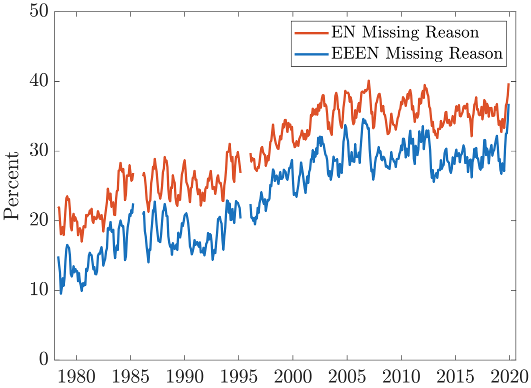
Transition Rates Across E-U-U Individuals

	From	*To* E	U	N
(*a*)	E – U(Quit) – U(Layoff)	0.339	0.553	0.108
(*b*)	E – U(Quit) – U(Quit)	0.343	0.536	0.121
(*c*)	E – U(Layoff) – U(Quit)	0.352	0.557	0.091
(*d*)	E – U(Layoff) – U(Layoff)	0.264	0.667	0.068

Note: Transition rates are shown for individuals that are in their second month of unemployment following an employment spell, split by reason for unemployment. The rates are computed for the period prior to the 1994 CPS redesign.

Back

Fraction of EN Transitions with Missing Reason



Note: The red line shows the proportion of individuals making an EN transition for which there is missing data on the reason for leaving the last job. The blue line shows the same calculation for individuals that were employed in each of the first three months before moving to nonparticipation. Series are smoothed using a centered 5-month moving average.

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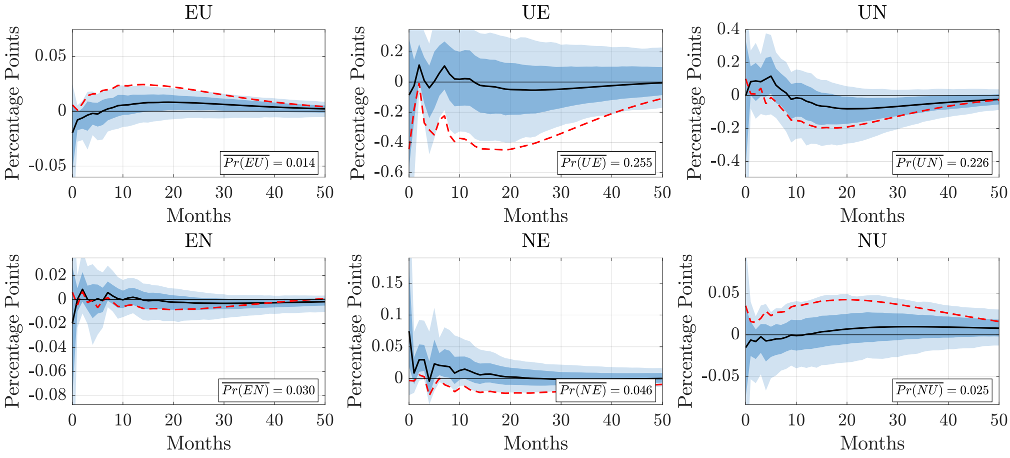
Labor Market Flows: No Speeches (Not Orthogonalized)



Robust F-statistic from Baseline VAR: 9.30

- High-frequency shocks from FOMC announcements only
- Dashed red lines report our baseline estimates

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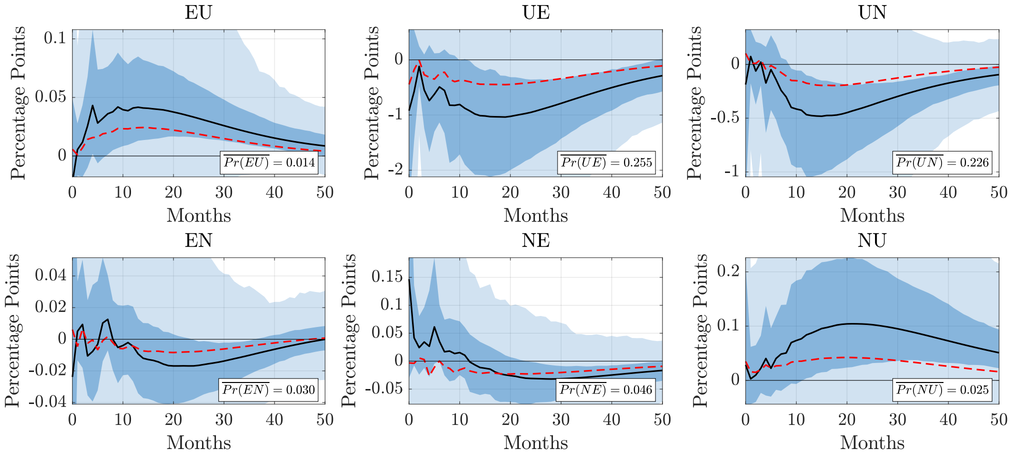
Labor Market Flows: No Speeches (Orthogonalized)

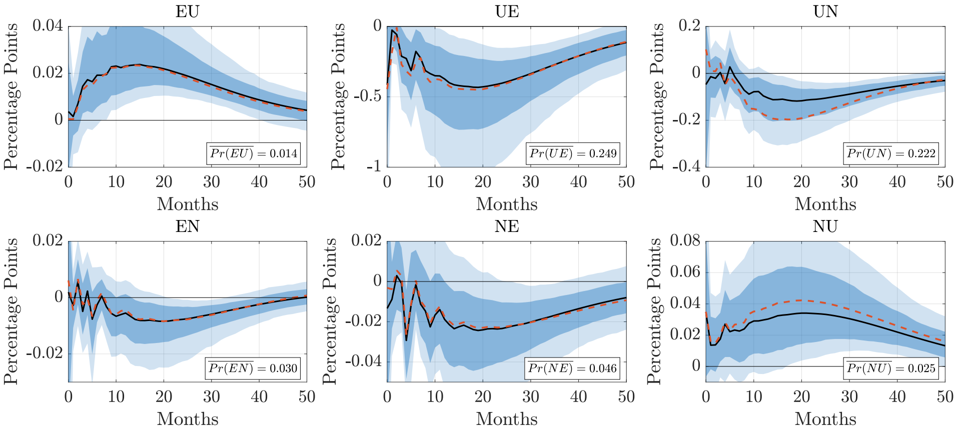


Robust F-statistic from Baseline VAR: 0.48

- FOMC announcements only, orthogonalized as in Bauer & Swanson (2023)
- Dashed red lines report our baseline estimates

Back

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
- Dashed red lines report our baseline estimates

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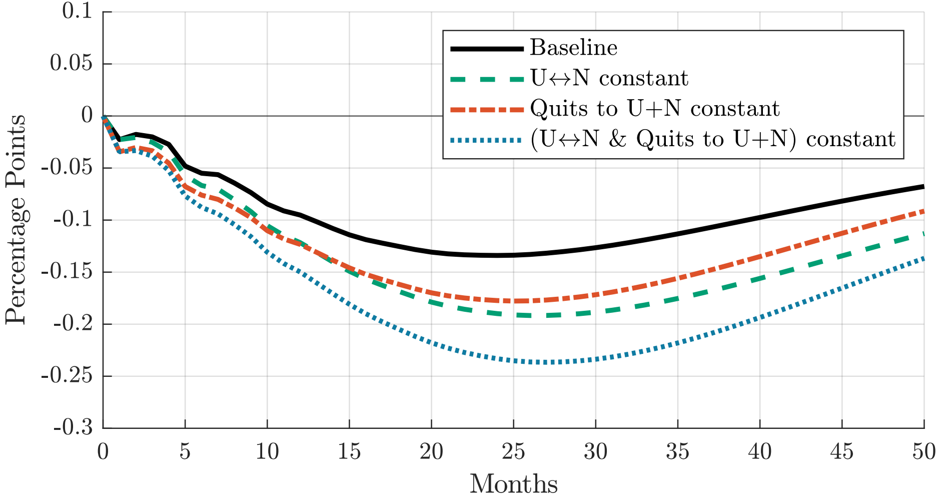
Decomposing Employment Response: Holding Composition Fixed



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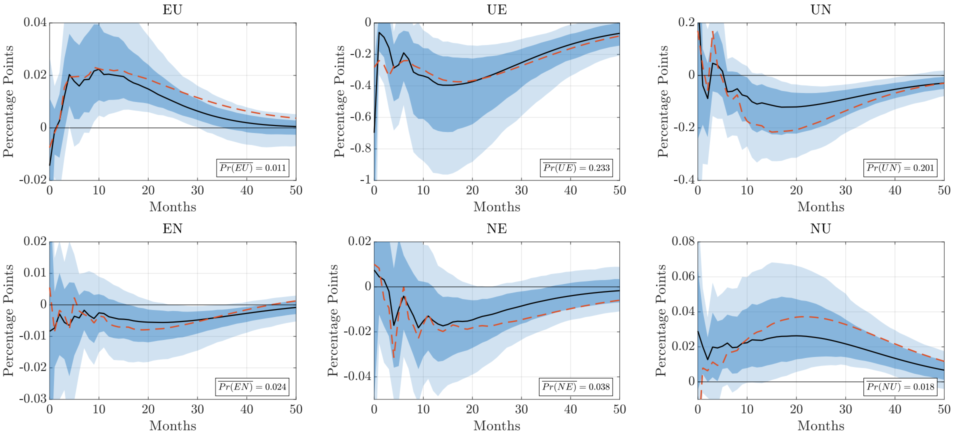
Labor Market Flows: Holding Composition Fixed (Full Controls)



- Fix shares using bins for age $\times$ gender $\times$ education $\times$ reason for unemployment $\times$ labor market status one year ago
- Dashed red lines are responses for unadjusted flows with the same sample

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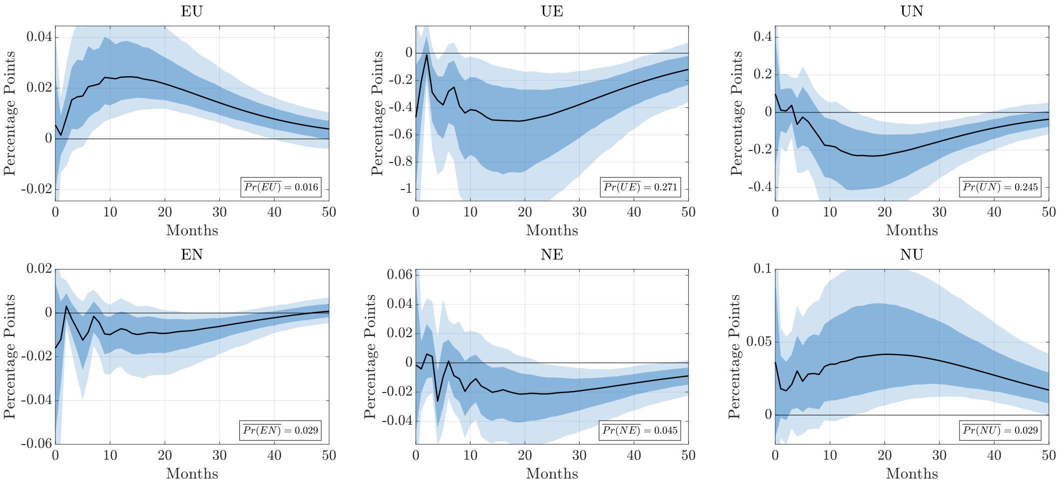
Labor Market Flows: Corrected for Time-Aggregation



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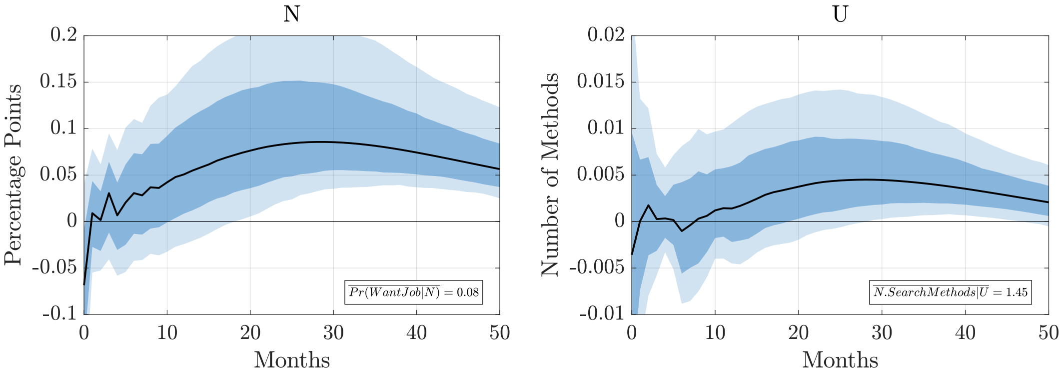
Intensive Margins of Labor Supply

Intensive margins of job 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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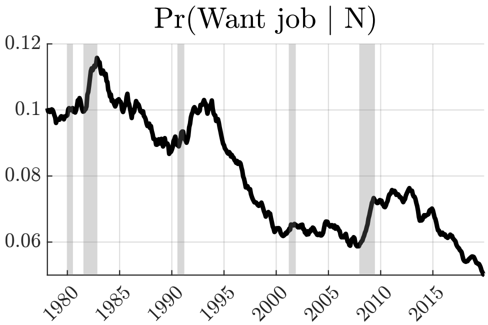
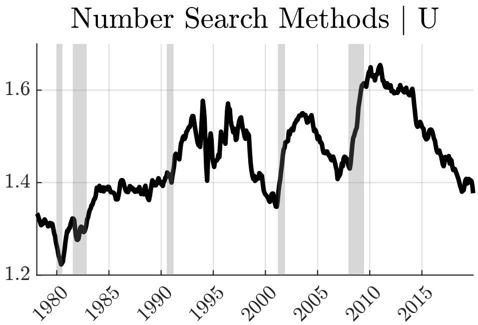
Intensive Margins: Time-Series





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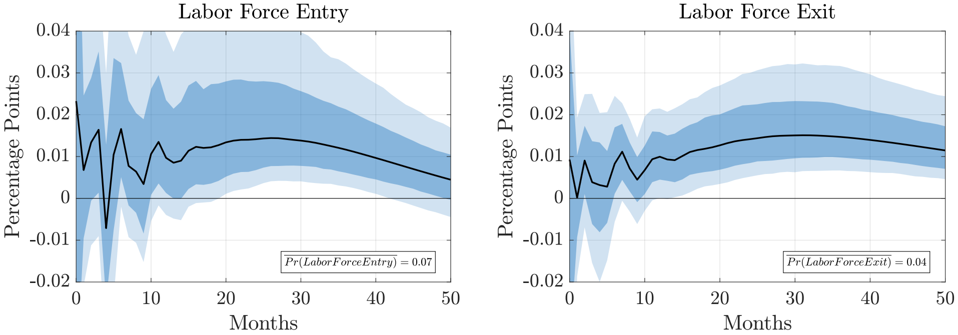
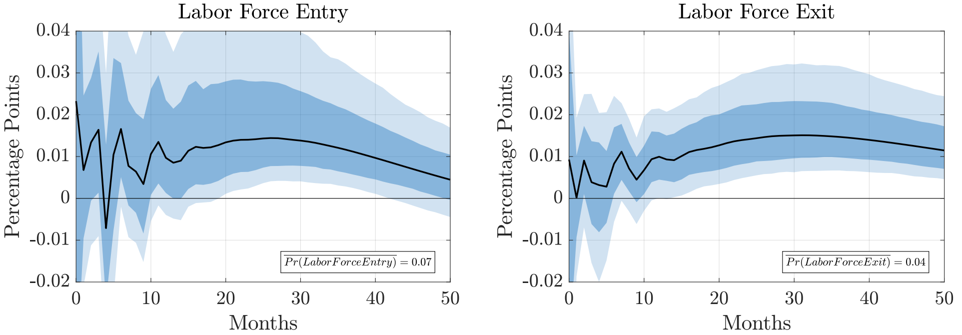
Participation: Response of Labor Force Entry and Exit



- Participation falls due to higher exit rate, offset by rise in entry

Participation: Response of Labor Force Entry and Exit



- Participation falls due to higher exit rate, offset by rise in entry
- Increase in exits driven by u_{t-1}, attenuated by UN_t and EN_t

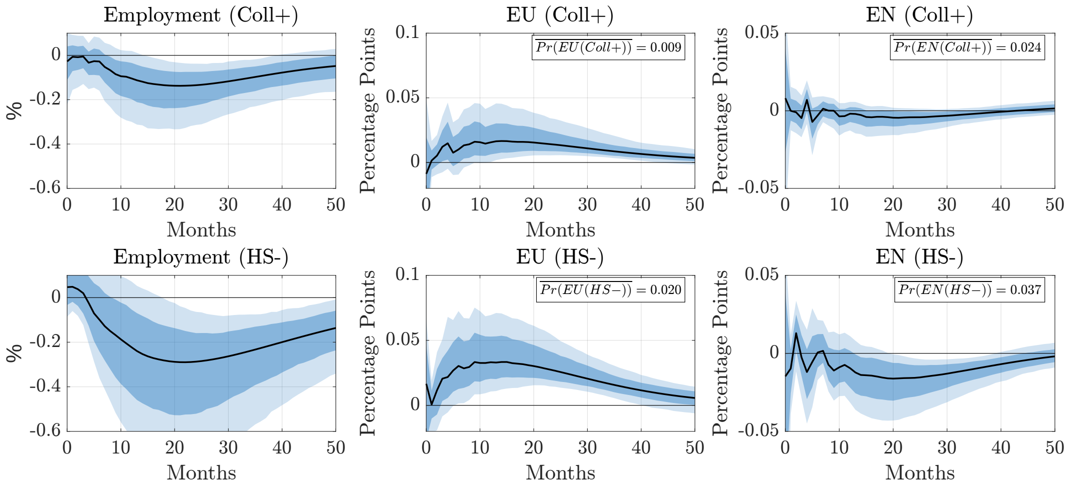
$$\left(\text{Labor Force Entry Rate}\right)_t = NU_t + NE_t,$$

$$\left(\text{Labor Force Exit Rate}\right)_t = u_{t-1} \cdot UN_t + (1 - u_{t-1}) \cdot EN_t,$$

where u_{t-1} denotes the unemployment rate (and $\overline{UN} >> \overline{EN}$)

◂ Back

Heterogeneity in Labor Market Responses: Education



- Decline in E-to-N concentrated among less educated

Flows: Coll+ | Flows: HS+

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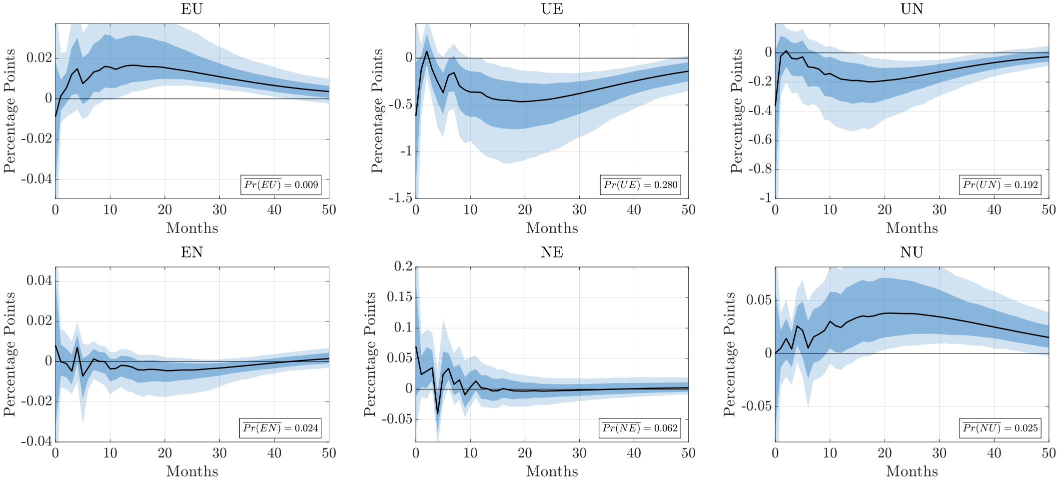
Labor Market Flows: Higher-Educated



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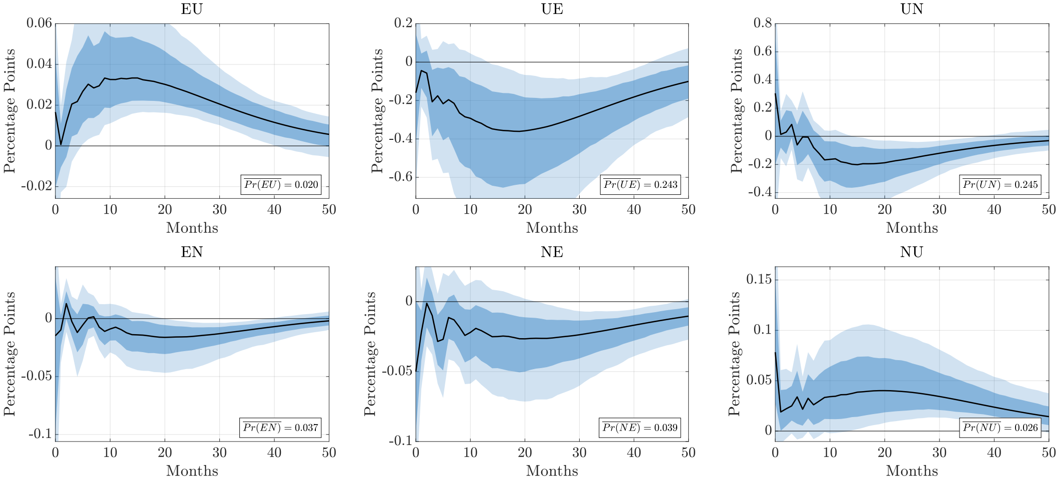
Labor Market Flows: Lower-Educated



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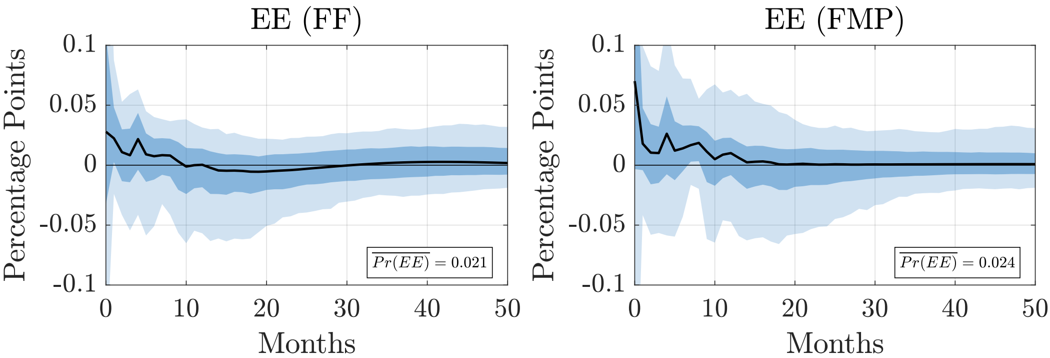
Response of Job-to-Job Flows (1995-2019)



Robust F-statistic from Baseline VAR: 5.44

- Use measures from Fujita, Moscarini, Postel-Vinay (2024)
- No response of EE rate to contractionary MPS
- Cyclicality of EE series from CPS possibly muted by workers who "jump ship"

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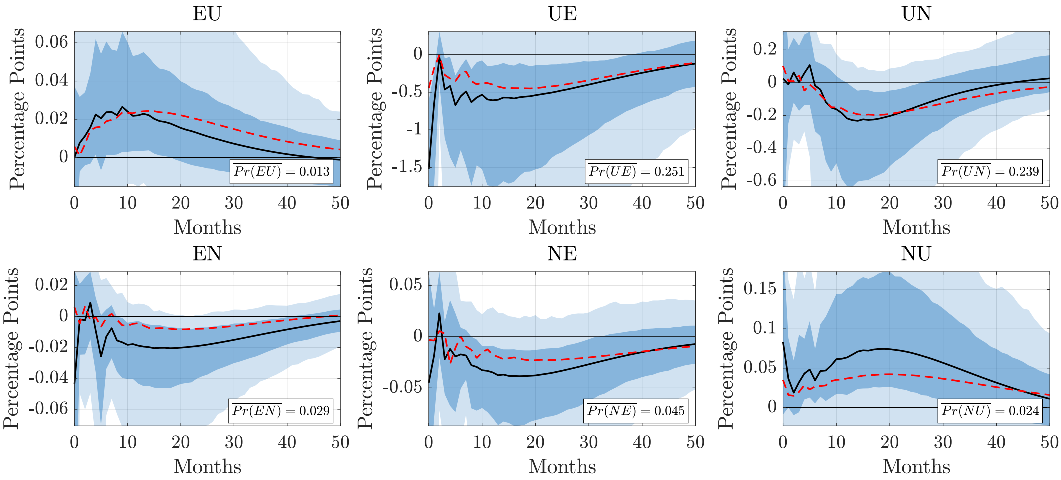
Response of Labor Market Flows (1995-2019)



Robust F-statistic from Baseline VAR: 5.44

- Dashed red lines report impulse responses using full sample

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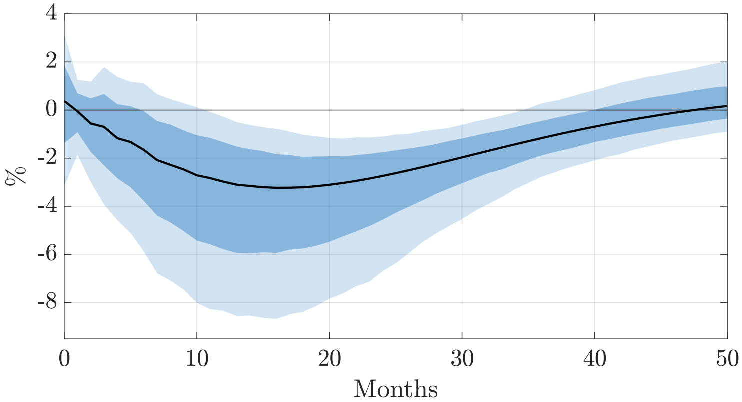
Response of Vacancies



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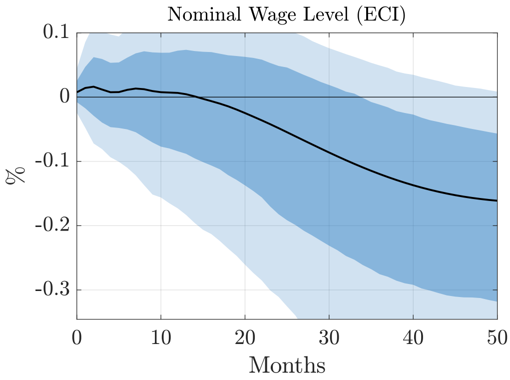
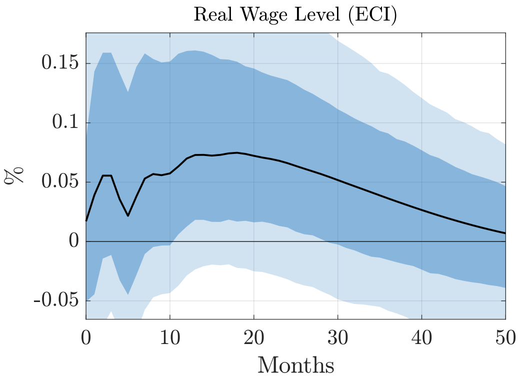
Response of Wages





- Nominal wages decline more slowly than CPI
- So real wages rise slightly in the short-run

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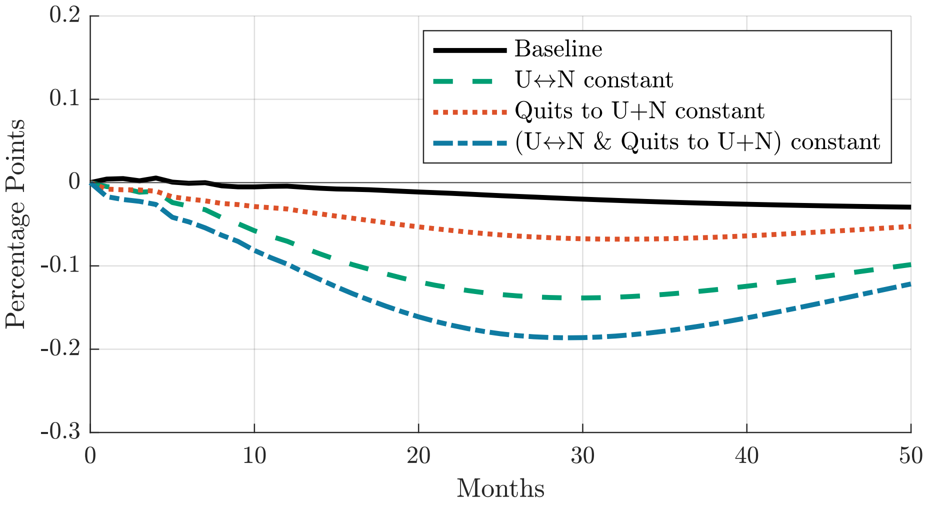
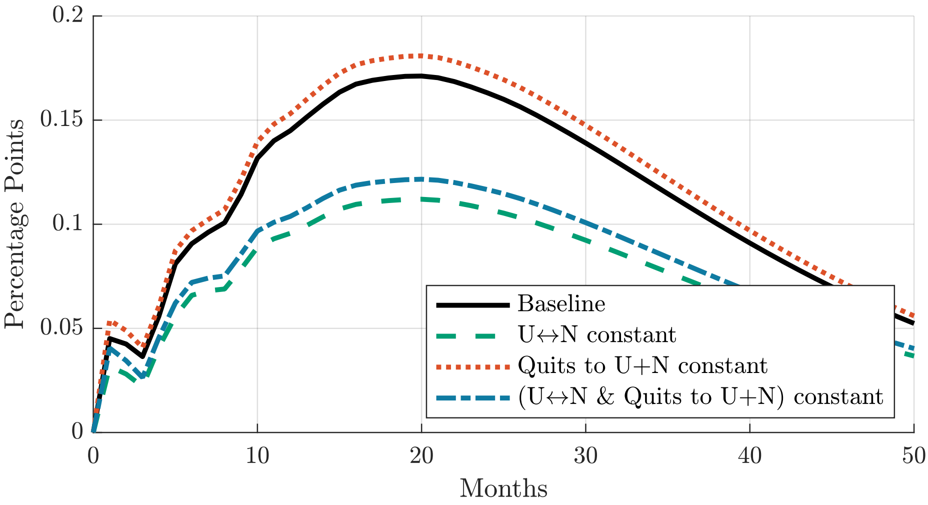
Participation Response to a Monetary Policy Shock



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

Back

Unemployment Response to a Monetary Policy Shock



- Response of quits not important for unemployment dynamics

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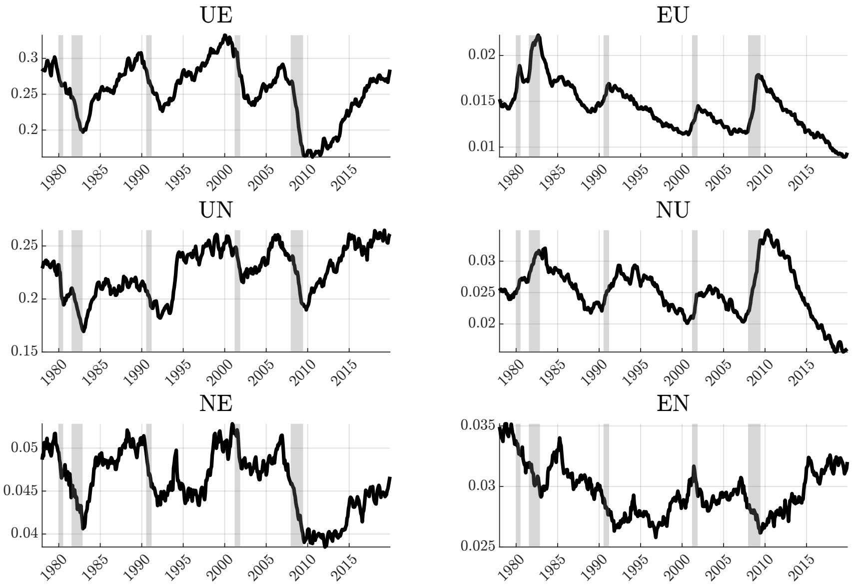
Time Series of Labor Market Flows



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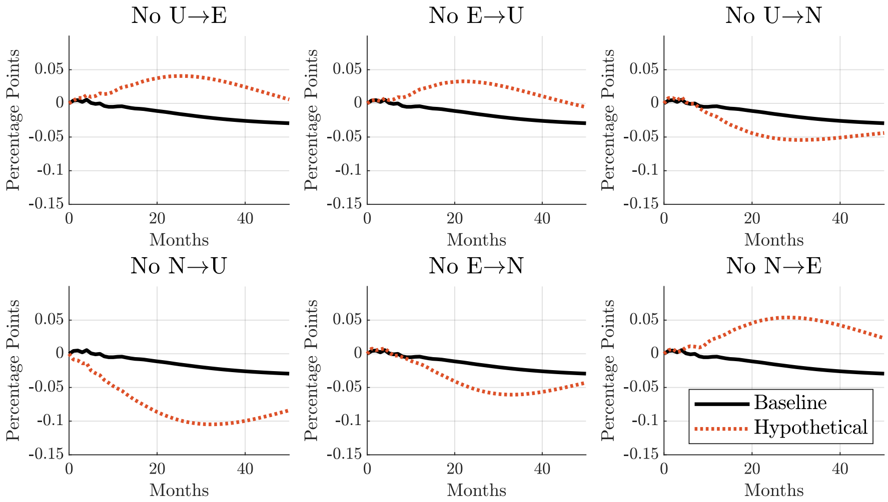
The Ins and Outs of Participation



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

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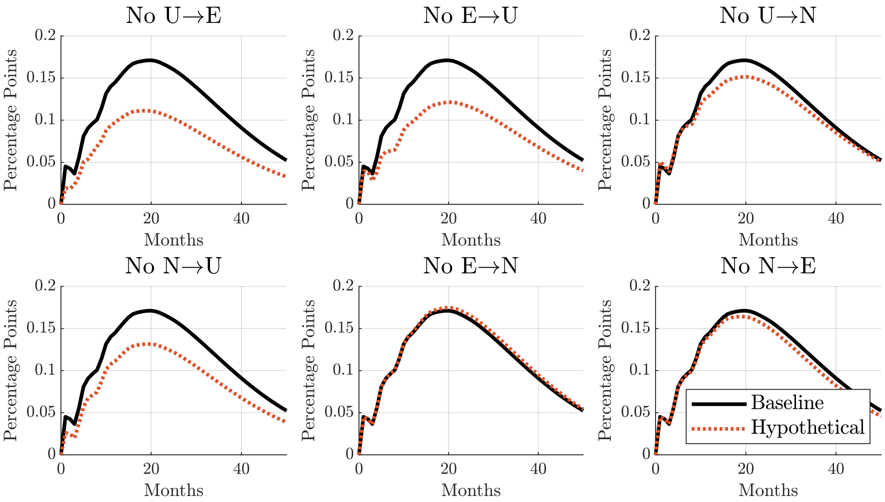
The Ins and Outs of Unemployment



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

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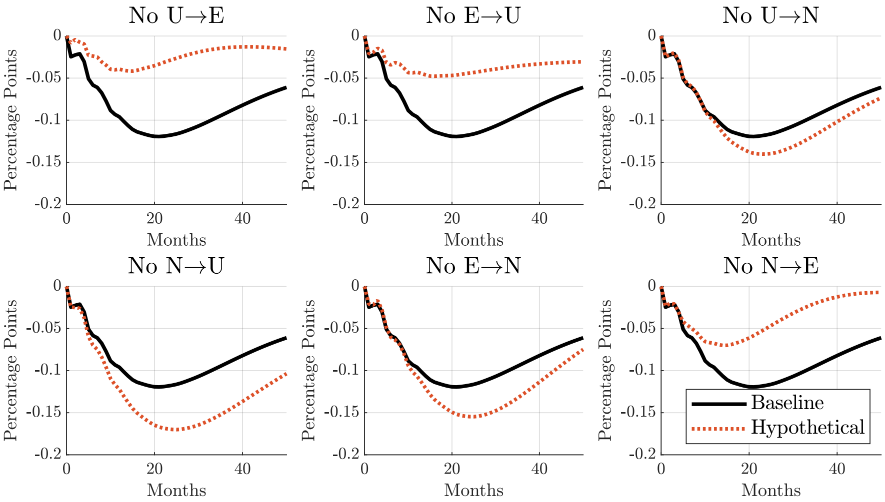
The Ins and Outs of Employment



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

◂ Back

Timing within a Model Period

1. All individuals draw a new value of productivity, z. Non-employed individuals draw an i.i.d. search cost, κ.
2. Employed individuals make consumption/saving decisions and choose whether or not to quit their job. Non-employed individuals make consumption/saving decisions and choose whether or not to search for a job.
3. Employed individuals who do not quit are exogenously laid off with probability δ. Non-employed individuals receive job offers with probabilities f_s of f_{ns}, depending on whether or not they actively search.
4. Non-employed individuals who receive job offers decide whether or not to accept such offers.
5. UI-eligible non-employed individuals who search and either do not receive a job offer or do not accept an offer are subject to UI expiry with probability δ_{UI}.

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Estimation: A Monetary Policy Shock in the Model

- Feed in response of job-finding rate, layoff rate, real interest rates and wages from the data
- Overall response of labor market flows also determined by endogenous changes in policy functions + distribution of households across labor market states

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  - Assume $u(c) = \frac{c^{1-\gamma}-1}{1-\gamma}$, $f_{ns} = \alpha f_s$

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Model Parameters

Calibrated			
Parameter	Description	Value	Source/Target
β	Discount Factor	0.988	Quarterly MPC of 7-8%
R	Steady-State Real Interest Rate	1.001	1% Annual
γ	Risk Aversion Coefficient	2	Standard value
δ^{UI}	Benefit Exhaustion Probability	0.167	Expected duration of UI
w	Steady-State Wage	1	Normalization
α	Efficiency of Passive Search	0.6	Job-finding rate from N
ϕ	UI Replacement Rate	0.50	Graves (2023)
$\bar{\phi}$	Maximum UI Payments	1.85	Graves (2023)
τ	Labor Income Tax Rate	0.33	Auclert et al. (2021)
T	Lump-sum Transfer	0.24	Auclert et al. (2021)
Estimated			
Parameter	Description	Value	Standard Error
ρ_z	Persistence of Labor Productivity	0.960	(0.004)
σ_z	Standard Deviation of Labor Productivity	0.362	(0.023)
μ_κ	Mean Value of Search Cost	0.783	(0.105)
σ_κ	Dispersion of Search Cost	0.167	(0.022)
ψ	Value of Leisure	0.421	(0.107)
δ	Steady-State Layoff Rate	0.019	(0.002)
f_s	Steady-State Job-Finding Rate	0.273	(0.028)

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Steady-State Labor Market Flows

Transition Rate	Model	Data
EU	0.0143	0.0143
EN	0.0297	0.0296
UE	0.2547	0.2547
UN	0.2260	0.2262
NE	0.0462	0.0461
NU	0.0253	0.0252

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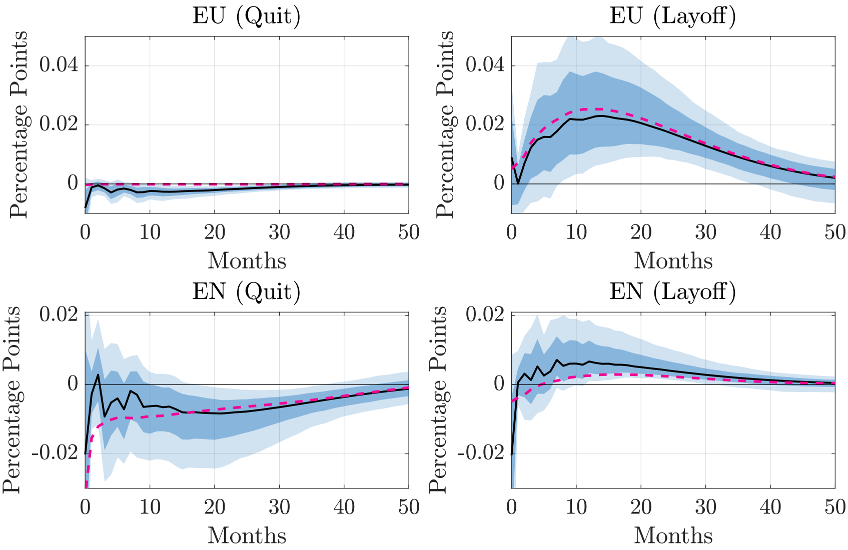
Response of Quits and Layoffs: Model vs Data



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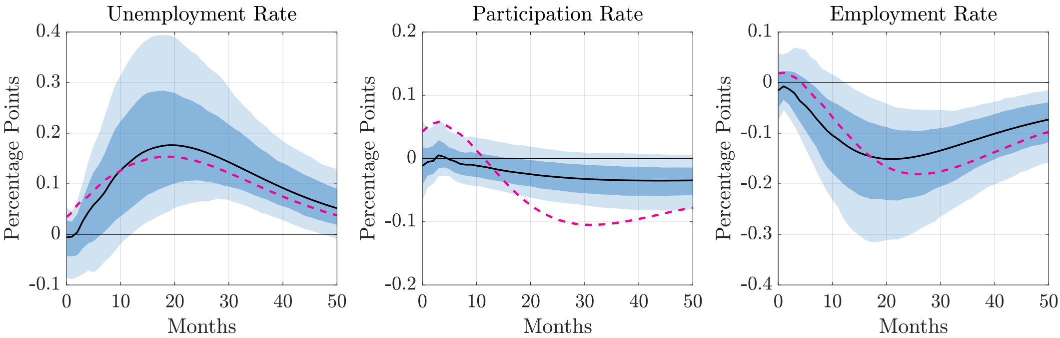
Response of Labor Market Stocks: Model vs Data



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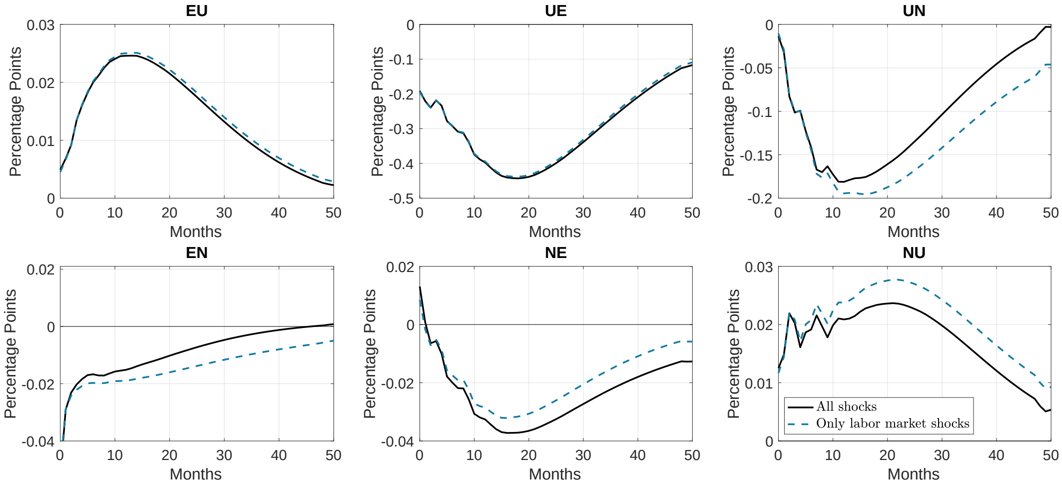
Decomposing Response of Labor Market Flows



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Related Literature

- **Labor Market Flows:** Fujita & Ramey (2009), Elsby et al (2009), Shimer (2012), Elsby et al (2015), Hobijn & Şahin (2021), Fujita et al (2023)
  - We provide a new decomposition of EN transitions into quits/layoffs

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  - We provide a new decomposition of EN transitions into quits/layoffs
- **Labor Market Response To Monetary Policy:** White (2018), Broer et al (2022), Faia et al (2022), Cantore et al (2023)
  - We extend state-of-the-art proxy SVAR to consider response of labor market flows
  - Document a quantitatively important response of supply-driven flows

Related Literature

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