

The Labor Demand and Labor Supply Channels of Monetary Policy

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- ▶ Study response of labor market flows to identified monetary policy shocks
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- ▶ 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
 - ▶ 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 $\approx 70\%$ 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

Data & Methodology

Labor Market Flows

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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!)

Estimating the Effects of Monetary Policy

- ▶ Begin with reduced-form VAR:

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

- ▶ Seven monthly variables for baseline specification: two-year Treasury yield, unemployment rate, participation rate, log CPI, log IP, spreads, vacancy rate

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- ▶ Seven monthly variables for baseline specification: two-year Treasury yield, unemployment rate, participation rate, log CPI, log IP, spreads, vacancy rate
- ▶ Assume structural shocks:

$$u_t = S\varepsilon_t \quad (2)$$

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:

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

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

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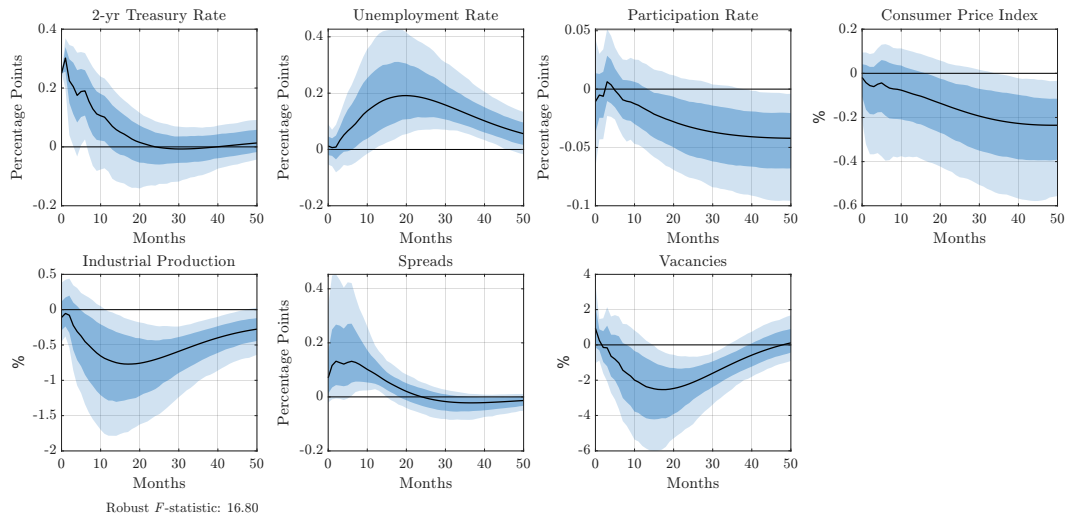
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- ▶ Labor market flows added one-by-one to the main VAR

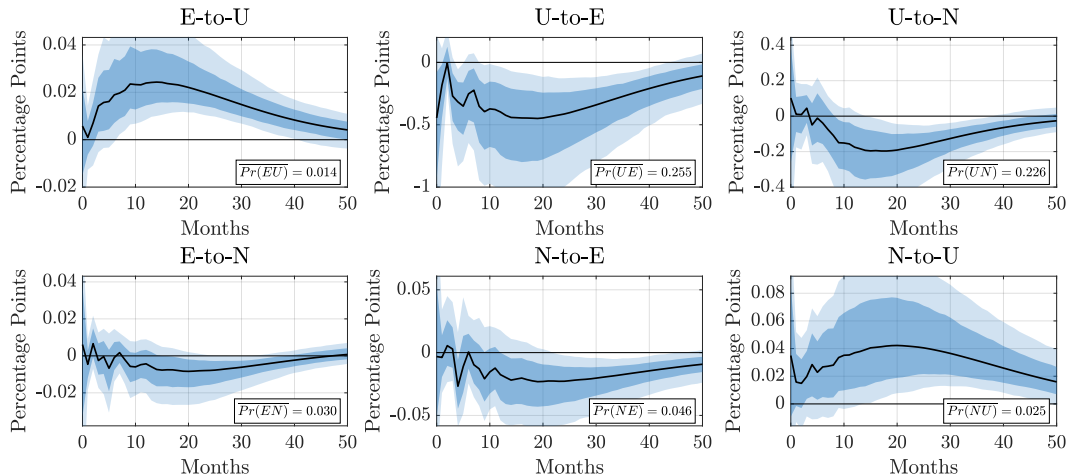
Estimates

Baseline VAR

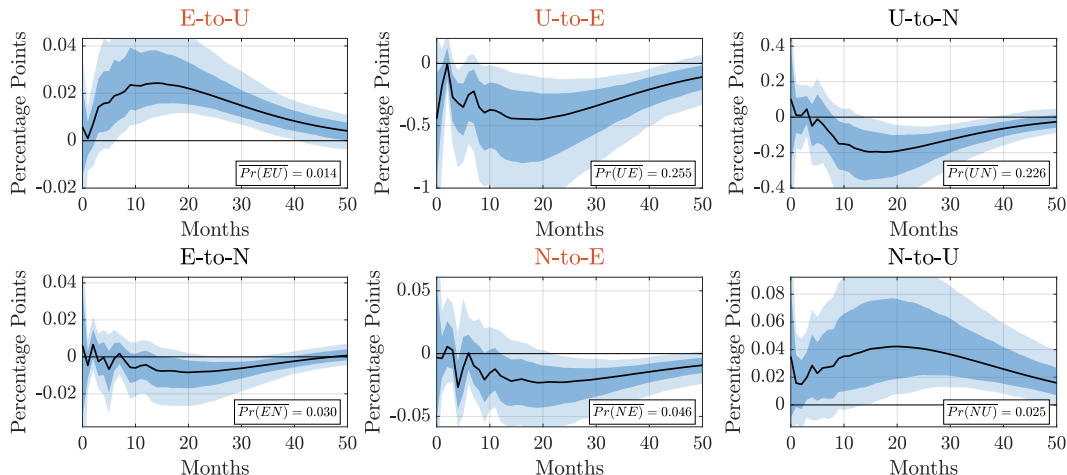


- ▶ Monthly data, 1978:M1–2019:M12
- ▶ Dark and light shaded regions report **68%** and **90%** confidence intervals

Response of Labor Market Flows

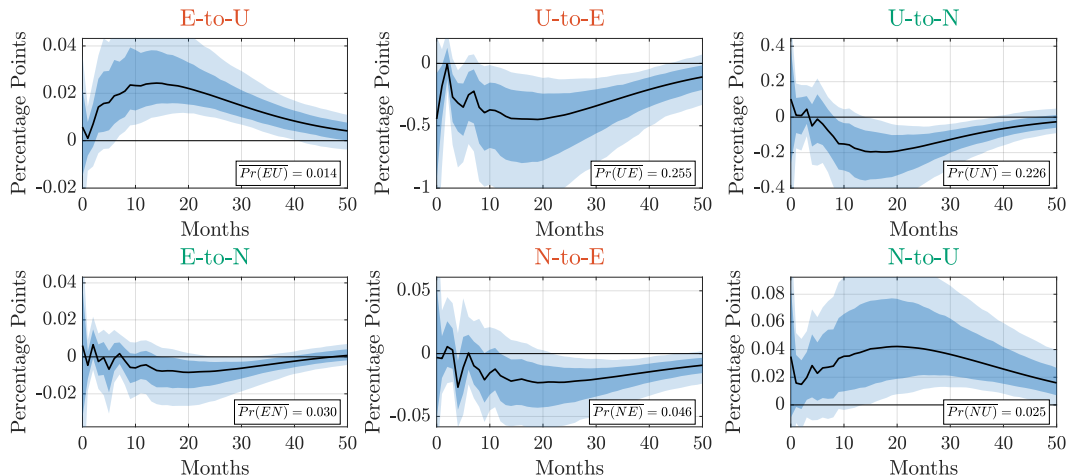


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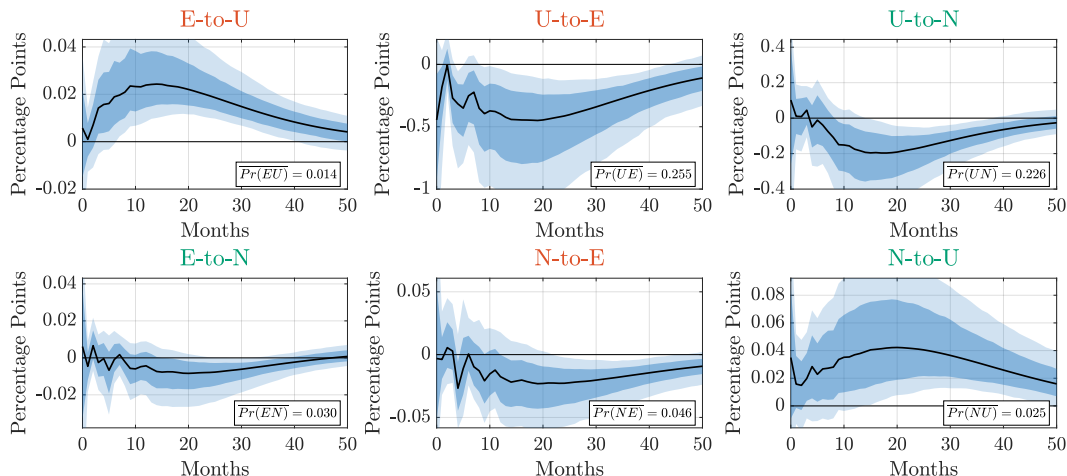
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3. Estimate qualitatively similar IRFs from “**Main Business Cycle Shock**” à la Angeletos et al (2020) 

Using Flows to Account for Dynamics of Labor Market Stocks

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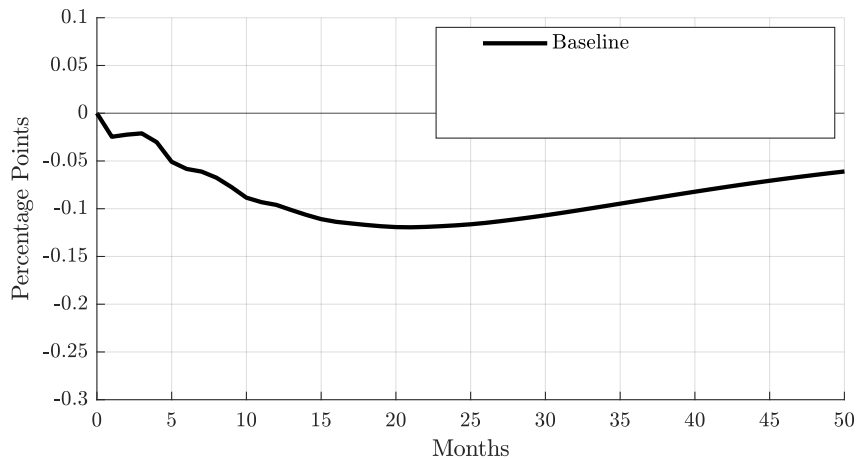
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- ▶ Repeat for all supply-driven flows, in various combinations

▶ Ins and Outs of Employment

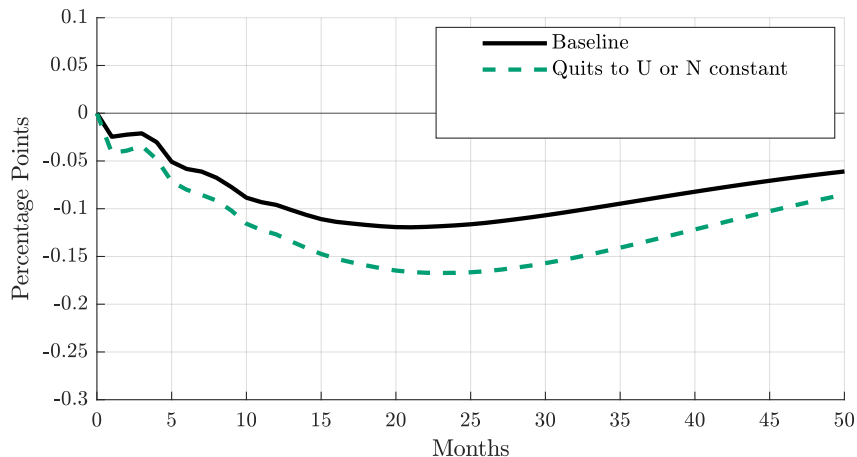
▶ Ins and Outs of Unemployment

▶ Ins and Outs of Participation

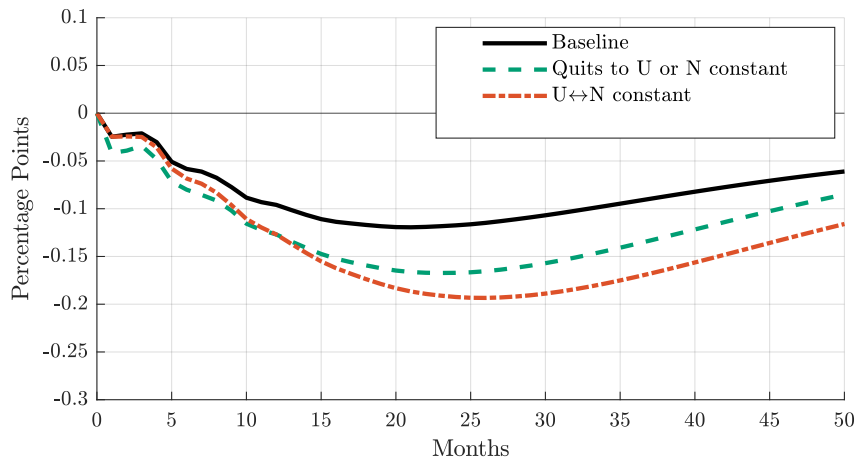
Decomposing Employment Response to a Monetary Policy Shock



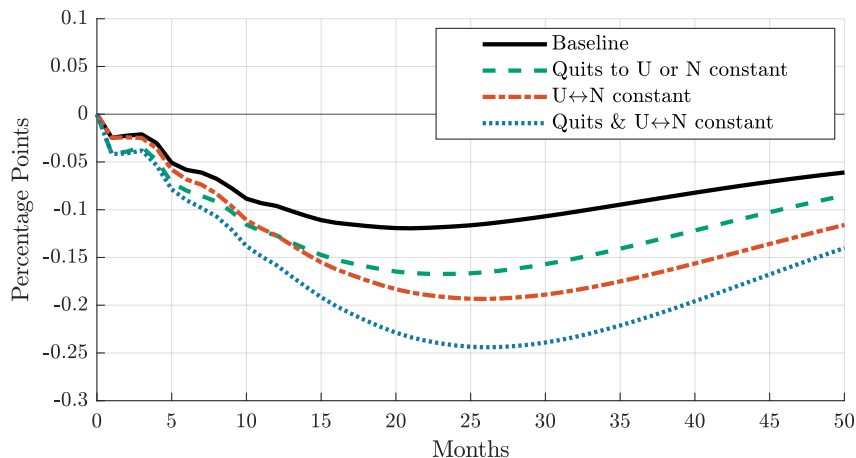
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► Holding **supply-driven** flows fixed \Rightarrow Employment falls **twice as much**

► Controls for composition

► Participation

► Unemployment

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Q': How important are **labor supply decisions** for matching the response of labor market flows to a contractionary monetary policy shock? **A: Very!**

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

subject to

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

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$$c + a' = Ra + (1 - \tau) \min\{\phi w z, \bar{\phi}\} + T, \quad a' \geq 0$$

where

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

$$\mathcal{V}_U^{ns}(a', z) = f_{ns} \cdot \max \{ \mathbb{E} V_E(a', z'), \mathbb{E} V_N(a', z', \kappa') \} + (1 - f_{ns}) \mathbb{E} V_N(a', z', \kappa')$$

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

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:

$$V_N(a, z, \kappa) = \max_{c, a'} \left\{ u(c) + \max \left\{ \underbrace{(1 - \kappa)\psi + \beta \mathcal{V}_N^s(a', z)}_{\text{Search}}, \underbrace{\psi + \beta \mathcal{V}_N^{ns}(a', z)}_{\text{Do Not Search}} \right\} \right\}$$

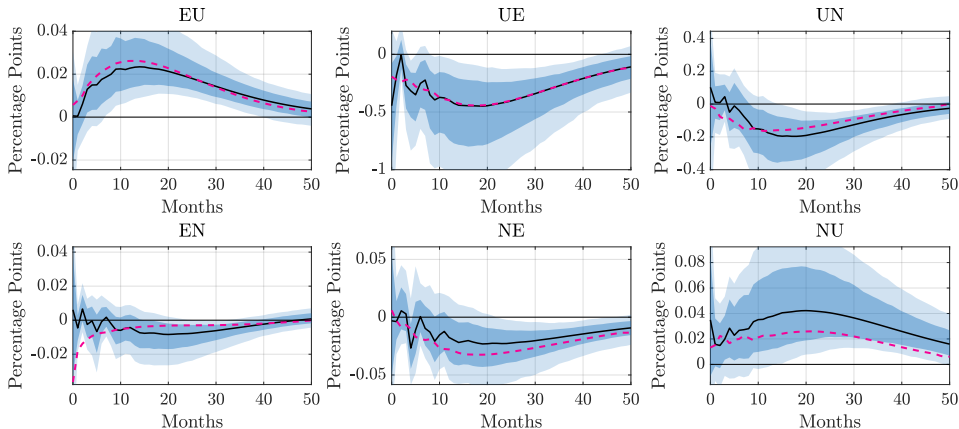
subject to

$$c + a' = Ra + T, \quad a' \geq 0$$

where

$$\begin{aligned} \mathcal{V}_N^s(a', z) &= f_s \cdot \max \{ \mathbb{E} V_E(a', z'), \mathbb{E} V_N(a', z', \kappa') \} + (1 - f_s) \mathbb{E} V_N(a', z', \kappa') \\ \mathcal{V}_N^{ns}(a', z) &= f_{ns} \cdot \max \{ \mathbb{E} V_E(a', z'), \mathbb{E} V_N(a', z', \kappa') \} + (1 - f_{ns}) \mathbb{E} V_N(a', z', \kappa') \end{aligned}$$

Response of Labor Market Flows: Model vs Data



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

► Steady State

► Response of Quits and Layoffs

► Response of Labor Market Stocks

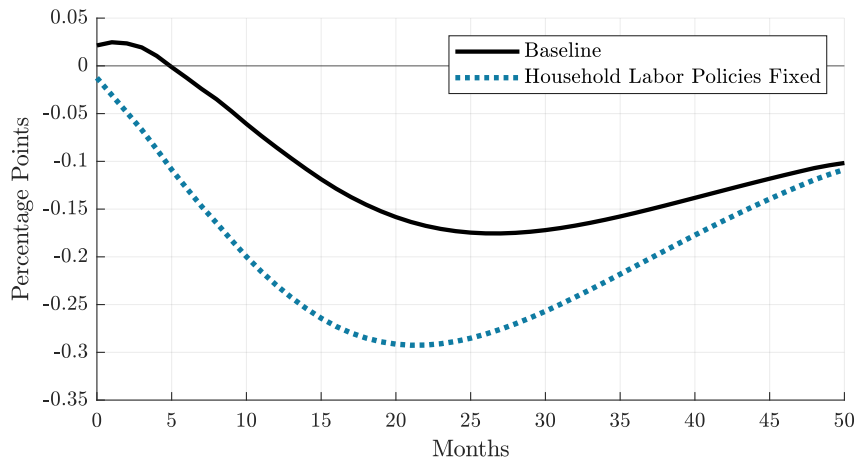
The Role of Labor Supply

- ▶ 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

The Role of Labor Supply

- ▶ 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**

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**
- ▶ **Future/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

Cyclical Properties of Labor Market Stocks

| | Employment- Population Ratio | Unemployment Rate | Participation Rate |
|-------------------------------|---------------------------------|----------------------|-----------------------|
| $\text{mean}(x)$ | 61.14 | 6.19 | 65.16 |
| $\text{std}(x)/\text{std}(Y)$ | 0.72 | 8.25 | 0.23 |
| $\text{corr}(x, Y)$ | 0.83 | -0.85 | 0.35 |

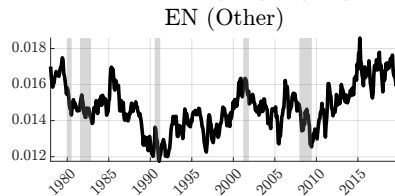
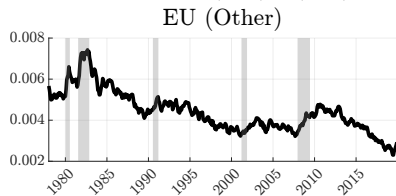
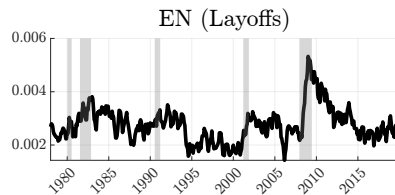
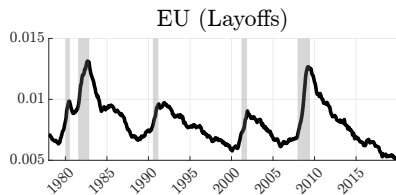
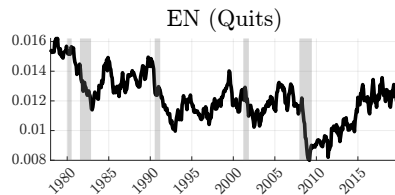
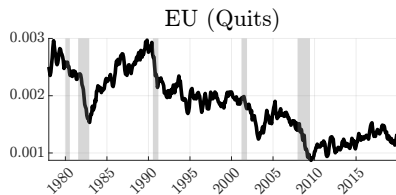
Note: x denotes the variable in each column, Y denotes HP-filtered log real GDP. Standard deviations and correlations are computed for HP-filtered quarterly averages. The sample is 1978-2019.

Cyclical Properties of Labor Market Flows

| | EU | EN | UE | UN | NE | NU |
|-------------------------------|-------|-------|-------|-------|-------|-------|
| $\text{mean}(x)$ | 0.014 | 0.030 | 0.255 | 0.226 | 0.046 | 0.025 |
| $\text{std}(x)/\text{std}(Y)$ | 5.20 | 2.46 | 5.69 | 4.14 | 3.00 | 5.22 |
| $\text{corr}(x, Y)$ | -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.

Decomposition of EU Flows



Relevance of Distinction Between Quits and Layoffs

Post-EU Transition Rates: Quits vs Layoffs

| <i>From</i> | <i>To</i> | | |
|---------------|-----------|-------|-------|
| | 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.

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.

Robustness of Quit/Layoff Distinction

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

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

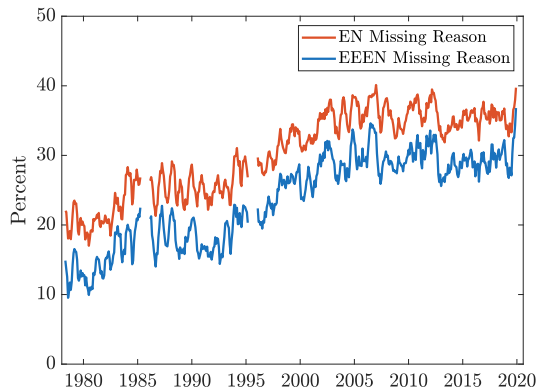
Note: The first row shows the probability of individuals switching their reason for unemployment from layoff to quit (in the first column), or from quit to layoff (in the second column), prior to the 1994 CPS redesign. The second row shows the same, but for the period following the redesign.

Transition Rates Across E-U-U Individuals

| | <i>From</i> | <i>To</i> | | |
|-----|---------------------------|-----------|-------|-------|
| | | 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 |

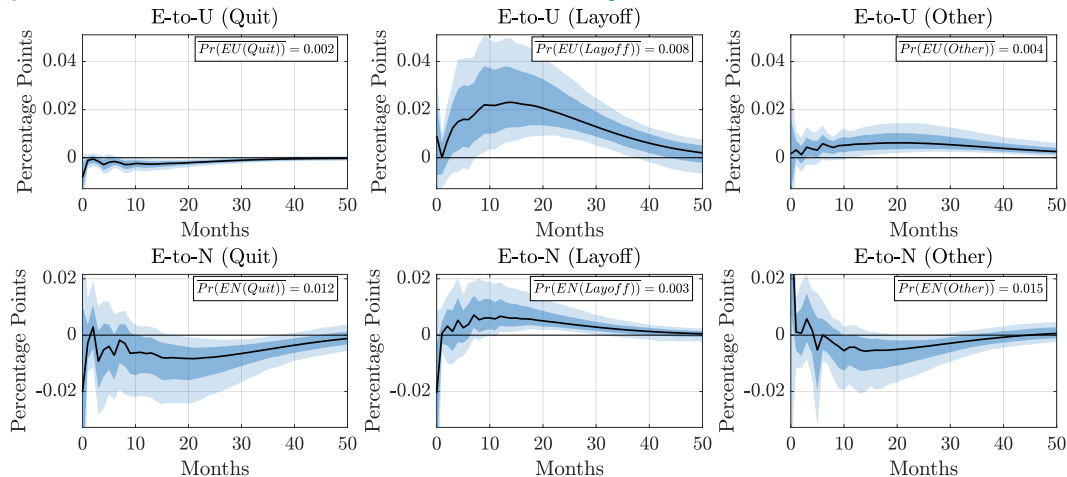
Note: Transition rates are shown for individuals that are in their second month of unemployment following an employment spell, split by reason for unemployment. The rates are computed for the period prior to the 1994 CPS redesign.

Fraction of EN Transitions with Missing Reason



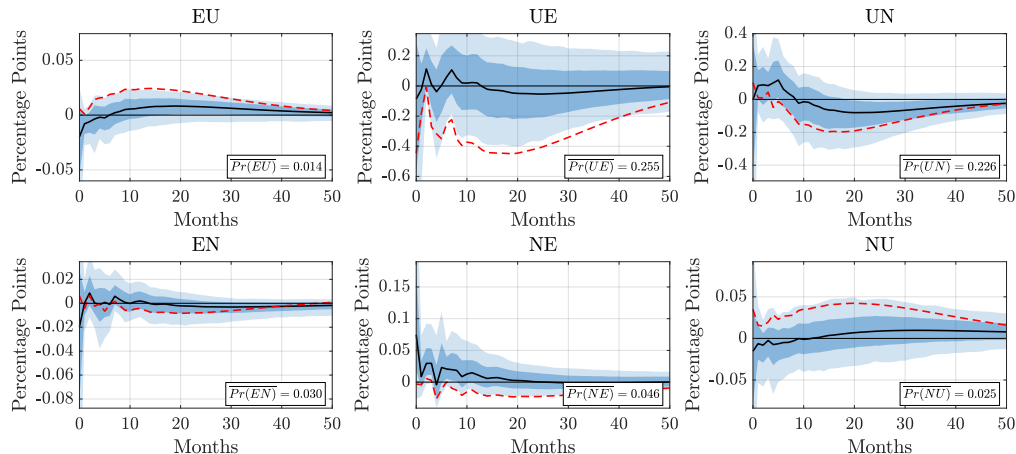
Note: The red line shows the proportion of individuals making an EN transition for which there is missing data on the reason for leaving the last job. The blue line shows the same calculation for individuals that were employed in each of the first three months before moving to nonparticipation. Series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

Response of EU & EN Flows: Quits vs Layoffs



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

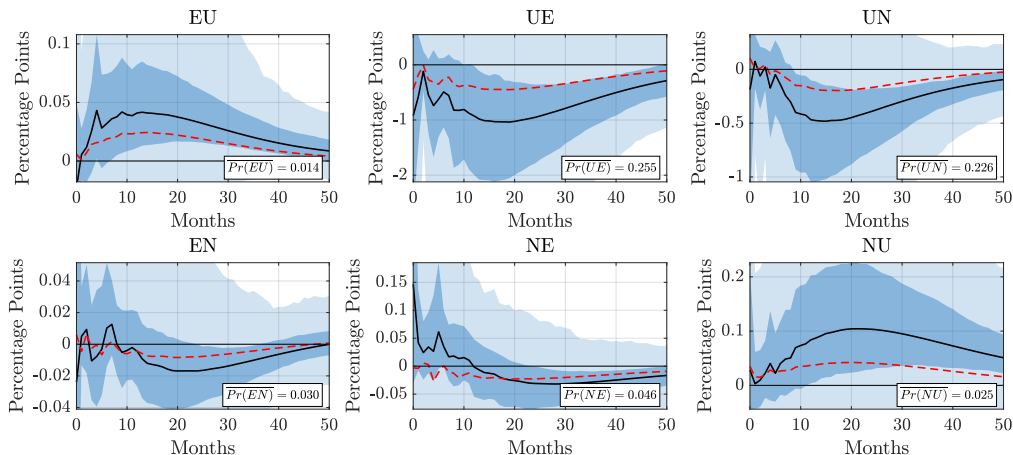
Labor Market Flows: No Speeches (Not Orthogonalized)



Robust F -statistic from Baseline VAR: 9.30

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

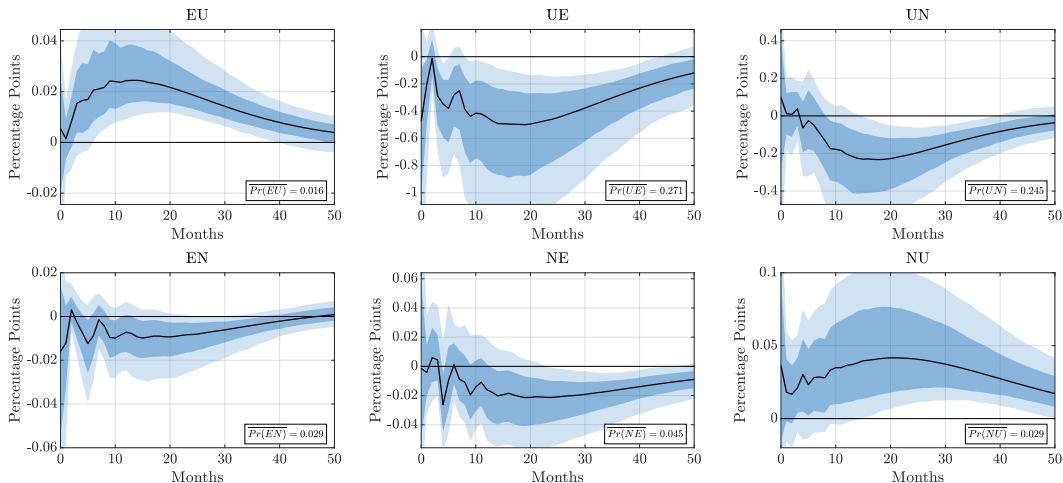
Labor Market Flows: No Speeches (Orthogonalized)



Robust F -statistic from Baseline VAR: 0.48

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

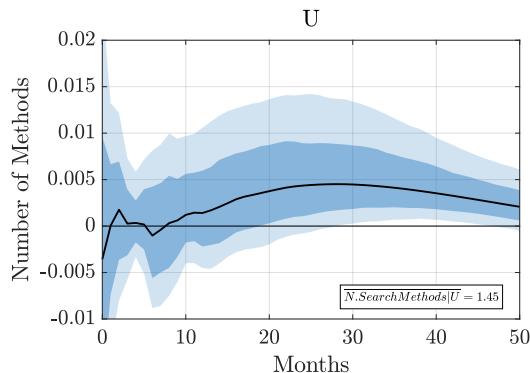
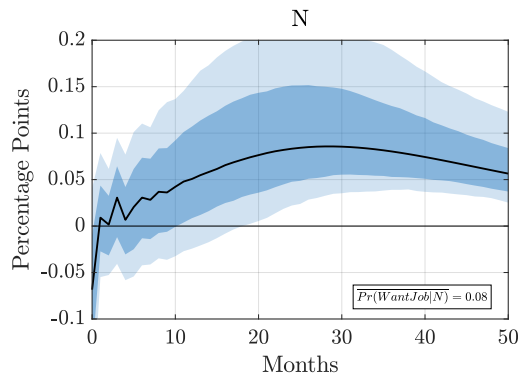
Labor Market Flows: Corrected for Time-Aggregation



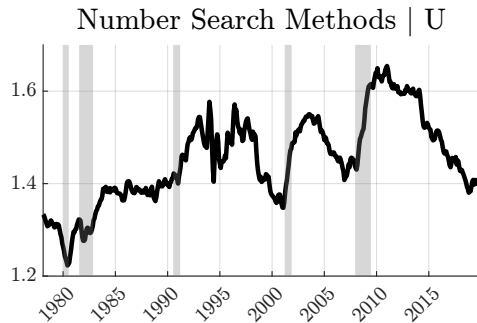
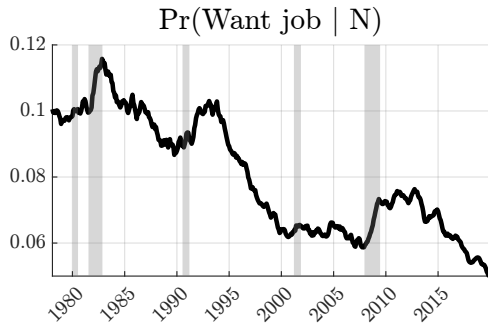
Intensive Margins of Labor Supply

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

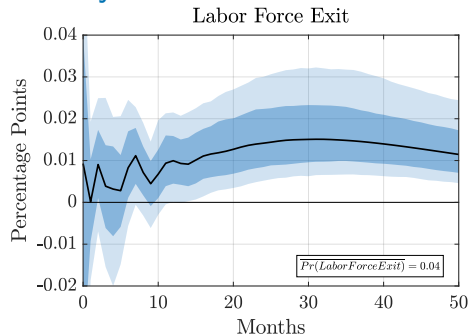
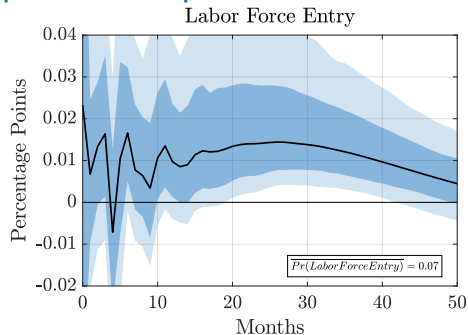


Intensive Margins: Time-Series



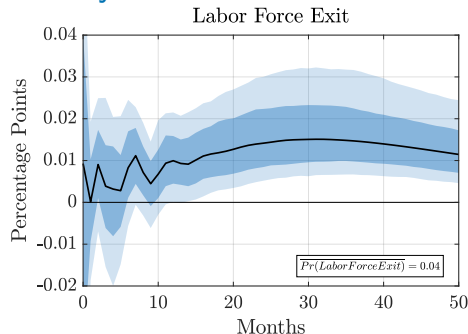
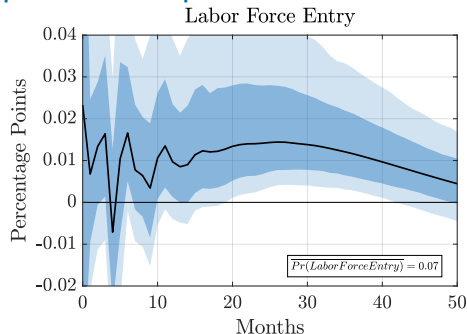
[← Back](#)

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



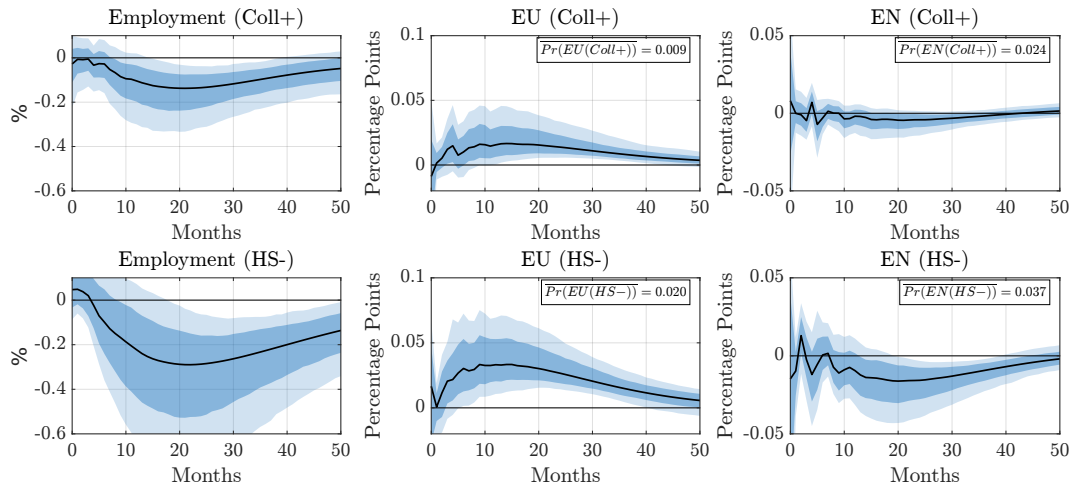
- ▶ Participation falls due to **higher exit rate**, offset by **rise in entry**
- ▶ Increase in exits driven by u_{t-1} , attenuated by UN_t and EN_t

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

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

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

Heterogeneity in Labor Market Responses: Education



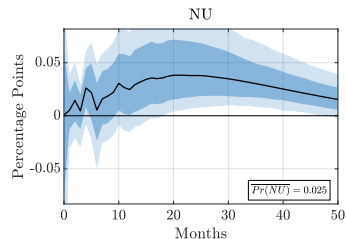
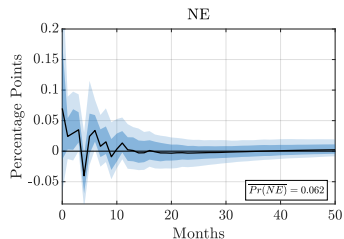
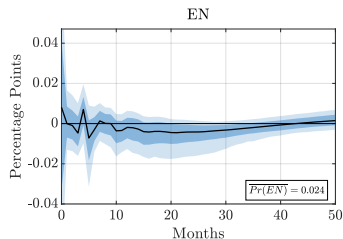
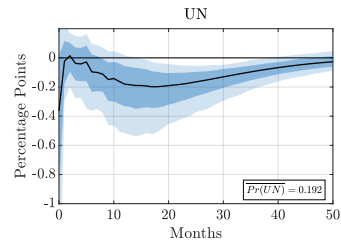
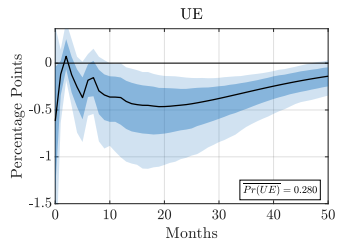
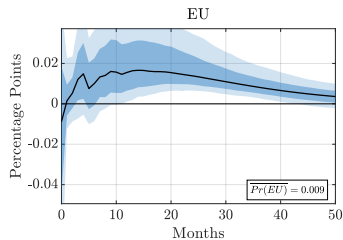
► Decline in E-to-N concentrated among less educated

► Flows: Coll+

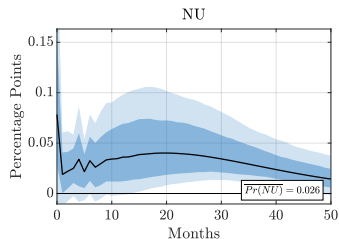
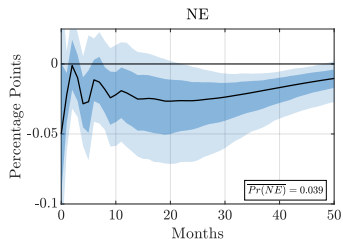
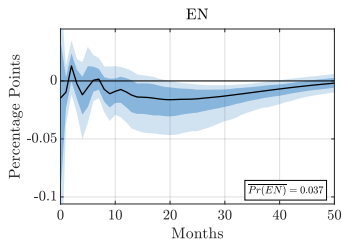
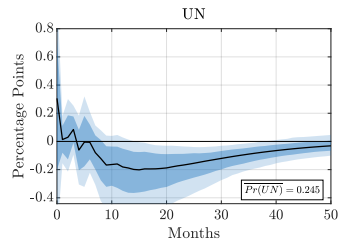
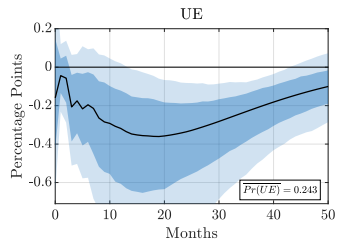
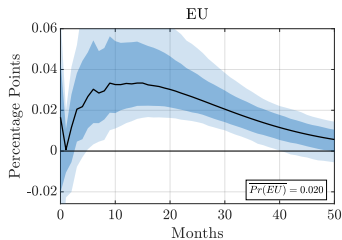
► Flows: HS+

◀ Back

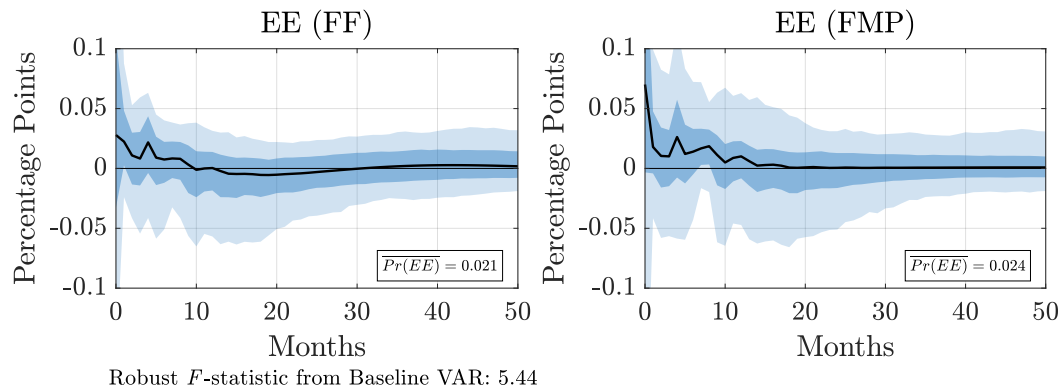
Labor Market Flows: Higher-Educated



Labor Market Flows: Lower-Educated

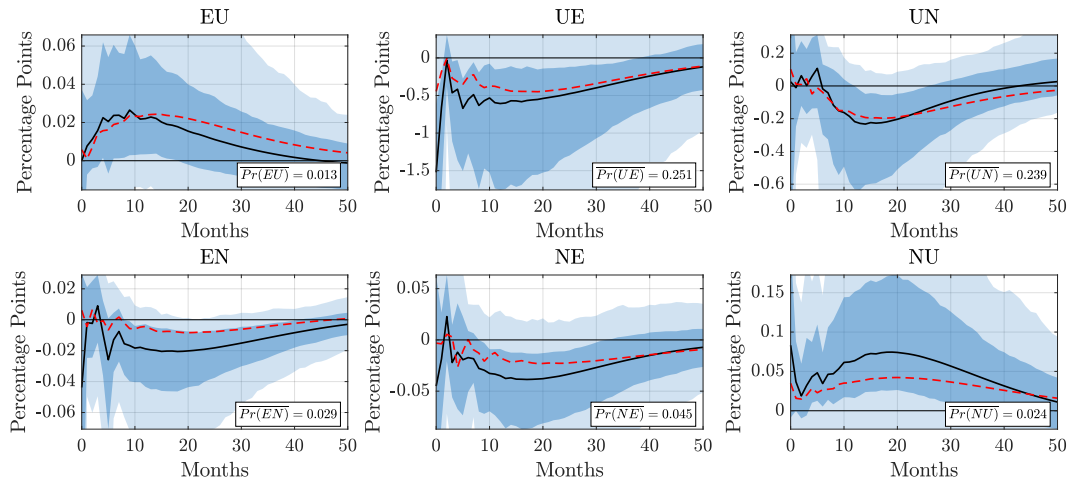


Response of Job-to-Job Flows (1995-2019)



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

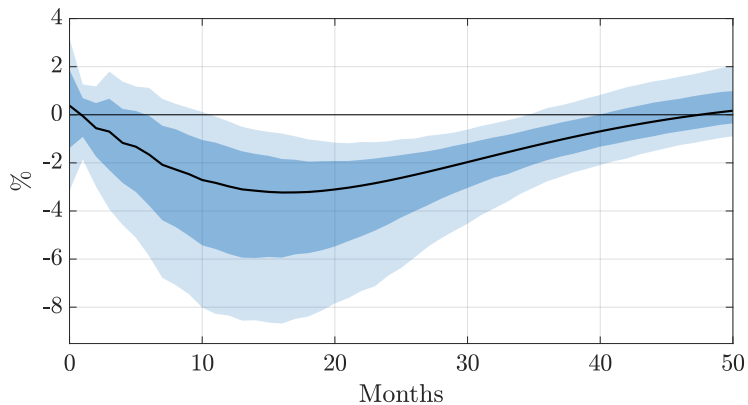
Response of Labor Market Flows (1995-2019)



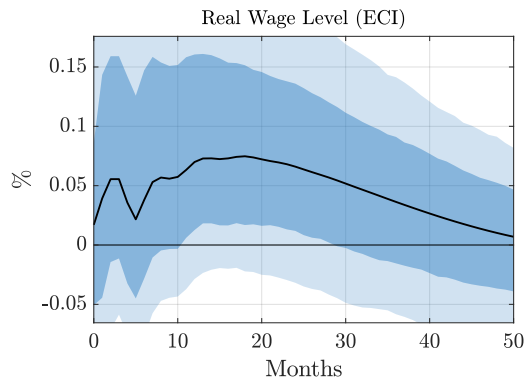
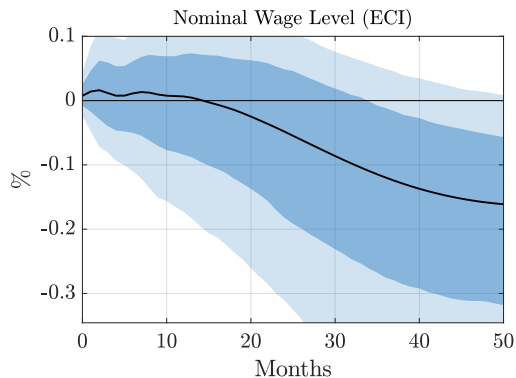
Robust F -statistic from Baseline VAR: 5.44

► Dashed red lines report impulse responses using full sample

Response of Vacancies

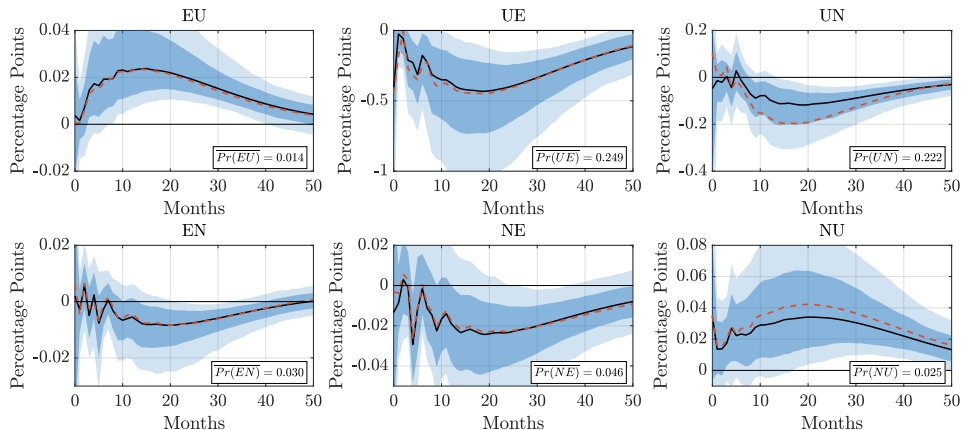


Response of Wages



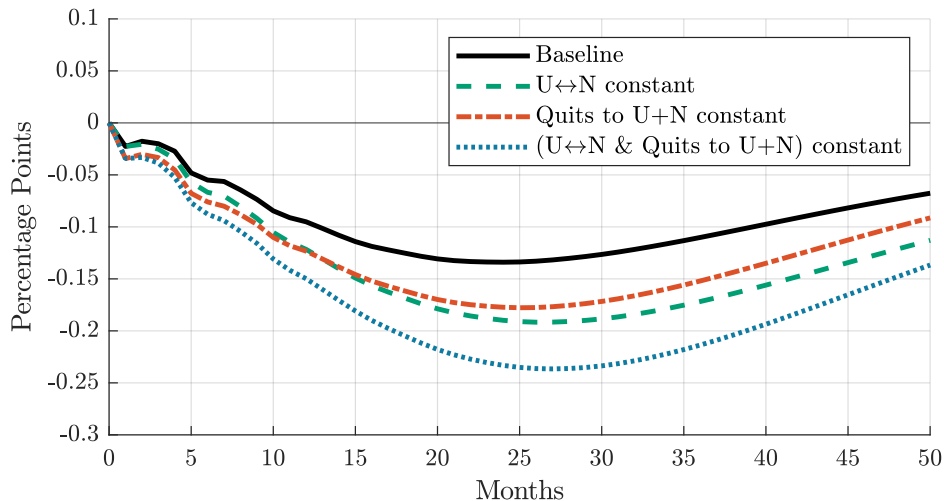
- ▶ Nominal wages **decline more slowly** than CPI
- ▶ So **real wages rise slightly** in the short-run

Labor Market Flows: Holding Composition Fixed

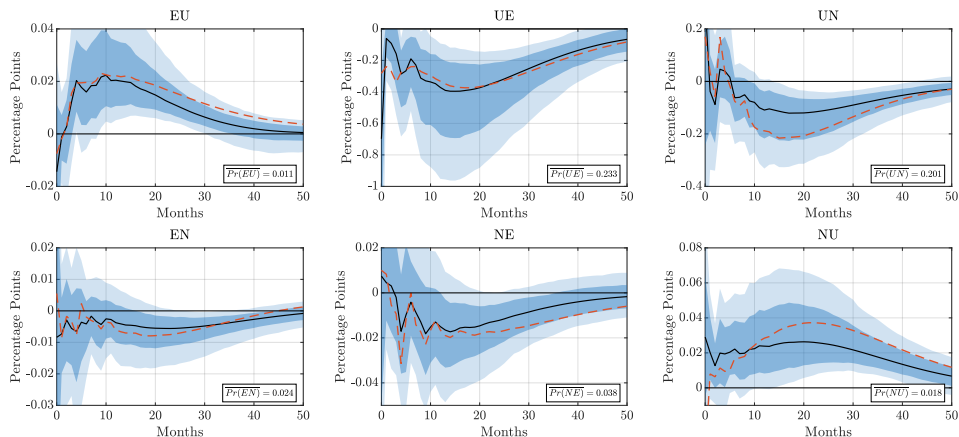


- Composition-adjusted flows by ex-ante characteristics, à la Elsby et al. (2015)
- Fix shares using bins for age \times gender \times education \times reason for unemployment
- Dashed red lines report our baseline estimates

Decomposing Employment Response: Holding Composition Fixed

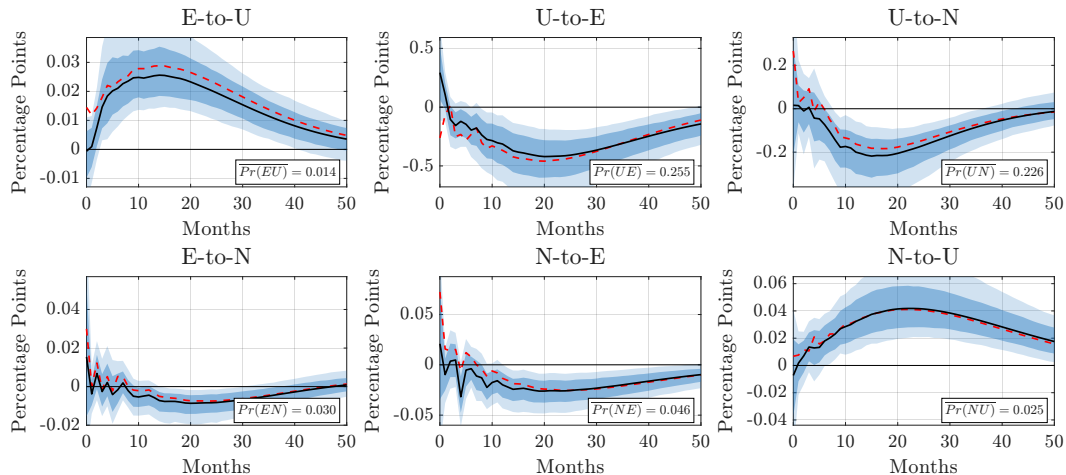


Labor Market Flows: Holding Composition Fixed (Full Controls)

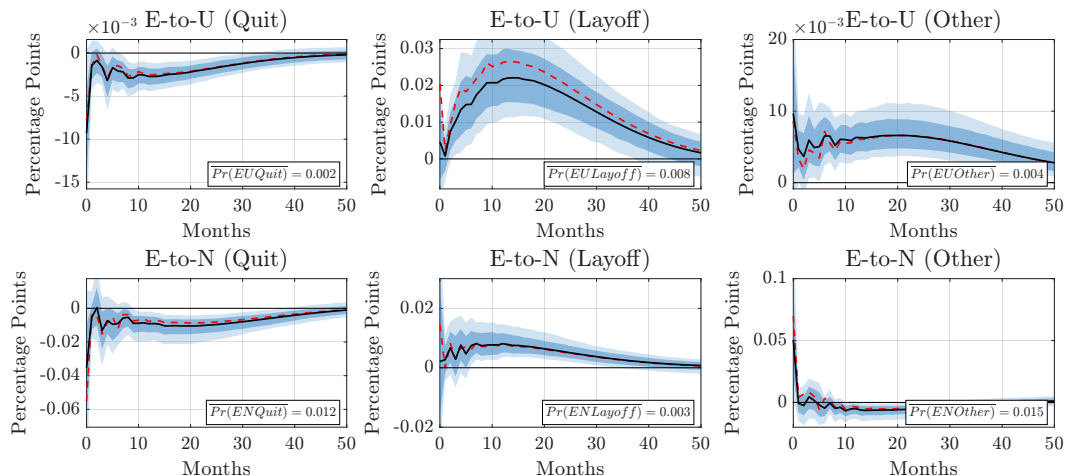


- Fix shares using bins for age \times gender \times education \times reason for unemployment \times labor market status one year ago
- Dashed red lines are responses for unadjusted flows with the same sample

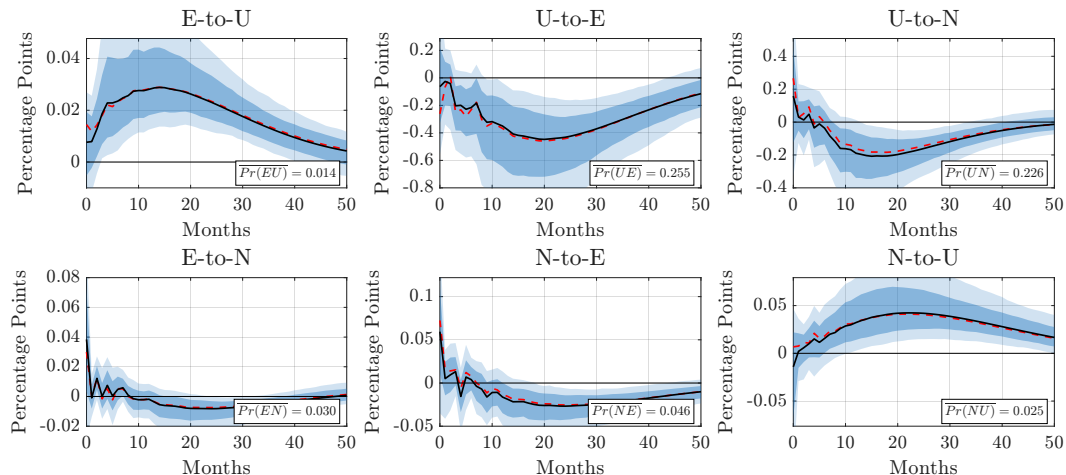
Response of Labor Market Flows (AD shocks)



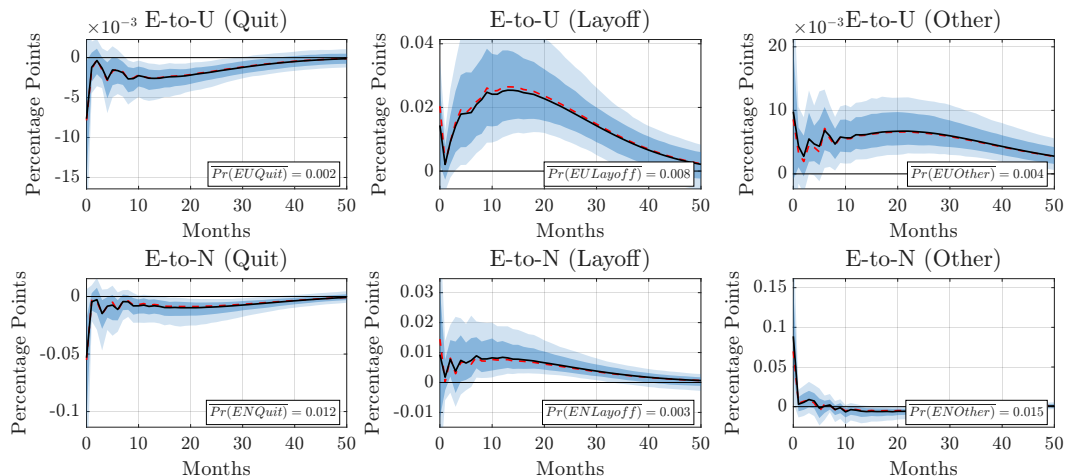
Response of EU & EN Flows: Quits vs Layoffs (AD shocks)



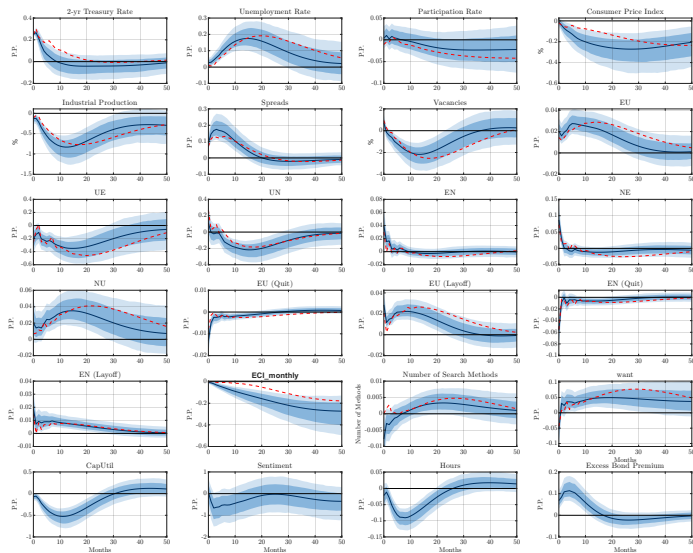
Response of Labor Market Flows (AD & BS shocks)



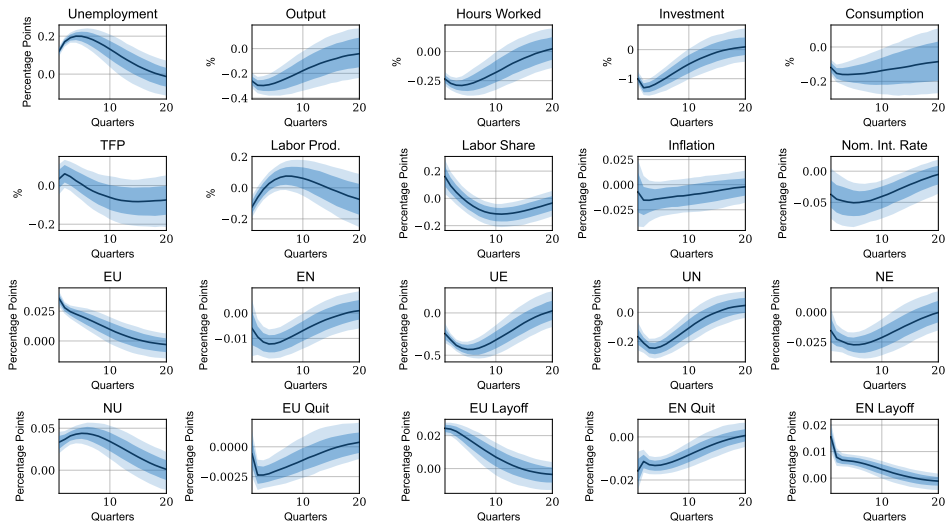
Response of EU & EN Flows: Quits vs Layoffs (AD & BS shocks)



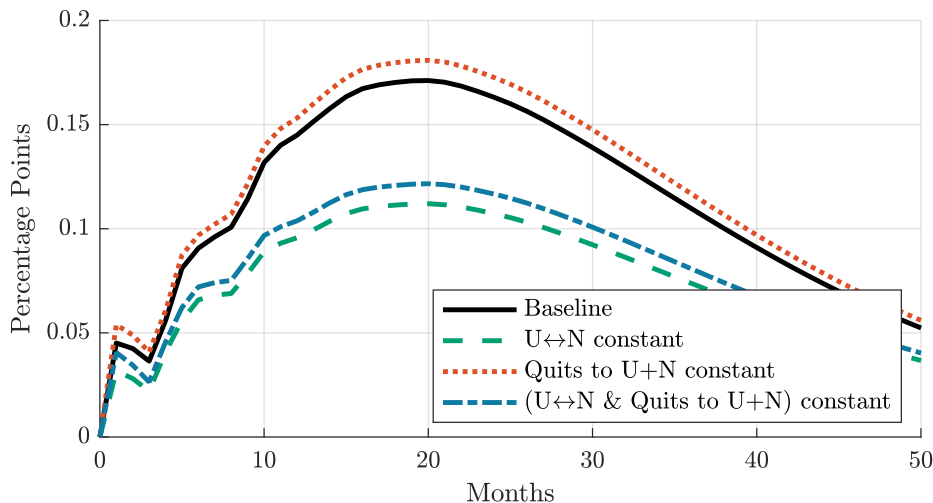
Bayesian SVAR



Main Business Cycle Shock

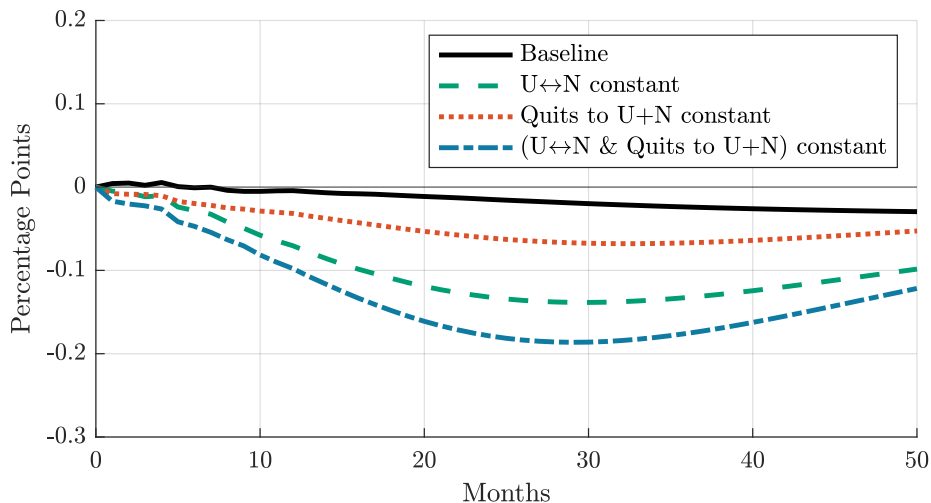


Unemployment Response to a Monetary Policy Shock



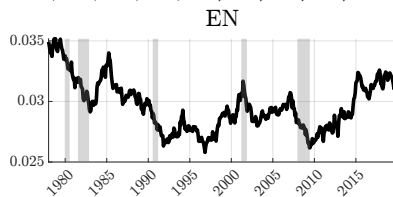
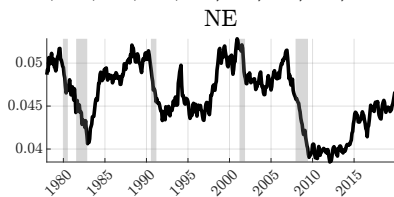
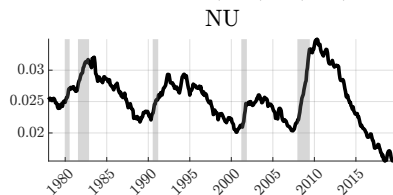
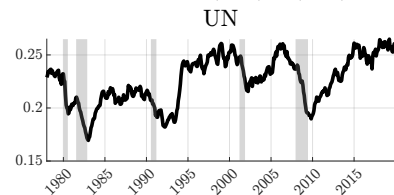
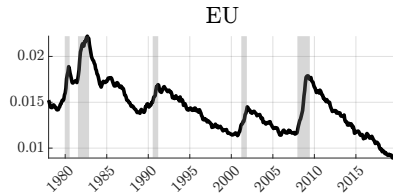
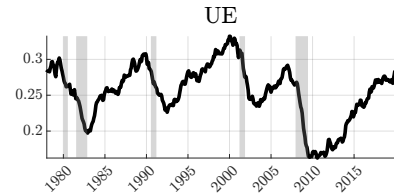
- Response of **quits** not important for unemployment dynamics

Participation Response to a Monetary Policy Shock

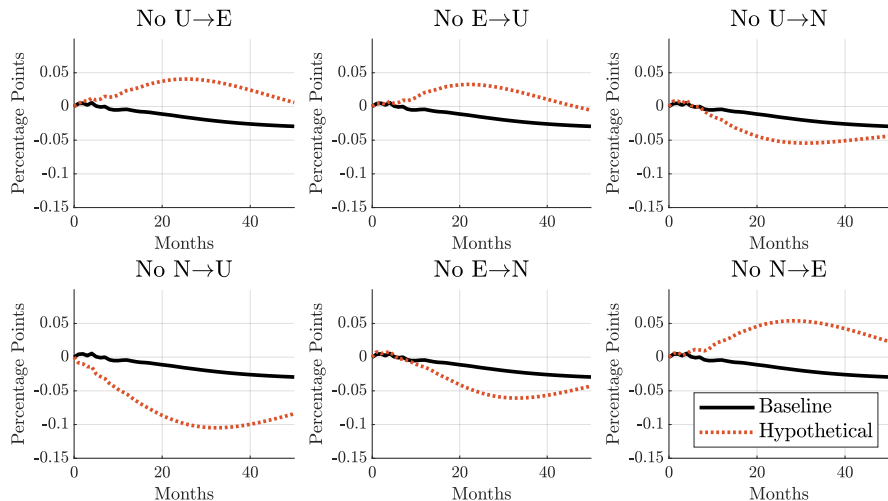


► With response of **supply-driven flows** fixed \Rightarrow Participation far **more procyclical**

Time Series of Labor Market Flows

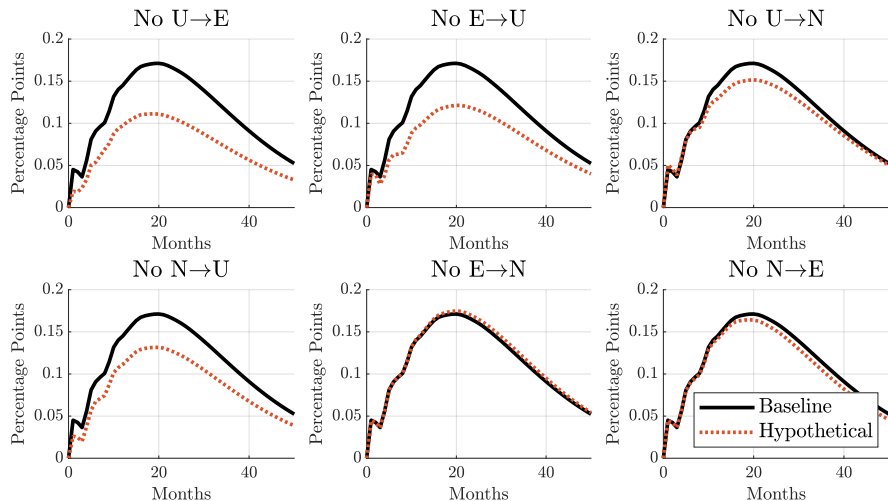


The Ins and Outs of Participation



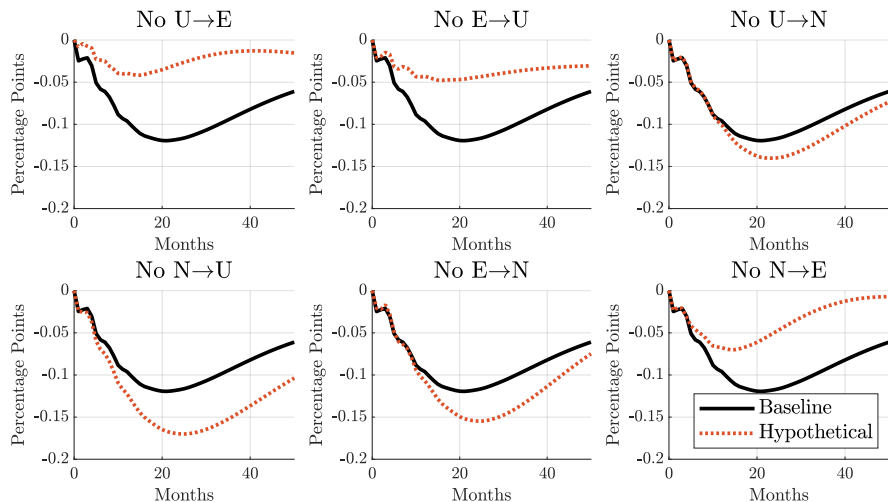
► $E \rightarrow U$ and $U \rightarrow E$ are important for participation cycle

The Ins and Outs of Unemployment



- $E \rightarrow U$ and $U \rightarrow E$ roughly equally responsible for rise in unemployment

The Ins and Outs of Employment



- $N \rightarrow U$ more important than $U \rightarrow N$ for supporting employment

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} .

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

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
- ▶ Calibrate a number of parameters, $\theta_{EXT} \equiv \{\beta, \gamma, \bar{R}, \delta_{UI}, w, \alpha, \phi, \bar{\phi}, \tau, T\}$
- ▶ 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

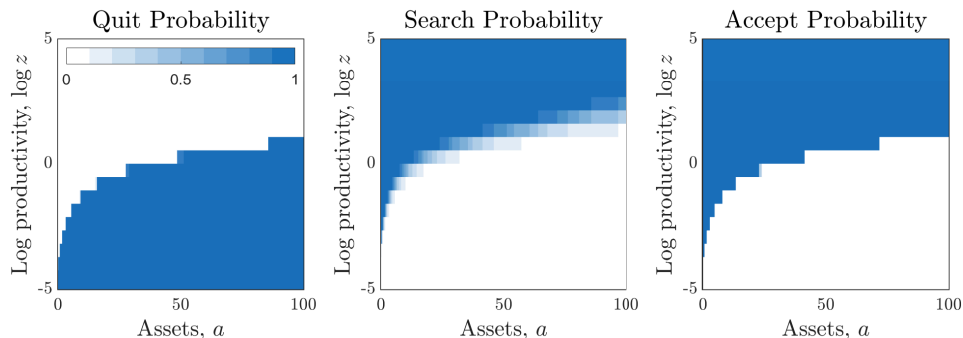
| Calibrated | | | |
|-----------------|--|-------|-------------------------|
| Parameter | Description | Value | Source/Target |
| β | Discount Factor | 0.988 | Quarterly MPC of 7-8% |
| R | Steady-State Real Interest Rate | 1.001 | 1% Annual |
| γ | Risk Aversion Coefficient | 2 | Standard value |
| 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) |


Steady-State Labor Market Flows

| Flow | Model | Data |
|------|--------|--------|
| EU | 0.0143 | 0.0142 |
| EN | 0.0296 | 0.0296 |
| UE | 0.2548 | 0.2547 |
| UN | 0.2263 | 0.2262 |
| NE | 0.0461 | 0.0461 |
| NU | 0.0253 | 0.0252 |

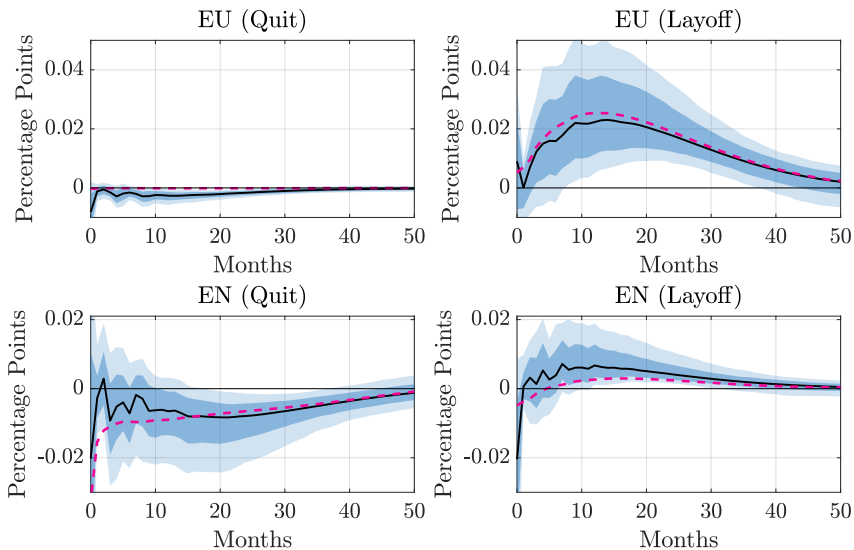
◀ Back

Results: Steady State

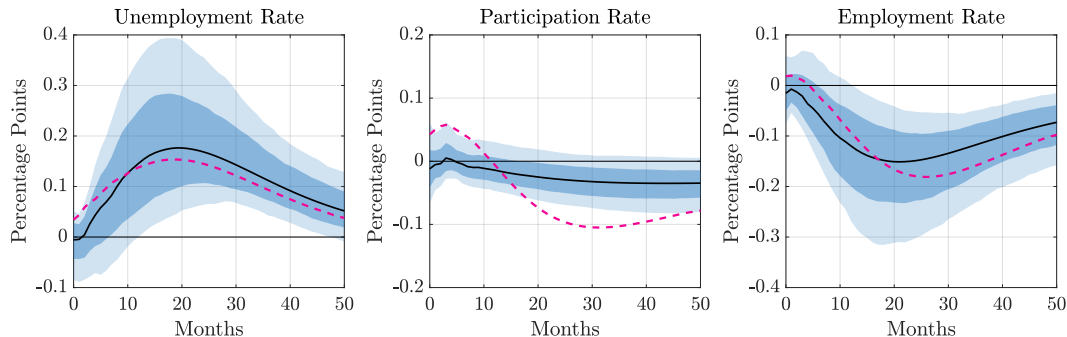


1. Model almost exactly fits steady-state transition rates between E, U and N 
2. Model produces quarterly MPC of 7-8%, annual MPE of 2-3%
In line with (recent) literature

Response of Quits and Layoffs: Model vs Data

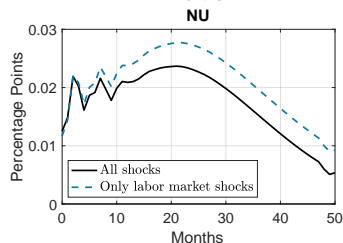
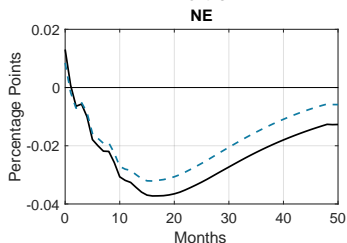
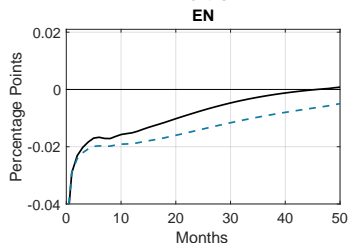
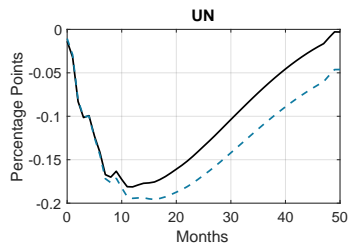
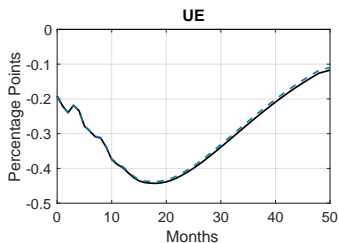
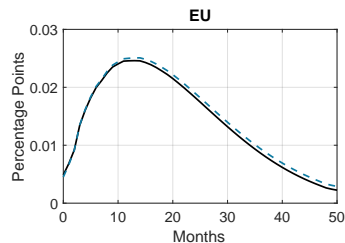


Response of Labor Market Stocks: Model vs Data



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Decomposing Response of Labor Market Flows



Related Literature

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 - ▶ Document a **quantitatively important** response of **supply-driven flows**

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