Joint Search over the Life Cycle

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Motivation

- Individual earnings/unemployment risk is large & varies by age
- Insurance margin for couples: Spousal labor supply
- Added Worker Effect (AWE):
  Labor force entry of spouse upon job loss of primary earner

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This Paper:

- Document heterogeneity in the AWE by age from U.S. micro data
  - AWE larger for young than for old
- Construct a life-cycle model of couples
  - frictional labor market, human capital formation, asset accumulation
- Counterfactuals: No need for AWE among old or no opportunity?

Added Worker Effect over the Life Cycle: Evidence

- Main earner job loss raises prob. of spouse joining labor force by 6pp
- Effect very heterogeneous by age
  - Age 25-35: 7.5pp
  - Age 56-65: 1.4pp

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  - across education groups
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  - across family types (children, excluding retired)
  - over the business cycle
  - across datasets (CPS, SIPP)

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- Age differential robust
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  - across datasets (CPS, SIPP)
- Reason for age differential? Different needs or opportunities?

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  - their labor market status: employed, searching, not searching
  - labor market experience: human capital accumulation
  - asset holdings: consumption-savings choice

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  - Age differential in arrival rates

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  - Age differential in arrival rates
- Model reproduces age differential in added worker effect
- Model counterfactuals
  - significant role for differential asset holdings across age groups
  - smaller roles for differential arrival rates and human capital

▸ Literature

Evidence

Data

- US data from Current Population Survey (CPS)
  IPUMS CPS (Flood, King, Rodgers, Ruggles, and Warren 2020)
  - Monthly rotating panel
  - Waves from 1994 to 2020

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- US data from Current Population Survey (CPS)
  IPUMS CPS (Flood, King, Rodgers, Ruggles, and Warren 2020)
  - Monthly rotating panel
  - Waves from 1994 to 2020
- Restrict sample to couples (primary earner + spouse)
  - Both members between 25 and 65 years old
  - Focus on one employed and one out of labor force

The Added Worker Effect

	Primary earner transition	
	EE	EU
Cond. prob. of spousal NE transition	6.03%	8.01%
Cond. prob. of spousal NU transition	1.63%	5.55%
Cond. prob. of spousal NN transition	92.34%	86.44%

▸ With EN

The Added Worker Effect

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▸ With EN

- Conditional on primary earner transitioning to unemployment
  - Higher probability of spouse entering labor force as employed
  - Higher probability of spouse entering labor force as unemployed
- Increase of roughly 6pp

Regression Analysis

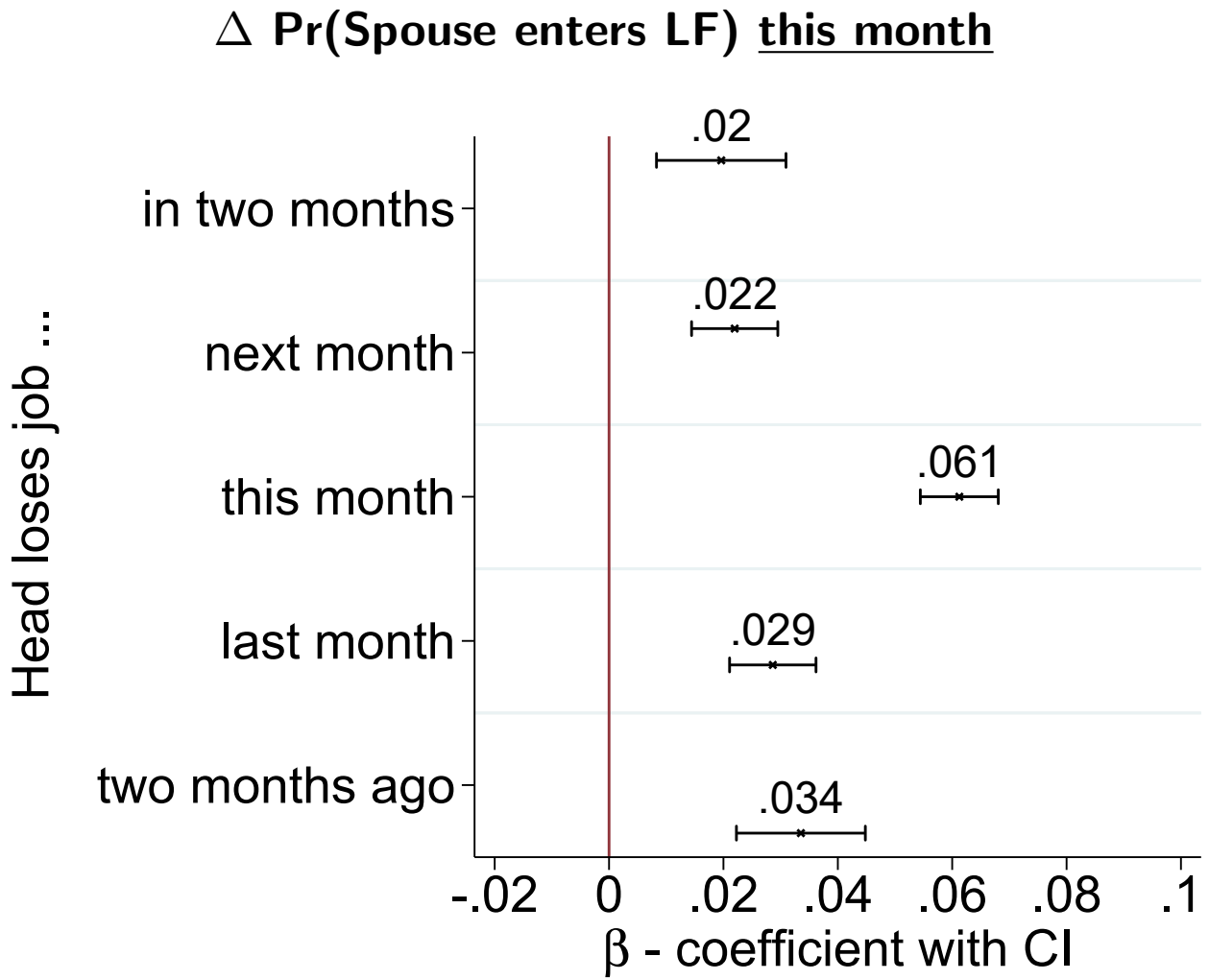
Regression of spousal labor market transition on head's transition to U:

$$\Delta LFS_{it}^{sp} = \alpha_j + \beta_j \Delta ES_{it+j}^{h} + \gamma_j X_{it} + \epsilon_{jit}$$

- Repeat analysis for $j = \{-2, -1, 0, 1, 2\}$
- ΔLFS_{it}^{sp}: Change in labor force status of spouse from $t-1 \rightarrow t$
- ΔES_{it}^{h}: Change in employment status of head from $t-1 \rightarrow t$

i = couple; t = month; h = head; sp = spouse;
X = add. controls (Unemployment Rate, month FE, year FE, state FE, sex, race, education, children)

The Added Worker Effect



▸ Reasons for unemployment

Added Worker Effect: Heterogeneity by Age

	Primary earner transition	
	EE	EU
Young (25-35):		
Cond. prob. of spousal NE transition	6.66%	9.30%
Cond. prob. of spousal NU transition	2.00%	6.89%
Cond. prob. of spousal NN transition	91.34%	83.81%
Old (56-65):		
Cond. prob. of spousal NE transition	4.29%	3.73%
Cond. prob. of spousal NU transition	0.90%	2.75%
Cond. prob. of spousal NN transition	94.81%	93.52%

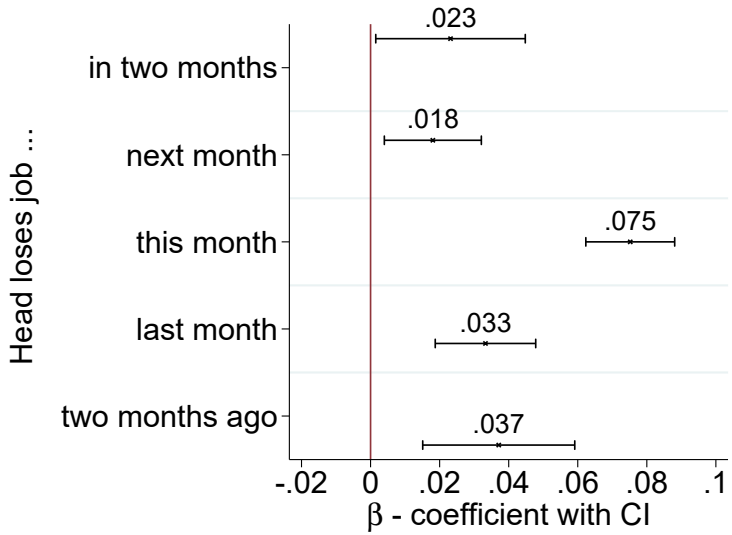
- Added worker effect larger for young: 7.53% vs. 1.29%

▸ EN ▸ Ages ▸ Edu. ▸ Sex ▸ Cohort ▸ Child ▸ Y. Child ▸ Why N ▸ Why U ▸ BC ▸ SIPP

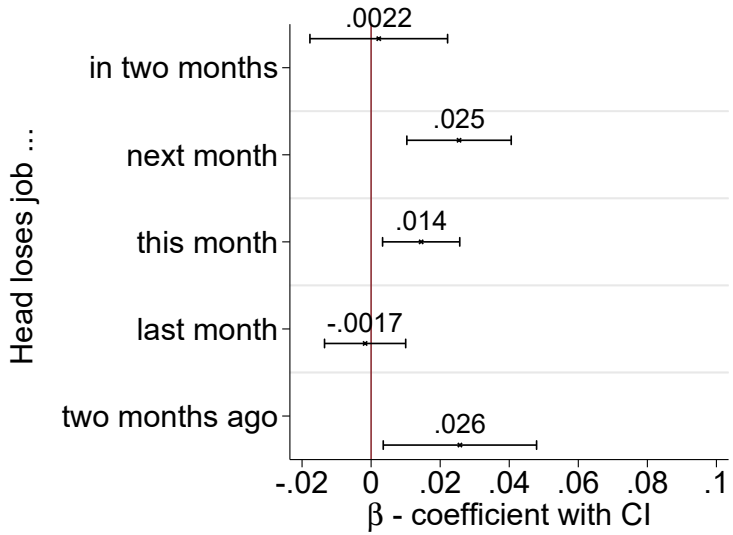
E = Employed U = Unemployed N = Non-Participating

Added Worker Effect: Heterogeneity by Age

Δ Pr(Spouse enters LF) <u>this month</u>



Age 25 to 35



Age 56 to 65

▸ Other Ages

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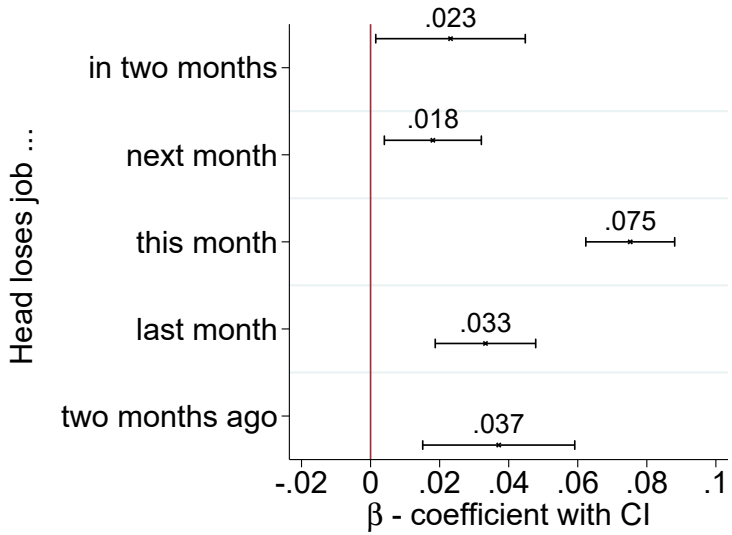

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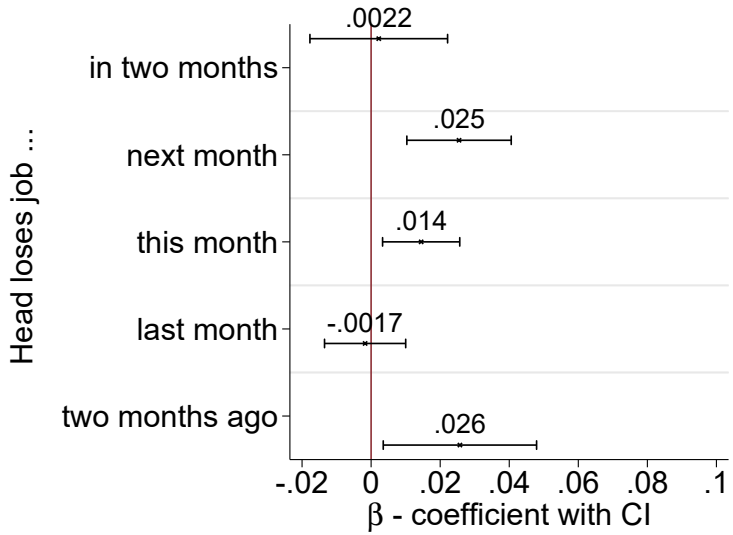

Age 56 to 65

▸ Other Ages

Overall: Strong AWE for young, weaker for old

Model

Households

Two-member households with **five states:**

Households

Two-member households with **five states: (t,**

1. **Age:**
    - T periods: work for $T_W < T$, retired for $T - T_W$

Households

Two-member households with **five states: (t, jk,**

1. **Age:**
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2. **Joint Labor Market Status:** ▸ Transitions
   - employed (E), unemployed with benefits (U), unemployed without benefits (S) or non-participating (N)
   - joint labor status $jk \in \mathcal{J} = \{E, U, S, N\} \times \{E, U, S, N\}$

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3. **Match Quality** $(z = (z_1, z_2))$**:**
   - only for employed members ▸ Exogenous Processes

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4. **Human Capital** $(h = (h_1, h_2))$**:**
   - accumulate while E, de-cumulate while U, S, N ▸ Exogenous Processes
5. **Assets:**
   - risk free bond at interest rate r

▸ Timing

Consumption-Savings Choice

$$V_t^{jk}(z,h,a) = \max_{a'} u(c^{jk}(z,h,a,a')) + \psi_t^{jk} + \beta\Theta_{t+1}^{jk}(z,h,a')$$

- Value consumption $u(c)$ (pooled within HH)

$$c^{jk}(z,h,a,a') = \underbrace{\mathbb{I}_{j=E}w(z_1,h_1) + \mathbb{I}_{k=E}w(z_2,h_2)}_{\text{labor income}} + \underbrace{\mathbb{I}_{j=U}\bar{b} + \mathbb{I}_{k=U}\bar{b}}_{\text{unemployment benefits}} - \underbrace{(a' - (1+r)a)}_{\text{net savings}}$$

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  $\Rightarrow$ Utility of staying at home and dis-utility of search

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- Continuation value $\Theta_t^{jk}(z,h,a')$ ▸ Continuation Value ▸ Choice Sets

Vacancy Posting and Arrival Rates

- Output of a match and wages
  - Output $y(z,h) = zh$
  - Wage $w(z,h) = \chi y(z,h)$

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  - Markets conditional on household state variables
- Scaled by search intensity
  - Equal intensities $\lambda_U = \lambda_S$ for unemployed
  - Lower intensity λ_N for out of the labor force

▸ Firm Problem

Calibration: Joint Labor Market States

- Model period is a month: 40 years of working life $\rightarrow$ 480 periods
- Target joint labor market states, income/asset profiles, flows, ...

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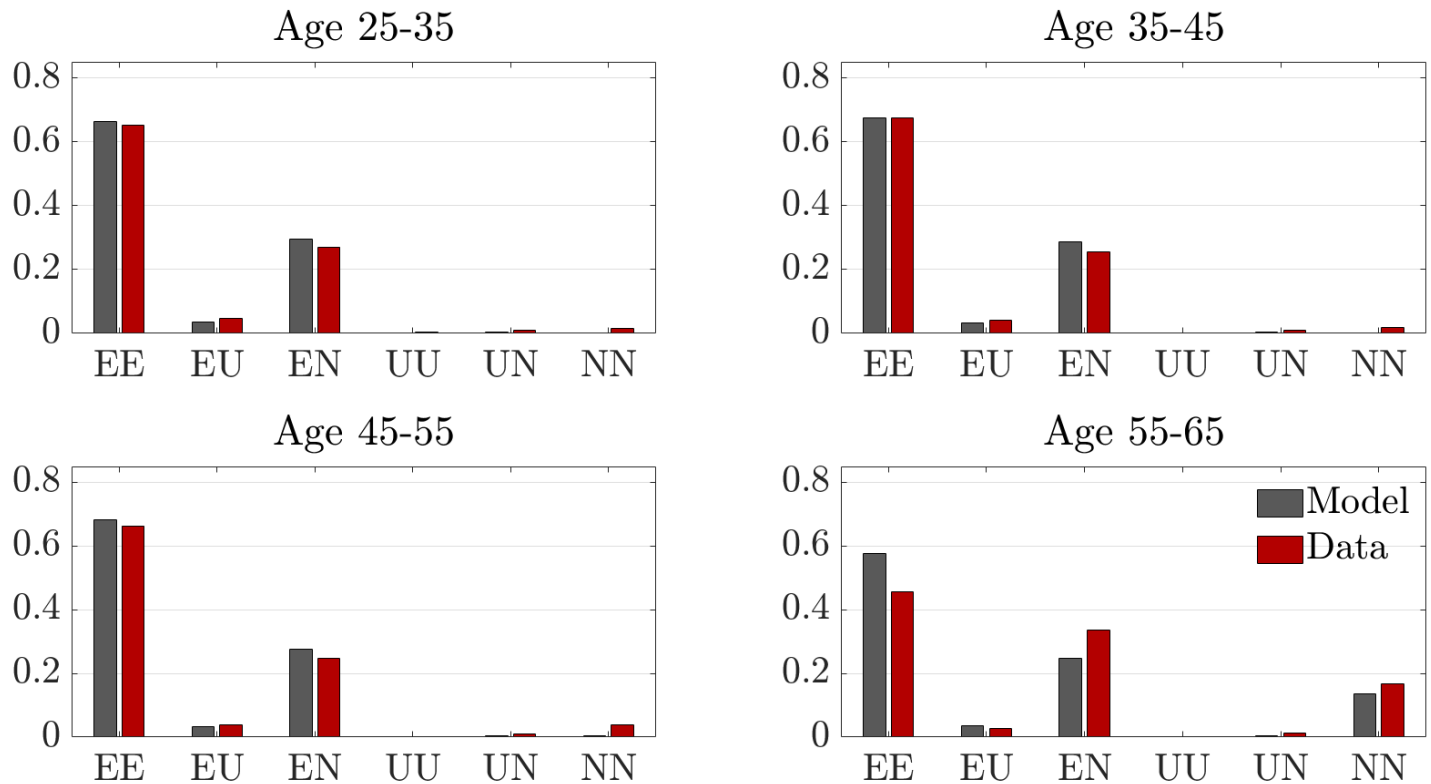

▸ Assets ▸ Income ▸ Transitions

The Added Worker Effect in the Model

Joint Labor Market Transitions by Age (Model vs. Data)

	Primary earner transition	
	EE	EU/ES
Young (25-35):		
Cond. prob. of spousal NE transition	2.26%	3.12%
	6.66%	9.30%
Cond. prob. of spousal NS transition	0.40%	5.28%
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Cond. prob. of spousal NN transition	97.34%	91.60%
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Old (55-65):		
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▸ Leads and Lags

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AWE for young: 5.74% 7.53%

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AWE for old: 1.35% 1.29%

▸ Leads and Lags

The AWE over the Life Cycle: Counterfactuals

Which factors explain the change in the AWE over the life cycle?

- Three candidates: arrival rates, human capital, assets
- Compute average values of old and young along each dimension
- Adjust every young household's state such that
  - On average, young have characteristics of old
  - Preserves within young position in distribution

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Cond. prob. of spousal NN transition	97.34%	91.60%
Counterfactual assets		
Cond. prob. of spousal NE transition	1.04%	1.73%
Cond. prob. of spousal NS transition	0.30%	3.31%
Cond. prob. of spousal NN transition	98.66%	94.96%

- Higher asset holdings
- AWE: 3.70% vs. 5.74%

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Cond. prob. of spousal NN transition	97.34%	91.60%
Counterfactual human capital		
Cond. prob. of spousal NE transition	1.70%	3.02%
Cond. prob. of spousal NS transition	0.24%	3.09%
Cond. prob. of spousal NN transition	98.06%	93.89%

- Approximately same human capital for out of labor force spouse
- Higher human capital for primary earner
- AWE: 4.17% vs. 5.74%

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Counterfactual meeting probabilities		
Cond. prob. of spousal NE transition	2.14%	2.93%
Cond. prob. of spousal NS transition	0.41%	5.36%
Cond. prob. of spousal NN transition	97.46%	91.71%

- Reduced meeting probabilities for young, but small effect
- New version: Larger role for arrival rates
  - Vacancy posting after exogenous separations

Conclusion

- Summary
  - Evidence: AWE stronger for young than for old
  - Model: Life-cycle search model of two-member households
  - Similar contributions of "no need" and "no opportunity" channels
- Next steps
  - Model estimation of new version
  - Age-dependent unemployment insurance
- **comments and questions very welcome: lukas.nord@eui.eu**

Appendix

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Related Literature

- Empirical work on the added worker effect

  Lundberg (1985), Maloney (1987, 1991), **Stephens (2002)**, Toohey (2012), Mankart and Oikonomou (2016), **Guner, Kulikova, and Valladares-Esteban (2021)**

  $\Rightarrow$ AWE over the entire life cycle

- Search models with two-member households

  Guler, Guvenen, and Violante (2012), Mankart and Oikonomou (2016), Fang and Shephard (2019), Wang (2019), Choi and Valladares-Esteban (2020), **Birinci (2021)**, Morazzoni and Smirnov (2021), Bardóczy (2022), Ellieroth (2022), Fernández-Blanco (2022)

  $\Rightarrow$ Life cycle, endogenous arrival rates

- Life-cycle search models

  Chéron, Hairault, and Langot (2011, 2013), Michelacci and Ruffo (2015), **Menzio, Telyukova, and Visschers (2016)**, Jung and Kuhn (2019), Griffy (2021)

- Life-cycle family labor supply

  Ortigueira and Siassi (2013), Blundell, Pistaferri, and Saporta-Eksten (2016), **Haan and Prowse (2020)**, Wu and Krueger (2021)

  $\Rightarrow$ Joint labor supply decisions with search frictions over life cycle

◂ Back

By Reasons for Unemployment

	EE	EU (by reasons for U)			
		Layoff	Job Loser	Temp. Job ended	Job Leaver
NE	6.03%	6.13%	8.81%	7.56%	10.47%
NU	1.63%	3.51%	6.66%	6.59%	7.68%
NN	92.34%	90.35%	84.53%	85.85%	81.86%

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- Layoff, potentially temporary => small AWE

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- Layoff, potentially temporary => small AWE
- Job loss, more permanent => larger AWE

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	EE	EU (by reasons for U)			
		Layoff	Job Loser	Temp. Job ended	Job Leaver
NE	6.03%	6.13%	8.81%	7.56%	10.47%
NU	1.63%	3.51%	6.66%	6.59%	7.68%
NN	92.34%	90.35%	84.53%	85.85%	81.86%

- Layoff, potentially temporary => small AWE
- Job loss, more permanent => larger AWE
- Temp. job ended, more permanent => larger AWE

Back

By Reasons for Unemployment

	EE	EU (by reasons for U)			
		Layoff	Job Loser	Temp. Job ended	Job Leaver
NE	6.03%	6.13%	8.81%	7.56%	10.47%
NU	1.63%	3.51%	6.66%	6.59%	7.68%
NN	92.34%	90.35%	84.53%	85.85%	81.86%

- Layoff, potentially temporary => small AWE
- Job loss, more permanent => larger AWE
- Temp. job ended, more permanent => larger AWE
- Quits => joint optimization

Back

Joint Labor Market Transitions of Couples

	Primary earner transition		
	EE	EU	EN
Cond. prob. of spousal NE transition	6.03%	8.01%	16.79%
Cond. prob. of spousal NU transition	1.63%	5.55%	1.33%
Cond. prob. of spousal NN transition	92.34%	86.44%	81.88%

◂ Back

Heterogeneity by Age

	Primary earner transition		
	EE	EU	EN
Young (25-35):			
Cond. prob. of spousal NE transition	6.66%	9.30%	26.93%
Cond. prob. of spousal NU transition	2.00%	6.89%	2.02%
Cond. prob. of spousal NN transition	91.34%	83.81%	71.05%
Old (56-65):			
Cond. prob. of spousal NE transition	4.29%	3.73%	8.69%
Cond. prob. of spousal NU transition	0.90%	2.75%	0.56%
Cond. prob. of spousal NN transition	94.81%	93.52%	90.76%

◂ Back

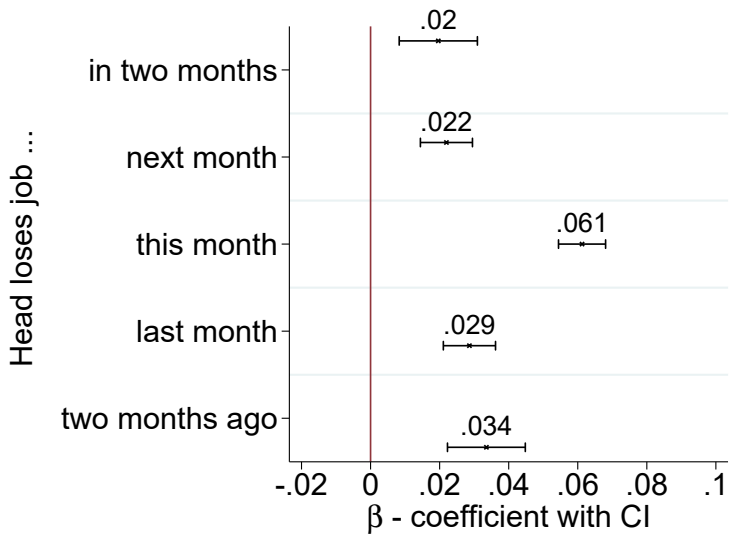
Heterogeneity by Age: Other Age Groups

	Primary earner transition		
	EE	EU	EN
Age Spouse 36-45:			
Cond. prob. of spousal NE transition	6.73%	9.32%	26.69%
Cond. prob. of spousal NU transition	1.86%	6.37%	2.00%
Cond. prob. of spousal NN transition	91.41%	84.31%	71.30%
Age Spouse 46-55:			
Cond. prob. of spousal NE transition	6.13%	7.96%	16.62%
Cond. prob. of spousal NU transition	1.62%	4.79%	1.72%
Cond. prob. of spousal NN transition	92.25%	87.25%	81.66%

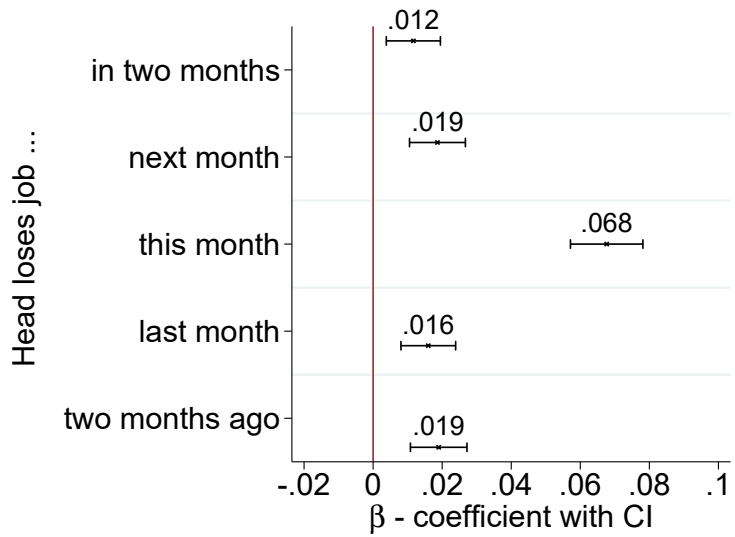
◂ Back

CPS vs. SIPP – Full Sample

Δ Pr(Spouse enters LF) <u>this month</u>



CPS Data

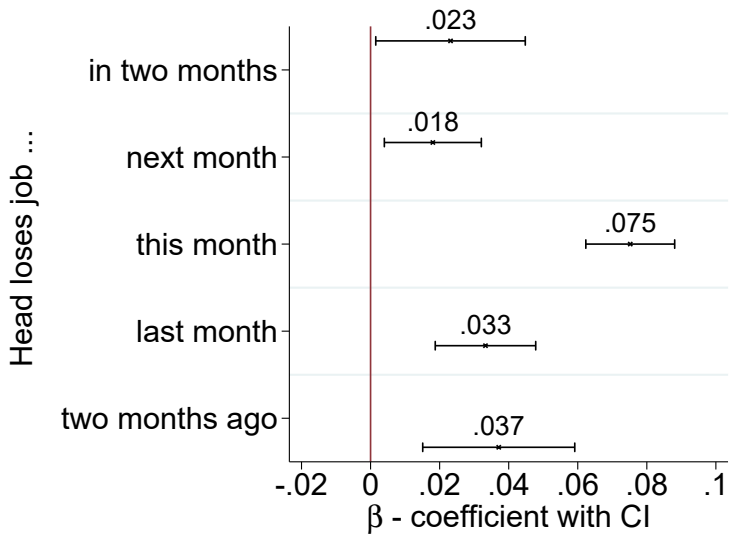


SIPP Data

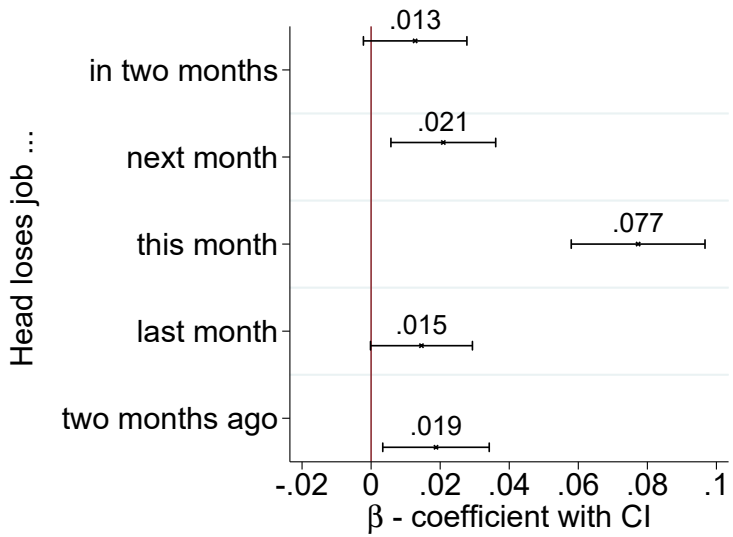
◂ Back

CPS vs. SIPP – Age 25 to 35

Δ Pr(Spouse enters LF) this month



CPS Data

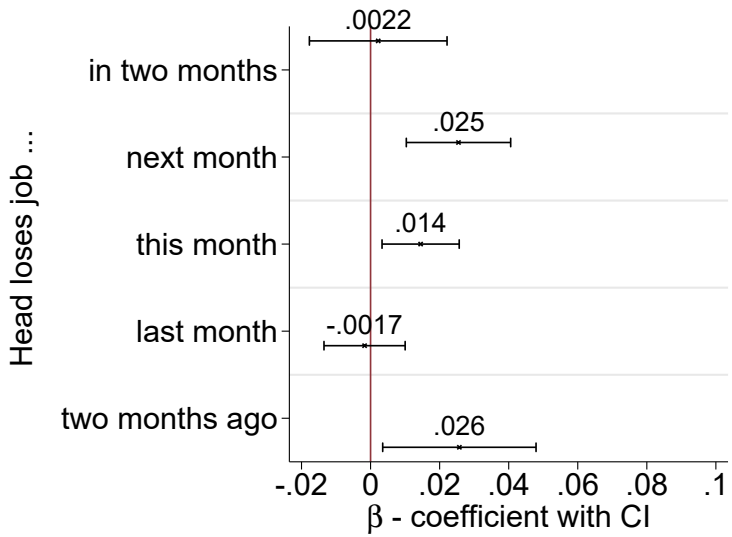


SIPP Data

Back

CPS vs. SIPP – Age 56 to 65

Δ Pr(Spouse enters LF) this month



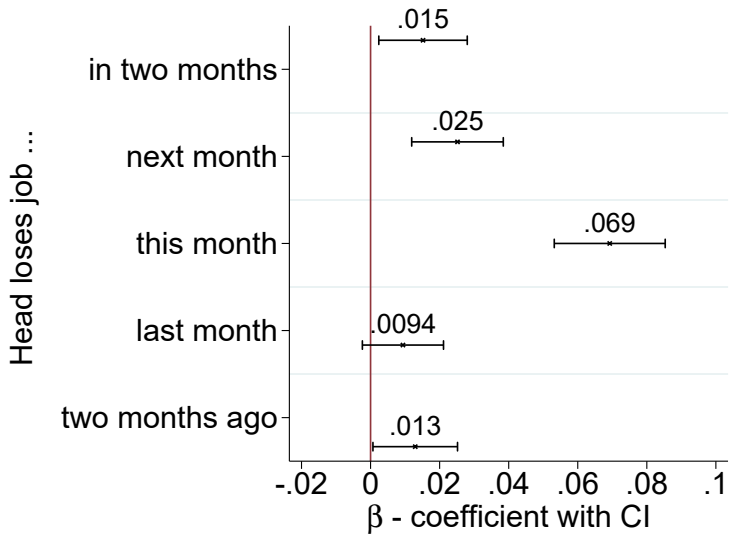
CPS Data

SIPP Data

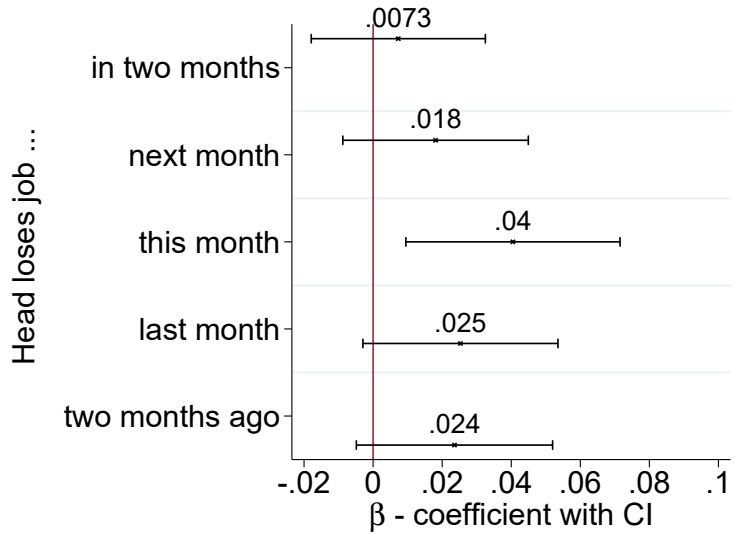
Back

Added Worker Effect by Net Liquid Wealth

Δ Pr(Spouse enters LF) <u>this month</u>



1^{st} Net Liquid Wealth Quartile



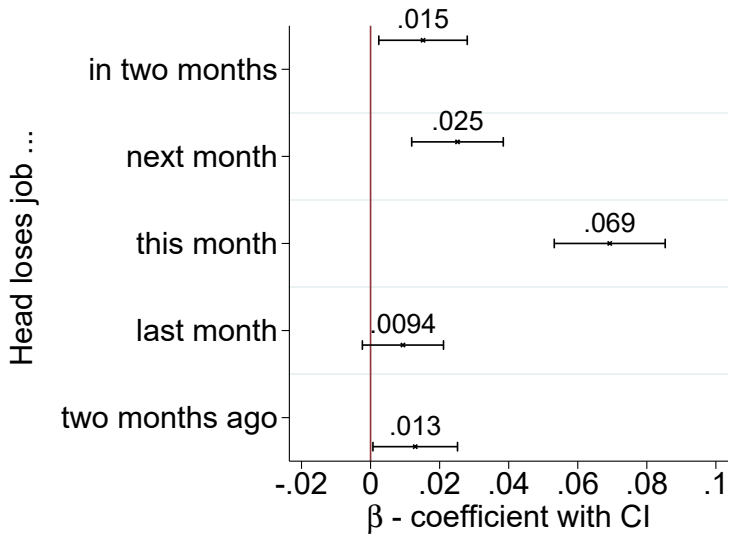
4^{th} Net Liquid Wealth Quartile

◂ Back

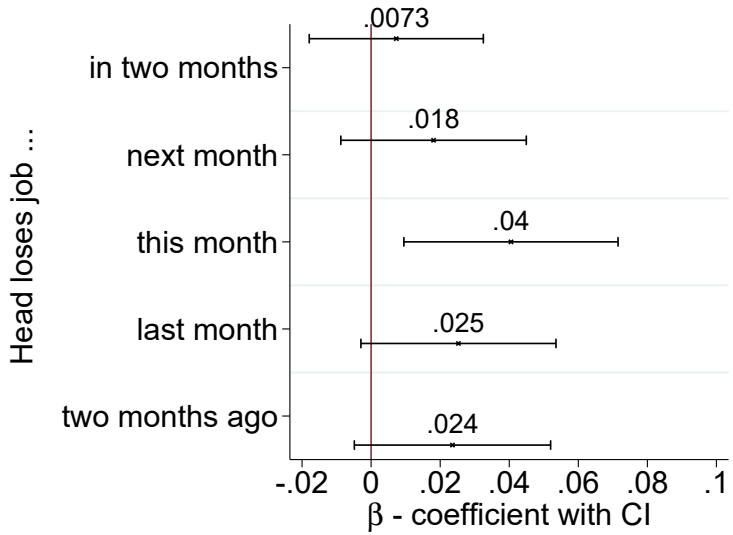
Regression add. controls for age; Net Liquid Wealth = total wealth - home equity - vehicle equity - unsec. debt; **Data Source: SIPP**

Added Worker Effect by Net Liquid Wealth

Δ Pr(Spouse enters LF) this month



1^{st} Net Liquid Wealth Quartile



4^{th} Net Liquid Wealth Quartile

Back

- Stronger AWE for low wealth households

Regression add. controls for age; Net Liquid Wealth = total wealth - home equity - vehicle equity - unsec. debt; **Data Source: SIPP**

Heterogeneity by Age and Education

College

	Primary earner transition		
	EE	EU	EN
Spouse Young:			
Cond. prob. of spousal NE transition	7.31%	13.25%	33.25%
Cond. prob. of spousal NU transition	1.70%	7.22%	1.29%
Cond. prob. of spousal NN transition	90.99%	79.53%	65.46%
Spouse Old:			
Cond. prob. of spousal NE transition	6.04%	7.72%	11.81%
Cond. prob. of spousal NU transition	1.35%	4.87%	0.86%
Cond. prob. of spousal NN transition	92.61%	87.41%	87.33%

Back

Heterogeneity by Age and Education

No College

	Primary earner transition		
	EE	EU	EN
Spouse Young:			
Cond. prob. of spousal NE transition	6.30%	8.34%	21.76%
Cond. prob. of spousal NU transition	2.01%	6.28%	2.21%
Cond. prob. of spousal NN transition	91.69%	85.37%	76.03%
Spouse Old:			
Cond. prob. of spousal NE transition	4.19%	4.20%	9.41%
Cond. prob. of spousal NU transition	0.99%	2.83%	0.80%
Cond. prob. of spousal NN transition	94.82%	92.97%	89.79%

◂ Back

Gender Heterogeneity

	Primary earner transition		
	EE	EU	EN
Spouse is a Man (Young) :			
Cond. prob. of spousal NE transition	13.54%	14.07%	44.10%
Cond. prob. of spousal NU transition	6.19%	11.69%	2.59%
Cond. prob. of spousal NN transition	80.27%	74.24%	53.31%
Spouse is a Man (Old):			
Cond. prob. of spousal NE transition	4.50%	4.59%	10.36%
Cond. prob. of spousal NU transition	1.13%	3.23%	0.63%
Cond. prob. of spousal NN transition	94.37%	92.18 %	89.01%

◂ Back

One Cohort

	Primary earner transition		
	EE	EU	EN
Spouse born between 1960-70 (Young):			
Cond. prob. of spousal NE transition	6.98%	8.62%	21.67%
Cond. prob. of spousal NU transition	1.89%	6.70%	2.42%
Cond. prob. of spousal NN transition	91.13%	84.68%	75.92%
Spouse born between 1960-70 (Old)			
Cond. prob. of spousal NE transition	4.28%	2.94%	12.86%
Cond. prob. of spousal NU transition	1.11%	3.68%	1.04%
Cond. prob. of spousal NN transition	94.61%	93.38%	86.10%

◂ Back

Children (Parents below 40)

	Primary earner transition		
	EE	EU	EN
Have Children:			
Cond. prob. of spousal NE transition	6.26%	8.71%	28.30%
Cond. prob. of spousal NU transition	1.75%	6.65%	2.31%
Cond. prob. of spousal NN transition	91.98%	84.64%	69.40%
No Children:			
Cond. prob. of spousal NE transition	9.68%	12.68%	23.69%
Cond. prob. of spousal NU transition	3.40%	8.54%	1.59%
Cond. prob. of spousal NN transition	86.91%	78.78%	74.72%

◂ Back

Young Children (Parents below 40)

	Primary earner transition		
	EE	EU	EN
Have Children below 5:			
Cond. prob. of spousal NE transition	5.63%	8.55%	30.09%
Cond. prob. of spousal NU transition	1.47%	6.14%	1.96%
Cond. prob. of spousal NN transition	92.90%	85.31%	67.95%
No Children below 5:			
Cond. prob. of spousal NE transition	8.08%	9.95%	24.82%
Cond. prob. of spousal NU transition	2.60%	7.80%	2.35%
Cond. prob. of spousal NN transition	89.32%	82.24%	72.82%

◂ Back

Reasons for Non-Participation

	Primary earner transition		
	EE	EU	EN
Excluding Retirement (Young):			
Cond. prob. of spousal NE transition	6.66%	9.32%	27.13%
Cond. prob. of spousal NU transition	2.00%	6.91%	2.06%
Cond. prob. of spousal NN transition	91.33%	83.77%	70.81%
Excluding Retirement (Old):			
Cond. prob. of spousal NE transition	4.95%	4.15%	11.45%
Cond. prob. of spousal NU transition	1.18%	3.33%	1.00%
Cond. prob. of spousal NN transition	93.87%	92.52%	87.54%

◂ Back

Reasons for Non-Participation

	Primary earner transition		
	EE	EU	EN
Excluding Disabled/Ill (Young):			
Cond. prob. of spousal NE transition	6.55%	9.34%	27.02%
Cond. prob. of spousal NU transition	1.96%	6.94%	2.01%
Cond. prob. of spousal NN transition	91.49%	83.72%	70.97 %
Excluding Disabled/Ill (Old):			
Cond. prob. of spousal NE transition	4.17%	3.42%	8.53%
Cond. prob. of spousal NU transition	0.88%	2.77%	0.50%
Cond. prob. of spousal NN transition	94.95%	93.81%	90.97%

◂ Back

Reasons for Non-Participation

	Primary earner transition		
	EE	EU	EN
Excluding Retired and Disabled/Ill (Young):			
Cond. prob. of spousal NE transition	6.55%	9.36%	27.23%
Cond. prob. of spousal NU transition	1.97%	6.96%	2.05%
Cond. prob. of spousal NN transition	91.48%	83.68%	70.72%
Excluding Retired and Disabled/Ill (Old):			
Cond. prob. of spousal NE transition	4.74%	3.62%	11.20%
Cond. prob. of spousal NU transition	1.16%	3.40%	0.89%
Cond. prob. of spousal NN transition	94.11%	92.99%	87.91%

Back

By State of the Business Cycle

	Primary earner transition		
	EE	EU	EN
NBER Recession, Young			
Cond. prob. of spousal NE transition	6.48%	7.74%	22.38%
Cond. prob. of spousal NU transition	1.98%	8.73%	0.99%
Cond. prob. of spousal NN transition	91.55%	83.53%	76.63%
NBER Recession, Old			
Cond. prob. of spousal NE transition	4.14%	5.43%	7.71%
Cond. prob. of spousal NU transition	0.83%	2.76%	0.68%
Cond. prob. of spousal NN transition	95.03%	91.81%	91.61%

Back

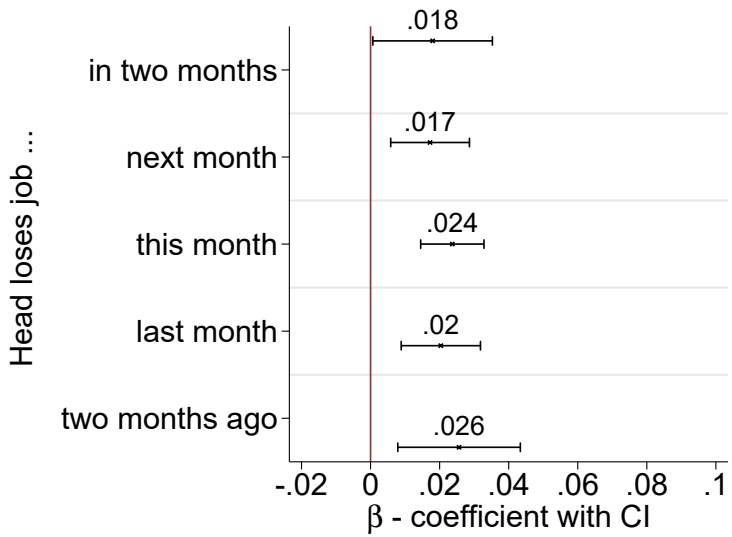
By State of the Business Cycle

	Primary earner transition		
	EE	EU	EN
No NBER Recession, Young			
Cond. prob. of spousal NE transition	6.68%	9.53%	27.45%
Cond. prob. of spousal NU transition	2.00%	6.63%	2.14%
Cond. prob. of spousal NN transition	91.31%	83.85%	70.41%
No NBER Recession, Old			
Cond. prob. of spousal NE transition	4.30%	3.46%	8.80%
Cond. prob. of spousal NU transition	0.91%	2.75%	0.54%
Cond. prob. of spousal NN transition	94.79%	93.79%	90.66%

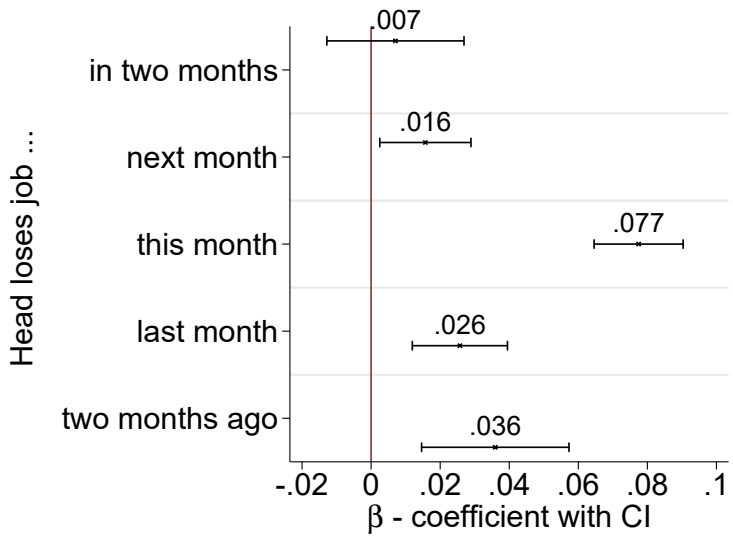
◂ Back

By Reasons for Unemployment

Δ Pr(Spouse enters LF) this month



Layoff

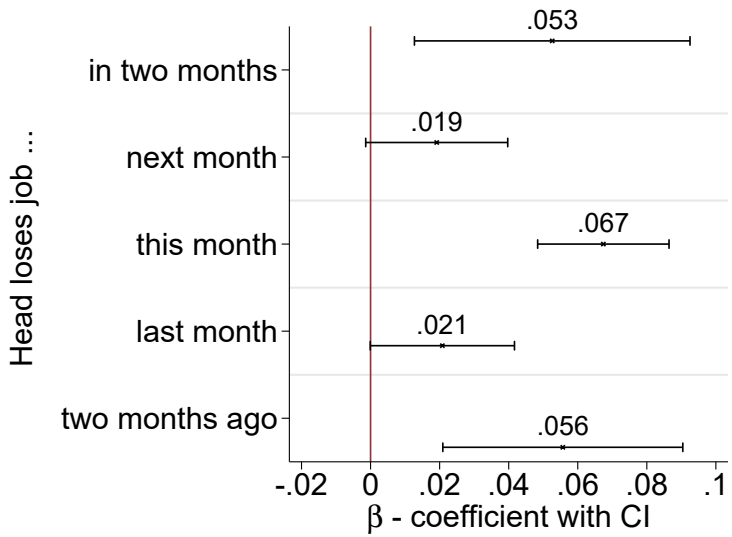


Job Loser

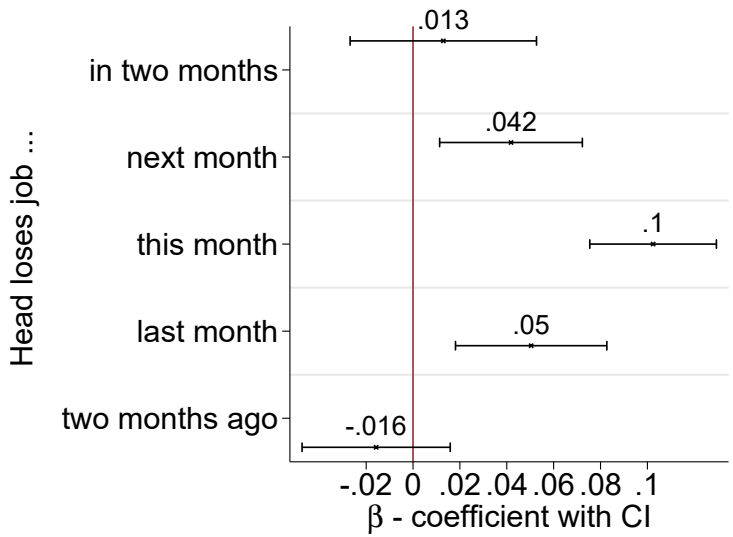
Back

By Reasons for Unemployment

Δ Pr(Spouse enters LF) this month



Temporary Job Ended

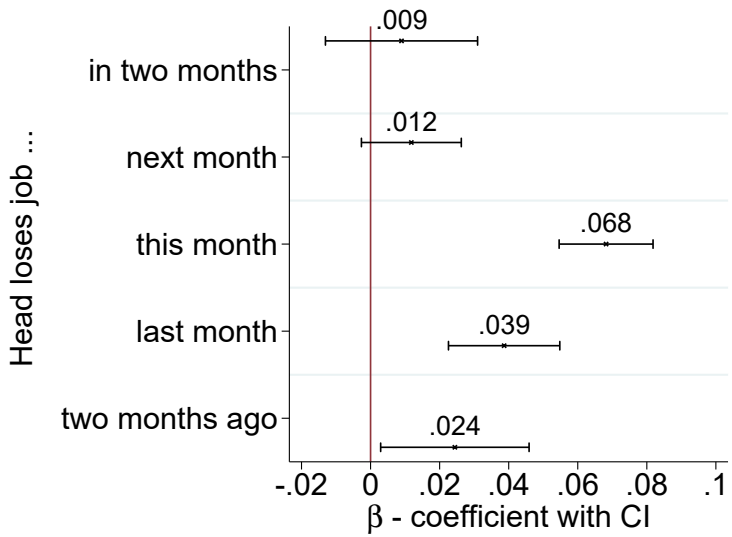


Job Leaver

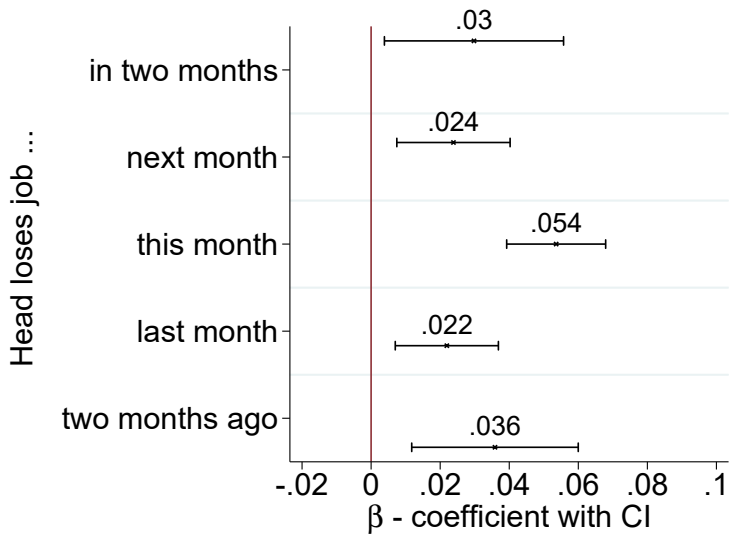
Back

Other Age Groups

Δ Pr(Spouse enters LF) this month



Age 36 to 45



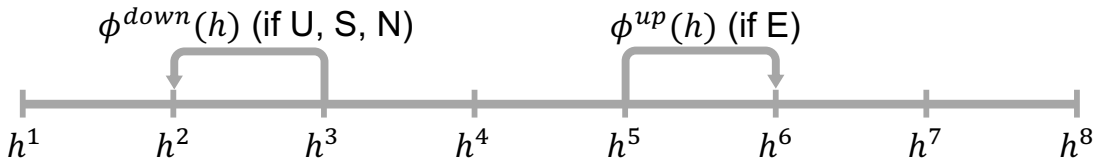
Age 46 to 55

Back

Exogenous Processes

Human Capital:

- E: increases one unit with $Pr(h_i' = h^{j+1} | h_i = h^j) = \phi^{up}(h_i)$
- U, S, N: decreases a unit with $Pr(h_i' = h^{j-1} | h_i = h^j) = \phi^{down}(h_i)$

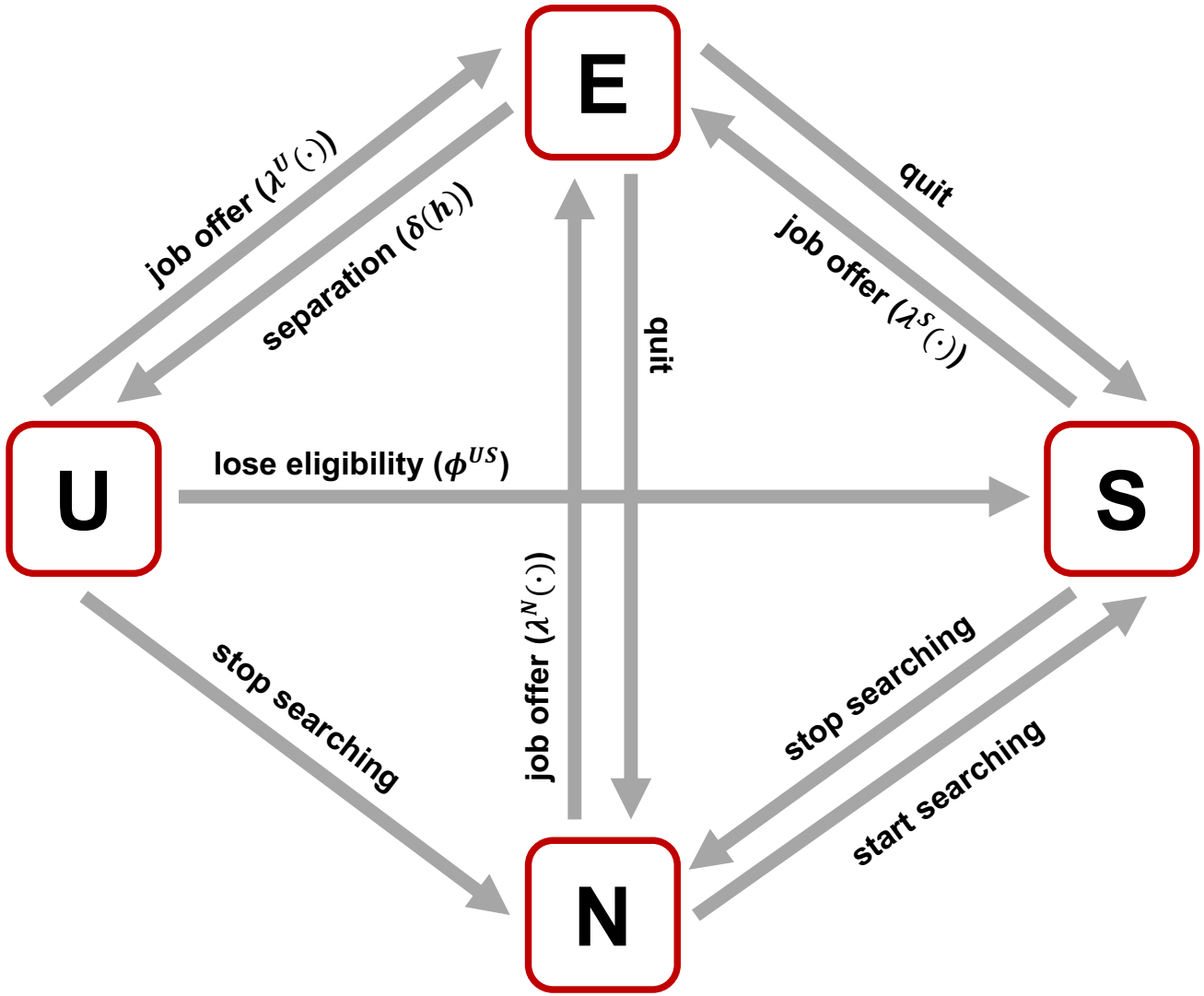


Match quality:

- Together with job offer receive initial draw from distribution $\pi_0(z)$
- Employed z evolves as Markov process.

◂ Back

Labor Market Transitions



◂ Back

Timing

Receive labor income (UI benefits) and asset income

↓

Consumption-savings choice

↓

Separation shocks and job offers realize

↓

Match quality shocks and human capital transitions realize

↓

Choose joint future labor market state from feasible subset of $\mathcal{J}$

◂ Back

Continuation Value

Continuation value if EE today can be defined in two steps:

1. Expectation over separations and resulting choice sets:

$$\begin{aligned}\Theta_{t+1}^{EE}(z_1, z_2, h_1, h_2, a') = \\ (1-\delta(h_1))(1-\delta(h_2))\ \widetilde{V}_{t+1}(z_1, z_2, h_1, h_2, a', \mathcal{J}_{XX}^{EE}) \\ +\delta(h_1)(1-\delta(h_2))\ \widetilde{V}_{t+1}(z_1, z_2, h_1, h_2, a', \mathcal{J}_{UX}^{XE}) \\ +(1-\delta(h_1))\delta(h_2)\ \widetilde{V}_{t+1}(z_1, z_2, h_1, h_2, a', \mathcal{J}_{XU}^{EX}) \\ +\delta(h_1)\delta(h_2)\ \widetilde{V}_{t+1}(z_1, z_2, h_1, h_2, a', \mathcal{J}_{UU}^{XX})\end{aligned}$$

◂ Back

Continuation Value

Continuation value if EE today can be defined in two steps:

2. Exogenous processes and labor supply decision:

$$\widetilde{V}_{t+1}(z_1, z_2, h_1, h_2, a, \mathcal{J}_{QR}^{OP}) =$$

$$\phi^{up}(h_1)\phi^{up}(h_2)\ \mathbb{E}_{z_1'|z_1}\mathbb{E}_{z_2'|z_2}\ \mathbb{E}_{\epsilon}\max_{\widehat{jk}\in\mathcal{J}_{QR}^{OP}}\left\{V_{t+1}^{\widehat{jk}}(z_1, z_2, h_1, h_2, a) + \sigma\epsilon^{\widehat{jk}}\right\}$$

$$+\phi^{up}(h_1)(1-\phi^{up}(h_2))\ \mathbb{E}_{z_1'|z_1}\mathbb{E}_{z_2'|z_2}\ \mathbb{E}_{\epsilon}\max_{\widehat{jk}\in\mathcal{J}_{QR}^{OP}}\left\{V_{t+1}^{\widehat{jk}}(z_1, z_2, h_1, h_2, a) + \sigma\epsilon^{\widehat{jk}}\right\}$$

$$+(1-\phi^{up}(h_1))\phi^{up}(h_2)\ \mathbb{E}_{z_1'|z_1}\mathbb{E}_{z_2'|z_2}\ \mathbb{E}_{\epsilon}\max_{\widehat{jk}\in\mathcal{J}_{QR}^{OP}}\left\{V_{t+1}^{\widehat{jk}}(z_1, z_2, h_1, h_2, a) + \sigma\epsilon^{\widehat{jk}}\right\}$$

$$+(1-\phi^{up}(h_1))(1-\phi^{up}(h_2))\ \mathbb{E}_{z_1'|z_1}\mathbb{E}_{z_2'|z_2}\ \mathbb{E}_{\epsilon}\max_{\widehat{jk}\in\mathcal{J}_{QR}^{OP}}\left\{V_{t+1}^{\widehat{jk}}(z_1, z_2, h_1, h_2, a) + \sigma\epsilon^{\widehat{jk}}\right\}$$

where $\epsilon \in \mathbb{R}^{|\mathcal{J}_{nm}^{jk}|}$ is a vector of i.i.d., mean zero extreme value shocks.

◂ Back

Labor Supply Choice Sets

Benefit Eligibility	**Job (Offer)** Both	Member 1	Member 2	None
Both	$\mathcal{J}_{UU}^{EE} = \{E,U,N\} \times \{E,U,N\}$	$\mathcal{J}_{UU}^{EX} = \{E,U,N\} \times \{U,N\}$	$\mathcal{J}_{UU}^{XE} = \{U,N\} \times \{E,U,N\}$	$\mathcal{J}_{UU}^{XX} = \{U,N\} \times \{U,N\}$
Member 1	$\mathcal{J}_{UX}^{EE} = \{E,U,N\} \times \{E,S,N\}$	$\mathcal{J}_{UX}^{EX} = \{E,U,N\} \times \{S,N\}$	$\mathcal{J}_{UX}^{XE} = \{U,N\} \times \{E,S,N\}$	$\mathcal{J}_{UX}^{XX} = \{U,N\} \times \{S,N\}$
Member 2	$\mathcal{J}_{XU}^{EE} = \{E,S,N\} \times \{E,U,N\}$	$\mathcal{J}_{XU}^{EX} = \{E,S,N\} \times \{U,N\}$	$\mathcal{J}_{XU}^{XE} = \{S,N\} \times \{E,U,N\}$	$\mathcal{J}_{XU}^{XX} = \{S,N\} \times \{U,N\}$
None	$\mathcal{J}_{XX}^{EE} = \{E,S,N\} \times \{E,S,N\}$	$\mathcal{J}_{XX}^{EX} = \{E,S,N\} \times \{S,N\}$	$\mathcal{J}_{XX}^{XE} = \{S,N\} \times \{E,S,N\}$	$\mathcal{J}_{XX}^{XX} = \{S,N\} \times \{S,N\}$

◂ Back

Firm Problem

Firms' value of employing member i:

$$J_t^{jk}(z_i, z_{-i}, h_i, h_{-i}, a)$$
$$= \pi(z_i, h_i) + \frac{1}{1+r}(1-\delta(h_1))\mathbb{E}_{P,R} EJ_{t+1}^{jk}(z_i, z_{-i}, h_i, h_{-i}, a', \mathcal{J}_{XR}^{EP})$$

with continuation value

$$EJ_{t+1}^{jk}(z_i, z_{-i}, h_i, h_{-i}, a', \mathcal{J}_{QR}^{OP})$$
$$= \mathbb{E}_{h_i'|h_i}\mathbb{E}_{h_{-i}'|h_{-i}}\mathbb{E}_{z_i'|z_i}\mathbb{E}_{z_{-i}'|z_{-i}}\mathbb{E}_{\hat{jk}\in\mathcal{J}_{QR}^{OP}}\mathbb{I}_{\hat{j}=E|x'} J_{t+1}^{\hat{jk}}(z_i', z_{-i}', h_i', h_{-i}', a')$$

and per-period profit

$$\pi(z_i, h_i) = y(z_i, h_i) - w(z_i, h_i) = (1-\chi)z_i h_i$$

◂ Back

Firm Problem

Free entry condition determines arrival for member i:

$$\kappa = q(\theta_t(h_i, h_{-i}, z_{-i}, a, jk))\mathbb{E}_{P,R} EJ_{t+1}^{jk}(z_i, z_{-i}, h_i, h_{-i}, a', \mathcal{J}_{XR}^{EP})$$

- incorporates endogenous acceptances and (future) quits
- depends on labor market transition of spouse $-i$

$\Rightarrow$ have to solve for arrivals simultaneously if both non-employed

◂ Back

Calibration – Asset Levels

Asset Levels

	Model	Data
All	10.4	11.8
Age 25-35	2.8	3.0
Age 35-45	4.9	7.0
Age 45-55	10.6	14.6
Age 55-65	23.3	24.1

- Target: Net financial assets (incl. IRA) + vehicle equity
- 1 unit = \$10,000

Back

Calibration – Income

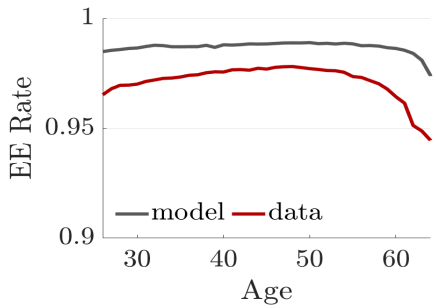
Income Levels and Dispersion

	Level		Standard deviation	
	Model	Data	Model	Data
All	0.3596	0.3424	0.1363	0.2374
Age 25-35	0.3296	0.3020	0.1172	0.2009
Age 35-45	0.3538	0.3572	0.1341	0.2456
Age 45-55	0.3752	0.3629	0.1429	0.2486
Age 55-65	0.3826	0.3400	0.1511	0.2466

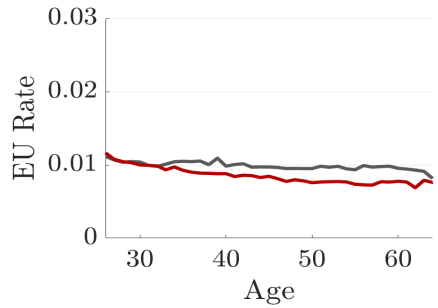
- Target: Labor Income
- 1 unit = \$10,000

◂ Back

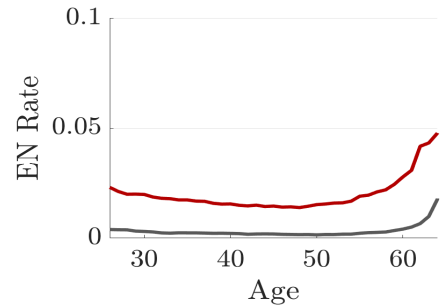
Calibration – Individual Labor Market Transitions



E to E

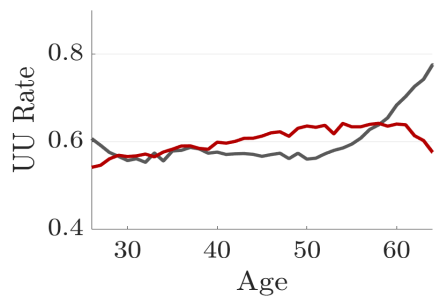


E to U

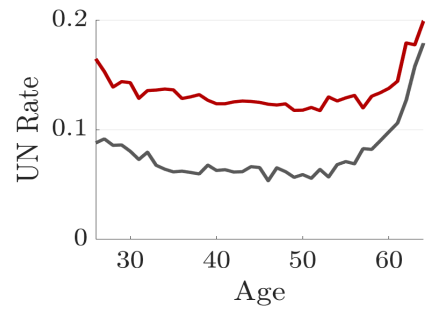


E to N

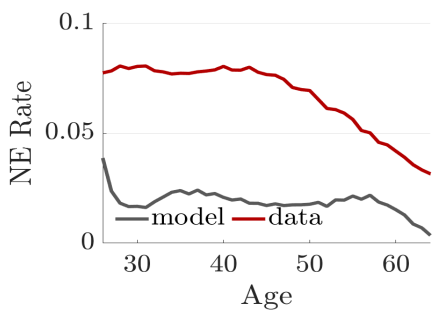
U to E



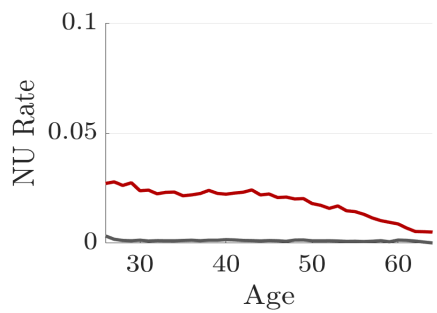
U to U



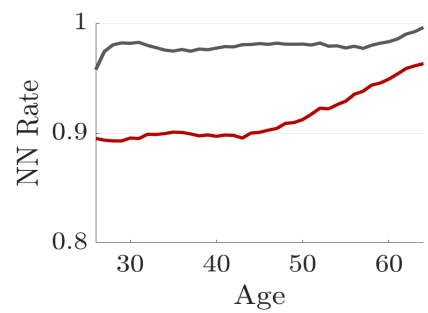
U to N



N to E



N to U

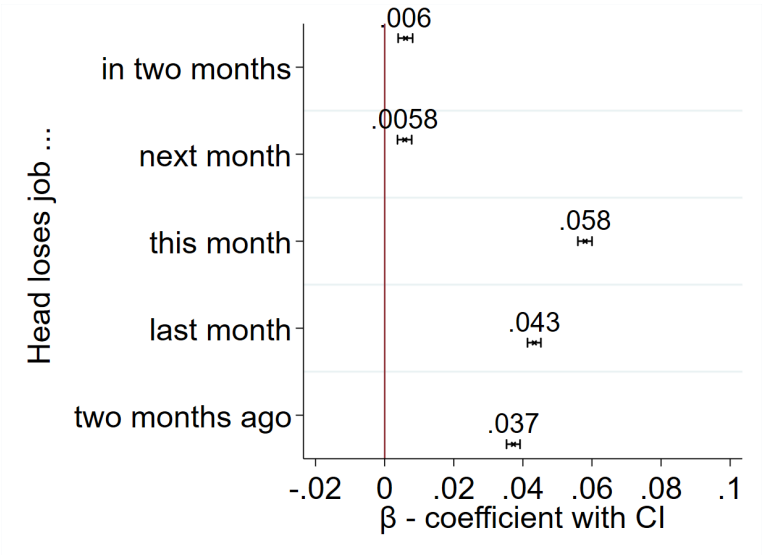


N to N

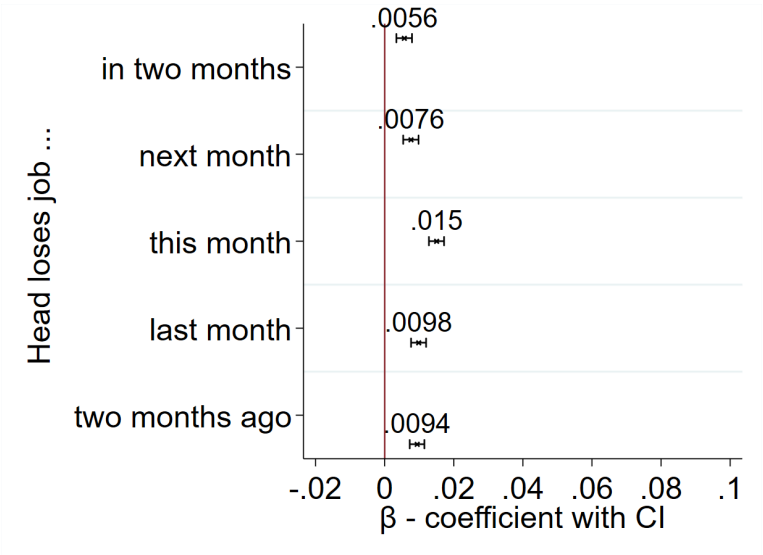
◂ Back

The Added Worker Effect in the Model

Δ Pr(Spouse enters LF) this month



Age 25 to 35



Age 56 to 65

Back