Job Search, Job Finding and the Role of Unemployment Insurance History

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Introduction

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First, this paper presents new empirical findings:

- Both current and former UI recipients search harder than those never receiving UI, but
- Both current and former UI recipients have a lower job finding rate than those never receiving UI

This Paper

To account for these empirical findings, I construct a search and matching model with endogenous search intensity, and

- Unproductive and/or inefficient job search

I then study the implications on

- Cyclical behaviour of search intensity
- Labour market dynamics (fluctuations and persistence)
- Effects of UI extensions (the Great Recession)

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- Effects of UI extensions (the Great Recession)

Main findings: Unproductive/inefficient job search $\rightarrow$

1. Acyclical aggregate search intensity + underestimated matching efficiency
2. Dampened labour market fluctuations and UI effects
3. More persistent unemployment

Literature

- Job search of employed vs non-employed: Faberman, Mueller, Şahin and Topa (2022)
- Job search and unemployment duration: Krueger and Mueller (2010, 2011), Guglielminetti, Lalive, Ruh and Wasmer (2018), Faberman and Kudlyak (2019), Marinescu and Skandalis (2021), DellaVigna, Heining, Schmieder and Trenkle (2022)
- Job search and the business cycle: Shimer (2004), DeLoach and Kurt (2013), Gomme and Lkhagvasuren (2015), Mukoyama, Patterson and Şahin (2018), Leyva (2018)
- UI and job findings:
  - Aaronson, Mazumder and Schechter (2010), Valletta and Kuang (2010), Farber and Valletta (2011), Rothstein (2011), Fujita (2011), Mazumder (2011), Nakajima (2012), Barnichon and Figura (2014)
  - Hagedorn, Karahan, Manovskii and Mitman (2019), Mitman and Rabinovich (2020), Rujiwattanapong (2022), Acosta et al. (2023), Birinci and See (2023)
- The persistence of unemployment and worker heterogeneity: Hornstein (2012), Kroft, Lange, Notowidigdo, and Katz (2015), Ravn and Sterk (2017), Hall and Schulhofer-Wohl (2018), Ahn and Hamilton (2020), Ahn (2022)

Data

- Current Population Survey (CPS): Basic monthly data + Occupational Mobility and Job Tenure supplements
- Period: 1998-2022
- Sample: Unemployed workers age 21-64
- Job search intensity:
  1. Average number of job search methods used:
     "What are all of the things you have done to find work during the last 4 weeks?"
  2. Minutes of daily job search:
     Imputed from American Time Use Survey à la Mukoyama et al. (2018)
- Job finding probability: Unemployment-to-employment transition probability

Data

- UI-related questions:
  1. "Did you receive unemployment insurance benefits after that job ended?"
  2. "Did you exhaust your eligibility for unemployment benefits?"

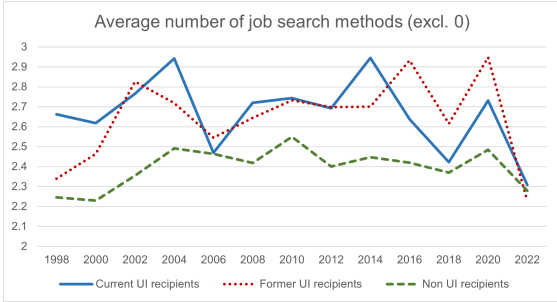
- Basic UI facts in the US:
  - ∼70% of UI-eligible workers collect their benefits (Auray et al., 2009)
  - ∼40% of all unemployed workers collect their benefits
  - 26 weeks of standard maximum UI duration
  - Some requirements:
    - Have earned enough wages during the base period
    - Be unemployed through no fault of your own

Job Search Methods

1. Contacted employer directly/interview
2. Contacted public employment agency
3. Contacted private employment agency
4. Contacted friends or relatives
5. Contacted school/university employment center
6. Sent out resumes/filled out application
7. Checked union/professional registers
8. Placed or answered ads
9. Other active
10. Looked at ads
11. Attended job training programs/courses
12. Nothing
13. Other passive

Data: Search Intensity

$\equiv$ number of job search methods used in a month



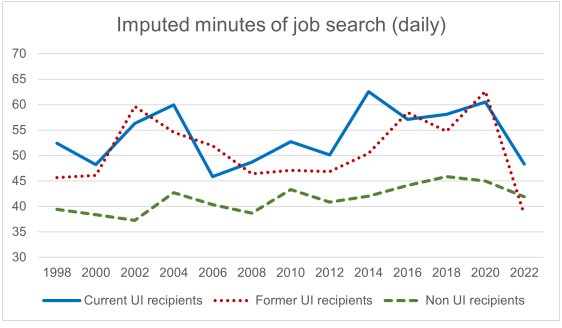
NB: Non-UI recipients = those who never received UI during current unemp. spell

Source: CPS monthly data & January supplements

- Current and former UI recipients search harder than those never received UI (respectively 12% and 11% more) ▸ Including zero methods

Data: Search Intensity

≡ (imputed) minutes of daily job search
à la Mukoyama et al. (2018)'s 2-stage Heckman selection model



NB: Non-UI recipients = those who never received UI during current unemp. spell

Source: CPS monthly data, CPS January supplements, ATUS

- Current and former UI recipients search longer than those never received UI (respectively 30% and 23% more)

What explains search intensity?

Dependent variable: Job search intensity		
	(1)	(2)
	Number of methods	Imputed minutes
Current UI recipient	0.162***	2.605**
	(0.053)	(1.201)
Former UI recipient	0.127***	2.192**
	(0.042)	(0.955)
Unemployment duration (quartic)	✓	✓
Controls for worker characteristics, time and state fixed effects, recession dummy, and state unemployment rates	✓	✓
N	7,561	7,561
R^2	0.354	0.486

- Linear regression coefficients (* p<0.05, ** p<0.01, *** p<0.001)
- CPS monthly data and January supplements (1998-2022)
- Excluding 0 search methods (those on recalls)
- Worker characteristics include: race, education, gender, age (quartic), marital status, married-female, occupation, industry, recall expectation, potential UI exhaustion month, reason for unemployment, last job tenure, last job's weekly earnings

▸ More coefficients

Search Intensity

- Current and former UI recipients search *more intensely* than those never receiving UI
  ▸ Who are they?
- Current UI recipients: UI eligibility and job search requirements (next slide)
- Former UI recipients: they now really want to be employed (?)
- How does search intensity translate into job finding probabilities?

UI Job Search Requirements in the US

- Every state must have a work search requirement but they design their own
- In strict states (e.g. Florida, Nebraska, Missouri, New Hampshire, and Utah):
  - Contact 4-5 new potential employers weekly
  - Submit a (bi-)weekly report
  - Use multiple methods (NH)
- In lenient states (e.g. California, Delaware, Massachusetts, South Carolina, West Virginia):
  - Broader definitions of work search activities
  - 1-2 activities each week (4 for WV but broad definitions)
  - Report upon request
  - If unemployment is high, no work search requirements (Michigan)
- Cross-state variations in the number of direct contacts and other activities required
  - An average state requires 1.2 direct contacts and a total of 2.8 work search activities each week (SD: 1.4 and 1.3)

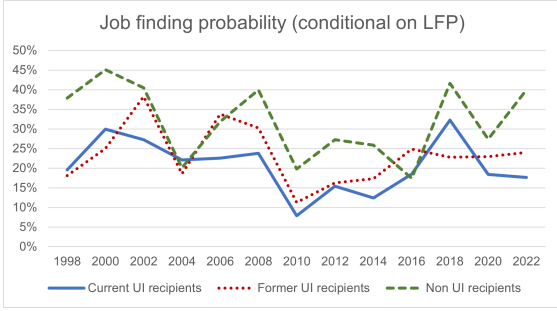
What explains search intensity?

	Dependent variable: Job search intensity					
	(1)	(2)	(3)	(4)	(5)	(6)
	Methods	Minutes	Methods	Minutes	Methods	Minutes
Current UI recipient	0.162***	2.605**				
	(0.053)	(1.201)				
Total search activities			0.010***	0.178**		
(required by state)			(0.003)	(0.073)		
No. of direct contacts					0.009*	0.077
(required by state)					(0.005)	(0.107)
No. of other activities					0.011***	0.246***
(required by state)					(0.004)	(0.090)
Former UI recipient	0.127***	2.192**	0.106**	2.056**	0.106**	2.064**
	(0.042)	(0.955)	(0.042)	(0.940)	(0.042)	(0.940)
N	7,561	7,561	7,561	7,561	7,561	7,561
R^2	0.354	0.486	0.347	0.486	0.347	0.487

- * $p<0.05$, ** $p<0.01$, *** $p<0.001$.
- Other control variables include race, education, gender, age (quartic), marital status, female and married, occupation, industry, unemployment duration (quartic), recall expectation, potential UI exhaustion month, reason for unemployment, previous job's tenure, previous job's weekly earnings, a linear time trend, a recession dummy, state fixed effects, and state unemployment rates.

Data: Job Finding Probability

$\equiv$ monthly transition prob. from unemployment to employment



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Source: CPS monthly data & January supplements

- Those never receiving UI find jobs the quickest (32%)
- Current UI recipients and former UI recipients are slower to find jobs (21% and 23%) despite searching harder

What explains the job finding probability?

	Dependent variable: Job finding probability					
	(1)	(2)	(3)	(4)	(5)	(6)
Current UI recipient	-0.087***	-0.080***	-0.086***	-0.082***		
	(0.013)	(0.013)	(0.022)	(0.022)		
Total search activities			0.000	0.000	-0.005***	-0.005***
(required by state)			(0.002)	(0.002)	(0.001)	(0.001)
Former UI recipient	-0.048***	-0.014	-0.047***	-0.014	-0.030**	0.002
	(0.015)	(0.016)	(0.015)	(0.016)	(0.015)	(0.015)
Search intensity	0.102*	0.101*	0.103*	0.102*	0.103*	0.102*
	(0.058)	(0.057)	(0.058)	(0.057)	(0.058)	(0.057)
Unemployment duration (quartic)	NO	YES	NO	YES	NO	YES
N	5,693	5,693	5,693	5,693	5,693	5,693
R^2	0.064	0.076	0.068	0.079	0.066	0.077

- * p<0.05, ** p<0.01, *** p<0.001.
- Other control variables include race, education, gender, age (quartic), marital status, female and married, occupation, industry, recall expectation, potential UI exhaustion month, search methods, reason for unemployment, previous job's tenure, previous job's weekly earnings, a linear time trend, a recession dummy, state fixed effects, and state unemployment rates. Re-employment wages

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- This paper proposes that
  1. Current UI recipients search harder due to UI search requirements, but they can *censor* their job search
     - Endogenously unproductive job search
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     - Endogenously unproductive job search
     - Wang and Williamson (1996, 2002), Hall and Mueller (2018), Faberman et al. (2022)
  2. Former UI recipients search harder, but less efficiently
     - Exogenously inefficient job search
     - Duration dependence: employer screening, loss of networks, human capital, genuine duration dependence, etc. (Kroft et al., 2015; Jarosch and Pilossoph, 2019; Ahn and Hamilton, 2020)
     - By definition: long-term unemployed, Measure directly from the data

Model Outline

Built on standard DMP model with random search + heterogeneous workers from UI history

What's endogenous?

Deterministic model: **job search intensity** + vacancy creation

Stochastic model: above + job formations + job separations

Model Setup: Deterministic

- Time is discrete, runs forever
- Economy is populated by a continuum of workers of mass one and a large continuum of firms:
  - Infinitely-lived, risk neutral, ex ante identical

Workers:

- Either employed (E) or unemployed
- Unemployment statuses:
  1. Current UI recipient: B
  2. Former UI recipient: X (no UI + search less efficiently)
  3. Non-UI recipient: N (no UI)

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- Firms: Either matched with one worker or unmatched
- Output of a worker-firm match is $y = z$ (TFP)

Model Setup: Deterministic

Job search:

- Current UI recipients are required to exert "$\underline{s_B}$" but *optimally* censor it at rate $1 - \gamma_B \in (0, 1)$ (to lower disutility from search)
  - Current UI recipients' *effective* search intensity = $\gamma_B \cdot \underline{s_B}$

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- Non-UI and former UI recipients optimally choose s_N and s_X (resp.)
  - Non-UI recipients' *effective* search intensity = s_N

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  - Non-UI recipients' *effective* search intensity = s_N
  - Former UI recipients' *effective* search intensity = $\gamma_X \cdot s_X$
  - $\gamma_X \in (0, 1)$: relative search efficiency

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Utility flows:

- Employed workers: wage w (Nash bargaining)
- N- and X-type workers: leisure flow h
- B-type workers: UI benefit b + leisure flow h

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Matches:

- $M(s, v) = \frac{sv}{(s^\alpha + v^\alpha)^{\frac{1}{\alpha}}}$; $\alpha > 0$: CRS, concave
  - v = number of vacancies
  - s = aggregate search intensity
    = number of searchers augmented by effective search intensity

Job finding rate per unit search: $\frac{M(s,v)}{s} \equiv p$

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- $Pr(X \to E) \quad \equiv p_X(s_X) \quad = \quad \gamma_X \times s_X \times p \quad$ (Former-UI)

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- $Pr(X \to E) \quad \equiv p_X(s_X) \quad = \quad \gamma_X \times s_X \times p \quad$ (Former-UI)
- $Pr(B \to E) \quad \equiv p_B(\gamma_B) \quad = \quad \gamma_B \times \underline{s_B} \times p \quad$ (Current-UI)
  - γ_X: relative search efficiency of former UI to non-UI workers
  - γ_B: censored job search
  - $\underline{s_B}$: UI search requirement

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- UI take-up: Upon job separation, a fraction $1-\psi \in (0,1)$ of employed workers receive benefits, i.e.
  - $Pr(E \to B \mid \text{separation}) = 1-\psi$
  - $Pr(E \to N \mid \text{separation}) = \psi$
  - $Pr(E \to X \mid \text{separation}) = 0$
  - Implications on eligibility, search cost heterogeneity, etc.

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- UI exhaustion: Current UI workers exhaust their benefits w/ probability $\phi \in (0,1)$ and become former UI workers
  - $Pr(B \to B \,|\text{stay unemployed}) = 1-\phi$
  - $Pr(B \to X \,|\text{stay unemployed}) = \phi$
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- UI budget: Balanced each period by taxing producing firms

Value Functions: Unemployed

Respectively for current UI (B), former UI (X), and non-UI (N) recipients:

$$U_B = \max_{\gamma_B} \; b + h\underbrace{-c(\gamma_B)}_{\text{disutility from not censoring}} + \beta\Big[\underbrace{p_B(\gamma_B)}_{Pr(B \to E)} W_B + \big(1 - p_B(\gamma_B)\big)\Big(\big(1-\phi\big)U_B + \underbrace{\phi}_{\text{Pr(UI exhausted)}} U_X\Big)\Big]$$

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$$U_X = \max_{s_X} \; h\underbrace{-c_X(s_X)}_{\text{disutility from search}} + \beta\Big[p_X(s_X) W_X + \big(1 - p_X(s_X)\big) U_X\Big]$$

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Respectively for current UI (B), former UI (X), and non-UI (N) recipients:

$$U_B = \max_{\gamma_B} \; b + h\underbrace{-c(\gamma_B)}_{\text{disutility from not censoring}} + \beta\Big[\underbrace{p_B(\gamma_B)}_{Pr(B\to E)} W_B + \big(1-p_B(\gamma_B)\big)\Big((1-\phi)U_B + \underbrace{\phi}_{\text{Pr(UI exhausted)}} U_X\Big)\Big]$$

$$U_X = \max_{s_X} \; h\underbrace{-c_X(s_X)}_{\text{disutility from search}} + \beta\Big[p_X(s_X)W_X + \big(1-p_X(s_X)\big)U_X\Big]$$

$$U_N = \max_{s_N} \; h - c(s_N) + \beta\Big[p_N(s_N)W_N + \big(1-p_N(s_N)\big)U_N\Big]$$

- $W_j \equiv$ value of employment given previous status $j \in \{B, X, N\}$
- $Pr(N \to E) \equiv p_N(s_N) = s_N \times p$ (Non-UI)
- $Pr(X \to E) \equiv p_X(s_X) = \gamma_X \times s_X \times p$ (Former-UI)
- $Pr(B \to E) \equiv p_B(\gamma_B) = \gamma_B \times \underline{s_B} \times p$ (Current-UI)
- $c'(\cdot) > 0, c''(\cdot) > 0$
- Search cost parameter for X-type is different from others

▸ Value functions for: Employed, Matched and Unmatched Firms

Value Functions: Employed, Matched and Unmatched Firm

The value functions of employed workers with previous status $j \in \{E, B, X, N\}$:

$$W_j = w_j + \beta \Big[\underbrace{(1-\delta)}_{\Pr(\text{match survives})} W_E + \underbrace{\delta}_{\Pr(\text{match destroyed})} \Big((1-\psi) U_B + \underbrace{\psi}_{\Pr(\text{not taking up UI})} U_N \Big) \Big]$$

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$$J_j = y - w_j - \tau + \beta(1-\delta) J_E$$

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The value function of an unmatched firm, assuming free entry, is:

$$0 = -\kappa + \beta q \left[\frac{\sum_{j \in \{B,X,N\}} \tilde{s}_j u_j J_j}{s} \right]$$

where $\tilde{s}_j$ = effective search intensity of type-j workers,
u_j = stock of unemployed of type j, and
s = aggregate search intensity

▸ Nash Wage ▸ Search Cost

Stochastic Model

- Very few *UIx* workers in the steady state
- Will instead study a recession together with UI extensions
  - The Great Recession in the US
  - UI extensions from standard 26 weeks to (up to) 99 weeks

- 3 additional ingredients:
  1. Aggregate productivity (z) as an $AR(1)$ process
     $\ln z_t = \rho_z \ln z_{t-1} + \varepsilon_t; \quad \varepsilon_t \sim N(0, \sigma_z^2)$

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       $\rightarrow$ Output of a match: $y = m \times z$
       $\rightarrow$ UI benefit $b(m) \uparrow$ with m

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  3. State-dependent UI extension: $\phi(u)$ ▸ More on $\phi(u)$ ▸ More on policy functions

Stochastic Model: Equilibrium Definition

A recursive competitive equilibrium is characterised by

- **value functions** $\{W_j(m;\omega), U_j(\omega), J_j(m;\omega),\ V(\omega)\}$;
- **market tightness** $\theta(\omega)$;
- **search policy** $s_j(\omega)$;
- **wage functions** $w_j(m;\omega)$;

for $j \in \{E(\tilde{m}), Bs(\tilde{m}), B\ell(\tilde{m}), X, N\}$, such that, given initial distribution of workers, government's policy $\{\tau(\omega), \phi(\omega)\}$ and law of motion for z:

1. Value functions and the market tightness satisfy the Bellman equations for workers and firms, and the free entry condition
2. Search decisions satisfy the FOCs for optimal search intensity ▸ FOCs for search
3. Wage functions satisfy the FOCs for the Nash bargaining rule
4. UI's budget constraint is satisfied
5. The distribution of workers evolves according to the transition equations, consistent with the maximising behaviour of agents ▸ transitions

Macro Implications

1. Unemployment-triggered UI extensions
   - → More of high-s types (those with a UI history) during recessions
   - → Countercyclical aggregate search intensity (?)

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   - → Dampened labour market fluctuations

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   - → UI recipients do not censor job search as much
   - → Weaker responses to aggregate shocks (including UI extensions)
   - → Dampened labour market fluctuations

3. Despite high search intensity,
   current UI workers' censored job search + former UI workers' inefficient job search
   - → Persistently low job finding rates
   - → Unemployment persistence

Calibration

- I calibrate a subset of parameters (12) to the US economy during 1948-2007 (SMM) including
  - Search cost parameter: a_X
  - Meeting function parameter
  - Match-specific productivity parameters
  - TFP-related parameters
  - UI-related parameters

- Other parameters are from the literature
- From Gruber (1997), set $b(m)$ and h to imply
  - 10% consumption drop from E to B (receiving $b(m) + h$); $\forall m$
  - 24% consumption drop from E to $\{X, N\}$ (receiving h)
  - Given 50% replacement rate

▸ Other fitted parameters ▸ Other fixed parameters

Targeted Moments

Moment	Data	Baseline	$\gamma_X = 1$
$\mathsf{E}(u)$	0.0583	0.0569	0.0577
$\mathsf{E}(\rho_{UE})$	0.4194	0.4414	0.4286
$\mathsf{E}(\rho_{EU})$	0.0248	0.0252	0.0251
$\mathsf{E}(\rho_{EE})$	0.0320	0.0322	0.0320
$\mathsf{E}(udur)$	15.416	11.251	13.063
$\mathsf{E}(u_B)$	0.0290	0.0302	0.0327
$\mathsf{std}(u)$	0.1454	0.1123	0.1453
$\mathsf{std}(\rho_{UE})$	0.0999	0.1035	0.1402
$\mathsf{std}(\rho_{EU})$	0.0890	0.0517	0.0641
$\mathsf{std}(LP)$	0.0131	0.0106	0.0104
$\mathsf{corr}(LP, LP_{-1})$	0.7612	0.7609	0.7593
$\mathsf{E}(\rho_{UE}^X/\rho_{UE}^N)$	0.7983	0.8012	1

- ρ_{UE}: job finding rate // ρ_{EU}: job separation rate // ρ_{EE}: job-to-job transition rate
  $udur$: mean unemployment duration (weeks) // LP: output per worker (quarterly)

- $\gamma_X = 1$: No duration dependence for former UI recipients
- Relative job finding rates much more realistic w.r.t. scenario without job search inefficiency

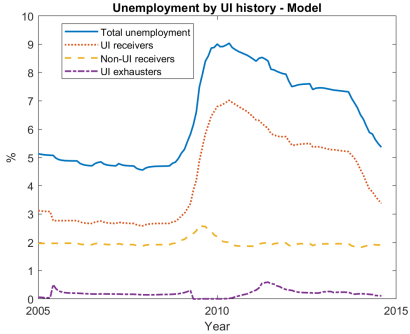
Application to the Great Recession in the US

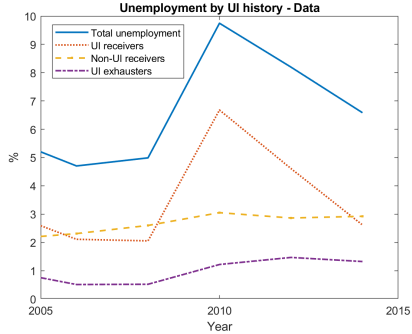
- I apply the model to the US economy (1948-2014) by feeding in:

1. Historical UI extensions:
   - Extension generosity varies with each recession
   - Exogenous changes in ϕ_L to match observed changes in UI extension policies
   - Agents rationally expect whether $\phi(u)$ will be ϕ or ϕ_L based on current u
   - Agents assume ϕ_L never changes its value until observed otherwise
   - Timings of extensions still endogenous - triggered when $u > \bar{u}$ ▸ Simulated UI extensions

2. A series of productivity shocks that match the deviations of output (GDP per capita) from HP trend

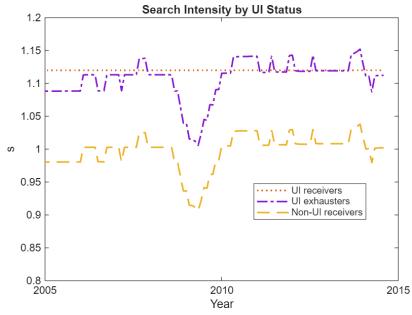
Unemployment Decomposition: Model vs Data

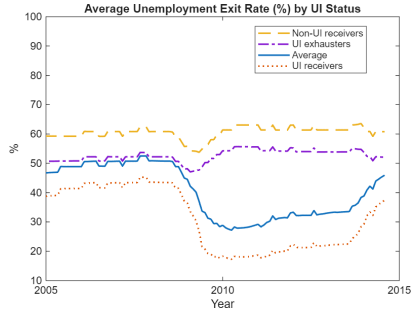




- Lower share of UI exhausters (X) in the model
- Slightly higher share of UI receivers (B) in the model
- The role of finer duration dependence? Unobserved heterogeneity?

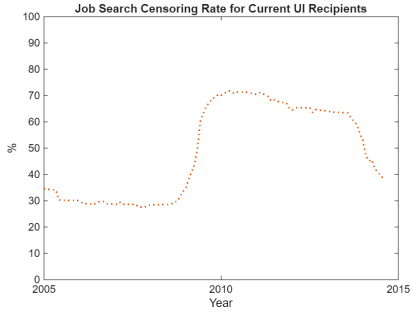
Search intensity and Job Finding

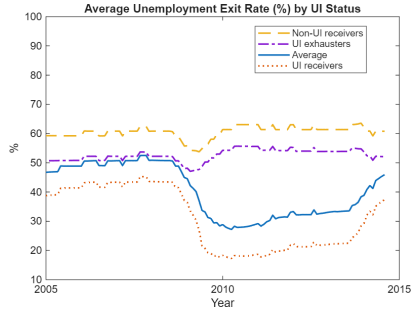




- UI exhausters' search inefficiency ($\gamma_X = 0.72$) is set such that $s_X/s_N = 1.11$
- Search is mildly procyclical for UI exhausters and non-UI receivers
- s_B is fixed at 1.12

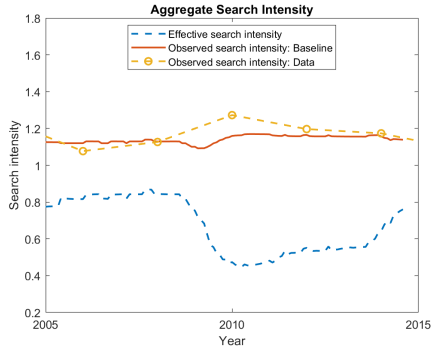
Job Censoring





- Current UI recipients' job censoring rate $(1 - \gamma_B)$: 37% on average
  - $\uparrow$ UI extensions, $\uparrow$ benefit amount $b(m) \rightarrow$ more censoring
  - $\uparrow z \rightarrow$ less censoring
  - Faberman et al. (2022): Unemployed workers reject 47% of best offers (52% of all offers)

Aggregate Search Intensity



- Observed search intensity: acyclical (mildly countercyclical)
  - Composition effect: more workers with UI history (high s) during recessions
  - Falsely suggesting limited role of search intensity

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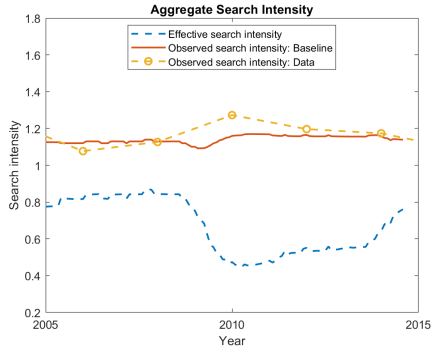
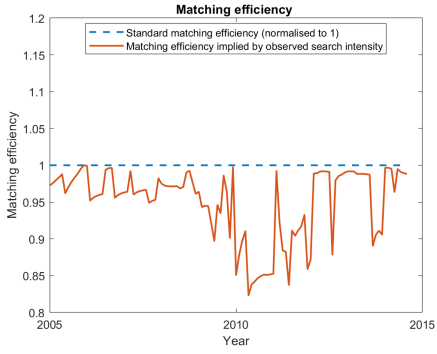


- Observed search intensity: acyclical (mildly countercyclical)
  - Composition effect: more workers with UI history (high s) during recessions
  - Falsely suggesting limited role of search intensity
- Effective search intensity: smaller + procyclical
  - UI receivers' search censoring + UI exhausters' inefficient search
  - Even further with UI extensions (from 2009)

Matching Efficiency



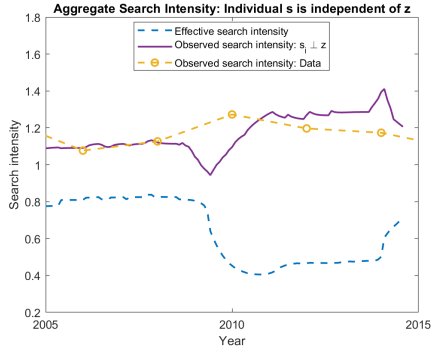
- $M = 1\frac{sv}{(s^\alpha + v^\alpha)^{1/\alpha}} = A\frac{s_{obs}v}{(s_{obs}{}^\alpha + v^\alpha)^{1/\alpha}}$
- With effective search intensity, the matching efficiency is 1 (normalisation)
- With observed search intensity, matching efficiency is the residual A
  - Not corrected for censoring + inefficient search
  - Underestimate the actual matching efficiency up to 17%

Conclusion

- This paper shows empirically there is high search intensity but low job finding rates for workers with a UI history
- To reconcile with these findings, I propose a model of unproductive and inefficient job search
- Aggregate search intensity may be overestimated, esp. in recessions, leading to an underestimation in matching efficiency
- Accounting for effective search intensity implies
  (1) smaller effects of UI extensions,
  (2) dampened labour market fluctuations, and
  (3) more persistent unemployment and its duration

Thank you

Aggregate Search Intensity: Individual Job Search $\perp$ Shocks



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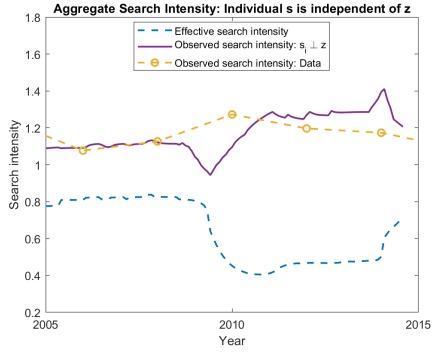
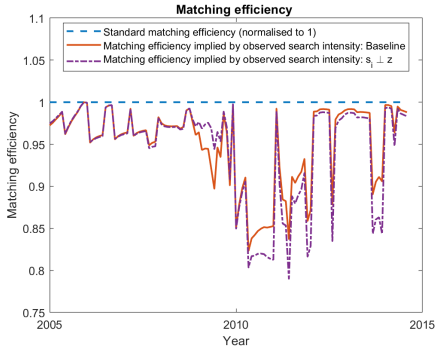


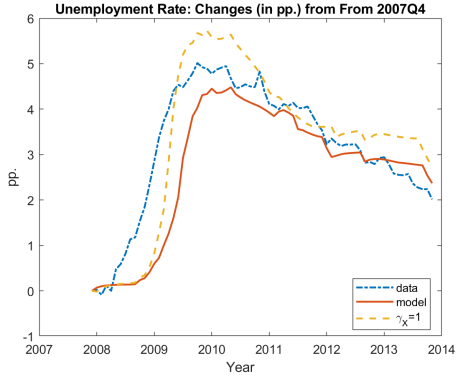
- Effective search intensity: smaller + procyclical
  - UI receivers' search censoring + UI exhausters' inefficient search
  - Even further with UI extensions (from 2009)
- Observed search intensity: Countercyclical but more volatile than the data
  - Assuming individual job search does not respond to shocks (z)

Matching Efficiency



- $M = 1\frac{sv}{(s^\alpha + v^\alpha)^{1/\alpha}} = A\frac{s_{obs}v}{(s_{obs}{}^\alpha + v^\alpha)^{1/\alpha}}$
- With effective search intensity, the matching efficiency is 1 (normalisation)
- With observed search intensity, matching efficiency is the residual A
  - Underestimate the actual matching efficiency up to 17%
  - Up to 21% when individual search is assumed to be acyclical

Unemployment



$\gamma_X = 1$: No duration dependence for former UI recipients

- Search inefficiency dampens the fluctuations in unemployment

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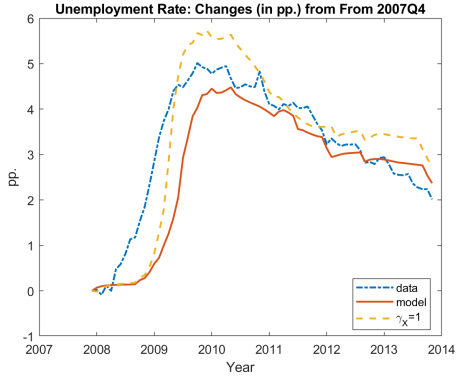
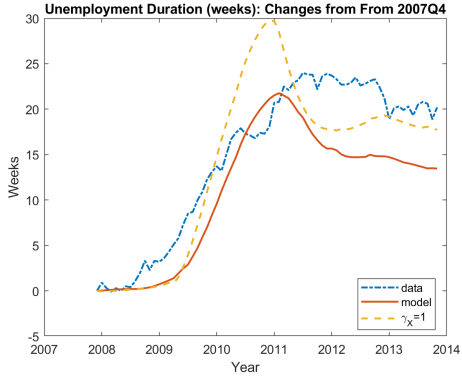


$\gamma_X = 1$: No duration dependence for former UI recipients

- Search inefficiency dampens the fluctuations in unemployment
- Baseline model: UI extensions account for 2pp↑ in unemployment
- No search inefficiency: overestimating the UI effect by 0.9pp (≈50%)

Average Unemployment Duration



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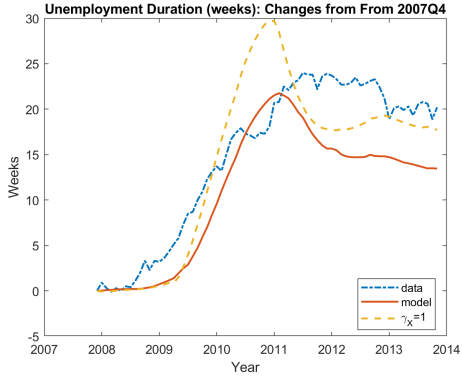
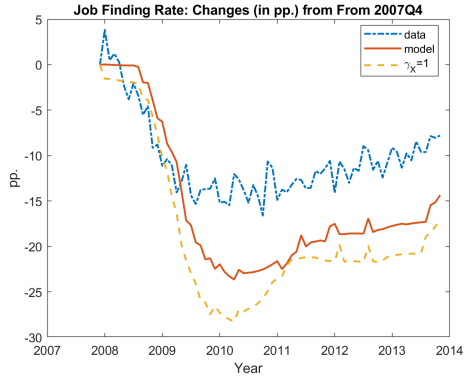


$\gamma x = 1$: No duration dependence for former UI recipients

- Search inefficiency dampens the response
- Baseline: UI extensions account for $\uparrow$ 16 weeks in unemp. duration
- No search inefficiency: overestimating the UI effect by 9 wks ($\approxeq$56%)
- Average elasticity of unemp. duration to UI duration: 0.11 vs 0.15

Job Findings

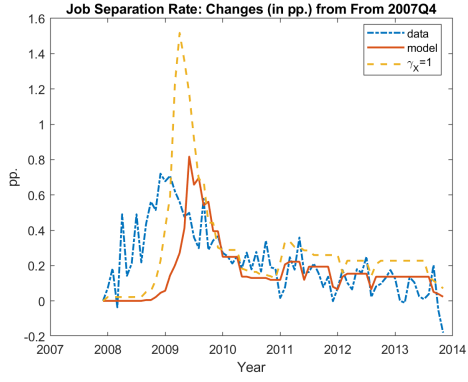


$\gamma_X = 1$: No duration dependence for former UI recipients

- Baseline model somewhat overshoots (negatively)
  - NB: negative trend in data
- But more moderate than a model without inefficient search where
  - No cost associated with being *UIx*

    $\rightarrow$ *UI* workers reject even more jobs when UI is generous

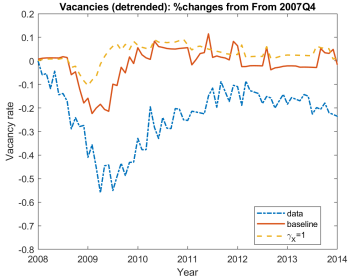
Job Separations

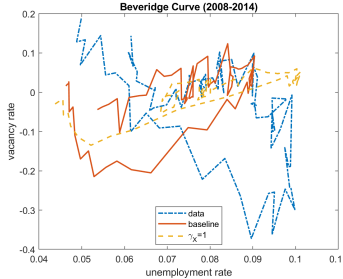


$\gamma_X = 1$: No duration dependence for former UI recipients

- Baseline model: realistic magnitude, despite lagged response
- model without inefficient search: heavily overestimating job separations ($> 100\%$)

Vacancy rate and Beveridge Curve





$\gamma_X = 1$: No duration dependence for former UI recipients

- Vacancies less volatile than the data (50% for baseline and 10% for the alternative model)
- Baseline produces a negative correlation between u and v, whilst the model without inefficient search produces a positive one

Labour Market Persistence

Autocorrelation coefficients for 1-month lag

Moment	Data	Baseline	$\gamma_X = 1$
$\text{corr}(u, u_{-1})$	0.9921	(100%)	(99%)
$\text{corr}(\rho_{UE}, \rho_{UE,-1})$	0.9510	(103%)	(103%)
$\text{corr}(\rho_{EU}, \rho_{EU,-1})$	0.9616	(98%)	(98%)
$\text{corr}(udur, udur_{-1})$	0.9965	(100%)	(99%)

- ρ_{UE}: job finding rate // ρ_{EU}: job separation rate // *udur*: mean unemployment duration (weeks)

- $\gamma_X = 1$: No duration dependence for former UI recipients
- Little difference for 1-month lag

▸ Persistence in levels

Labour Market Persistence

Autocorrelation coefficients for 12-month lag

Moment	Data	Baseline	$\gamma_X = 1$
$\text{corr}(u, u_{-12})$	0.7302	(82%)	(65%)
$\text{corr}(\rho_{UE}, \rho_{UE,-12})$	0.8119	(69%)	(60%)
$\text{corr}(\rho_{EU}, \rho_{EU,-12})$	0.7850	(30%)	(6%)
$\text{corr}(udur, udur_{-12})$	0.9220	(80%)	(69%)

- ρ_{UE}: job finding rate // ρ_{EU}: job separation rate // $udur$: mean unemployment duration (weeks)

- $\gamma_X = 1$: No duration dependence for former UI recipients
- Baseline noticeably performs better, particularly unemployment and unemployment duration

▸ Persistence in levels

Labour Market Persistence

Autocorrelation coefficients for 24-month lag

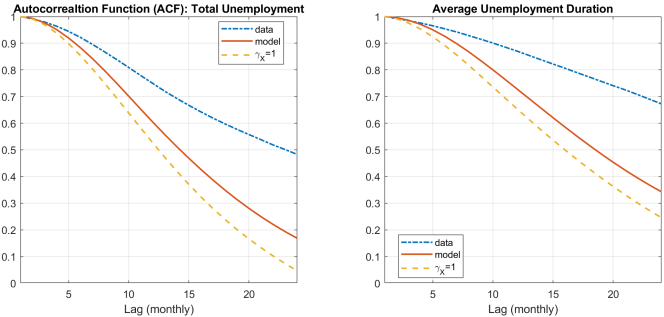
Moment	Data	Baseline	$\gamma_X = 1$
$\text{corr}(u, u_{-24})$	0.4783	(38%)	(4%)
$\text{corr}(\rho_{UE}, \rho_{UE,-24})$	0.6468	(20%)	(6%)
$\text{corr}(\rho_{EU}, \rho_{EU,-24})$	0.7138	(8%)	(0.1%)
$\text{corr}(udur, udur_{-24})$	0.7909	(47%)	(30%)

- ρ_{UE}: job finding rate // ρ_{EU}: job separation rate // $udur$: mean unemployment duration (weeks)

- $\gamma_X = 1$: No duration dependence for former UI recipients
- Baseline fares much better especially for unemployment

▸ Persistence in levels

Persistence of Unemployment



$\gamma_X = 1$: no duration dependence for former UI recipients

- Duration dependence improves the persistence of unemployment and its duration:
  - By construction + its dampening effects on current UI recipients
- A duration dependence model w/o UI status: Little persistence since all workers exit unemployment quickly from the start

Labour Market Fluctuations

Moment	Data	Baseline	$\gamma_X = 1$
std(u)	0.1454	0.1123	0.1453
		(77%)	(99%)
std(ρ_{UE})	0.0999	0.1035	0.1402
		(103%)	(140%)
std(ρ_{EU})	0.0890	0.0517	0.0641
		(58%)	(72%)
std($udur$)	6.9327	5.6412	6.1954
		(81%)	(90%)

- ρ_{UE}: job finding rate // ρ_{EU}: job separation rate // $udur$: mean unemployment duration (weeks) // In parentheses are percentages w.r.t. empirical counterparts

- Labour market fluctuations dampened by 10-35% due to the duration dependence (esp. job finding rate)
  - $\because$ In baseline, current UI workers less responsive to shocks + exit unemployment more quickly

What explains the re-employment wages?

Dependent variable: log re-employment weekly earnings		
	(1)	(2)
Current UI recipient	-0.057	-0.090
	(0.124)	(0.124)
Former UI recipient	-0.478***	-0.589***
	(0.148)	(0.154)
Search intensity	0.271	0.282
	(0.356)	(0.353)
Unemp. duration (quartic)		✓
Controls for worker characteristics, time and state fixed effects, recession dummy, and state unemployment rates	✓	✓
N	303	303
R^2	0.411	0.411

- Linear probability model (* $p<0.05$, ** $p<0.01$, *** $p<0.001$)
- CPS monthly data and January supplements (1998-2022) excluding workers exiting the labour force next period
- Worker characteristics: race, education, gender, age (quartic), marital status, married-female, occupation, industry, recall expectation, search methods (-1), potential UI exhaustion month, reason for unemployment, last job tenure, last job's weekly earnings

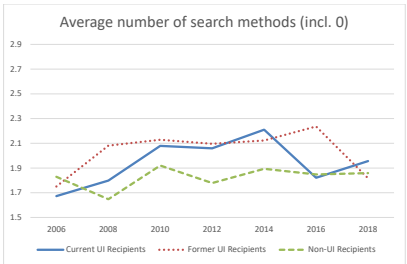
Back to Linear Regression Model

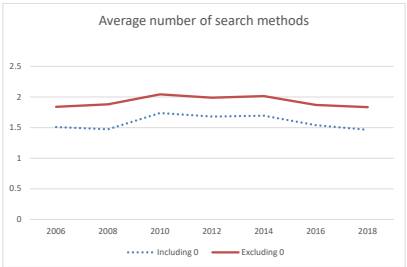
What explains job finding probability?

	Dependent variable: Job finding probability					
	(1)	(2)	(3)	(4)	(5)	(6)
Current UI recipient	-0.087***	-0.080***	-0.086***	-0.082***		
	(0.013)	(0.013)	(0.022)	(0.022)		
Total search activities (required by state)			0.000	0.000	-0.005***	-0.005***
			(0.002)	(0.002)	(0.001)	(0.001)
Former UI recipient	-0.048***	-0.014	-0.047***	-0.014	-0.030**	0.002
	(0.015)	(0.016)	(0.015)	(0.016)	(0.015)	(0.015)
Search intensity	0.102*	0.101*	0.103*	0.102*	0.103*	0.102*
	(0.058)	(0.057)	(0.058)	(0.057)	(0.058)	(0.057)
Unemployment duration (quartic)	NO	YES	NO	YES	NO	YES
N	5,693	5,693	5,693	5,693	5,693	5,693
R^2	0.064	0.076	0.068	0.079	0.066	0.077

- * p<0.05, ** p<0.01, *** p<0.001.
- Other control variables include race, education, gender, age (quartic), marital status, female and married, occupation, industry, recall expectation, potential UI exhaustion month, reason for unemployment, previous job's tenure, previous job's weekly earnings, a linear time trend, a recession dummy, state fixed effects, and state unemployment rates. Back to Linear Regression Model

Data: Search Intensity (only active methods)



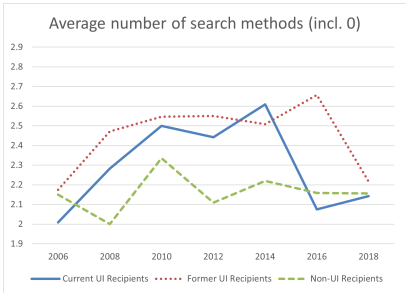


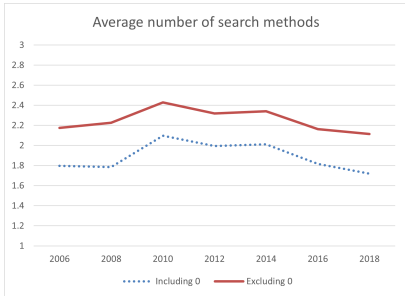
Non-UI recipients = those who never received UI

Source: CPS monthly data & January supplements

Back to average number of methods excl 0

Data: Search Intensity



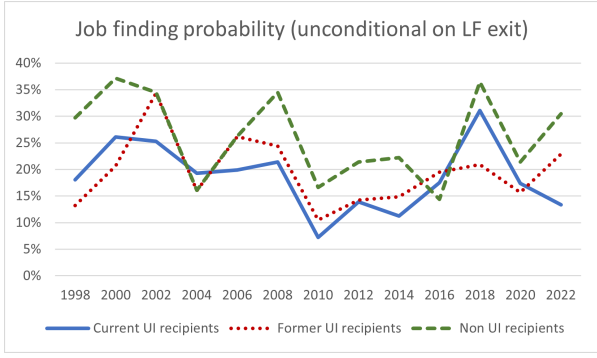


Non-UI recipients = those who never received UI

Source: CPS monthly data & January supplements

▸ Back to average number of methods excl 0

Data: Job finding rate unconditional on LF exits

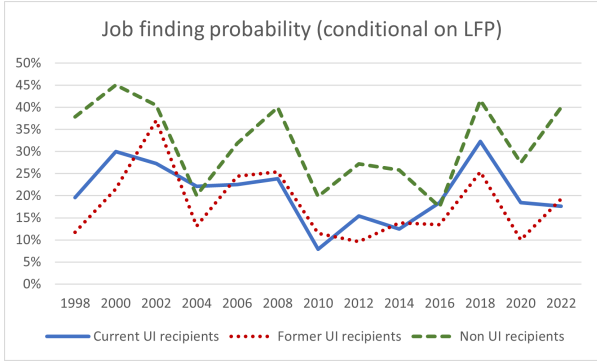


NB: Non-UI recipients = those who never received UI

Source: CPS monthly data & January supplements

Back to conditional UE rate

Data: Job Finding Rate controlling for LTU for UIx workers



NB: Non-UI recipients = those who never received UI

Source: CPS monthly data & January supplements

Back to conditional UE rate

Data: Job Finding Rate (uncond. on LFP)

Table: **Dependent variable: Job Finding Probability**

	(1)	(2)	(3)	(4)
Have received UI	-0.061***		-0.060***	
	(0.012)		(0.012)	
Current UI recipient		-0.076***		-0.078***
		(0.012)		(0.012)
Former UI recipient		-0.024		-0.021
		(0.015)		(0.015)
Long-term unemployed	-0.062***	-0.071***		
	(0.011)	(0.012)		
Unemp. duration (weeks)			-0.001***	-0.001***
			(0.000)	(0.000)
Great Recession ('10-'12)	-0.064***	-0.059***	-0.063***	-0.056***
	(0.011)	(0.011)	(0.011)	(0.011)
Worker characteristics	✓	✓	✓	✓
R^2	0.0775	0.0801	0.0784	0.0819

- Linear probability model (dependent variable = 1 if a worker moves from unemp. to emp., = 0 if remaining unemployed) (* p<0.05, ** p<0.01, *** p<0.001)
- CPS monthly data and January supplements: every 2 years between 2006-2018 (4,729 obs.)
- Worker characteristics include race, education, gender, age (quadratic), time trend (linear), occupation, industry, search method dummies
- Excluding 0 number of search methods

▸ Back to regression results with conditional on LFP

Data: Job Finding Rate

Table: **Dependent variable: Job Finding Probability**

	(1)	(2)	(3)	(4)
Number of search methods	-0.009*	-0.009*	-0.009*	-0.009*
	(0.005)	(0.005)	(0.005)	(0.005)
Have received UI	-0.085***		-0.085***	
	(0.013)		(0.013)	
Current UI recipient		-0.104***		-0.105***
		(0.014)		(0.014)
Former UI recipient		-0.034**		-0.031*
		(0.017)		(0.018)
Long-term unemployed	-0.066***	-0.078***		
	(0.013)	(0.013)		
Unemp. duration (weeks)			-0.001***	-0.001***
			(0.000)	(0.000)
Great Recession ('10-'12)	-0.077***	-0.070***	-0.075***	-0.067***
	(0.013)	(0.013)	(0.013)	(0.013)
Worker characteristics	✓	✓	✓	✓
R^2	0.0775	0.0801	0.0784	0.0819

- Linear probability model (dependent variable = 1 if a worker moves from unemp. to emp., = 0 if remaining unemployed) (* p<0.05, ** p<0.01, *** p<0.001)
- CPS monthly data and January supplements: every 2 years between 2006-2018 (4,109 obs.)
- Worker characteristics include race, education, gender, age (quadratic), time trend (linear), occupation, industry
- Excluding 0 number of search methods and workers exiting the labour force next period

▸ Back to regression results with conditional on LFP

Data: UO Rate

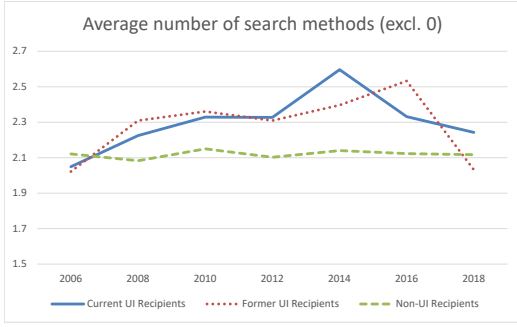
Table: **Dependent variable: UO Transtion Rate (not filled)**

	(1)	(2)	(3)	(4)
Have received UI	-0.061***		-0.060***	
	(0.012)		(0.012)	
Current UI recipient		-0.076***		-0.078***
		(0.012)		(0.012)
Former UI recipient		-0.024		-0.021
		(0.015)		(0.015)
Long-term unemployed	-0.062***	-0.071***		
	(0.011)	(0.012)		
Unemp. duration (weeks)			-0.001***	-0.001***
			(0.000)	(0.000)
Great Recession ('10-'12)	-0.064***	-0.059***	-0.063***	-0.056***
	(0.011)	(0.011)	(0.011)	(0.011)
Worker characteristics	✓	✓	✓	✓
R^2	0.0775	0.0801	0.0784	0.0819

- Linear probability model (dependent variable = 1 if a worker moves from unemp. to emp., = 0 if remaining unemployed) (* p<0.05, ** p<0.01, *** p<0.001)
- CPS monthly data and January supplements: every 2 years between 2006-2018 (4,109 obs.)
- Worker characteristics include race, education, gender, age (quadratic), time trend (linear), occupation, industry, search method dummies
- Excluding 0 number of search methods

▸ Back to regression results with conditional on LFP

Data: Search Intensity



NB: Non-UI recipients = those who never received UI

Source: CPS monthly data & January supplements

- Search intensity measured by the number of active job search methods (6 answers max.) of unemployed workers
- Excluding 0 search methods (workers expecting a recall)
- Current and former UI recipients generally search harder than those never received UI

▸ Search methods (active+passive) ▸ Average number of methods, including 0 ▸ List of possible methods

Job Search Methods

1. Contacted employer directly/interview (*+)
2. Contacted public employment agency (*–)
3. Contacted private employment agency
4. Contacted friends or relatives
5. Contacted school/university empl center (*–)
6. Sent out resumes/filled out application (**–)
7. Checked union/professional registers
8. Placed or answered ads
9. Other active
10. Looked at ads
11. Attended job training programs/courses
12. Nothing
13. Other passive

Back to average number of methods excl 0

Job Search Methods: Current UI Workers

1. Contacted employer directly/interview
2. Contacted public employment agency
3. Contacted private employment agency
4. Contacted friends or relatives
5. Contacted school/university empl center
6. Sent out resumes/filled out application (*–)
7. Checked union/professional registers
8. Placed or answered ads
9. Other active
10. Looked at ads
11. Attended job training programs/courses
12. Nothing
13. Other passive

Back to average number of methods excl 0

Job Search Methods: Exhausted UI Workers

1. Contacted employer directly/interview
2. Contacted public employment agency
3. Contacted private employment agency (**+)
4. Contacted friends or relatives
5. Contacted school/university empl center
6. Sent out resumes/filled out application
7. Checked union/professional registers (**–)
8. Placed or answered ads
9. Other active
10. Looked at ads
11. Attended job training programs/courses
12. Nothing
13. Other passive

Back to average number of methods excl 0

Job Search Methods: Non UI Workers

1. Contacted employer directly/interview
2. Contacted public employment agency (*–)
3. Contacted private employment agency
4. Contacted friends or relatives (*–)
5. Contacted school/university empl center
6. Sent out resumes/filled out application
7. Checked union/professional registers
8. Placed or answered ads
9. Other active
10. Looked at ads
11. Attended job training programs/courses
12. Nothing
13. Other passive

Back to average number of methods excl 0

Stochastic Model: Value functions: Firms

- The value of a matched firm with a worker whose work history is $j \in \{E(\tilde{m}), Bs(\tilde{m}), B\ell(\tilde{m}), X, N\}$ is

$$\begin{aligned} J_j(m;\omega) \quad = \quad & y(m;\omega) - w_j(m;\omega) - \tau(\omega) + \beta E_{\omega'|\omega}\Big[... \\ & (1-\delta)(1-\lambda)\Big[(1-p_E(m;\omega)(1-F(m)))J_{E(m)+}(m;\omega')\Big] \\ & +(1-\delta)\lambda E_{m'}\Big[(1-p_E(m;\omega)(1-F(m')))J_{E(m)+}(m';\omega')\Big] \\ & +\delta V(\omega')\Big] \end{aligned}$$

- $J_{E(m)+}(m';\omega') \equiv \max\{J_{E(m)}(m';\omega'), V(\omega')\}$

Back to value function for the employed

Stochastic Model: Value Functions: Unemployed

- Define ω as the set of state variables
- For $j \in \{X, N\}$:

$$U_j(\omega) = \max_{s_j(\omega)} h - c_j(s_j(\omega)) + \beta E_{m'\omega'|\omega}\left[p_j(\omega)\underbrace{\max\left\{W_j(m';\omega'), U_j(\omega')\right\}}_{\text{job formation/rejection decision}} + (1-p_j(\omega))U_j(\omega')\right]$$

Back to policy functions

Stochastic Model: Value Functions: Unemployed

- Define ω as the set of state variables
- For $B\ell$-workers with benefit $b(\tilde{m})$ and long unemp. duration:

$$
\begin{aligned}
U_{B\ell}(\tilde{m};\omega) \quad = \quad & \max_{\gamma_{B\ell}(\tilde{m};\omega)} \; b(\tilde{m}) + h - c\big(\gamma_{B\ell}(\tilde{m};\omega)\underline{s_B}\big) \\
& + \beta E_{m'\omega'|\omega}\Bigg[p_{B\ell}(\tilde{m};\omega) \max\Big\{ W_{B\ell(\tilde{m})}(m';\omega'), \ldots \\
& \underbrace{(1-\phi(u))(1-\xi)}_{\text{keep UI} \mid \text{meeting a firm}} U_{B\ell}(\tilde{m};\omega') + \underbrace{\big(\phi(u)+(1-\phi(u))\xi\big)}_{\text{lose UI} \mid \text{meeting a firm}} U_X(\omega')\Big\} \\
& + (1-p_{UI\ell}(\tilde{m};\omega))\Big((1-\phi(u))U_{B\ell}(\tilde{m};\omega') + \phi(u)U_X(\omega')\Big)\Bigg]
\end{aligned}
$$

$\xi \equiv$ Pr(losing UI eligibility | rejecting job offers)

Back to policy functions

Stochastic Model: Value Functions: Unemployed

- Define ω as the set of state variables
- For Bs-workers with benefit $b(\tilde{m})$ and short unemp. duration:

$$
\begin{aligned}
U_{Bs}(\tilde{m};\omega) \quad = \quad & \max_{\gamma_{Bs}(\tilde{m};\omega)} \quad b(\tilde{m}) + h - c\big(\gamma_B(\tilde{m};\omega)\underline{s_B}\big) \\
& + \beta E_{m'\omega'|\omega}\Big[p_{Bs}(\tilde{m};\omega) \max\Big\{ W_{Bs(\tilde{m})}(m';\omega'), \ldots \\
& \underbrace{(1-\phi(u))(1-\xi)}_{\text{keep UI} \mid \text{meeting a firm}} \big((1-\gamma_\ell)U_{Bs}(\tilde{m};\omega') + \gamma_\ell U_{B\ell}(\tilde{m};\omega')\big) + \ldots \\
& \underbrace{\big(\phi(u) + (1-\phi(u))\xi\big)}_{\text{lose UI} \mid \text{meeting a firm}} U_X(\omega')\Big\} \\
& + (1 - p_{Bs}(\tilde{m};\omega)) \times \Big(\ldots \\
& (1-\phi(u))\big((1-\gamma_\ell)U_{Bs}(\tilde{m};\omega') + \gamma_\ell U_{B\ell}(\tilde{m};\omega')\big) + \phi(u)U_X(\omega')\Big)\Big]
\end{aligned}
$$

$\xi \equiv$ Pr(losing UI eligibility | rejecting job offers)

Back to policy functions

Stochastic Model: Value Function: Employed

- The value of a type-i employed worker with last period's employment status and associated benefit level $j \in \{E(\tilde{m}), Bs(\tilde{m}), B\ell(\tilde{m}), X, N\}$:

$$
\begin{aligned}
W_j(m;\omega) \quad = \quad & \max_{s_E(m;\omega)} \quad w_j(m;\omega) - c_E(s_E(m;\omega)) + \beta E_{\omega'|\omega}\Big[\\
& (1-\delta)(1-\lambda)\Big[(1-p_E(m;\omega)(1-F(m)))W_{E(m)+}(m;\omega') \\
& +p_E(m;\omega)(1-F(m))E_{m'|m'>m}[W_{E(m)+}(m';\omega')]\Big] \\
& +(1-\delta)\lambda E_{m'}\Big[(1-p_E(m;\omega)(1-F(m')))W_{E(m)+}(m';\omega') \\
& +p_E(m;\omega)(1-F(m'))E_{m''|m''>m'}[W_{E(m)+}(m'';\omega')]\Big] \\
& +\delta\Big((1-\psi)U_{Bs}(m,\omega') + \psi U_N(\omega')\Big)\Big]
\end{aligned}
$$

$$
W_{E(m)+}(m';\omega') \equiv \max\{W_{E(m)}(m';\omega'), (1-\psi)U_{Bs}(m,\omega') + \psi U_N(\omega')\}
$$

▸ Value function: Matched firms ▸ Back to policy functions

Stochastic Model: Free Entry

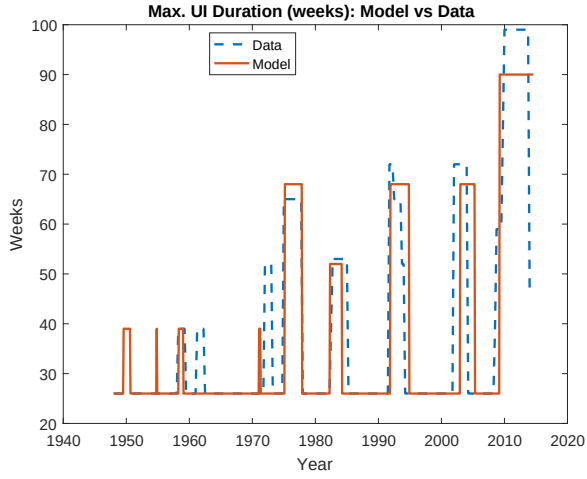
- The value of an unmatched firm is

$$
\begin{aligned}
V(\omega) \quad = \quad & -\kappa + \beta q(\omega) E_{\omega'|\omega} \Big[... \\
& \sum_m \zeta_E(m;\omega)(1-F(m)) E_{m'|m'>m}[J^{E(m)+}(m';\omega')] \\
& + \sum_m \zeta_B(m,\omega) E_{m'}[J^{UI(m)+}(m';\omega')] \\
& + \zeta_N(\omega) E_{m'}[J^{UU+}(m';\omega')] + \zeta_X(\omega) E_{m'}[J^{UIx+}(m';\omega')] \Big]
\end{aligned}
$$

$$
\begin{aligned}
\text{where} \quad \zeta_E(m) \quad &= \quad \frac{(1-\lambda)s_E(m)E(m) + \lambda f(m)\sum_m s_E(m)E(m)}{s} \\
\zeta_B(m) \quad &= \quad \frac{\gamma_B(m)\underline{s_B}U_B(m)}{s}; \quad \zeta_N = \frac{s_N U_N}{s}; \quad \zeta_X = \frac{s_X U_X}{s} \\
s \quad &= \quad \sum_m \left((1-\lambda)s_E(m)E(m) + \lambda f(m) \sum_m s_E(m)E(m) + \gamma_B(m)\underline{s_B}U_B(m) \right) \\
& \quad + s_N U_N + s_X U_X
\end{aligned}
$$

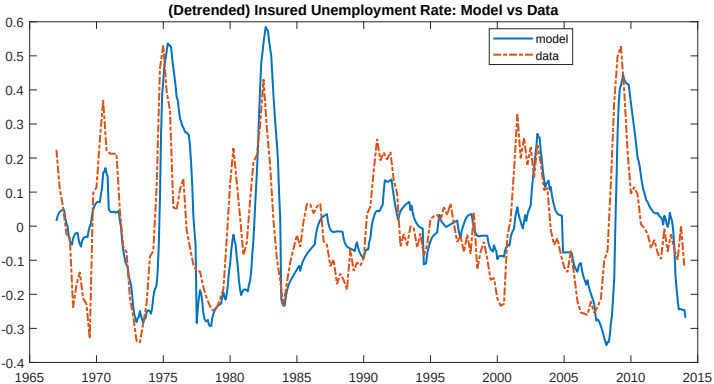
- Free entry condition implies $V(\omega) = 0, \forall \omega$

UI Extensions



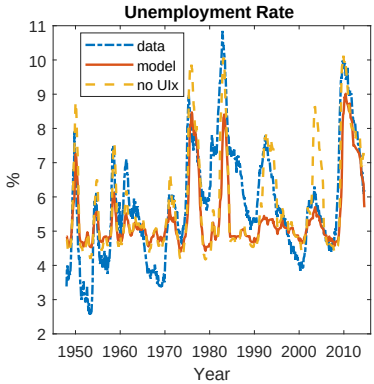
- UI extension triggered by high unemployment rate above 6%
- The Great Recession: Emergency Unemployment Compensation (EUC08) + Extended Benefits programmes Back to TGR application

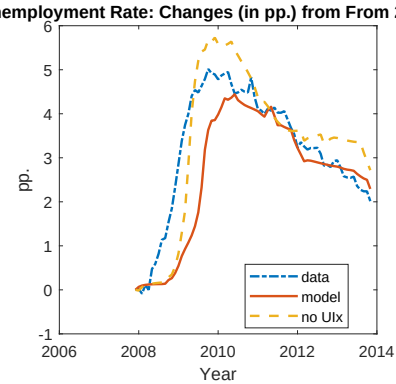
Insured Unemployment Rate



Go back to TGR's Unemployment Rate

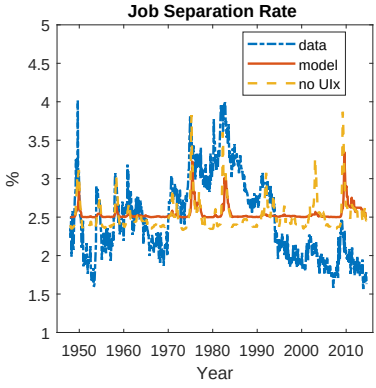
Unemployment: Longer Horizon

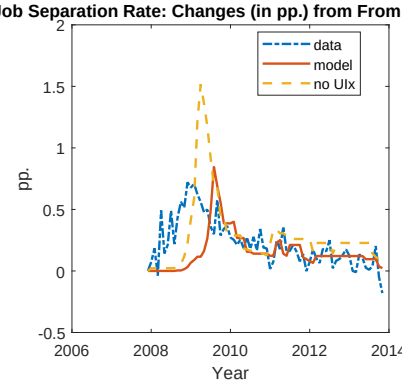




Go back to TGR's Unemployment Rate

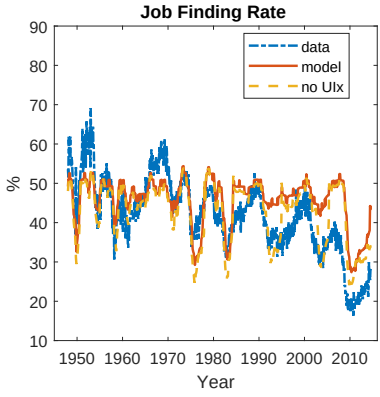
Job Separations: Longer Horizon

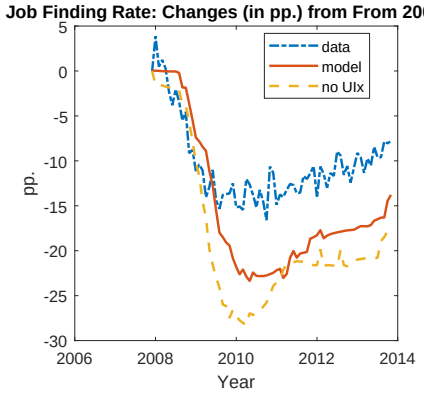




▸ Back to TGR's Job Findings ▸ Go back to TGR's Unemployment Rate

Job Finding: Longer Horizon





▸ Back to TGR's Job Findings ▸ Go back to TGR's Unemployment Rate

Fitted parameters (monthly)

Parameter	Description	Value
α	Matching function	0.51
δ	Exogenous separation	0.023
λ	Redrawing new m	0.50
ψ	Losing UI after becoming unemp.	0.49
ξ	Losing UI after meeting firm	0.50
a_E	Search cost function	0.15
a_{UIx}	Search cost function	0.0717
$\underline{m}$	Lowest match-specific prod.	0.396
β_1	Match-specific prod. distribution	2.55
β_2	Match-specific prod. distribution Dist. of m	5.26
ρ_z	Persistence of TFP	0.9562
σ_z	Standard deviation of TFP shocks	0.0075

Moments to match

- Mean and SD of unemployment, *UE* and *EU* transition rates, and average unemployment duration
- Persistence and SD of labour productivity, correlation between output and labour productivity, mean insured unemployment, and mean job-to-job transition rate
- $M(s, v) = sv/\left(s^\alpha + v^\alpha\right)^{1/\alpha}$

Back to the Setup

Fixed parameters (monthly)

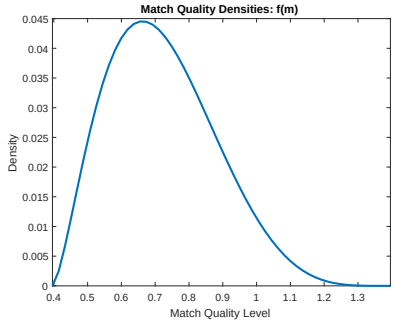
- $b(m)$ and h imply consumption drop of 24% for U_{UU} and 10% for U_{UI} at 50% replacement rate (Gruber 1997)

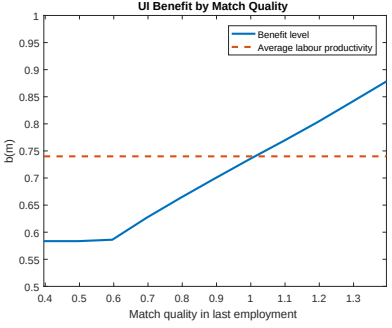
Parameter	Description	Value	Source/Remarks
β	Discount factor	0.9967	Annual interest rate of 4%
κ	Vacancy posting cost	0.0392	Fujita & Ramey (2012)
μ	Worker's bargaining power	0.5	Den Haan, Ramey & Watson (2000)
ϕ	UI exhaustion rate	1/6	6 months max UI duration, ETA
ϕ_{L1}	UI exhaustion rate	1/9	9 months max UI duration, ETA
ϕ_{L2}	UI exhaustion rate	1/12	12 months max UI duration, ETA
ϕ_{L3}	UI exhaustion rate	1/16	16 months max UI duration, ETA
ϕ_{L4}	UI exhaustion rate	1/21	21 months max UI duration, ETA
$\bar{u}$	UI policy threshold	0.06	ETA
a_U	Search cost function	0.1116	Normalisation
d_u, d_e	Search cost function	1	Christensen et al. (2004), Yashiv (2000)
h	Leisure flow	0.5835	Gruber (1997)
γ_{UIx}	Search inefficiency of UIx	0.72	Relative search intensity of UIx wrt UU, CPS

▸ Fitted parameters ▸ Benefit Levels and Match Quality Distribution ▸ Back to the Setup

Benefit Levels and Match Quality

- The distribution of match quality is crucial for the heterogeneity of the unemployment exit rates amongst U_{UI}





Back to calibration

What explains search intensity?

Dependent variable: Job search intensity		
	Number of methods	Imputed minutes
Recall expected	-2.486***	-35.528***
	(0.046)	(1.032)
Male	0.015	10.536***
	(0.044)	(0.985)
Married female	-0.147**	-24.939***
	(0.059)	(1.325)
State unemp. rate	0.037***	0.530*
	(0.013)	(0.283)
dur	0.012*	0.337**
	(0.007)	(0.158)
dur2	-0.000	-0.013**
	(0.000)	(0.006)
dur3	0.000	0.000**
	(0.000)	(0.000)
dur4	-0.000	-0.000**
	(0.000)	(0.000)
R^2	0.354	0.486

- Linear regression coefficients (* p<0.05, ** p<0.01, *** p<0.001), $N = 7,561$
- CPS monthly data and January supplements (1998-2022)
- Worker characteristics include: race, education, gender, age (quartic), marital status, married-female, occupation, industry, recall expectation, potential UI exhaustion month, reason for unemployment, last job tenure, last job's weekly earnings

Back to intro: search intensity

What explains search intensity?

Dependent variable: Job search intensity		
	Number of methods	Imputed minutes
Potential UI exhaustion month	0.022	0.142
	(0.055)	(1.238)
High School	0.120***	6.411***
	(0.046)	(1.034)
Some College	0.219***	21.165***
	(0.049)	(1.105)
College	0.386***	48.213***
	(0.059)	(1.332)
Last job's weekly earnings	0.001**	0.017***
(Unit: USD1000)	(0.000)	(0.009)
R^2	0.354	0.451

- Linear regression coefficients (* p<0.05, ** p<0.01, *** p<0.001). $N = 7,561$. CPS monthly data and January supplements (1998-2022). Excluding 0 search methods (those on recalls) Back to OLS
- Worker characteristics include: race, education, gender, age (quartic), marital status, married-female, occupation, industry, recall expectation, potential UI exhaustion month, reason for unemployment, last job tenure, last job's weekly earnings

Summary statistics by UI history

	UI receivers	UI exhausters	Non-UI receivers
Share of total unemp.	39.21%	20.51%	40.27%
Age (year)	42.68	44.49	38.27
Female	39.56%	41.65%	40.95%
Married female	20.54%	20.63%	17.80%
Black	10.02%	15.99%	16.88%
<High school	10.59%	11.61%	19.67%
High school	34.20%	36.30%	36.12%
Some College	22.26%	21.15%	19.28%
College and more	32.95%	30.95%	24.93%
Job loser/on lay off	14.10%	8.96%	13.46%
Other job loser	69.51%	60.93%	43.25%
Temp job ended	9.34%	11.86%	16.42%
Job leaver	1.75%	2.71%	8.05%
Re-entrant	5.26%	15.41%	18.65%
New entrant	0.03%	0.13%	0.16%
Unemp. Duration (weeks)	23.3	42.26	19.4
Fraction of LTU	31.97%	63.83%	24.96%
Given/expecting a recall	14.10%	8.96%	13.46%
Last job's tenure (year)	5.72	5.53	3.15
Last job's weekly earning	854.08	789.31	589.18

- CPS monthly data and January supplements: every 2 years between 1998-2022 (7561 obs.)

Back to intro

Model ▶ FOCs

Back to Model: Equilibrium

$$
\begin{aligned}
c_E'(s_{E(\tilde{m})}(m;\omega)) &= -\beta(1-\delta)M(\theta(\omega))E_{\omega'|\omega}\Big[... \\
&\quad (1-\lambda)(1-F(m))\Big(WS_{E(m)+}(m;\omega') - E_{m'|m'>m}[WS_{E(m)+}(m';\omega')]\Big) \\
&+ \lambda E_{m'}\Big[(1-F(m'))(WS_{E(m)+}(m';\omega') - E_{m''|m''>m'}[WS_{E(m)+}(m'';\omega')])\Big]\Big] \\
c'(\gamma_{B(m)}(\omega)) &= \beta M(\theta(\omega))E_{m'\omega'|\omega}\Big[\max\{WS_{B(m)}(m';\omega'),0\}... \\
&\quad -\xi(1-\phi)US(m,\omega')\Big] \\
c'(s_N(\omega)) &= \beta M(\theta(\omega))E_{m'\omega'|\omega}\Big[\max\{WS_N(m';\omega'),0\}\Big] \\
c_X'(s_X(\omega)) &= \beta M(\theta(\omega))E_{m'\omega'|\omega}\Big[\max\{WS_X(m';\omega'),0\}\Big]
\end{aligned}
$$

Dependent variable: Job Finding Probability

	(1)	(2)	(3)	(4)
Have received UI	-0.082***		-0.067***	
	(0.013)		(0.013)	
Current UI recipient		-0.100***		-0.087***
		(0.014)		(0.014)
Former UI recipient		-0.035**		-0.019
		(0.018)		(0.018)
Long-term unemployed	-0.064***	-0.076***		
	(0.013)	(0.013)		
U duration			-0.015***	-0.014***
			(0.003)	(0.003)
U duration^2			0.000***	0.000***
			(0.000)	(0.000)
U duration^3			-0.000***	-0.000***
			(0.000)	(0.000)
U duration^4			0.000***	0.000**
			(0.000)	(0.000)
Great Recession	-0.077***	-0.070***	-0.069***	-0.061***
(2010-2012)	(0.013)	(0.013)	(0.013)	(0.013)
R^2	0.0784	0.0819	0.0775	0.0801

- Linear probability model (dependent variable = 1 if a worker moves from unemp. to emp., = 0 if remaining unemployed) (* p<0.05, ** p<0.01, *** p<0.001)
- CPS monthly data and January supplements: every 2 years between 2006-2018 (4,109 obs.)
- Other regressors include: worker characteristics (race, education, gender, age (quartic), occupation, industry, recall expectation, search methods), linear time trend and state FE
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Model ▶ Transitions I: Unemployment

Back to Model: Equilibrium

$$
\begin{aligned}
U_{Bt+1}(m) \quad = \quad & \underbrace{(1-\psi)\rho_{eu,t}(m)e_t^{post}(m)}_{\text{separated match, not losing UI}} \\
& + \underbrace{(1-\phi_t)(1-p_{B,t}(m))U_{B,t}(m)}_{\text{no meeting, not losing UI}} \\
& + \underbrace{\chi_{B,t}(m)(1-\phi_t)(1-\xi)p_{B,t}(m)U_{B,t}(m)}_{\text{bad meeting, not losing UI}}
\end{aligned} \tag{1}
$$

$\chi_{B,t}(\tilde{m})$ is the rate the meetings with $U_B(\tilde{m})$ are unproductive. Namely, $\chi_{B,t}(\tilde{m}) = \int \mathbf{1}\{S_{B(\tilde{m})t}(m) \leq 0\} f(m) dm$.

Model ▶ Transitions I: Unemployment (Cont.)

Back to Model: Equilibrium

$$
\begin{aligned}
U_{Nt+1} &= \underbrace{\phi_t(1-p_{B,t}(m))U_{UI,t}(m)}_{\text{no meeting, losing UI}} + \underbrace{\chi_{UI,t}(m)\Big(\phi_t+(1-\phi_t)\xi\Big)p_{B,t}(m)U_{B,t}(m)}_{\text{bad meeting, losing UI}} \\
&\quad +(1-\rho_{ue,tN})U_{N,t} + \underbrace{\psi\rho_{eu,t}e_t^{post}}_{\text{separated match, losing UI}} \\
u_{t+1} &= \sum_m U_{B,t+1}(m) + U_{N,t+1}
\end{aligned}
$$

$\chi_{B,t}(\tilde{m})$ is the rate the meetings with $U_B(\tilde{m})$ are unproductive. Namely, $\chi_{B,t}(\tilde{m}) = \int \mathbf{1}\{S_{B(\tilde{m}),t}(m) \leq 0\} f(m) dm$.

Model ▶ Transitions II: Employment

Back to Model: Equilibrium

$$
\begin{aligned}
e_{m,it+1} \quad = \quad & \Big((1-\delta)(1-\lambda)(1 - p_{E\,m,it} + p_{E\,m,it} F(m)) e_{m,it} \\
& + (1-\delta)(1-\lambda) f(m) \sum_{m'<m} p_{E\,m',it} e_{m',it} \\
& + (1-\delta)\lambda f(m) \sum_{m'} (1 - p_{E\,m',it} + p_{E\,m',it} F(m)) e_{m',it} \\
& + (1-\delta)\lambda \Big(\sum_{m'<m} f(m') \Big) f(m) \sum_{m'} p_{E\,m'i,t} e_{m',it} \Big) \mathbf{1}\{S_{E\,m,\omega_{it+1}} > 0\} \\
& + \sum_{\tilde{m}} f(m)(U_{B,t}(\tilde{m}) p_{B,t}(\tilde{m})) \mathbf{1}\{S^{B(\tilde{m})}_{m,\omega_{t+1}} > 0\} \\
& + f(m)(U_{N,t} p_{N,t}) \mathbf{1}\{s_{N\,m,\omega_{t+1}} > 0\}
\end{aligned}
$$

The sum in the 2nd and 4th lines is over employed workers with match qualities worse than m who hence make a job-to-job transition.

Model ▶ Transitions III: Job Separation Rate

Back to Model: Equilibrium

$$
\begin{aligned}
\rho_{eu,t}(m) &= \begin{cases} \delta & \text{if } S_{E\,m,\omega_{t+1}} > 0, \\ 1 & \text{otherwise} \end{cases} \\
\rho_{eu,t} &= \frac{\delta \int_{\{m: S_{E\,m,t+1} > 0\}} e^{post}_{m,t}\, dm + \int_{\{m: S_{E\,m,t+1} \leq 0\}} e^{post}_{m,t}\, dm}{e_t} \\
(&\equiv \rho^{exo}_{eu,t} + \rho^{endo}_{eu,t})
\end{aligned}
$$

$$
\begin{aligned}
\text{where } e^{post}_{m,t} \equiv\ & (1-\lambda)(1 - p_{E\,m,t} + p_{E\,m,t} F(m)) e_{m,t} \\
& + (1-\lambda) f(m) \sum_{m' < m} p_{E\,m',t} e_{m',t} \\
& + \lambda f(m) \sum_{m'} (1 - p_{E\,m',t} + p_{E\,m',t} F(m)) e_{m',t} \\
& + \lambda \Big(\sum_{m' < m} f(m') \Big) f(m) \sum_{m'} p_{E\,m',t} e_{m',t}
\end{aligned}
$$

Model ▶ Transitions IV: Job Finding Rate

Back to Model: Equilibrium

For $j = \{B(\tilde{m}), N\}$

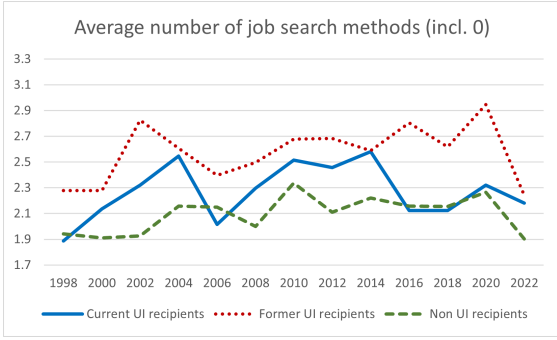
$$\begin{aligned}
\rho^{ue}_{j,t} &= \int \rho^{ue}_{j,t}(m) f(m) dm \\
\rho^{ue}_{t} &= \frac{\sum_{\tilde{m}} (u_{B(\tilde{m}),t} \rho^{ue}_{B(\tilde{m}),t}) + u_{N,t} \rho^{ue}_{N,t}}{u_{UI,t} + U_{N,t}} \\
\text{where } \rho^{ue}_{j,t}(m) &= \begin{cases} p^{j}_{\omega_t} & \text{if } S^{j}_{m',\omega_{t+1}} > 0, \\ 0 & \text{otherwise} \end{cases}
\end{aligned}$$

Job-to-job transition rate is

$$\begin{aligned}
\rho^{ee}_{m,t} &= (1-\delta)\Big((1-\lambda) p^{E}_{m,t} (1 - F(m)) E_{m'>m}[\mathbf{1}\{S^{e(m)}_{m',\omega_{t+1}} > 0\}] \\
&\quad + \lambda \sum_{m'} p^{E}_{m,t} f(m') (1 - F(m')) E_{m''>m'}[\mathbf{1}\{S^{e(m)}_{m'',\omega_{t+1}} > 0\}] \Big) \\
\rho^{ee}_{t} &= \frac{\sum_m \rho^{ee}_{m,t} e_{m,t}}{e_t}
\end{aligned}$$

Data: Search Intensity

≡ number of job search methods used



NB: Non-UI recipients = those who never received UI

Source: CPS monthly data & January supplements

- Current and former UI recipients search harder than those never received UI (respectively 8% and 23% more)

Back to job search intensity

Stochastic Model: UI Extensions

State-dependent UI extension:

- via UI exhaustion rate, $Pr(B \to X)$, as a function of unemployment

$$\phi(u_t) \quad = \quad \begin{cases} \phi & \text{when} \quad u_t < \bar{u} \\ \phi_L & \text{when} \quad u_t \geq \bar{u} \end{cases}$$

- Assume $\phi_L < \phi \quad \leftrightarrow \quad \frac{1}{\phi_L} > \frac{1}{\phi}$
- Recall $\frac{1}{\phi(u_t)}$ = expected UI duration
- $\bar{u}$ = threshold above which UI extension is triggered
- Consistent with UI extension policies in the US (countercyclical)
- Due to UI extensions, some *UI* workers can be long-term unemployed $\to \{Bs, B\ell\}$

Back to stochastic model

Stochastic Model: Policy Functions

Joint worker-firm (total match) surplus varies with

- $m(+)$: match-specific productivity
- $z(+)$: total factor productivity
- $u(-)$: unemployment rate (UI extension policy)
  + cross-sectional distribution of workers (to predict u')

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Search intensity/censoring varies with

- $z(+)$: total factor productivity
- $u(-)$: unemployment rate (UI extension policy - only *UI* workers)
  + cross-sectional distribution of workers (to predict u')
- $b(m)(-)$: UI benefit amount (only B-type workers)
- $m(-)$: match-specific productivity (only E workers)

▸ Bellman equations ▸ Back to stochastic model

Optimal Search/Job Censoring

Search inefficiency discourages workers from searching harder:

- Convex search cost vs. job finding prob. linear in search effort

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$$\frac{\partial c_X(s_X)}{\partial s_X} = \beta \times \gamma_X \times p \times (W_X - U_X)$$

- Given $\gamma_X \in (0,1)$, to obtain $s_X \geq s_N$ (empirically consistent),
  $\rightarrow$ MC of job search for $UIx \leq$ that for UU ▸ E.g.: Quadratic search cost

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UI workers' optimal search censoring (γ_B):

- Compare the job finding rate given $\underline{s_B}$ vs. optimal s_B^*
  - s_B^* : what current UI workers would have optimally exerted
- $\gamma_B^* \cdot \underline{s_B} \cdot p \equiv s_B^* \cdot p$

▸ Back to the Bellman Equations

Optimal Search: Quadratic search cost

Assume $c_j(s) = a_j \cdot s^2$ à la Christensen et al. (2015)
Optimal search intensity: FOCs:

$$\frac{\partial c(s_N)}{\partial s_N} = 2 \cdot a \cdot s_N = \beta \cdot p \cdot (W_N - U_N)$$
$$\frac{\partial c_X(s_X)}{\partial s_X} = 2 \cdot a_X \cdot s_X = \beta \cdot \gamma_X \cdot p \cdot (W_X - U_X)$$

- Assume the limiting case: $\lim_{\delta \to 0} \frac{W_X - U_X}{W_N - U_N} = 1$ (generally < 1)

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$$\rightarrow \frac{a_X}{a} = \gamma_X < 1$$

- But since empirically $s_X > s_N$

$$\rightarrow \frac{a_X}{a} < \gamma_X < 1$$

▸ Back to optimal search cost

Wage

- Wages are negotiated using a generalised Nash bargaining rule
- Workers with previous employment status $j \in \{E, B, X, N\}$ receive

$$w_j \quad = \quad \text{argmax} \left(WS_j\right)^{\mu} \left(J_j\right)^{(1-\mu)}$$

- $\mu =$ worker's bargaining power
- $WS_j =$ Surplus of employed workers with history j
- Total match surplus $S_j \equiv WS_j + J_j$

$\rightarrow$ $WS_j = \mu S_j$ and $J_j = (1-\mu)S_j$

Back to Bellman

What explains search intensity?

Dependent variable: (1) Number of job search methods (2) Imputed minutes of job search à la Mukoyama et al. (2018)					
Strict UI search requirements	(1)	(2)	Lenient UI search requirements	(1)	(2)
Florida	0.263*	3.070	California	−0.100	−2.062
	(0.142)	(3.198)		(0.130)	(2.919)
Missouri	0.200	2.984	Delaware	−0.249	−3.880
	(0.158)	(3.560)		(0.198)	(4.447)
Nebraska	0.237	8.188*	Massachusetts	−0.011	−4.011
	(0.200)	(4.492)		(0.167)	(3.760)
New Hampshire	0.287*	4.134	South Carolina	−0.296*	−4.043
	(0.165)	(3.700)		(0.171)	(3.828)
Utah	0.324*	0.410	West Virginia	−0.408**	−7.612*
	(0.191)	(4.286)		(0.174)	(3.911)
N	7,561	7,561	N	7,561	7,561
R^2	0.354	0.486	R^2	0.354	0.486

- Linear regression coefficients (* $p<0.05$, ** $p<0.01$, *** $p<0.001$)
- Alabama is the reference state (3 work search contacts weekly)
- CPS monthly data and January supplements (1998-2022), excluding 0 search methods (those on recalls)
- Worker characteristics include: UI status, race, education, gender, age (quartic), marital status, occupation, industry, recall expectation, potential UI exhaustion month, reason for unemployment, last job tenure, last job's weekly earnings