Duration Dependence and Heterogeneity: Learning from Early Notice of Layoff

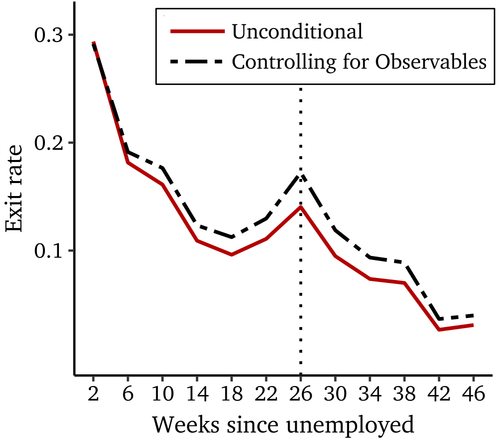
Div Bhagia

California State University, Fullerton

December 15, 2023

Introduction

- The *observed* job-finding rate declines with the duration of unemployment
  ↳ Except for a spike at UI exhaustion
- Longer unemployment duration reduces the odds of exiting unemployment?
  ↳ negative duration dependence
  ↳ e.g. employer discrimination, human capital depreciation, etc.
- However, long-term unemployed also tend to be negatively selected
  ↳ unobserved heterogeneity
  ↳ "better" workers exit early



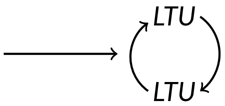
Source: Displaced Worker Supplement, CPS 1996-2020

Other Countries

Introduction

- Long literature in economics tries to disentangle duration dependence from unobserved heterogeneity
- Why do we care?
  - → High incidence of long-term unemployment (LTU)

Negative duration dependence



  - → Implications for unemployment policies

Introduction

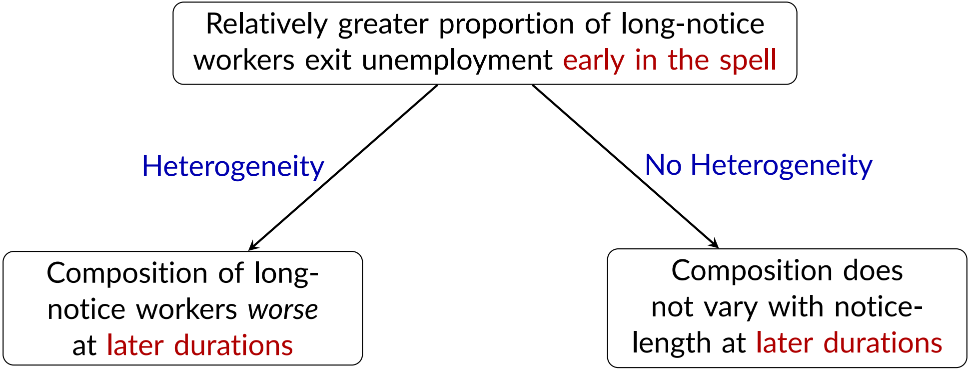
- Long literature in economics tries to disentangle duration dependence from unobserved heterogeneity

- Why do we care?
  → High incidence of long-term unemployment (LTU)

  → Implications for unemployment policies

This Paper: Leverage variation in the *length of notice* that workers receive before being displaced to disentangle these two sources of decline in the job-finding rate

Key Idea



Pin down heterogeneity → Estimate duration dependence

Overview

- Use data from the Displaced Worker Supplement (DWS)
  - Compare *similar* workers with different notice lengths
  - Job-finding rate for long-notice workers initially higher, but lower later in the spell
  - Suggests that "better" workers exit early from the long-notice group
- Set up a Mixed Hazard model and specify conditions under which duration dependence is identified while allowing for arbitrary heterogeneity
- Estimate the model using Generalized Method of Moments (GMM) and find:
  - 60% of the decline in exit rate over first five months due to duration dependence
  - After that a worker's job-finding probability increases until benefit exhaustion and remains constant after
- Calibrate a search model and show that findings are consistent with
  - Standard search theory + $\downarrow$ returns to search early in the spell

Contribution to the Literature

Identification & Estimation of Mixed Hazard Models

Elbers and Ridder (1982), Heckman and Singer (1984), Honoré (1993), Van den Berg et. el. (1996), Brinch (2007), Hausman and Woutersen (2014), Alvarez et al. (2021)

↳ minimal restrictions, unconfoundedness, consistent estimator

Duration Dependence in Job-Finding

Machin and Manning (1999), Krueger and Mueller (2011), Kroft et. al. (2013), Jarosch and Pilossoph (2019), Alvarez et al. (2020), Mueller et. al. (2021)

↳ robust, flexible estimate in the US context

Spike at Unemployment Exhaustion

Katz and Meyer (1990), Ganong and Noel (2019), Boone and van Ours (2012), DellaVigna et. al. (2017), Marinescu and Skandalis (2019), DellaVigna et. al. (2021)

↳ explanation: decline after exhaustion due to compositional changes

Context and Data

Data Description

- Displaced Worker Supplement (DWS) 1996-2020
  - Biennial supplement of the CPS
  - Workers who lost/left a job in the last three years due to, (1) plant closure, (2) position being abolished or (3) insufficient work
- Sample consists of workers aged 21-64:
  - employed full-time at their previous job for 6+ months with health insurance
  - did not expect to be recalled
  - received a notice of *<2 or >2 months*
  - exclude those who lost a job last year
- Reweight the sample using inverse propensity score weighting

▸ Institutional Details ▸ All Workers ▸ Notice Length from SCE ▸ Propensity Scores ▸ UI Take-Up ▸ UI Timing

Descriptive Statistics: Unbalanced Sample

	<2 months	>2 months	Difference
Age	42.24	43.85	1.61***
Female	0.43	0.46	0.04**
Married	0.59	0.65	0.05***
Black	0.10	0.08	-0.02**
College Degree	0.39	0.38	0.00
Plant Closure	0.40	0.63	0.23***
Union Membership	0.15	0.15	0.00
In Metro Area	0.83	0.82	-0.01
Years of Tenure	6.53	9.22	2.69***
Log Earnings	6.50	6.56	0.05***
Observations	2147	1409	

Descriptive Statistics: Balanced Sample

	<2 months	>2 months	Difference
Age	43.03	42.97	-0.06
Female	0.45	0.46	0.01
Married	0.61	0.61	-0.01
Black	0.09	0.09	0.00
College Degree	0.39	0.40	0.01
Plant Closure	0.49	0.49	-0.01
Union Membership	0.15	0.16	0.00
In Metro Area	0.83	0.83	0.00
Years of Tenure	7.74	7.78	0.03
Log Earnings	6.53	6.53	-0.01
Observations	2147	1409	

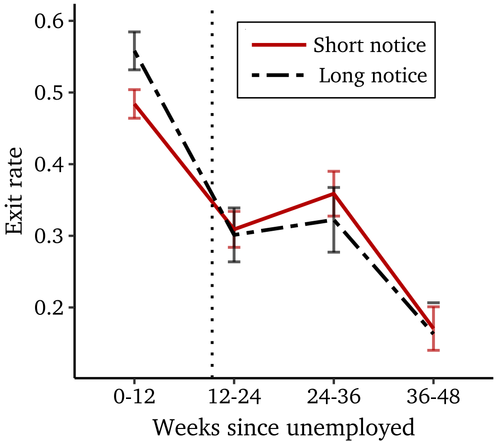
▸ Overlap ▸ Notice over time ▸ Industry ▸ Occupation

Job-Finding Rate Early in the Spell

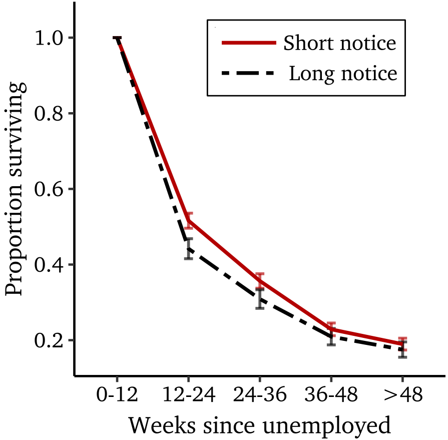
	(1)	(2)	(3)	(4)
	Panel A. $\mathbb{I}\{$Unemployment duration $= 0$ weeks$\}$			
>2 month notice	0.112***	0.087***	0.087***	0.085***
	(0.013)	(0.015)	(0.017)	(0.014)
	Panel B. $\mathbb{I}\{$Unemployment duration $\leqslant 12$ weeks$\}$			
>2 month notice	0.091***	0.082***	0.074***	0.074***
	(0.017)	(0.018)	(0.020)	(0.018)
Controls	No	Yes	No	Yes
Weights	No	No	Yes	Yes
	3556	3556	3556	3556

▸ Earnings

Job-Finding Rate



Survival Rate



▸ 4-Week Intervals ▸ 9-Week Intervals

Econometric Framework

Mixed Hazard Model in Discrete Time

- Unemployment duration, $D \in \{1, 2, 3, ...\}$
- $G(.)$ and $g(.)$ denote cumulative and probability distribution of D, respectively
- Workers have some fixed unobservable type $\nu \sim F(.)$
- Prior to layoff, workers receive a notice of length L
- Vector of observable characteristics $X \sim F_X(.)$
- Hazard rate $h(d|\nu, l, X)$ represents an individual's probability of exiting unemployment at duration d, given that the individual has not exited yet.

Mixed Hazard Model in Discrete Time

Assumption 1 (Mixed Hazard)

An individual's exit probability at duration d is given by:

$$h(d|\nu, l, X) = \psi_l(d, X)\nu$$

where

- *structural hazard* $\psi_l(d, X) \in (0, \infty)$
- *worker's type* $\nu \in (0, \bar{\nu}]$ *with* $\bar{\nu} = 1/\max_{d,l,X}\{\psi_l(d, X)\}$

Identification Issue

An individual worker's hazard at each duration:

$$h(d|\nu, I, X) = \psi_I(d, X)\nu$$

In the data, we observe the average hazard rate at any duration:

$$\tilde{h}(d|I, X) = \frac{Pr(D = d|I, X)}{Pr(D \geqslant d|I, X)} = \underbrace{\psi_I(d, X)}_{\text{Structural Duration Dependence}} \cdot \underbrace{\mathbb{E}(\nu|D \geqslant d, I, X)}_{\text{Average Type Surviving at } d}$$

Identifying Assumptions

Assumption 2 (Conditional Independence)

The length of notice L is independent of the worker's unobservable type ν, given observable characteristics X, i.e., $L \perp \nu | X$.

Assumption 3 (Stationarity)

For all l, X, and $d > 1$,

$$\psi_l(d, X) = \psi(d, X)$$

▸ Discussion ▸ Validity

Identification Results

Theorem 1

Under Assumptions 1–3, for any l, l' *with* $\psi_l(1, X) \neq \psi_{l'}(1, X)$ *and some integer* $\bar{D}$*, the structural hazards* $\{\psi_l(1, X), \psi_{l'}(1, X), \{\psi(d, X)\}_{d=2}^{\bar{D}}\}$ *and the conditional moments of the type distribution* $\{\mathbb{E}(\nu^k|X)\}_{k=1}^{\bar{D}}$ *are identified up to a scale from the conditional duration distribution* $\{G(d|l, X), G(d|l', X)\}_{d=1}^{\bar{D}}$.

Intuition

Identification Results

Proposition 2

Suppose Assumptions 1–3 and $\psi_l(d,X) = \psi_l(d)\phi(X)$ hold. For any l, l' with $\psi_l(1) \neq \psi_{l'}(1)$, consider the set of weights $\omega_l(x)$ and $\omega_{l'}(x)$ that ensure

$$f_X^{\omega}(x) = f_X(x|l) = f_X(x|l')$$

for all x on some common support $\mathcal{X}$ of $f_X(.|l)$ and $f_X(.|l')$. Then, the structural hazards $\{\psi_l(1), \psi_{l'}(1), \psi(d)\}_{d=2}^{\bar{D}}$ and the weighted moments of the type distribution $\{\mu_k^{\omega}\}_{k=1}^{\bar{D}}$ are identified up to a scale from the weighted unemployment distribution $\{G^{\omega}(d|l), G^{\omega}(d|l')\}_{d=1}^{\bar{D}}$.

Related Literature

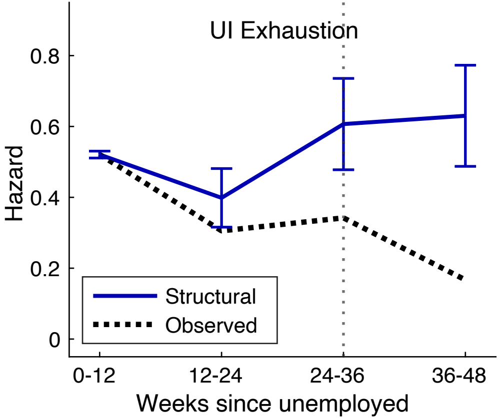
Estimation and Results

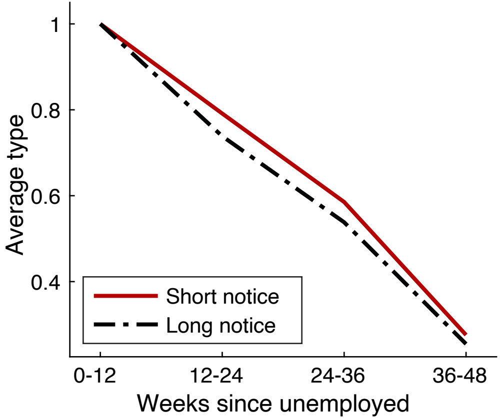
Estimation

- Construct a consistent estimator for the structural hazards and weighted moments of the unobserved heterogeneity distribution using Generalized Method of Moments (GMM) based on Proposition 2
- Estimator utilizes weighted moments of the duration distribution where weights are proportion to the estimated propensity scores
- Derive the asymptotic distribution of the estimator

▸ Details on Estimation and Inference

Baseline Estimates





▸ Point Estimates ▸ UI Timing ▸ Robustness

SUMMARIZING THE RESULTS

First five months

- Under half of the decline due to structural duration dependence
- Cannot rule out employer discrimination (Kroft et. al., 2013)

Leading up to benefit exhaustion

- Individual worker's job-finding probability increases
- Workers search harder and/or lower their expectations

After benefit exhaustion

- No further decline in a worker's job-finding probability
- Decline after UI exhaustion consistent with standard search theory ▸ Calibration
  ↳ limited scope for behavioral explanations (DellaVigna et. al., 2017; 2021)

Conclusion

- Disentangle the role of structural duration dependence from heterogeneity in determining the job-finding rate using variation in notice lengths
- Document that workers with longer notice more likely to exit unemployment early; however, their exit rate is lower at later durations.
  - ↳ points towards the presence of heterogeneity across workers
- Utilize these reduced-form moments and estimate a Mixed Hazard model
- Key takeaway: substantial heterogeneity across job seekers
  - ↳ Only about half of the decline in the exit rate over the first five months represents a decline in an individual's exit probability
  - ↳ After first five months, all the decline in the exit rate due to dynamic selection
- Highlights importance of incorporating heterogeneity in economic analysis

Thank you!

Contact Information:

Div Bhagia
dbhagia17@gmail.com
www.dbhagia.com

Scan for the full paper.

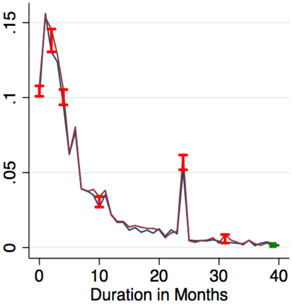
Appendix

Data and Moments Appendix

- Job-Finding Rate: Other Countries
- Institutional Details
- Notice Length from SCE
- Sample vs. All Workers
- Propensity Score Estimation
- Propensity Score Distributions
- UI Take-Up
- UI Timing
- Length of Notice over Time
- Industry and Occupation
- Earnings at Subsequent Job
- 4-Week and 9-Week Bins

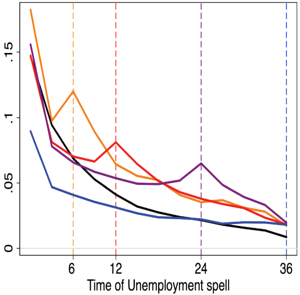
Job-Finding Rate: Other Countries

Spain



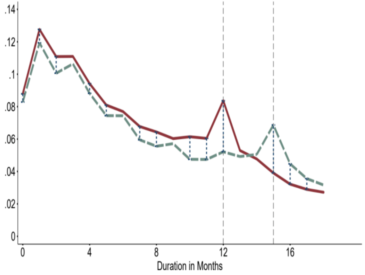
Gerard Domènech and Vannutelli (2020)

France



Marinescu and Skandalis (2021)

Germany



DellaVigna, Heining, Schmieder, and Trenkle (2021)

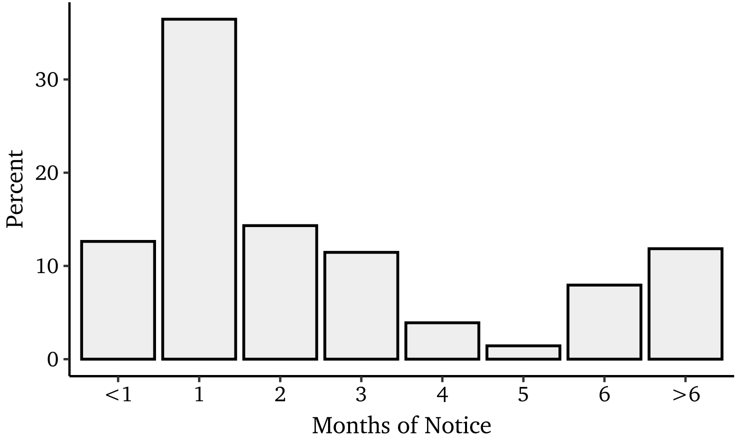
Back

Institutional Details

- The Worker Adjustment and Retraining Notification (WARN) Act requires a 60 calendar-day notice
  - employers with 100 or more full-time employees
  - plant closures (shutdown of employment site, 50+ workers)
  - mass layoffs (one-third if 50+ or 500+ workers)
  - little variation across states (except California, New York, Illinois)
- Workers terminated without cause, eligible for UI benefits for a limited duration
  - maximum period for receiving benefits, 26 weeks for most states
  - for 9 states, uniform benefit duration of 26 weeks
  - temporary programs to extend benefits during recessions
  - benefit exhaustion at 26 weeks for an average worker in the sample Show

Back

Notice Length from SCE



Source: Survey of Consumer Expectations (2013-2019), $N = 768$

Back

Sample vs. All Workers

	Sample (1)	DWS (2)	CPS (3)
Age	42.87	40.61	42.17
Female	0.44	0.44	0.52
Black	0.09	0.11	0.10
Married	0.61	0.54	0.60
Educational Attainment			
HS Dropout	0.04	0.09	0.09
HS Graduate	0.57	0.65	0.60
College Degree	0.39	0.26	0.30
Employment Status			
Employed	0.89	0.67	0.74
Unemployed	0.09	0.21	0.04
NILF	0.02	0.12	0.21
Observations	3556	44707	969604

Back

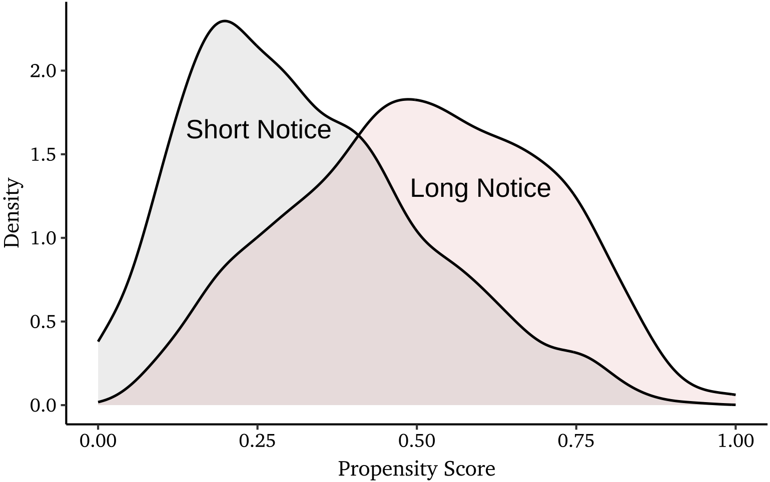
Propensity Score Weighting

- Estimate propensity scores $\hat{p}(X_i)$ using a logistic regression where odds of receiving a longer notice are a function of:
  - Demographics: age, gender, marital status, race, education
  - Characteristics of the lost job:
    - laid off due to plant closure
    - union status
    - tenure and earnings
    - occupation fixed effects
    - metro area status; state fixed effects
    - displacement year $\times$ industry fixed effects
- Reweight the data using the following weights for workers:

$$\text{Long-notice: } \frac{1}{\hat{p}(X_i)} \qquad \text{Short-notice: } \frac{1}{1-\hat{p}(X_i)}$$

Back

Propensity Score Distributions



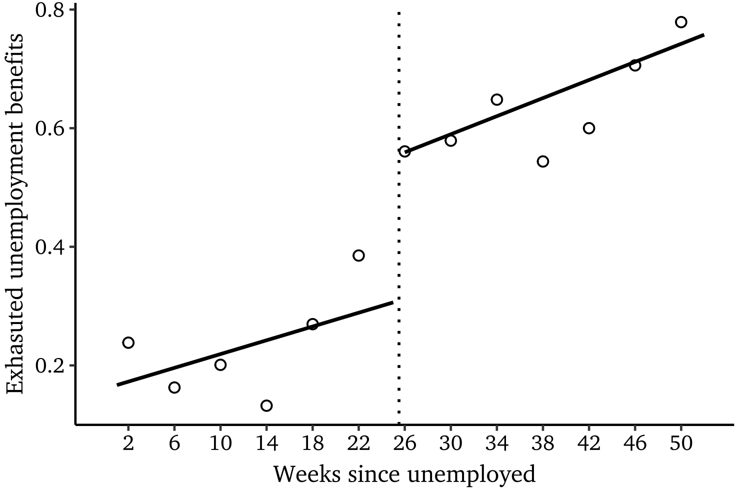
Back

Unemployment Insurance Take-Up

Unemployment Duration	Observations	Recieved UI Benefits
0 Weeks	591	0.07
0-4 Weeks	797	0.30
4-8 Weeks	335	0.63
8-12 Weeks	303	0.69
>12 Weeks	1516	0.83

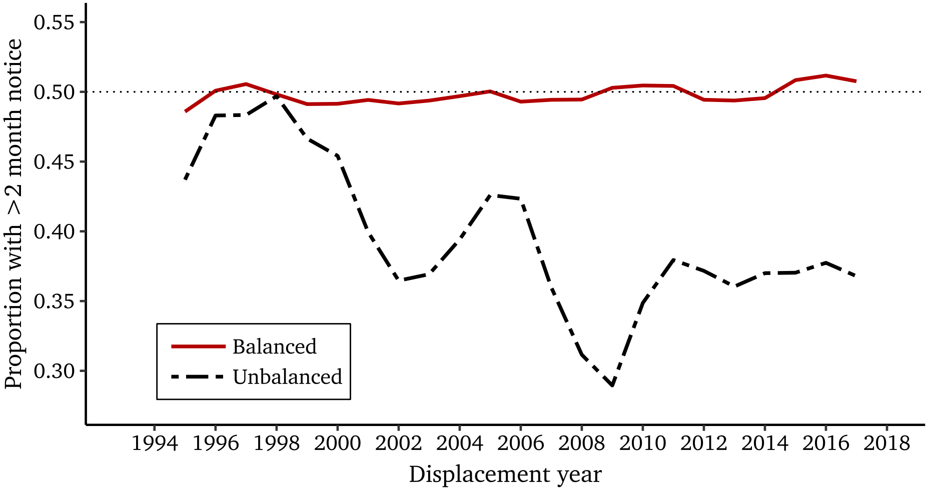
Back

Unemployment Insurance Timing



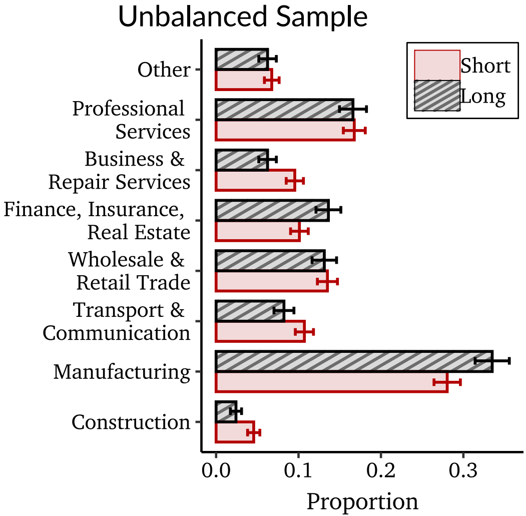
Institutional Details Back to Data Back to Estimates

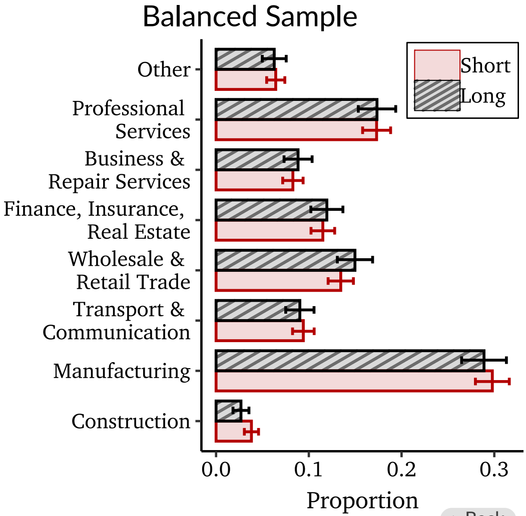
Length of Notice over Time



Back

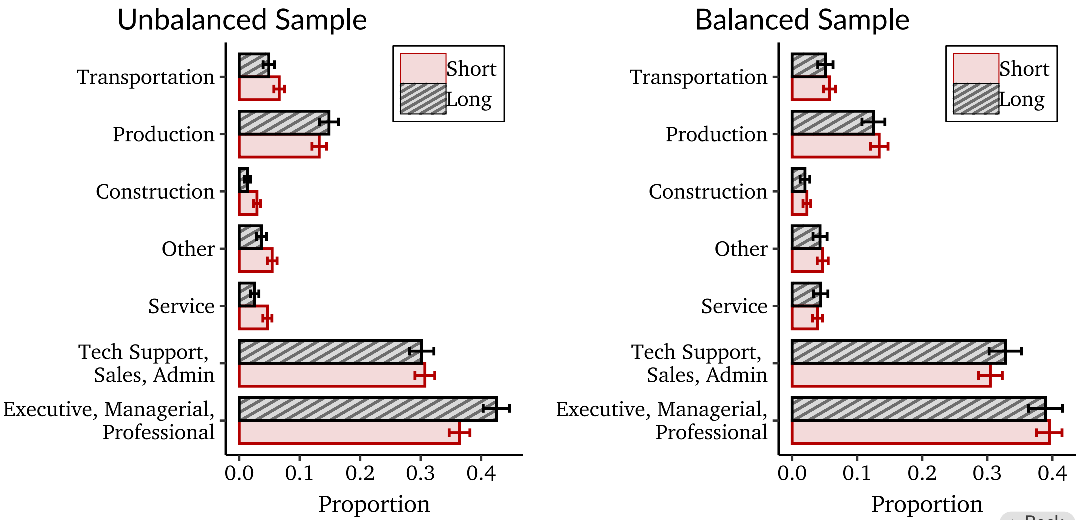
INDUSTRY





Back

Occupation



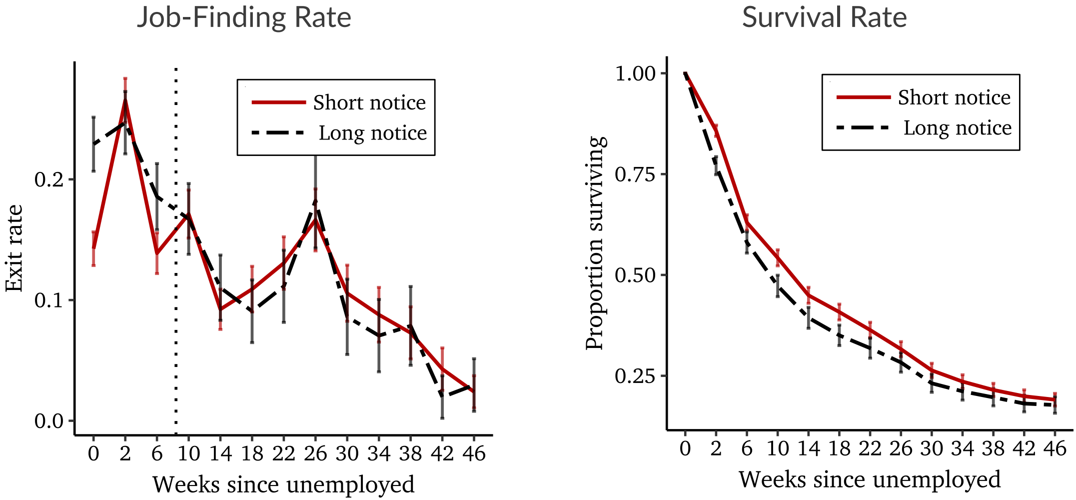
Back

Earnings at Subsequent Job

	Weekly Log Earnings			
	(1)	(2)	(3)	(4)
>2 month notice	0.144***	0.129***	0.130***	0.126***
	(0.041)	(0.036)	(0.044)	(0.034)
Controls	No	Yes	No	Yes
Weights	No	No	Yes	Yes
	2370	2370	2370	2370

Back

4-Week Intervals

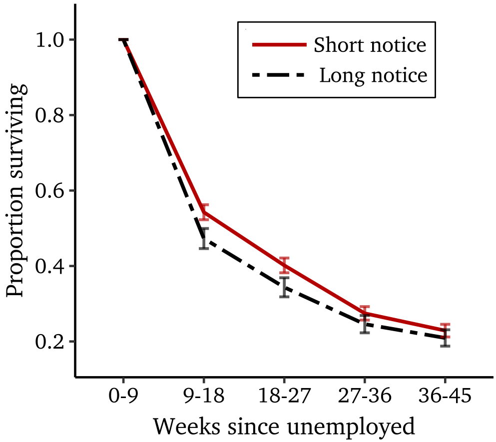


Back

9-Week Intervals

Job-Finding Rate

Survival Rate



Back

Econometric Framework Appendix

- Discussion of Stationarity Assumption
- Intuition for Identification
- Related Literature on Mixed Hazard Models
- Estimation and Inference
- Point Estimates

Discussion: Stationarity Assumption

- The *Stationarity Assumption* states that an individual's exit probability is not impacted by length of notice later in the spell
- In other words, individual exit probabilities only vary with unemployment duration and not with time spent searching for a job
- Consistent with:
  - human capital depreciation
  - employer discrimination
  - large class of search models (even with non-stationarity such as Lentz and Tranæs (2005))

Back

Potential Violations of the Stationarity Assumption

Case I: time spent searching increases an individual's exit probability

- ↳ For instance, if workers learn while searching and become better at job search (Burdett and Vishwanath, 1988; Gonzalez and Shi, 2010)
- ↳ Those with longer notice would have a higher hazard even at later durations
- ↳ Underestimate the extent of heterogeneity

Case II: time spent searching decreases an individual's exit probability

- ↳ Stock-flow model (Coles and Smith, 1998)
- ↳ Those with shorter notice have a higher hazard at later durations
- ↳ Overestimate the extent of heterogeneity

▸ Back

Validating Assumptions

- Under the identifying assumptions, lower exit rate of long-notice workers after the initial 12 weeks attributed to heterogeneity

- Alternative explanations:
  - Long-notice workers (even conditional on observables) negatively selected
  - Time spent searching decreases an individual's exit probability
    - ↳ e.g. Stock-Flow model (Coles and Smith, 1998) or discouragement

- Test for these by estimating a more general model that allows:
  - the mean of the underlying type distributions to vary by notice length
  - structural hazards to vary with notice beyond the initial period by a constant

▸ Extension ▸ Back

Intuition

- Focus on the case without observables
- Individual worker's exit probability:

$$h(d|l,\nu) = \psi_l(d)\nu$$

- Observed exit rate:

$$\tilde{h}(d|l) = \psi_l(d)\mathbb{E}[\nu|D \geqslant d]$$

- Hazard rate in second vs first period:

$$\frac{\tilde{h}(2|l)}{\tilde{h}(1|l)} = \frac{\psi(2)}{\psi_l(1)} \cdot \frac{\mathbb{E}[\nu|D \geqslant 2]}{\mathbb{E}[\nu|D \geqslant 1]} = \frac{\psi(2)}{\psi_l(1)} \cdot \left(\frac{1 - \tilde{h}(1|l) \cdot \frac{\mathbb{E}[\nu^2]}{\mathbb{E}[\nu]^2}}{1 - \tilde{h}(1|l)} \right)$$

Back

Intuition

Second vs first period:

$$\frac{\tilde{h}(2|l)}{\tilde{h}(1|l)} = \underbrace{\frac{\psi(2)}{\psi_l(1)}}_{\text{Duration Dependence}} \cdot \underbrace{\left(\frac{1-\tilde{h}(1|l)\cdot Het}{1-\tilde{h}(1|l)}\right)}_{\text{Dynamic Selection}} \quad where \quad Het = \frac{\mathbb{E}[\nu^2]}{\mathbb{E}[\nu]^2}$$

Heterogeneity captured by: $var(\nu) = \mathbb{E}[\nu^2] - \mathbb{E}[\nu]^2$

- No heterogeneity: $var(\nu) = 0 \rightarrow Het = 1 \rightarrow \frac{\tilde{h}(2|l)}{\tilde{h}(1|l)} = \frac{\psi(2)}{\psi_l(1)}$
- With heterogeneity: $var(\nu) > 0 \rightarrow Het > 1 \rightarrow \frac{\tilde{h}(2|l)}{\tilde{h}(1|l)} < \frac{\psi(2)}{\psi_l(1)}$

Back

Intuition

- If we knew the extent of heterogeneity as captured by $Het = \mathbb{E}[\nu^2]/\mathbb{E}[\nu]^2$, we could back out structural dependence $\psi(2)/\psi_l(1)$ from observed exit rates
- The variation in notice lengths allows us to learn about the heterogeneity
- For two lengths of notice l and l':

$$\frac{\tilde{h}(2|l)}{\tilde{h}(2|l')} = \left(\frac{1-\tilde{h}(1|l)\cdot Het}{1-\tilde{h}(1|l)}\right) \Big/ \left(\frac{1-\tilde{h}(1|l')\cdot Het}{1-\tilde{h}(1|l')}\right)$$

- WLOG, $\tilde{h}(1|l') > \tilde{h}(1|l)$, then
  - No heterogeneity: $Het = 1 \rightarrow \tilde{h}(2|l') = \tilde{h}(2|l)$
  - With heterogeneity: $Het > 1 \rightarrow \tilde{h}(2|l') < \tilde{h}(2|l)$

Back

Related Literature on Mixed Hazard Models

- Existing non-parametric identification results for the Mixed Hazard model rely on variation in an exogenous variable that enters the structural hazard multiplicatively (Elbers and Ridder, 1982; Heckman and Singer, 1984).

- The practical implementation of these results has been limited due to the challenge of locating a variable that meets this criterion, as well as the absence of a convenient estimator.

- Another approach to identification is using multiple spell data (Honoré, 1993). However, this approach assumes that the unobserved characteristics of the jobseeker remain constant across repeated spells.

▸ Back

Related Literature on Mixed Hazard Models

- The framework I employ is analogous to a Mixed Hazard model with a time-varying exogenous variable.
- Brinch (2007) provides a non-constructive proof for this model in continuous time, the key distinction here is that the exposition is in discrete time, which leads to a consistent estimator for the model's parameters using GMM.
- To the best of my knowledge, Alvarez et al. (2021) is the only other study that utilizes moment conditions from a discrete version of the Mixed Hazard model and constructs a GMM estimator. However, their identification result and estimator pertain to multiple spell data.
- In addition, none of the existing results or estimators allow for unconfoundedness and require independence of the main variable

▸ Back

Estimation and Inference

- Normalize the first weighted moment to $\mu_1^\omega = 1$
- With J possible notice lengths, the vector of $2(\bar{D}-1)+J$ unknown parameters:

$$\Theta = \{\{\psi_l(1)\}_{l=1}^{J}, \{\psi(d)\}_{d=2}^{\bar{D}}, \{\mu_k^\omega\}_{k=2}^{\bar{D}}\}$$

- For each individual i, define the following moment condition:

$$m_i(l,d,\Theta) = \mathbb{I}\{L_i = l\} w_i \big[\mathbb{I}\{D_i = d\} - g^w(d|l;\Theta)\big]$$

- Under the model assumptions, we have

$$\mathbb{E}[m_i(\Theta)] = 0, \quad \textit{where} \;\; m_i(\Theta) = \{\{m_i(l,d,\Theta)\}_{d=1}^{\bar{D}}\}_{l=1}^{J}$$

  Note that $m_i(\Theta)$ contains $J \times \bar{D}$ moment conditions

Back

Estimation and Inference

To construct the GMM estimator, note that the corresponding sample average for $\mathbb{E}[m_i(\Theta)]$:

$$\hat{m}(\Theta) = \frac{1}{n}\sum_{i=1}^{n} m_i(\Theta) = \left\{ \{\pi_l[\hat{g}^{\omega}(d|l) - g^{\omega}(d|l;\Theta)]\}_{d=1}^{\bar{D}} \right\}_{l=1}^{J}$$

Here,

- n is the sample size,
- $\pi_l = (\sum_{L_i=l} w_i)/n$.
- $\hat{g}^{\omega}(d|l) = \left(\sum_{i:L_i=l} w_i \mathbb{I}\{D_i = d\}\right) / \left(\sum_{i:L_i=l} w_i\right)$ is the sample counterpart of the weighted duration distribution

Back

Estimation and Inference

The GMM estimator $\hat{\Theta}$ is then given by:

$$\hat{\Theta} = \arg\max_{\Theta} \hat{m}(\Theta)'\hat{W}\hat{m}(\Theta)$$

- When the model is just-identified, $\hat{W}$ is given by the identity matrix.
- In the case of over-identification, the efficient weighting matrix is given by $\hat{W} = \hat{\Omega}^{-1}$, where $\hat{\Omega} = \left[\frac{1}{n}\sum_{i=1}^{n} m_i(\hat{\Theta})m_i(\hat{\Theta})'\right]^{-1}$. Using the two-step estimation process, we can compute $\hat{\Theta}$.

The asymptotic distribution of this estimator is given by

$$\sqrt{n}(\hat{\Theta} - \Theta) \rightarrow N(0, (\hat{M}'\hat{\Omega}^{-1}\hat{M})^{-1}), \quad where \;\; \hat{M} = \partial\hat{m}(\hat{\Theta})/\partial\Theta$$

Back

Estimation and Inference

- Due to small sample size, need to minimize the number of parameters
- Assume that the structural hazard $\psi(d)$ for $d > 1$ has a log-logistic form:

$$\psi(d) = \frac{(\alpha_2/\alpha_1)(d/\alpha_1)^{\alpha_2 - 1}}{1 + (d/\alpha_1)^{\alpha_2}}, \quad \alpha_1 > 0, \alpha_2 > 0$$

- The hazard specified above is:
  - monotonically decreasing when $\alpha_2 \leqslant 1$
  - unimodal, initially increasing and subsequently decreasing when $\alpha_2 > 1$
- Flexible parametrization for the structural hazard that allows non-monotonicity, unlike other commonly used parametrizations, such as Weibull or Gompertz

Back

Point Estimates

Parameter	Explanation	Estimate	SE
Panel A: Estimated Parameters			
$\psi_S(1)$	Structural hazard 0-12 weeks: Short notice	0.49	0.01
$\psi_L(1)$	Structural hazard 0-12 weeks: Long notice	0.55	0.01
α_1	Scale parameter for $\psi(d)$	1.21	0.09
α_2	Shape parameter for $\psi(d)$	1.46	0.45
Panel B: Duration Dependence			
$\bar{\psi}(1)$	Structural hazard: 0-12 weeks	0.52	0.01
$\psi(2)$	Structural hazard: 12-24 weeks	0.40	0.05
$\psi(3)$	Structural hazard: 24-36 weeks	0.61	0.08
$\psi(4)$	Structural hazard: 36-48 weeks	0.63	0.09
Hansen-Sargan Test			
	Test statistic: 2.14	Critical value, $df = 1, \chi^2_{0.05}$: 3.84	

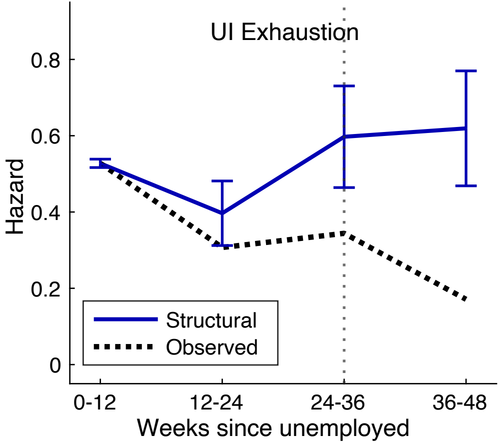
Back

Robustness Appendix

- Alternative Notice Categories
- Unweighted Sample
- Different Functional Forms
- Alternative Binning
- Extensions to relax assumptions
  - Allow average type to vary
  - Allow structural hazards to vary
  - Allow both to vary

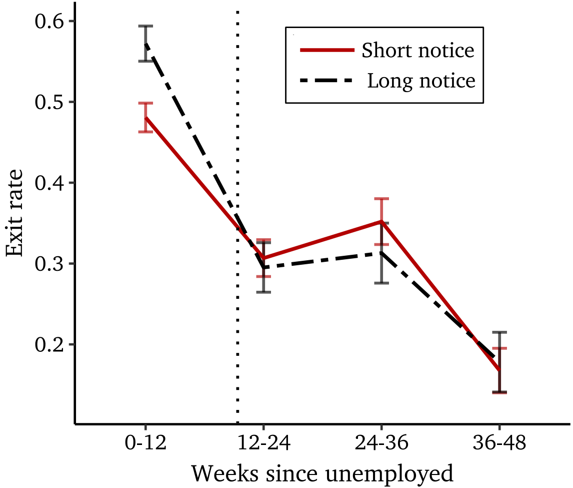
Back to Baseline Estimates

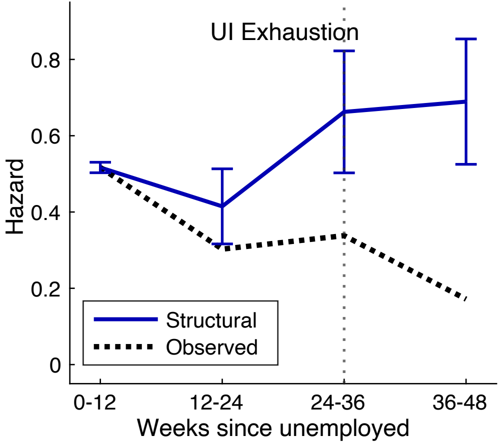
Alternative Notice Categories



Back to Baseline Estimates

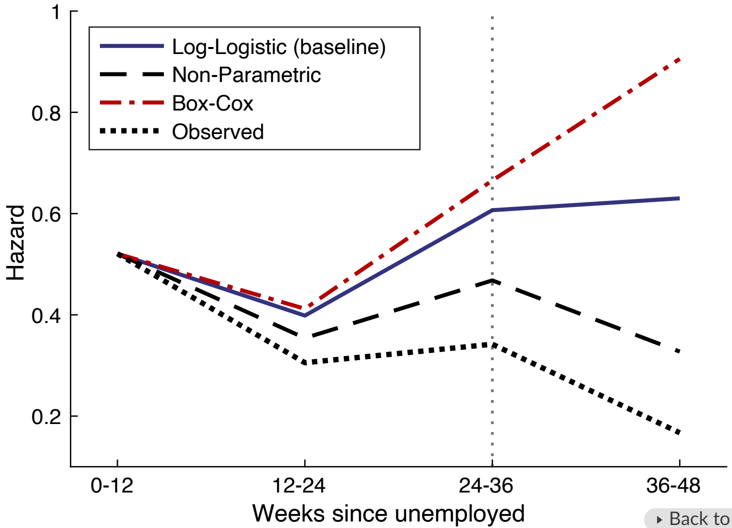
Unweighted Sample





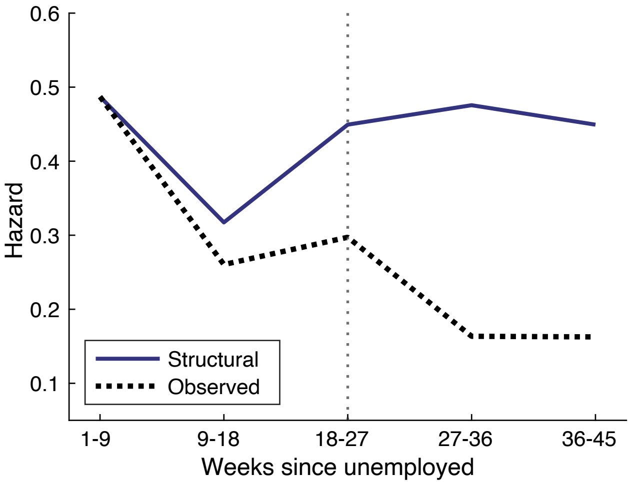
Back to Baseline Estimates

Different Functional Forms



Back to Baseline Estimates

Estimates: 9-Week Intervals



Back to Baseline Estimates

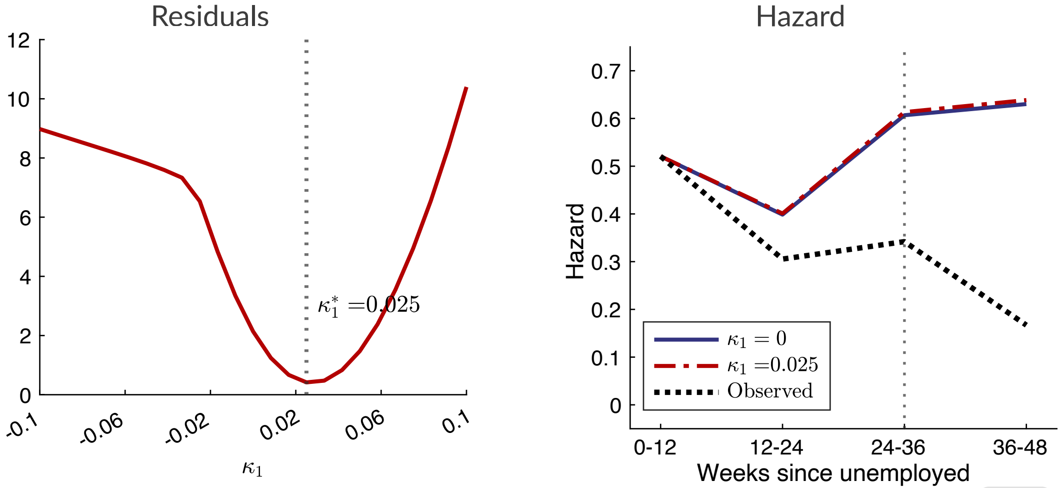
Extensions to Relax Assumptions

- Extended model allows the following to vary by notice length:
  - mean of the type distributions: $\mathbb{E}(\nu|L) = \mathbb{E}(\nu|S) - \kappa_1$
  - structural hazards beyond the initial period: $\psi_L(d) = \gamma\psi_S(d) \quad \text{for } d > 1$
- Can show that duration dependence is identified in the extended model if κ_1 and γ are known; however, not possible to show that κ_1 and γ are identified
- Estimate the model by varying the values of additional parameters and identifying optimal values that minimize residuals
- Exercise suggests:
  - no mean differences between the two groups
  - slightly higher hazard for long-notice workers, even after the first 12 weeks

    ↳ Baseline estimates underestimate the extent of heterogeneity

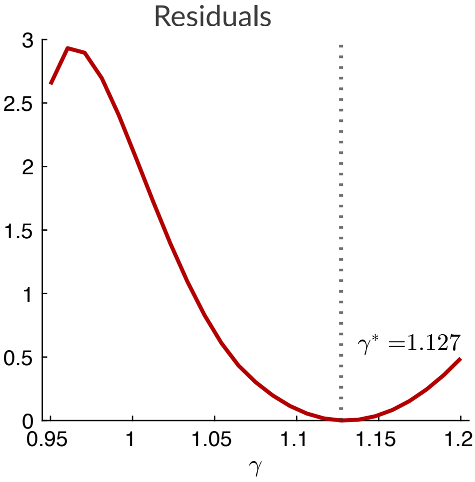
▸ Back to Assumptions ▸ Back to Baseline Estimates

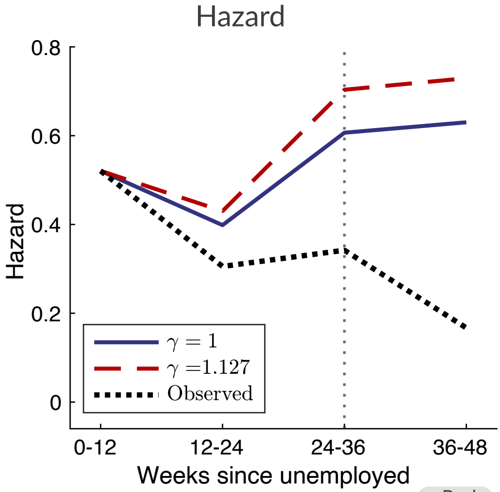
Allow average type to vary



Back

Allow structural hazards to vary

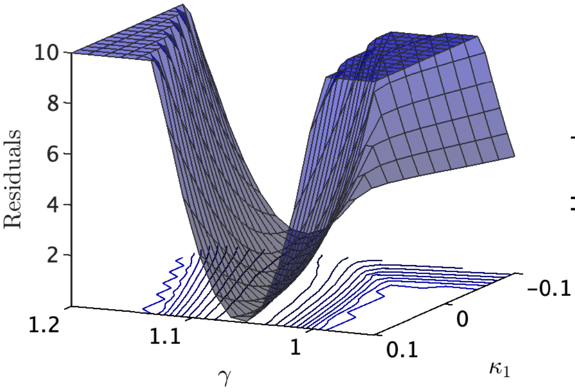




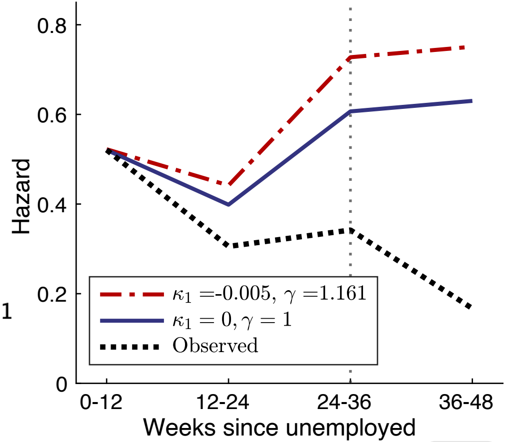
Back

Allow both to vary

Residuals



Hazard



Back

Appendix: Search Model

Search Model

- Workers choose search effort s to maximize discounted expected utility
- Costs of job search $c(s)$, increasing, convex, twice differentiable
- Probability that worker finds a job, $\lambda(d, \nu, s) = \delta(d)\nu\, s(d, \nu)$
- Two types of workers $\nu_H > \nu_L$, π is the share of high-type
- Calibrate ▸ Details
  - With heterogeneity, assume two-types of workers and set
    $$\mathbb{E}[h(d, \nu)] \approx \hat{\psi}(d)\ (estimate)$$
  - Without heterogeneity, set
    $$\mathbb{E}[h(d, \nu)] \approx \tilde{h}(d)\ (data)$$

▸ Back

Calibration

Offer Arrival Rate, $\delta(d)$

Search Effort, $\mathbb{E}[s(d, \nu)]$

Back

Calibration Details

Parameter	Value
Length of each period	12 Weeks
Discount factor β	0.985
Relative risk aversion σ	1.75
Per period wages w	1
Annuity Payments	0.1
Unemployment benefits	0.5
Benefit exhaustion D_B	3
Search cost parameter ρ	1
Search cost parameter θ	50
First period arrival rate $\delta(1)$	1

Search cost: $c(s) = \theta s^{(1+\rho)}/(1+\rho)$

Back