The Effect of Unemployment Insurance Eligibility in Equilibrium

Ying H. Chao   Benjamin S. Griffy   David Wiczer

Stony Brook University

University at Albany

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Introduction

Does UI affect outcomes?

Paying unemployed affects the relative value of unemployment?

- Difficult to study the causal effect because:
  - Eligibility determined by endogenous factors
  - Receipt itself is endogenous, given incomplete take-up
- This paper focuses on the lower bound of eligibility
  - Important as quasi-experimental causal evidence
  - Local estimates here are important b/c high marginal utility

This paper: RD estimates & model-based interpretation

- UI system has *minimum* income eligibility!
- Exploit a regression discontinuity design:
  - Worker characteristics are continuous across the eligibility cutoff
  - UI payment availability jumps discretely
- A causal effect on next earnings $\sim$ \$300 – \$900 from UI eligibility
- Interpreting the causal effect as:
  - better match quality
  - higher rents

  in light of endogenous UI take-up (claiming & approval)

Background on the literature

In most cases, the quasi-experimental variation is duration

- Cross-state duration differences:
  Chodorow-Reich, Coglianese & Karabarbounis (2019) vs Hagedorn, Karahan, Mitman, Manovskii (2019)
- Age differences in duration:
  Schmieder, von Wachter & Bender (2016) vs Nekoei & Weber (2017)

A key problem is that duration itself affects outcomes:

- Longer duration $\rightarrow$ selection, loss of human capital, etc.

Studies often

- Find competing or null results
- Study a small subset of the unemployed—bad location for a LATE

Credibly identified,
quasi-experimental, reduced-form,
causal estimates

Graphical evidence of the discontinuity

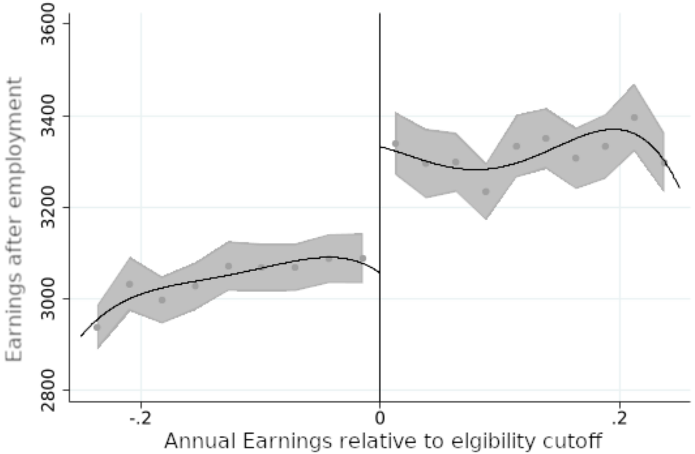

Figure: Running variable is earnings relative to threshold

States choose minimum earnings thresholds

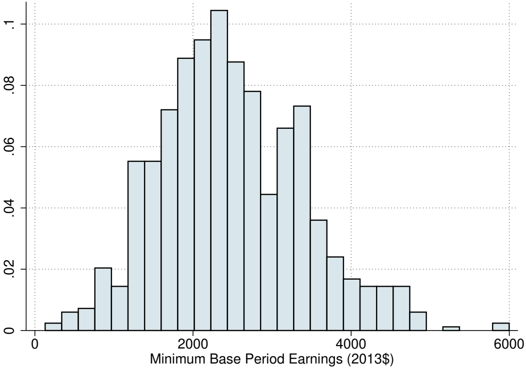

Figure: The state-year distribution of minimum earnings requirements for covered employment in the previous year. $\sim \frac{1}{5}$ are below the cutoff.

- Below the threshold, definitely ineligible
- Above the threshold, mostly eligible but not 100% takeup

Data on earnings histories

Administrative data on earnings to accurately measure eligibility

- Longitudinal Employer-Household Dynamics (LEHD) is administrative earnings data based on UI accounts
- Sample of 2% of population in 17 states, approximately 0.7% of labor force
- Quarterly frequency, so a separation is:
  - Full quarter of non-employment
  - Two abutting employers without a quarter in which both paid
  - Two abutting employers with a quarter in which both paid, but less than the minimum of the two adjacent quarters

The RDD estimating equation

We estimate the following regression:

$$\begin{aligned} y_{i,t} =& \mathbb{I}(B_t \geq \underline{B}_{s,y}) f\left(\frac{B_t - \underline{B}_{s,y}}{\underline{B}_{s,y}}, \gamma_R\right) + \mathbb{I}(B_t \leq \underline{B}_{s,y}) f\left(\frac{B_t - \underline{B}_{s,y}}{\underline{B}_{s,y}}, \gamma_L\right) \\ & + \beta B_{i,t} + D_y + D_s + \epsilon_{i,t} \end{aligned}$$

Where i indexes the individual, t indexes time, s, y indexes the state and year of i, t

- $f()$ is a polynomial/kernel regression w/ parameters γ_L, γ_R
- B_t are base period earnings (4 qtrs prior to qtr of separation)
- $\underline{B}$ is the minimum earnings requirement
- D_y and D_s are time/location dummies

Estimate of fuzzy treatment effect

We use local linear regression with independent bandwidths (Calonico et al , 2014) to estimate:

$$\lim_{B_t \to^{+} \underline{B}_{s,y}} E[f(\cdot, \gamma_R) \,|\cdot] - \lim_{B_t \to^{-} \underline{B}_{s,y}} E[f(\cdot, \gamma_L) \,|\cdot]$$

Dependent	$y_{i,t}$		$\frac{y_{i,t}}{\underline{B}_{s,y}}$	
	(1)	(2)	(3)	(4)
Bias-Corrected	318.92	276.913	0.102	0.0970
	(67.47)	(69.22)	(0.0351)	(0.0328)
Robust	318.92	276.913	0.102	0.0970
	(80.81)	(82.71)	(0.0415)	(0.0393)
With B_t control		X		X

Table: Effect of UI receipt in 2013$ or as a fraction of cutoff. Standard errors in parentheses

Using the SIPP to "compliance"

Potentially two reasons for non-compliance:

1. Ineligibility due to other monetary or non-monetary criteria
2. Endogenous non-takeup.

Sample SIPP for $\frac{B_t - \underline{B}_{s,y}}{\underline{B}_{s,y}} \in (0, 0.2)$

	Ineligibility	Non-claiming
Non-Compliance	0.405	0.434
Implied effect	536.55	946.20

Table: The underlying treatment can be ~3X

ineligibility from self-reported separation reason

Are characteristics continuous across $B_{i,t} = \underline{B}_{s,y}$?

	Born	Tenure	Some college	Female	Non-white	Employment
$< \underline{B}_{s,y}$	1973.63	12.85	0.49	0.54	0.37	0.54
	(0.058)	(0.099)	(0.002)	(0.002)	(0.002)	(0.0015)
$> \underline{B}_{s,y}$	1973.06	12.48	0.49	0.53	0.36	0.51
	(0.065)	(0.112)	(0.002)	(0.002)	(0.002)	(0.0017)

Table: Characteristics within 2% of $B_{i,t} = \underline{B}_{s,y}$. Standard errors in parentheses.

- Check for “manipulation,” i.e. excess mass above/below $B_{s,y}$

Statistic	P-value
-1.40	0.1620

Employment before and after the separation

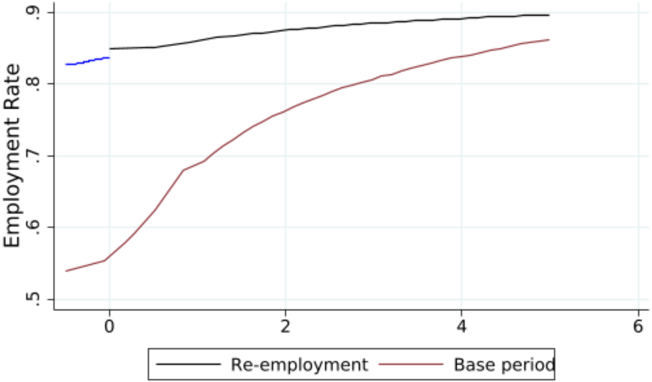

Figure: Employment rate among separators by base-period earnings

Why the low base-period earnings?

- Non-employment (often at same employer)

Match quality vs. rents

What drive the earnings jump?

- Rents: workers' outside option is higher, so larger share of production
- Match quality: workers' can wait, so more productive next job

Interpret tenure as proxy for match quality:

Dependent	$\tau_{i,d}$		$E_{i,d}$	
	(1)	(2)	(3)	(4)
Bias-Corrected	-0.004	-0.009	-0.0042	-0.0036
	(0.038)	(0.033)	(0.0047)	(0.0047)
Robust	-0.004	-0.009	-0.0042	-0.0036
	(0.040)	(0.044)	(0.0056)	(0.0051)
With B_t control		X		X

Table: Average tenure (quarters) and employment rate upon re-employment

An analytical model to frame concepts

Interpreting the results

Model gives interpretation for two features

1. Should we "inflate" the fuzzy RD estimate?
   - Non-compliers in the treatment group would have the same treatment?
   - Depends on why they're non-compliers
2. What suggests whether the effect is rents or productivity?
   - In many models, employment duration indicates match quality
   - What is the primitive that is indicated by our estimates?

Here: analytically tractable model to illustrate answers

Setup

- One period, workers start unemployed, no UI.
- At start of period, unemployed can choose to claim UI (ℓ):
  - Costs ϕ utility
  - Probability ξ of approval after claim.
- colorredDirected search over piece-rate w (match rates $p(\theta), q(\theta)$)
- Reservation strategy over random match quality, $\check{z}$
- Posting cost κz with free entry
- Production if become employed: $z \sim F(z)$, paid wz
- UI receivers get b_R and non-receivers get b_N.

Workers' problem

$$\max_{\ell \in \{0,1\}} \ell \Bigg\{ \xi (\max_{p,\check{z}} pw \int_{\check{z}}^{1} z dF(z) + (1 - p(1 - F(\check{z})))b_R)$$

$$(1-\xi)(\max_{p,\check{z}} pw \int_{\check{z}}^{1} z dF(z) + (1 - p(1 - F(\check{z})))b_N) - \phi \Bigg\}$$

$$+(1-\ell) \Bigg\{ \max_{p,\check{z}} pw \int_{\check{z}}^{1} z dF(z) + (1 - p(1 - F(\check{z})))b_N \Bigg\}$$

Timing:

- Choose whether or not to claim benefits (ℓ)
- Receive or not with probability ξ
- Choose search direction p and productivity threshold $\check{z}$

Heterogeneous claiming: costs or outside options?

Claim if

$$U_R(\phi, b_R) \geq U_N(\phi, b_N) \Leftrightarrow \max_{p,\check{z}} pw \int_{\check{z}}^{1} z dF(z) + (1 - p(1 - F(\check{z})))b_R - \frac{\phi}{\xi}$$
$$\geq \max_{p,\check{z}} pw \int_{\check{z}}^{1} z dF(z) + (1 - p(1 - F(\check{z})))b_N$$

(view costs as either utility cost, ϕ, or approval probability, ξ)

differences can be driven by $\phi \sim G_\phi$ or $b_N \sim G_b$

- The policies depend on the state: $p(\phi, b), \check{z}(\phi, z)$
- If $\frac{\phi}{\xi} \sim G_\phi$, inflate measured treatment by non-compliance
- If $b_N \sim G_b$, do no inflate measured treatment by non-compliance

The treatment effect in two scenarios

- With ϕ heterogeneity the *observed* treatment is:

$$\widehat{\Delta w} = \int_\phi (w_R(\phi) - w_N)\mathbb{I}_{U_R(\phi)\geq U_N} dG_\phi(\phi)$$

And the *true* treatment effect is

$$\Delta w = \frac{\int_\phi (w_R(\phi) - w_N)\mathbb{I}_{U_R(\phi)\geq U_N} dG_\phi(\phi)}{\int_\phi \mathbb{I}_{U_R(\phi)\geq U_N} dG_\phi(\phi)}$$

because the non-compliers *would* adjust:

- With b_N heterogeneity the *observed* & *true* treatment is:

$$\widehat{\Delta w} = \int_\phi (w_R - w_N(b_N))\mathbb{I}_{U_R\geq U_N(b_N)} dG_b(b_N)$$

because if $U_R < U_N(b_N)$ then $w_R < w_N(b_N)$

Solving backwards for the treatment

- Firms' posting choice is

$$V = (-\kappa + q(\theta)(1-w))\, z$$

- Implies firm is indifferent between different z
- Workers' FOC in direction p yields simple (w,p) policy

$$p_x = \left(\frac{1-\alpha}{\kappa}\left(1-\frac{b_x}{\tilde{z}_x}\right)\right)^{\frac{1-\alpha}{\alpha}} \quad w_x = \alpha + (1-\alpha)\frac{b_x}{\tilde{z}_x}$$

for $x \in \{R, N\}$ where $\tilde{z}_x = \int_{\check{z}_x}^{1} t dF(t)/(1-F(z))$

- The workers' FOC in $\check{z}_x$ sets $\check{z}_x = \frac{b_x}{w_x}$

The importance of α

Policies:

$$w_x \tilde{z}_x = \alpha \tilde{z}_x + (1-\alpha) b_x$$
$$\check{z}_x w_x = b_x$$

Recalling, the empirics said most of the $\Delta w \tilde{z}$ came from w not z

Proposition

As $\alpha \to 0$ $\frac{\partial w}{\partial b}\frac{b}{w} \to 1$ and $\frac{\partial z}{\partial b}\frac{z}{w} \to 0$

With $\alpha = 0$, z_R, z_N independent of b_R, b_U.

- α is competitive search analog of bargaining weight with Nash
- Large $\alpha \to$ extract rents rather than wait for high z

Conclusion

Empirically:

- We estimated a fuzzy RDD at the UI eligibility threshold
- The effect of eligibility was $\sim$ \$300 implying \$500-\$950 treatment
- This was mostly due to changes in wages, not employment

Understanding this in light of a model

- Interpreting non-compliance depends on one's stand on
  - heterogeneity in application costs
  - heterogeneity in outside option
- The wage effect suggest *very* low worker bargaining weight.

A Quantitative Model of Equilibrium UI Eligibility and Take-Up

What's the model for?

Interpreting the RDD:

- What forces drove this result?
- Is the reduced-form treatment an upper- or lower-bound?

Extrapolating from the RDD:

- Beyond the local treatment, what is the effect of UI?
- Can this reconcile other quasi-experimental evidence, e.g. duration?

Informing search models, generally:

- Exogenous variation in outside options is novel identification of bargaining power

Model Environment

- Infinite horizon, common discount β
- Agents:
  - Employed and unemployed workers (differ by UI status).
  - Matched and unmatched firms.
- Technology:
  - Frictional matching in labor markets.
  - UI eligibility depends on earnings/emp. history.

Agents

- Risk-averse workers with state:
  - Employed: wage, productivity, past earnings, hours (w, z, μ, h)
  - Unemployed: μ and status
    - receiving UI (R),
    - not rec. UI (NR),
    - not claiming (NC),
    - not eligible/exhausted (X)
- Continuum of profit maximizing risk-neutral firms:
  - Post vacancies that specify piece-rate w.
- Type-distribution $\psi' = \Psi(\psi)$ (suppressed throughout).

Search and Matching Technology

- Directed search (Moen, 1997):
  - Submarket: homogeneous workers (μ) and firms (w)
  - Workers apply to job in submarket w/ known piece-rate w.
- Matching technology:
  - # of matches in submkt (w, μ): $M = M(u, v)$ (CRS).
  - Submarket tightness: $\theta(\cdot) = \frac{v}{s}$
  - Worker finding rate: $q(\theta) = \frac{M(u,v)}{v}$
  - Job finding rates: $p(\theta) = \frac{M(u,v)}{s} = \theta q(\theta)$

Employed Worker's Problem

- States:
  - Emp: $s_E = (w, z, \mu, h)$, $s'_E = (w, z', \mu', h')$
  - Unemp: $s_U = (\mu')$, depends on eligibility & claiming.
- Value of employment:

$$U_E(s_E) = u(c) + \beta E[(1 - D(s'_E, \delta)U_E(s'_E) + D(s'_E, \delta)U_U(s_U)] \quad (1)$$

$$\text{s.t. } c = wh \quad (2)$$

$$z' \sim iid \quad (3)$$

- $D(s'_E, \delta)$: separation indicator

Employed Worker's Problem

- States:
  - Emp: $s_E = (w, z, \mu, h)$, $s'_E = (w, z', \mu', h')$
  - Unemp: $s_U = (\mu')$, depends on eligibility & claiming.
- $D(s'_E, \delta) = \max\{d_w(w, z', \mu', h'), \delta, d_f(w, z', h')\}$:
  - $d_w(w, z', \mu', h')$: worker quits $(U_X > U_{Elig.})$
  - δ: Cousin Eddie shock
  - $d_f(w, z', h')$: fired by firm. Explain at firm's problem.
- μ: income eligibility process. Will discuss after more Bellman's.

Firms

- States: $s_J = (w, z, \mu, h), s'_J = (w, z', \mu', h')$
- Matched firms:
  - iid shocks: z and h.
  - separation decision: worker may quit $\delta + d_w$, firm may fire d_f
  - continue w/ value $J(s'_J)$
- Value of filled vacancy with type-s_J worker:

$$J(s_J) = \max(Az - w)h - \tau \tag{1}$$

$$+ \beta E_{z'|z,h'|h}\{D(s'_J, \delta)V(w', z') + [1 - D(s'_J, \delta)]J(s'_J)\} \tag{2}$$

$$\tag{3}$$

$$D(w, z', \mu', \delta, h') = \max\{d_f(w, z', h'), \delta, d_w(w, z', \mu', \delta)\} \tag{4}$$

$$d_f(w, z', h') = 1_{\{J'<0\}} \tag{5}$$

Free Entry and Equilibrium Job-Finding Rates

- Unmatched firms:
  - Pay κ to post (profitable) vacancies.
  - Match w/ prob. $q(\theta(s_J))$.
- Value of vacancy with type-s_J worker:

$$V(s_J) = -\kappa + q(\theta(s_J))J(s_J)$$

- Free Entry ($V(s_J) = 0$):

$$q(\theta(s_J)) = \frac{\kappa}{J(s_J)}$$
$$\theta(s_J) = q^{-1}\left(\frac{\kappa}{J(s_J)}\right)$$

- Eqm job finding rate: $p(\theta) = \theta q(\theta)$ determined by J, κ
- Eqm: $\frac{\partial P}{\partial \mu} < 0$

Unemployed Worker's Problem

- Start in non-claiming state (*NC*). Claim ($\ell = 1$), get w/ prob $\xi(\mu)$
- Then may be one of following $T = \{R, NR, X\}$:
  - *R*: receiving UI (μ);
  - *NR*: Not receiving;
  - *X*: exhausted UI.
- Value of unemployment (*NC*):

$$U_{NC}(\mu) = \max_{\ell \in \{0,1\}} u(c) + \beta E[\mathbb{I}_{\{\ell=1\}}\{\xi(\mu) R_R(\mu') \tag{6}$$

$$+ (1 - \xi(\mu)) R_{NR}(\mu') - \eta - \epsilon\} + \mathbb{I}_{\{\ell=0\}} R_{NC}(\mu')\}] \tag{7}$$

$$s.t. \;\; c = b_n \tag{8}$$

$$\mu' = \left(1 - \frac{1}{T}\right)\mu \tag{9}$$

$$\xi = \begin{cases} \xi_h & \text{if } \mu \geq \bar{\omega} \\ \xi_l & \text{if } \mu < \bar{\omega} \end{cases} \tag{10}$$

(11)

Unemployed Worker's Problem

- Then may be one of following $T = \{R, NR, X\}$:
  - R: receiving UI (μ), lose stochastically (λ), depends on μ ($\xi(\mu)$);
  - NR: Not receiving ($\lambda, \phi = 0$);
  - X: exhausted UI ($\lambda, \phi, \xi = 0$).
- Value of unemployment (R):

$$
\begin{aligned}
U_R(\mu) =& u(c) - \phi \\
&+ \beta E[\{\lambda R_x(\mu') + (1-\lambda) R_R(\mu')\}] \\
s.t.\ \ c &= b_r(\mu) \\
\mu' &= \left(1 - \frac{1}{T}\right)\mu \\
\xi(\mu) &= \begin{cases} \xi_h & \text{if } \mu \geq \bar{\omega} \\ \xi_l & \text{if } \mu < \bar{\omega} \end{cases}
\end{aligned} \tag{6}
$$

UI eligibility

- Income eligibility:
  - updates each period.
  - μ represents the past earning in the latest four quarters, and μ evolves as the following:

$$\mu' = \begin{cases} \left(1 - \frac{1}{T}\right)\mu + \frac{1}{T}wh, & \text{if employed} \\ \left(1 - \frac{1}{T}\right)\mu, & \text{otherwise} \end{cases}$$

- No fault eligibility:
  - Quit $\rightarrow$ not eligible, can apply (probabilistically caught).
  - Fired: eligible.
- All must pay cost of take-up.

UI take-up

- Decision of UI take-up:
  - Random, logit cost of application, ϵ.
  - Fixed cost of application, η .
  - Then the probability of taking up UI is

$$\Pr(E_{z'|z}\{\xi R_R + (1-\xi)R_{NR} - \epsilon - \eta\} > E_{z'|z}[R_{NC}])$$
$$= \frac{1}{1 + \exp(E_{z'|z}\{R_{NC} - [\xi R_R + (1-\xi)R_{NR} - \eta]\})}$$

- Keys for empirical strategy:
  - h is iid, eligibility around threshold random.
  - Some workers quit, can capture this.
  - Some workers receive UI despite ineligibility, can capture this.
  - η defined by $\xi = 0$ case

Equilibrium

A *Block Recursive Equilibrium* (BRE) in this model is a set of value functions, associated policy and market tightness functions, which satisfy

1. The policy functions solve the workers problems.
2. θ satisfies the free entry condition for all open submarkets.
3. The aggregate law of motion is consistent with all policy functions.

Preliminary Computational Results

Some parameters

Utility	$\frac{c^{1-\gamma}}{1-\gamma}$	b_n	0.01
Matching	$n_0 \frac{uv}{(u^{n_1}+v^{n_1})^{1/n_1}}$	(n_0, n_1)	(0.5,0.5)
Production	Az,	Δ_z	0.01
		Δ_h, Pr $h = 0$	0.1,0.04
		(ξ_l, ξ_h)	$(0, 0.8)$
		$\bar{w}$	0.5
		ϕ	0.005
		τ	0.01
		δ	0.3

Wage choice policies

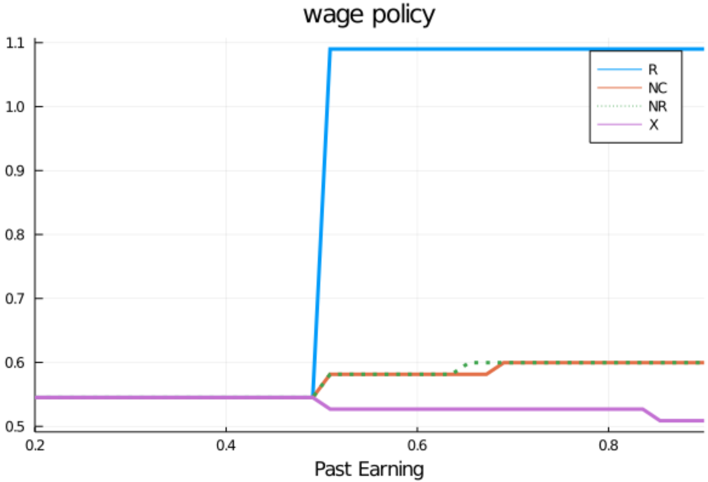

Figure: Wage policies show the behavioral effect of UI receipt

Take-up policy

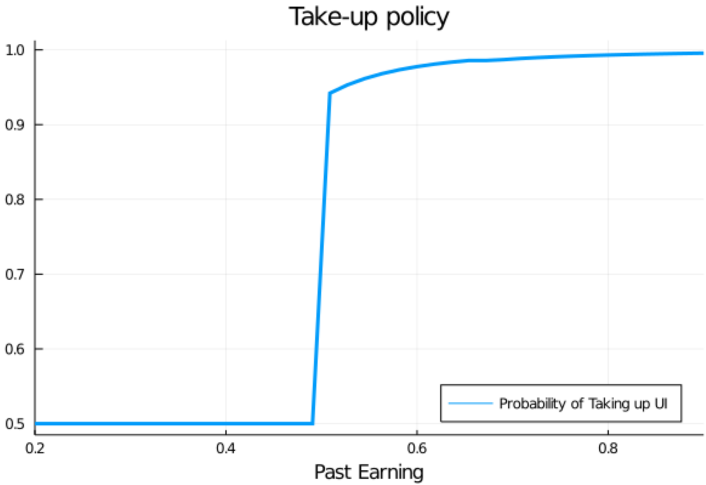

Figure: Those with higher value of claiming do so, and some with no chance do as well

The model generates the same discontinuity

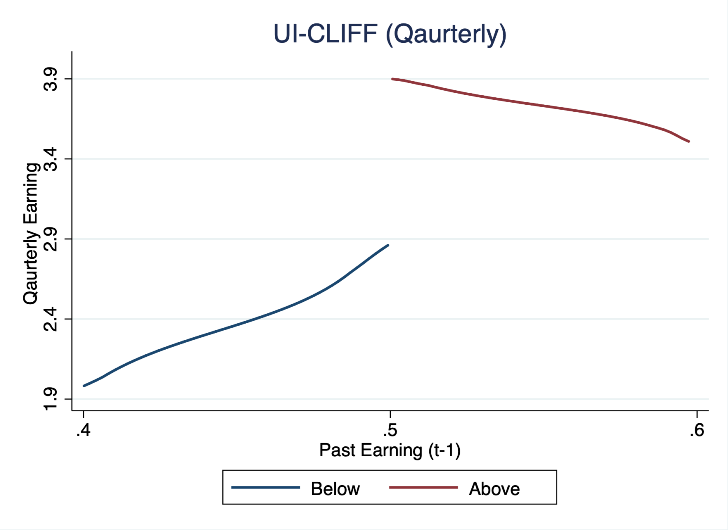

Figure: The model's discontinuity: averages over claiming and hours

Certainty-equivalent welfare from UI receipt

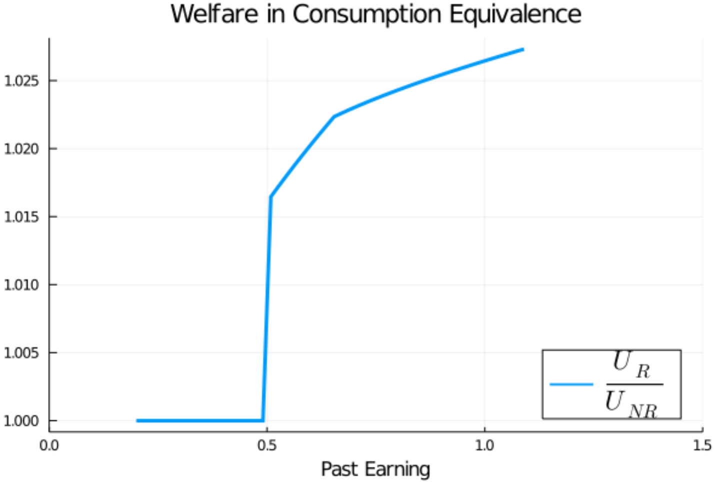

Figure: The model allows use to extrapolate welfare gains of UI beyond the cutoff

Quarterly earnings distribution

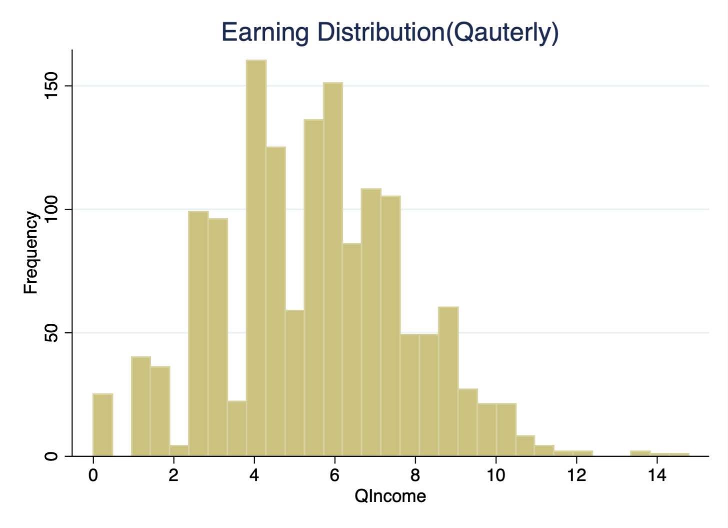

Figure: Hours shocks and endogenous wage policy generates a smooth past earnings distribution

μ distribution at separation

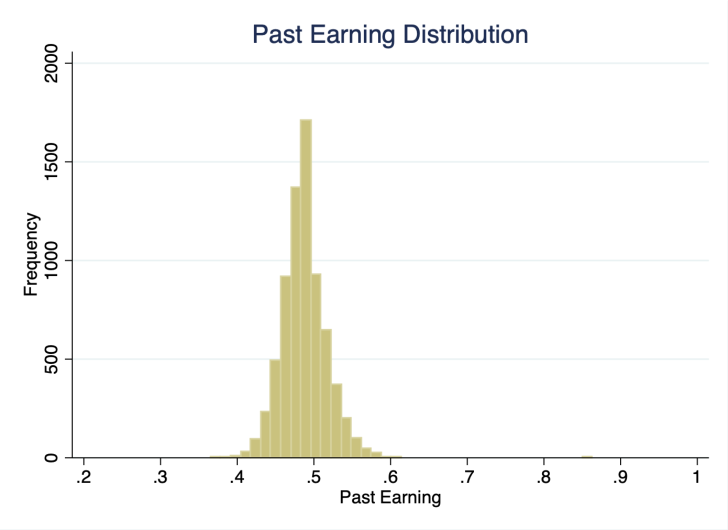

Figure: Hours shocks and endogenous wage policy generates a smooth past earnings distribution

Appendix