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The Surprising Power of the Floor: Unemployment Insurance and Worker Heterogeneity

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The problem with unemployment insurance

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insurance vs. incentives

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insurance vs. incentives

- heterogeneity matters: unemployment risk, asset holdings, human capital / experience, time to retirement
- correlated with idiosyncratic characteristics, e.g. age and ability
- potential for conditioning policies
- conditional policies potentially problematic

The problem with unemployment insurance

insurance vs. incentives

- heterogeneity matters: unemployment risk, asset holdings, human capital / experience, time to retirement
- correlated with idiosyncratic characteristics, e.g. age and ability
- potential for conditioning policies
- conditional policies potentially problematic

Research question:

What is the optimal unemployment insurance policy and how can it be implemented?

Related literature

- Baily, 1978: key trade-off is consumption smoothing vs. moral hazard
- Shavell and Weiss, 1979: wealth and and worker discretion matter
- Brown and Kaufold, 1988: human capital channel is important for UI policy
- Shimer and Werning, 2008: UI serves double role (insurance + liquidity)
- Michelacci and Ruffo, 2015: age affects optimal replacement rates

Some background information

- Unemployment risk decreases with education and with age
  - unemployment probabilities
- Ability to self-insure increases with education and with age, but remains limited for low education workers
  - share of low wealth workers
- The U.S. UI system consists of a replacement rate, a benefit floor and a benefit cap
  - rate, floor, cap system
- The UI cap affects a large share of the unemployed, the UI floor is ineffective
  - share at bounds
- Effective UI replacement rates are decreasing with education and u-shaped in age
  - effective replacement rates

Model framework

- lifecycle model with endogenous search effort
- human capital depends on ability type k (permanent) and experience h (endogenous)
- homogenous and additively separable CRRA preferences over consumption and leisure

$$U(c, l) = u(c) + \alpha\psi(l) = \frac{c^{1-\sigma^c}}{1-\sigma^c} + \alpha\frac{l^{1-\sigma^l} - 1}{1-\sigma^l}$$

- workers receive wages $\bar{\omega}h$ when employed and UI benefits $b_k(n, h)$ when unemployed
- government sets UI policy to maximize expected utility of newborn worker
- no productive sector

Human capital accumulation

- workers enter with initial experience $h_{k,0}$
- workers accumulate experience when employed (learning-by-doing)
- experience h depreciates at fixed rate δ_k^h
- law of motion for experience

$$h_k'(h, e) = \mathbb{1}_{\{e=1\}} \alpha_k h^{\phi_k} + (1 - \delta_k^h) h$$

Job search

- workers separate exogenously at heterogeneous rates $\delta_{k,n}$
- searching workers allocate 1 unit of time between job search s and leisure l
- all workers have leisure utility function $\psi(l)$ and use type-dependent search technology $\zeta_k(s)$
- workers choose search effort and receive leisure utility
- successful search leads to employment in the same period

Government programs

1. **Unemployment Insurance:**
   - financed by labor tax τ^{UI} (endogenous)
   - pays out UI benefits $b_k(n, h)$ (policy choice) to all unemployed agents
2. **Social Security:**
   - financed by labor tax τ^{SS} (exogenous)
   - pays out pension benefits π (endogenous) to all retired agents
3. **General income tax and transfer system:**
   - financed by income tax τ^{I} (exogenous) on labor and capital income
   - pays out lumpsum transfers T (endogenous) in all states and periods

Household problem – optization problem

Value functions

- employed:

$$V_k^e(n,h,a) = \max_{a' \geq \underline{a}} u(c_k^e(n,h,a,a')) + \beta \left[(1-\delta_{k,n}) V_k^e(n+1, h'(h,1), a') + \delta_{k,n} V_k^s(n+1, h'(h,1), a') \right] \quad (1)$$

- unemployed:

$$V_k^u(n,h,a) = \max_{a' \geq \underline{a}} u(c_k^u(n,h,a,a')) + \beta V_k^s(n+1, h'(h,0), a') \quad (2)$$

- searching:

$$V_k^s(n,h,a) = \max_{s \in [0,1]} \psi(1-s) + \zeta_k(s) V_k^e(n,h,a) + [1-\zeta_k(s)] V_k^u(n,h,a) \quad (3)$$

Budget constraints:

- employed:

$$c_k^e(n,h,a,a') = (1-\tau^{UI}-\tau^{SS}-\tau^I)\bar{\omega}h + [1+(1-\tau^I)r]a + T - a' \quad (4)$$

- unemployed:

$$c_k^u(n,h,a,a') = b_k(n,h) + [1+(1-\tau^I)r]a + T - a' \quad (5)$$

Government Problem

Objective:

$$\max_{b_k(n,h)} \sum_{k \in K} \chi_k V_k^s(0, h_{k,0}, 0) \tag{6}$$

Budget constraints:

- Unemployment Insurance:

$$\sum_{k \in K} \sum_{n=0}^{\bar{n}_w} \beta^n \int_{R^+} b_k(n,h) \chi_k^u(n, dh) = \sum_{k \in K} \sum_{n=0}^{\bar{n}_w} \beta^n \int_{R^+} \tau^{UI} \bar{\omega} h \chi_k^e(n, dh) \tag{7}$$

- Social Security:

$$\sum_{k \in K} \sum_{n=\bar{n}_w+1}^{\bar{n}_w+\bar{n}_r} \beta^n \pi \chi_k = \sum_{k \in K} \sum_{n=0}^{\bar{n}_w} \beta^n \int_{R^+} \tau^{SS} \bar{\omega} h \chi_k^e(n, dh) \tag{8}$$

- Tax and transfer system:

$$\sum_{k \in K} \sum_{n=0}^{\bar{n}_w+\bar{n}_r} \beta^n T \chi_k = \sum_{k \in K} \left(\sum_{n=0}^{\bar{n}_w} \beta^n \int_{R^+} \tau^I \bar{\omega} h \chi_k^e(n, dh) + \sum_{n=0}^{\bar{n}_w+\bar{n}_r} \beta^n \int_{R^+} \tau^I r a \chi_k(n, da) \right) \tag{9}$$

Calibration

- one model period corresponds to one quarter
- 45 years of working age ($\bar{n}_w = 180$) and 20 years of retirement ($\bar{n}_r = 80$)
- model calibrated to U.S. male population (CPS basic monthly data, 1989–2020):
  - hc technology via relative wages ▸ hc parameters
  - search technology parameters via unemployment probabilities ▸ search tech parameters
  - 3-month separation probabilities via 1-month transition probabilities
- remaining parameters standard from the literature ▸ other parameters

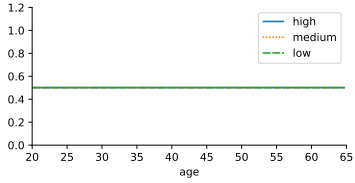
Policy experiments

Classes for UI policy functions:

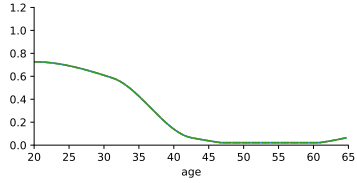
- constant replacement rate: $b_k(n,h) = \bar{\rho}\omega_k(h)$
- age-dependent replacement rates: $b_k(n,h) = \rho_n\omega_k(h)$
- age-and-type-dependent replacement rates: $b_k(n,h) = \rho_{k,n}\omega_k(h)$
- constant replacement rate, benefit floor and cap: $b_k(n,h) = \min\{\bar{b}; \max\{\underline{b}; \bar{\rho}\omega_k(h)\}\}$

Optimal policies

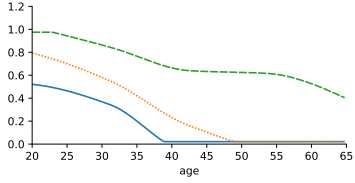
Figure 1: Effective replacement rates by type



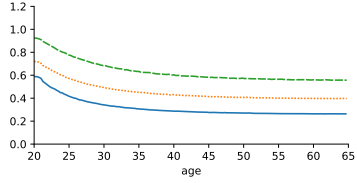
(a) constant rate



(b) age-dependent replacement rate



(c) age-and-type-dependent replacement rate



(d) rate, floor, cap

Welfare analysis

Table 1: Consumption equivalents

	Consumption equivalent			
	low	medium	high	average
Policy				
Baseline	0.00	0.00	0.00	0.00
Common and constant rate	0.02	0.00	-0.02	0.00
Rate, floor, cap	1.33	0.14	-0.34	0.20
Age-dependent	0.14	0.24	0.29	0.24
Age-and-type-dependent	2.11	0.25	-0.45	0.35

- sizeable welfare gains from all policies: 0,5 ppt CI correspond to ca. 20% of UI budget
- *"rate, floor, cap"* implementation generates 80% of gains from age-dependent policies and 60% of gains of age-and-type-dependent policies

Conclusion

- age and education capture substantial heterogeneity across workers
- the human capital channel is a key driver of this heterogeneity
- the current U.S. UI system differentiates by age and education (but not enough)
- optimal UI replacement rates fall with ability and age
- potential welfare gains from conditioning replacement rates are sizeable
- large share of these gains can be generated with the current U.S. system

References I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Brown, E., & Kaufold, H. (1988). Human capital accumulation and the optimal level of unemployment insurance provision. *Journal of Labor Economics*, *6*(4), 493–514.


Michelacci, C., & Ruffo, H. (2015). Optimal life cycle unemployment insurance. *American Economic Review*, *105*(2), 816–59.


Shavell, S., & Weiss, L. (1979). The optimal payment of unemployment insurance benefits over time. *Journal of Political Economy*, *87*(6), 1347–1362.

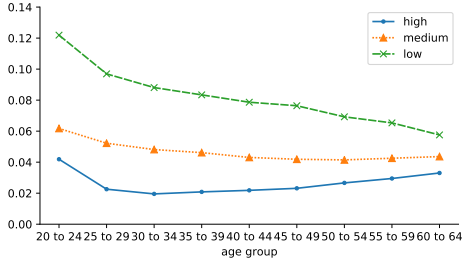

Shimer, R., & Werning, I. (2008). Liquidity and insurance for the unemployed. *American Economic Review*, *98*(5), 1922–42.

Data

- **CPS basic monthly** (male sample, 1989–2020): unemployment rates, transition rates, wages
- **CPS tenure supplements** (male sample, 2002–2018): returns to tenure
- **SCF extracts** (male sample, 1989–2019): assets-to-income-ratios, share of low-wealth households
- **ETA UI policy statistics** (1989–2019): replacement rates, benefit floors, benefit caps

U.S. workers by age and education

Figure A.1: Unemployment probabilities by age and education



Notes: Life-cycle profiles of unemployment probabilities (left panel) and share of population with zero or negative net worth (right panel) by education.
Source: CPS basic monthly (male sample, 1989-2020), SCF extracts (male sample, 1989–2019).

- Unemployment risk is decreasing in education
- Unemployment risk is decreasing in age for low and medium edu workers, u-shaped for high edu workers

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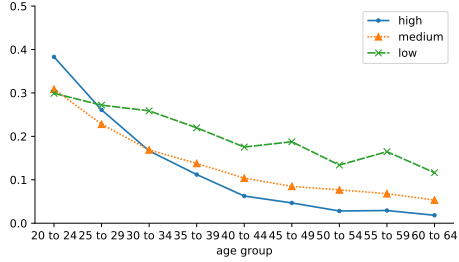
U.S. workers by age and education

Figure A.2: Share of low-wealth households by age and education



Notes: Life-cycle profiles of unemployment probabilities (left panel) and share of population with zero or negative net worth (right panel) by education.
Source: CPS basic monthly (male sample, 1989-2020), SCF extracts (male sample, 1989–2019).

- Ability to self-insure is lower for young workers
- Substantial share of low edu workers cannot effectively self-insure throughout working life

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The U.S. UI system - mechanism

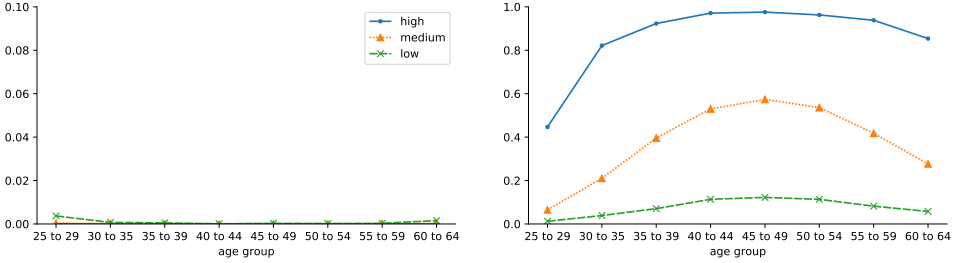
Figure A.3: Effective replacement rates by income (stylized)

- **replacement rate** on pre-unemployment wages, benefit **floor** and benefit **cap**
- cap and floor cause non-linear effective replacement rates
- binding floor **increases** effective rate, binding cap **reduces** effective rate

back

The U.S. UI system - bounds

Figure A.4: Share affected by UI floor and UI cap by age and education



(a) share of recipients at floor

(b) share of recipients at cap

Notes: Life-cycle profiles of the share of workers at the benefit floor (right panel) and at the benefit cap (left panel) by education group.
Source: CPS basic monthly (male sample, 1989–2020) and ETA UI policy statistics (1989–2020).

- average replacement rate ca. 50%, benefit floor ca. 30$/week, benefit cap ca. 220$/week (1990 USD)
- benefit cap is binding for substantial share of medium and high education workers
- benefit floor is largely ineffective

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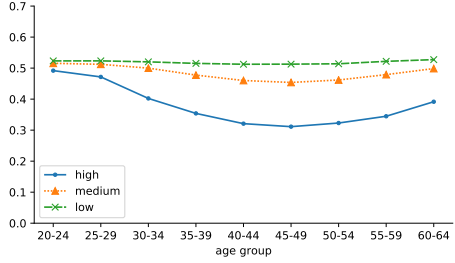
The U.S. UI system - effective replacement rates

Figure A.5: Effective replacement rates by age and education



Notes: Life-cycle profiles of imputed effective replacement rates (left panel) by education group.
Source: CPS basic monthly (male sample, 1989–2020) and ETA UI policy statistics (1989–2020).

- effective replacement rates fall with education
- effective rates are mostly flat for low education workers, u-shaped in age for medium and high education workers

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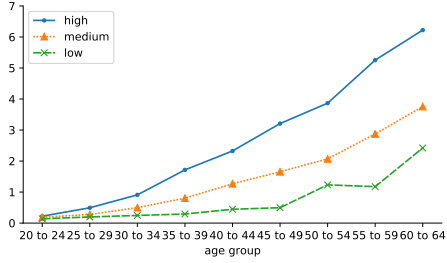
Asset holdings

Figure A.6: Median relative net worth over the life cycle



Notes: Life-cycle profiles of median assets over median quarterly income by education.
Source: SCF extracts (male sample, 1989–2019).

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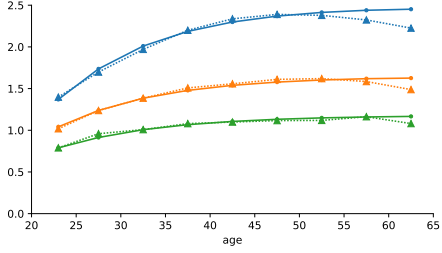
Calibration – Human capital technology

Table B.1: Calibrated human capital techology

Parameter	Definition	Value low	medium	high
$h_{0,k}$	initial human capital level	0.70	0.90	1.10
α_k	Learning ability parameter	0.03	0.04	0.06
ϕ_k	Human capital curvature parameter	0.10	0.10	0.10
δ_k^h	Human capital depreciation rate	0.03	0.03	0.03

Figure B.1: Fit of simulated wage profiles



- targets obtained by estimating relative wages by age group and education group
- mismatch close to retirement driven by insufficient decrease in simulated hc

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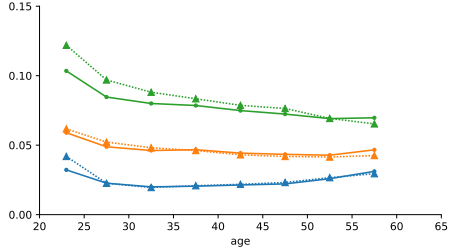
Calibration – Leisure utility function and search technology

Table B.2: Calibrated leisure and search tech

Parameter	Definition	Value low	medium	high
σ^l	Leisure utility curvature		2.00	
α	Leisure utility weight		1.00	
α_k	Search technology slope	1.00	1.01	1.09
γ_k	Search technology intercept	0.14	0.12	0.08

Figure B.2: Fit of simulated unemployment rates



- unemployment probabilities estimated by age group and education group
- calibration of search technology parameters by minimizing distance to empirical moments

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Calibration

Table B.3: Remaining calibrated parameters of the baseline economy

Parameter	Definition	Value low	Value medium	Value high
$\bar{n}_w$	Working periods		180	
$\bar{n}_r$	Retirement periods		80	
β	Discount factor		0.99	
σ^c	Risk aversion coefficient for consumption		2.0	
χ_k	Type share of population	0.11	0.58	0.31
π	Retirement pensions		0.68	
T	Lumpsum transfers		0.14	
$\underline{a}$	Borrowing constraint		-1.12	
τ^{UI}	Unemployment insurance tax rate	0.013	0.013	0.013
τ^{SS}	Social security tax rate	0.050	0.050	0.050
τ^{I}	General income tax rate	0.100	0.100	0.100
$\rho_{k,n}$	UI replacement rate		0.50	
b_{min}	UI floor		0.00	
b_{max}	UI cap		inf	

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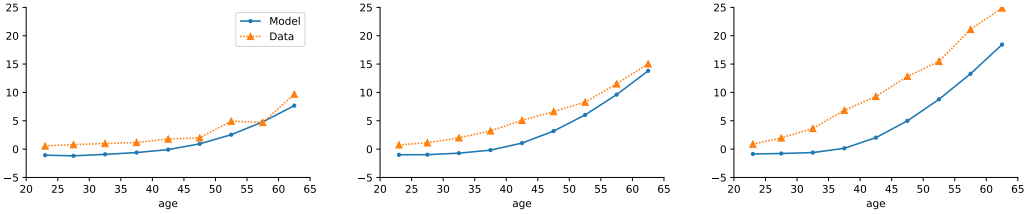
Model fit

Figure B.3: Assets over income

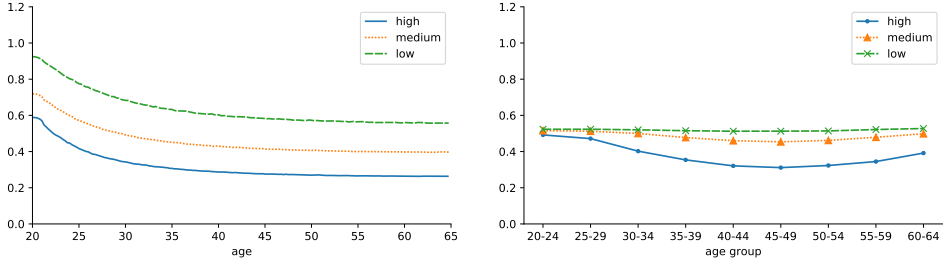


(a) low (b) medium (c) high

Notes: Life-cycle profiles of average simulated assets over income by worker type vs. empirical counterpart.
Source: Simulation study with N=100,000 workers and SCF extracts (male sample, 1989–2019).

Comparison to current U.S. system

Figure C.1: Effective replacement rates (*"rate, floor, cap"*)



(a) Model (optimized)

(b) Data (imputed)

- Policy qualitatively in line with model optimum
- Indicative of potential welfare gains through moderate reforms ("tweaking the system")

Welfare analysis - decomposition

Figure C.2: Optimal age-and-type-dependent replacement rates (fixed budget)

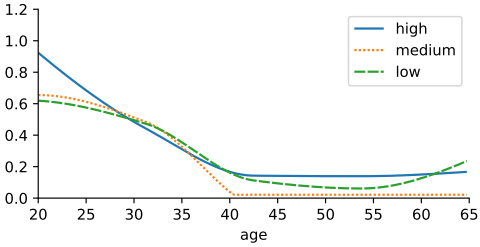


Table D.1: Consumption equivalents (fixed budget)

	Consumption equivalent			
	low	medium	high	average
Policy				
Age-and-type-dependent	2.11	0.25	-0.45	0.35
Age-and-type-dependent (fixed budget)	0.26	0.25	0.27	0.26
Baseline	0.00	0.00	0.00	0.00

- holding UI budgets fixed by worker type, welfare gains from optimal age-and-type-dependent replacement rates are 0.25 ppt of consumption
- ca. two thirds of the welfare gains are due to improved targeting of the program; about one third due to increased redistribution across types