How do Assets Affect Worker Productivity?

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Nov 23, 2017

Macro Reading group
Bristol

The broad purpose of this paper:

- **How does the distribution of assets affect job search decisions?**

  1. Do workers with different assets get different productivity jobs?

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- **How does the distribution of assets affect job search decisions?**

  1. Do workers with different assets get different productivity jobs?

  2. What is optimal level of government-provided unemployment insurance (UI) as a function of asset ?

Motivation
Model Ingredients

- Unemployment risk as source of income uncertainty
- Two sources of market incompleteness:
  1. Uninsurable Unemployment Risk
  2. Job search

- Heterogeneous asset holdings
  - Different job finding behaviour

- How UI affects LM outcome?
  - Literature: Incentive effects, reservation wage, effort
  - This paper: Consumption smoothing and job search behaviour

THE MECHANISM
THE LABOR MARKET AS AN INSURANCE MECHANISM

- High productivity firms:
  - ↑ opportunity cost of unfilled job → post high wages
- High asset holders:
  - ↓ marginal utility of consumption → more willing to take risk

- Asset holdings of workers + firm heterogeneity:
  - Natural preference complementarity and hence sorting
- Different asset holdings affect job search decision:
  - Asset dependent precautionary job search motive

- UI affects:
  - Consumption smoothing
  - Job search decisions and sorting of workers to firms

Related Literature

- Partial Equilibrium
  - Danforth (1979)
  - Hopenhayn-Nicolini (1992)
  - Shimer-Werning (2007, 2008)
- General Equilibrium
  - Acemoglu-Shimer (1999): homogeneous assets; CARA; focus on firm investment and job creation
  - Golosov-Menzio-Maziero (2011): homogenous agents, private job search decision
- Quantitative
  - Aiyagari (1994)
  - Krusell, Mukoyama, Sahin (2010)
  - ...

RELATED LITERATURE

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$\Rightarrow$ New: asset distribution, two sided heterogeneity

Population, preferences and technology

- Time is discrete and agents discount the future at rate β
- There is a continuum of risk averse workers (employed/unemployed) with asset levels $a \in \mathcal{A} = [\underline{a}, \overline{a}] \subset \mathbb{R}_+$
- There is a continuum of risk neutral firms with productivities $y \in \mathcal{Y} = [\underline{y}, \overline{y}] \subset \mathbb{R}_+$
- r is return to saving
- τ is a proportional tax on wage and UI is tax financed

Matching:

- Search is Directed
- Firm y: announce w and workers apply for different firms
- Firm-to-worker ratio: θ in each submarket
- Matching prob: $m(\theta)$; $m' > 0, m'' < 0$; firms $q(\theta) = \theta m(\theta)$
- Separation with exogenous probability $\lambda \in (0, 1)$

WORKERS

- Unemployed

$$U(a) = \max_{a',\theta} \left\{ u(c_u) + \beta \left[m(\theta)E(a', w) + (1 - m(\theta))U(a') \right] \right\}$$

$$\text{s.t:} \quad c_u + a' = (1 + r)a + b + d$$

$$a' \geq \underline{a}$$

- Employed

$$E(a, w) = \max_{a'} \left\{ u(c_e) + \beta[\lambda U(a') + (1 - \lambda)E(a', w)] \right\}$$

$$\text{s.t:} \quad c_e + a' = (1 + r)a + (1 - \tau)w + d$$

$$a' \geq \underline{a}$$

FIRMS

- The value of posting a vacancy

$$V(y) = -k + \max_w \beta[q(\theta)J(y, w) + (1 - q(\theta))V(y)]\}$$

- The value of a filled job

$$J(y, w) = f(y) - w + \beta[\lambda V(y) + (1 - \lambda)J(y, w)]$$

EQUILIBRIUM

DEFINITION

An equilibrium is a pair of market clearing distributions
$(P(y, w), Q(a, a', y, w))$ such that:

1. Worker optimality: $(a, a', y, w) \in \text{supp } Q$ only if (y, p)
   maximizes $U(a, a', y, w), E(a, a', y, w)$;

2. Firm optimality: $(y, w) \in \text{supp } P$ only if w maximizes $V(y)$;

- Monotone matching (positive) $\mu : \mathcal{A} \to \mathcal{Y}$. Market Clearing:

$$\int_a^{\overline{a}} \theta(y) f(a) da = \int_{\mu(a)}^{\overline{y}} g(y) dy.$$

Solution

- Substitute $J(y, w)$ into $V(y)$
- Substitute wage from firm problem into worker problem.
- $\phi(a, y, V)$ is a match surplus.

$$\Phi(a, y, V) = \max_{a', \theta, y} \left\{ u(c_u) + \beta \left[m(\theta) E(a', w) + (1 - m(\theta)) \Phi(a') \right] \right\}$$

Where:

$$
\begin{aligned}
c_u &= (1 + r)a + b + d - a' \\
c_e &= (1 + r)a + (1 - \tau)w + d - a' \\
w &= f(y) - \frac{1 - \beta(1 - \lambda)}{q(\theta)} \left[(1 - \beta(1 - q(\theta)))V + k \right]
\end{aligned}
$$

SOLUTION

- FOCs:
  - Consumption smoothing
  - Optimal job search
  - Optimal allocation
- Supermodularity of Φ:

$$\frac{d^2}{da\,dy}\Phi = \Phi_{ay} + \Phi_{Vy}\frac{\partial V}{\partial y} = \Phi_{ay} - \frac{\Phi_y}{\Phi_V}\Phi_{Va} > 0$$

  - Higher a apply to higher y $\iff$ Φ supermodular.

Proposition

Workers with higher initial asset levels a will apply for higher wage jobs provided

$$\frac{E_{a'}(a', w) - \Phi_{a'}(a')}{E(a', w) - \Phi(a')} < \frac{E_{a',w}(a', w)}{E_w(a', w)} \qquad (\mathbf{U}_\infty)$$

Proposition

Under condition ($\mathbf{U}_\infty$) and for a given worker with assets a, the job productivity y decreases in the duration of unemployment.

two periods

ASSETS – PRODUCTIVITY ALLOCATION

Under condition $\mathbf{U}_\infty$

- High asset workers ($a \uparrow$):
    1. apply for high productivity jobs ($y \uparrow$)
    2. earn higher wages ($w \uparrow$)
    3. have higher unemployment ($\theta \downarrow \Rightarrow m(\theta) \downarrow$)
    4. have higher expected consumption ($c \uparrow$)
    5. have higher expected utility ($U \uparrow$)

- High productivity firms ($y \uparrow$):
    1. post higher wages ($w \uparrow$)
    2. attract higher asset workers ($a \uparrow$)
    3. have higher expected profits ($\pi \uparrow$)
    4. fill vacancies faster ($\theta \downarrow \Rightarrow q(\theta) \uparrow$)

Equilibrium Properties

Under condition $\mathbf{U}_\infty$

- High asset holders have higher risk tolerance
- High productivity firms want to hire with high probability
  $\Rightarrow$ post high wage

$\Rightarrow$ Natural preference complementarity between assets and productivity

EQUILIBRIUM PROPERTIES

Under condition $\mathbf{U}_\infty$

- High asset holders have higher risk tolerance
- High productivity firms want to hire with high probability
  $\Rightarrow$ post high wage

$\Rightarrow$ Natural preference complementarity between assets and productivity

But, there is no technological complementarity

Calibration

- One period is set to be 6 weeks.
- $a \in \mathcal{A} = [-100, 300]$ and $y \in \mathcal{Y} = [150, 250]$
- $u(c) = log(c)$, $f(y) = y$, $q(\theta) = \theta(1 + \theta^\gamma)^{\frac{1}{\gamma}}$

Parameter	Definition	Value
β	discount factor	0.99
r	interest rate	0.005
b	unemployment benefit	80
k	cost of vacancy	50
λ	Probability of Separation	0.03
γ	elasticity of matching fn	1.2

Characterization of the Steady State

$$u(\%) = 4.2 \qquad avg(\theta) = 1.11 \qquad avg(w) = 196.82$$
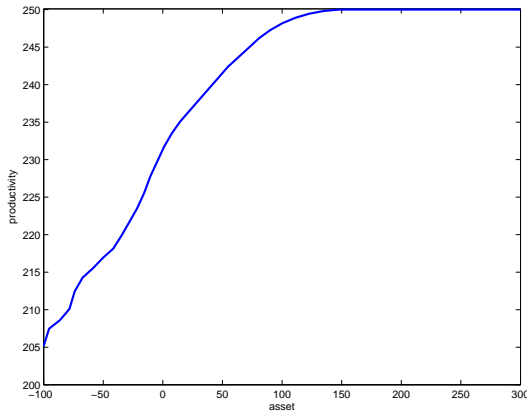
Figure: Allocation of firms and workers in labour market

Probability of job finding and Wage
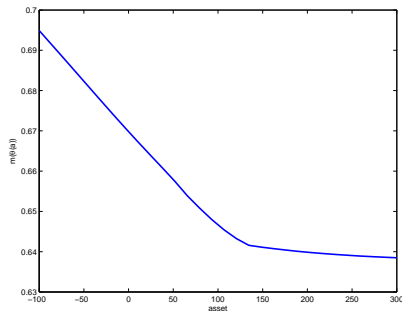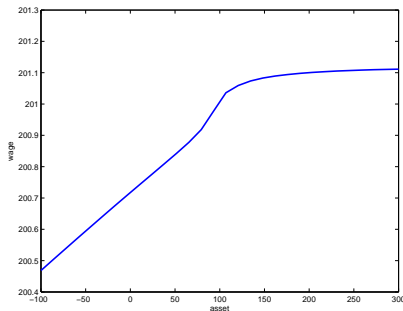
Figure: Wages and job finding probabilities by asset

Value of workers and firms
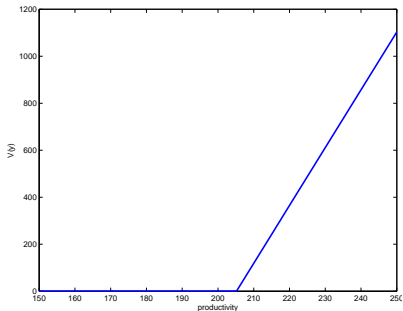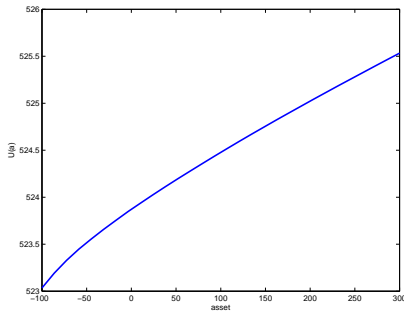
FIGURE: The value of unemployment as a function of asset and vacancy as a function of productivity

DISTRIBUTION OF ASSET AND PRODUCTIVITY
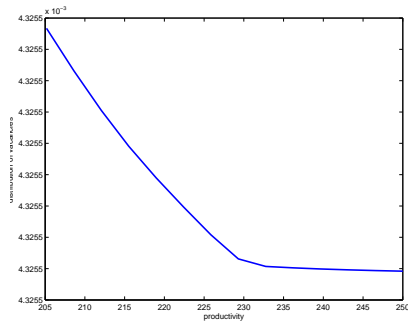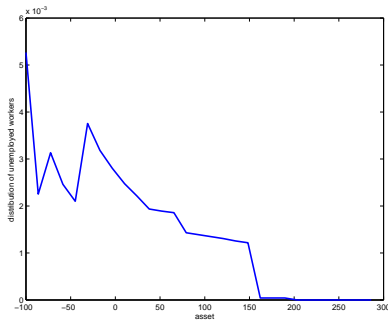
FIGURE: Distribution of workers and firms

EQUILIBRIUM EFFECTS OF UI

Is UI improving the value of unemployment?

1. Consumption

2. Allocation and probability of job finding

3. Firms entry

THE VALUE OF UNEMPLOYMENT
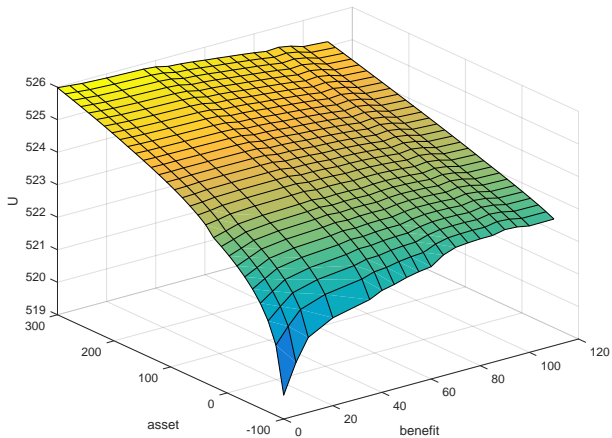
Optimal UI and asset holding
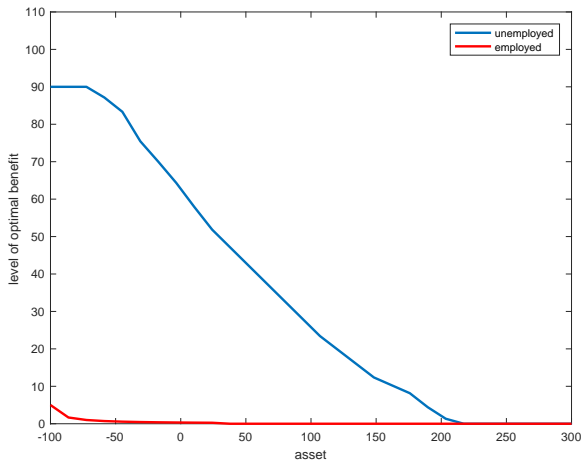
Consumption
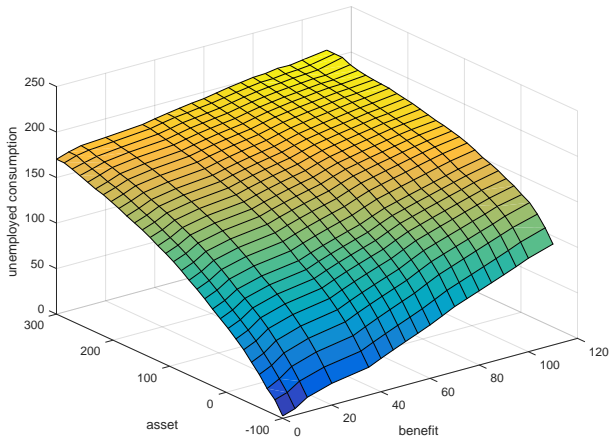
FIGURE: Consumption of unemployed workers

ALLOCATION
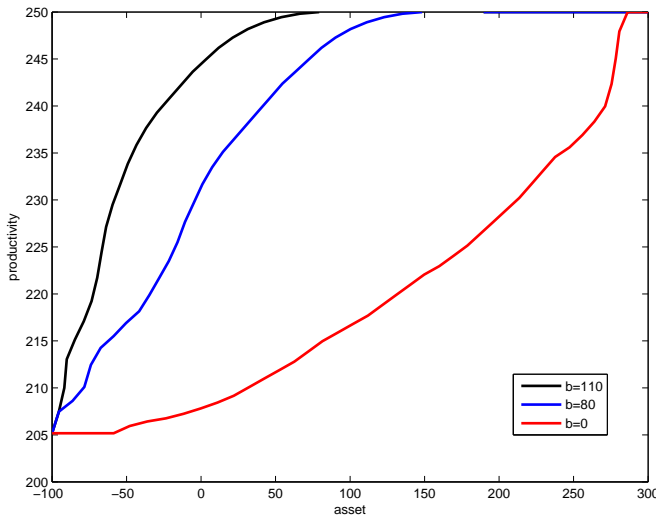
FIGURE: Change in allocation of asset holders to firms of different productivities

DISTRIBUTION
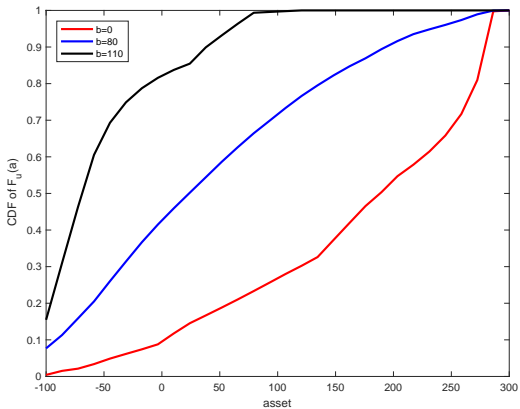
FIGURE: CDF of asset distribution unemployed

PROBABILITY OF JOB FINDING
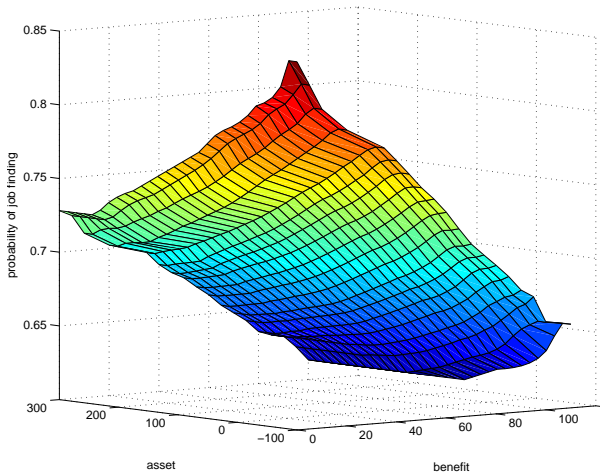
FIGURE: Probability of job finding as a function of asset and unemployment benefit
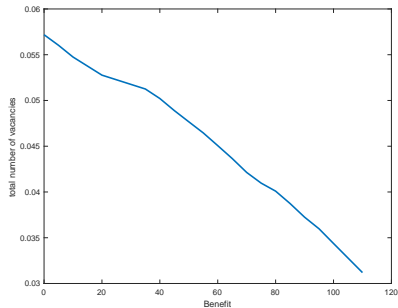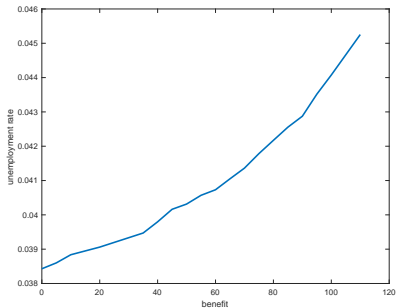
Figure: Unemployment rate and total vacancies as a function of unemployment benefit

Comparison

Aiyagari(1994)

- The employment process is exogenously given
- UI and taxes are nondistortionary
- Welfare is monotonically increasing in benefit

Krusell et al(2010)

- Frictional labour market, Nash bargaining, homogenous firms
- Same probability of job finding for all workers

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This paper

- ⇒ New: asset distribution, two sided heterogeneity
- Asset dependent precautionary job search motive

IS UI WELFARE IMPROVING?

- Comparing steady states with different levels of UI

- ψ : percentage change in life time consumption required to give workers the steady state average lifetime utility

- Fix the distribution of workers at benchmark economy

- c_t: benchmark, $\hat{c}_t$ counterfactual experiments

$$\mathbb{E}_0\Big[\sum_{t=0}^{\infty}\beta^t \log((1+\psi)c(a_t))\Big] = \mathbb{E}_0\Big[\sum_{t=0}^{\infty}\beta^t \log(\hat{c}(a_t))\Big]$$
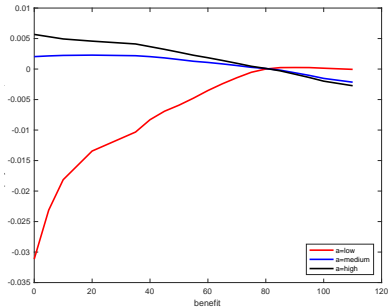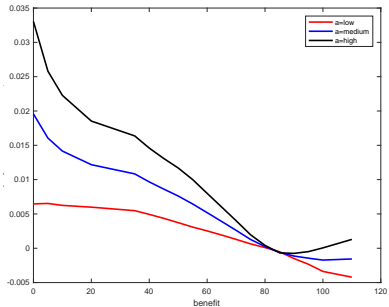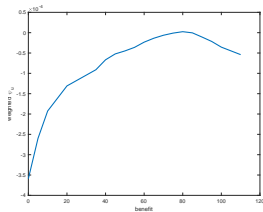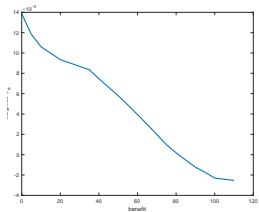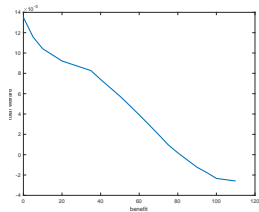
unemployed workers   employed workers

Average ψ_u Average ψ_e Total welfare

WELFARE

$b = 80$ to	Total (%)	Welfare Gain Unemp. (%)	Emp. (%)	Fraction of agents gaining Unemp.	Emp.	Total
0	1.35	-0.04	1.39	0.01	1	0.9587
35	0.84	-0.01	0.85	0.56	1	0.9818
45	0.64	-0.01	0.65	0.56	1	0.9811
60	0.43	-0.00	0.43	0.55	1	0.9811
65	0.29	-0.00	0.30	0.60	1	0.9835
75	0.10	0.00	0.09	0.85	1	0.99
80	0	0	0	0	0	0
85	-0.08	-0.00	-0.08	0.12	0	0.0053
95	-0.18	-0.00	-0.18	0.35	0	0.0149

WELFARE: SUMMARY

- Individuals have clear individual preferences over benefits:
  1. Unemployed high assets types like low benefits
  2. Unemployed low assets like high benefits

- But on average from a decrease in the benefits:
  - Employed workers gain
  - Unemployed workers loose

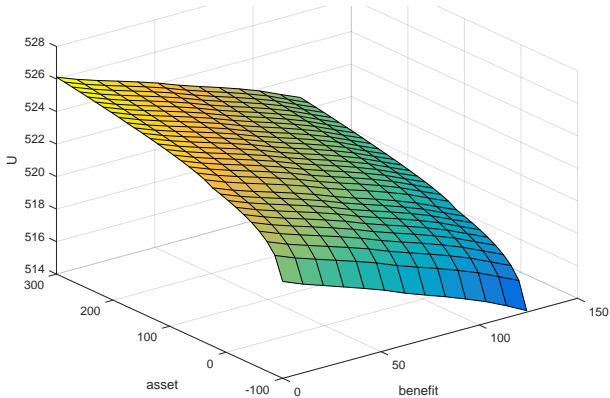$\Rightarrow$ With a Utilitarian Planner: low benefits is optimal

optimal UI

SEVERANCE PAY

- S: a lump sum payment upon separation.
- $b = 0$

$$E(a, y, w) = \max_{a'} \left\{ u(c_e) + \beta[\lambda U(a' + S) + (1 - \lambda)E(a', y, w)] \right\}$$
$$\text{s.t.} \quad c_e + a' = Ra + (1 - \tau)w + d \quad \text{and} \quad a' \geq \underline{a}$$

THE VALUE OF UNEMPLOYMENT
SEVERANCE PAY
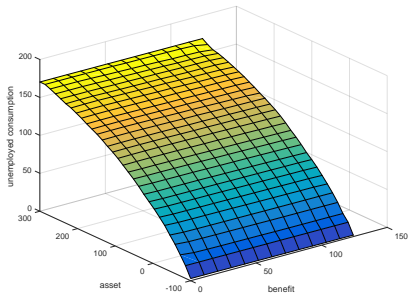
Consumption

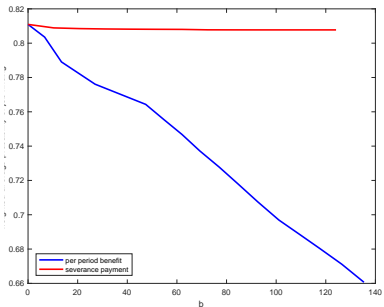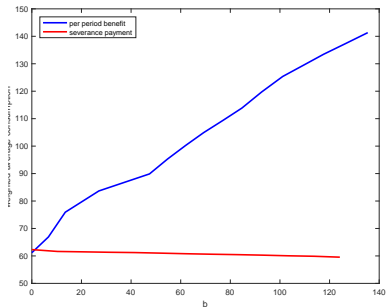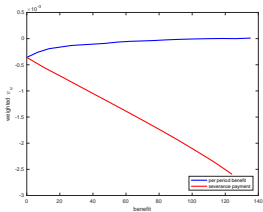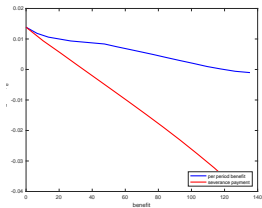Probability of Job Finding

FIGURE: Average consumption and probability of job finding
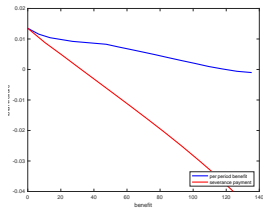
Welfare
Comparing Per-Period Benefit & Severance Pay

Average U value   Average E value   Total welfare

CONCLUSION

- Two sided heterogeneity: asset holding of workers $+$ firm prod.
- Natural preference complementarity and sorting
- Asset dependent precautionary job search motive

- UI: Consumption, job search decision, asset distribution
  - Individual preferred replacement rate depends on their asset holding
  - Utilitarian Planner: low benefits is optimal

How do Assets Affect Worker Productivity?

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Appendix

Proposition

Workers with higher initial asset levels a will apply for more productive jobs provided

$$\frac{u'(c_e) - u'(Ra')}{u(c_e) - u(Ra')} < \frac{u''(c_e)}{u'(c_e)} \tag{U}$$

- Within HARA, condition (**U**) is equivalent to DARA:
  - $<$ CRRA – log
  - $=$ CARA – risk neutrality
  - $>$ quadratic
- DARA, $\frac{u''}{u'} < 0$ (or positive risk prudence $u''' > 0$):
  - sufficient for small w

back

Related empirical literature

- Silvio (AER-2006), Card, Chetty, and Weber (QJE-2007), and Lentz (RED-2009): document that higher asset holdings lead to prolonged job search

- Chetty (JPE-2008) shows that the elasticity of the job finding rate with respect to unemployment benefits decreases with liquid wealth

- Browning and Crossley (JPE-2001) show that unemployment insurance improves consumption smoothing for poor agents, but not for rich ones