Optimal Design of Welfare-to-Work Programs

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Introduction

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- Offer income support & promote economic self-sufficiency

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  - Transitional Work: “stepping stone” to private sector job
  - Training
  - Earnings subsidies/employment bonuses

Language and question

- *A policy is a prescription of an activity (search, work, train, or rest) to the participant, with an associated conditional transfer*
- *A WTW program is a government expenditure program that combines different policies*
- *An optimal WTW program minimizes government expenditures s.t. delivering a given level of ex-ante utility to the participant*

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- *An optimal WTW program minimizes government expenditures s.t. delivering a given level of ex-ante utility to the participant*

Question: how to optimally design a welfare-to-work (WTW) program

Approach: dynamic contracting

- Point of departure: optimal UI literature
  - Shavell-Weiss (1979): unobservable job search effort
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- Critique
  - Excessive focus on optimal level and path of UI benefits

    Cahuc-Lehmann (2000), Hassler-Rodriguez Mora (2002), Kocherlakota (2004), Coles-Masters (2007), Pavoni (2007), Chetty (2008), Sanchez (2008), Shimer-Werning (2008), Hagedorn-Kaul-Mennel (2010), Landais-Michaillat-Saez (2010), Michelacci-Ruffo (2011)

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  - Policy debate is on which instrument is best for whom
- Generalization
  - additional technologies $\leftrightarrow$ policies
  - human capital (agent heterogeneity)

1. Economic Environment

Preferences, endowments, and storage

- Agent is infinitely lived with discount factor $\beta \in (0, 1)$
- Intra-period utility: $\log(c) - a$
  - Consumption $c \geq 0$ and effort $a \in \{0, e\}$

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- Agent endowed with fixed human capital h
- Storage with return $R = \beta^{-1}$
- No access to credit

Rest, search, and private-sector job

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  - Low effort $(a = 0)$

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- Job search
  - Job-finding probability: $\pi(h) \equiv \pi(h, e) > \pi(h, 0) \equiv 0$
  - Success of job search $\rightarrow$ private sector job

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  - Success of job search $\rightarrow$ private sector job
- Private-sector job (absorbing state)
  - Requires high effort $(a = e)$ to produce $\omega(h) \geq 0$

Remark: search effort can be lower than work effort

- Krueger-Muller (2010); Aguiar-Hurst-Karabarbounis (2012)

Additional technologies

- Search Assistance
  - At cost κ^A, agency takes over search on behalf of participant
  - Participant saves her search effort
  - Agency's search equally efficient as private search

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- Search Assistance
  - At cost κ^A, agency takes over search on behalf of participant
  - Participant saves her search effort
  - Agency's search equally efficient as private search
- Public-sector production
  - At cost κ^P, public job readily available (no search friction)
  - Requires high effort $(a = e)$ to produce $\underline{\omega} \geq 0$

Information structure

- Observable and contractible:
  - Agent type h
  - Work effort on public $\&$ private jobs (e.g., supervised)
  - Saving $(= 0)$

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  - Agent type h
  - Work effort on public $\&$ private jobs (e.g., supervised)
  - Saving $(= 0)$
- Private information of the agent and under her control:
  - Job-search effort (IC-Search)
  - Job offer upon contact (IC-Retention)

2. Contract

Principal-Agent relationship

- Risk neutral principal who discounts at rate $R^{-1} = \beta$

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- At every pair (U, h), the contract specifies:
  - Effort level: $a \in \{0, e\}$
  - Activity: assignment to technology
  - Payments: welfare benefits/wage tax or subsidy
  - Continuation utility: (U^s, U^f) conditional on outcome of activity

Principal-Agent relationship

- Risk neutral principal who discounts at rate $R^{-1} = \beta$
- Recursive formulation with states: (U, h) and employment status
- At every pair (U, h), the long-term contract specifies:
  - Effort level: $a \in \{0, e\}$
  - Activity: assignment to technology
  - Payments: welfare benefits/wage tax or subsidy
  - Continuation utility: (U^s, U^f) conditional on outcome of activity

Principal-Agent relationship

- Risk neutral principal who discounts at rate $R^{-1} = \beta$
- Recursive formulation with states: (U, h) and employment status
- At every pair (U, h), the Markovian contract specifies:
  - Effort level: $a \in \{0, e\}$
  - Activity: assignment to technology
  - Payments: welfare benefits/wage tax or subsidy
  - Continuation utility: only conditional on employment status

Options of contract as policies of WTW program

- Combination of prescriptions on effort a and use of technologies leads to five policy instruments (i):
  - $\mathbf{SA}$: Social Assistance (rest, $a = 0$)
  - $\mathbf{UI}$: Unemployment Insurance (private search, $a = e$)
  - $\mathbf{JA}$: Job-search Assistance (assisted search, $a = 0$)
  - $\mathbf{MW}$: Mandatory Work (public-sector work, $a = e$)
  - $\mathbf{TW}$: Transitional Work (public work + assisted search, $a = e$)

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$$V(U,h) = \max_{i \in \{SA,UI,JA,MW,TW\}} V^i(U,h)$$

3. VALUE FUNCTIONS

SA and MW

- Social Assistance (SA)

$$
\begin{aligned}
V^{SA}(U) &= \max_{c} \; -c + \beta V^{SA}(U) \\
\text{s.t.} &: \\
U &= \log(c) + \beta U \qquad (PK)
\end{aligned}
$$

SA and MW

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- Mandatory Work (MW)

$$\begin{aligned} V^{MW}(U) &= \max_{c} \; \underline{\omega} - \kappa^{P} - c + \beta V^{MW}(U) \\ \text{s.t.} &: \\ U &= \log(c) - e + \beta U \qquad (PK) \end{aligned}$$

Unemployment Insurance (UI)

$$V^{UI}(U,h) = \max_{c,U^s} -c + \beta\left[\pi(h)W(U^s,h) + (1-\pi(h))\,V^{UI}(U,h)\right]$$

s.t. :

$$U = \log(c) - e + \beta\left[\pi(h)U^s + (1-\pi(h))U\right] \qquad (PK)$$

$$U^s \geq U + \frac{e}{\beta\pi(h)} \qquad (IC-S)$$

$$U^s \geq U \qquad (IC-R)$$

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\text{s.t.} &: \\
U &= \log(c) - e + \beta\left[\pi(h)U^s + (1-\pi(h))U\right] && (PK) \\
U^s &\geq U + \frac{e}{\beta\pi(h)} && (IC-S) \\
U^s &\geq U && (IC-R)
\end{aligned}
$$

Remark:

- Job-search Monitoring: at a cost, eliminate IC-S and IC-R
  - Aiyagari-Alvarez (1995); Pavoni-Violante (2006); Setty (2011)
  - Meyer (1995); van den Berg-van der Klaauw (2006)

Job-search Assistance (JA)

$$V^{JA}(U,h) = \max_{c,U^s} -c - \kappa^A + \beta \left[\pi(h) W(U^s,h) + (1-\pi(h)) V^{JA}(U,h)\right]$$

s.t. :

$$U = \log(c) + \beta\left[\pi(h)U^s + (1-\pi(h))U\right] \qquad (PK)$$

$$U^s \geq U \qquad (IC-R)$$

Job-search Assistance (JA)

$$V^{JA}(U,h) \quad = \quad \max_{c,U^s} \; -c - \kappa^A + \beta\left[\pi(h)W(U^s,h) + (1-\pi(h))\,V^{JA}(U,h)\right]$$

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$$U^s \quad \geq \quad U \qquad (IC-R)$$

No search effort $\rightarrow$ no IC-S

Transitional Work (TW)

- Policy combining public-sector work and search assistance

$$V^{TW}(U,h) \quad = \quad \max_{c,U^s} \; \underline{\omega} - \kappa^P - \kappa^A - c + \beta \left[\pi(h) W(U^s,h) + (1-\pi(h))\, V^{TW}(U,h) \right]$$

s.t. :

$$U \quad = \quad \log(c) - e + \beta \left[\pi(h) U^s + (1-\pi(h)) U \right] \qquad (PK)$$

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s.t. :

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IC-R not binding: both TW and private employment require effort

Closed-form of value functions

$$V^i(U,h) = \frac{1}{1-\beta} \cdot \left[A^i(h) - B^i(h) \cdot \exp((1-\beta)U)\right]$$

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$$V^i(U,h) = \frac{1}{1-\beta} \cdot \left[A^i(h) - B^i(h) \cdot \exp((1-\beta)U)\right]$$

- $A^i(h)$: output net of administrative cost (κ^A, κ^P)
- $B^i(h)$: cost of promising a unit of U in c terms (relative to SA)

Returns and costs of each policy

$$V^i(U,h) = \frac{1}{1-\beta} \cdot \left[A^i(h) - B^i(h) \cdot \exp((1-\beta)U)\right]$$

	$A^i(h)$: Net Return	$B^i(h)$: Cost of Promising U
$SA:$	0	
MW:	$\underline{\omega} - \kappa^P$	
$UI:$	$\frac{\beta\pi(h)}{1-\beta+\beta\pi(h)}\omega(h)$	
JA:	$\frac{\beta\pi(h)}{1-\beta+\beta\pi(h)}\omega(h) - \frac{1-\beta}{\beta\pi(h)}\kappa^A$	
TW:	$\frac{\beta\pi(h)}{1-\beta+\beta\pi(h)}\omega(h) + \frac{1-\beta}{\beta\pi(h)}\left(\underline{\omega} - \kappa^P - \kappa^A\right)$	

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MW:	$\underline{\omega} - \kappa^P$	$\exp(e)$
$UI:$	$\frac{\beta\pi(h)}{1-\beta+\beta\pi(h)}\omega\,(h)$	$\frac{1-\beta+\beta\pi(h)\exp\left\{e+\frac{1-\beta}{\beta\pi(h)}e\right\}}{1-\beta+\beta\pi(h)}$
JA:	$\frac{\beta\pi(h)}{1-\beta+\beta\pi(h)}\omega\,(h) - \frac{1-\beta}{\beta\pi(h)}\kappa^A$	$\frac{1-\beta+\beta\pi(h)\exp(e)}{1-\beta+\beta\pi(h)}$
TW:	$\frac{\beta\pi(h)}{1-\beta+\beta\pi(h)}\omega\,(h) + \frac{1-\beta}{\beta\pi(h)}\left(\underline{\omega} - \kappa^P - \kappa^A\right)$	$\exp(e)$

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JA:	$\frac{\beta\pi(h)}{1-\beta+\beta\pi(h)}\omega\,(h) - \frac{1-\beta}{\beta\pi(h)}\kappa^A$	$\frac{\beta\pi(h)}{1-\beta+\beta\pi(h)}\exp\,(e) \times$ cost of (IC-R)
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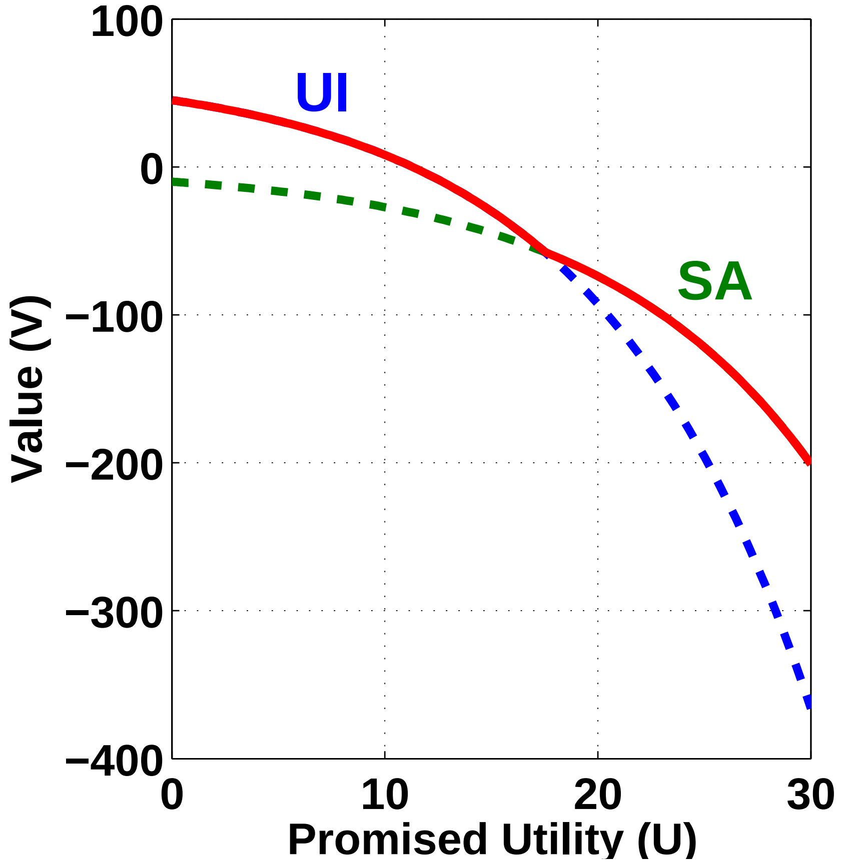
Value functions: UI - SA comparison



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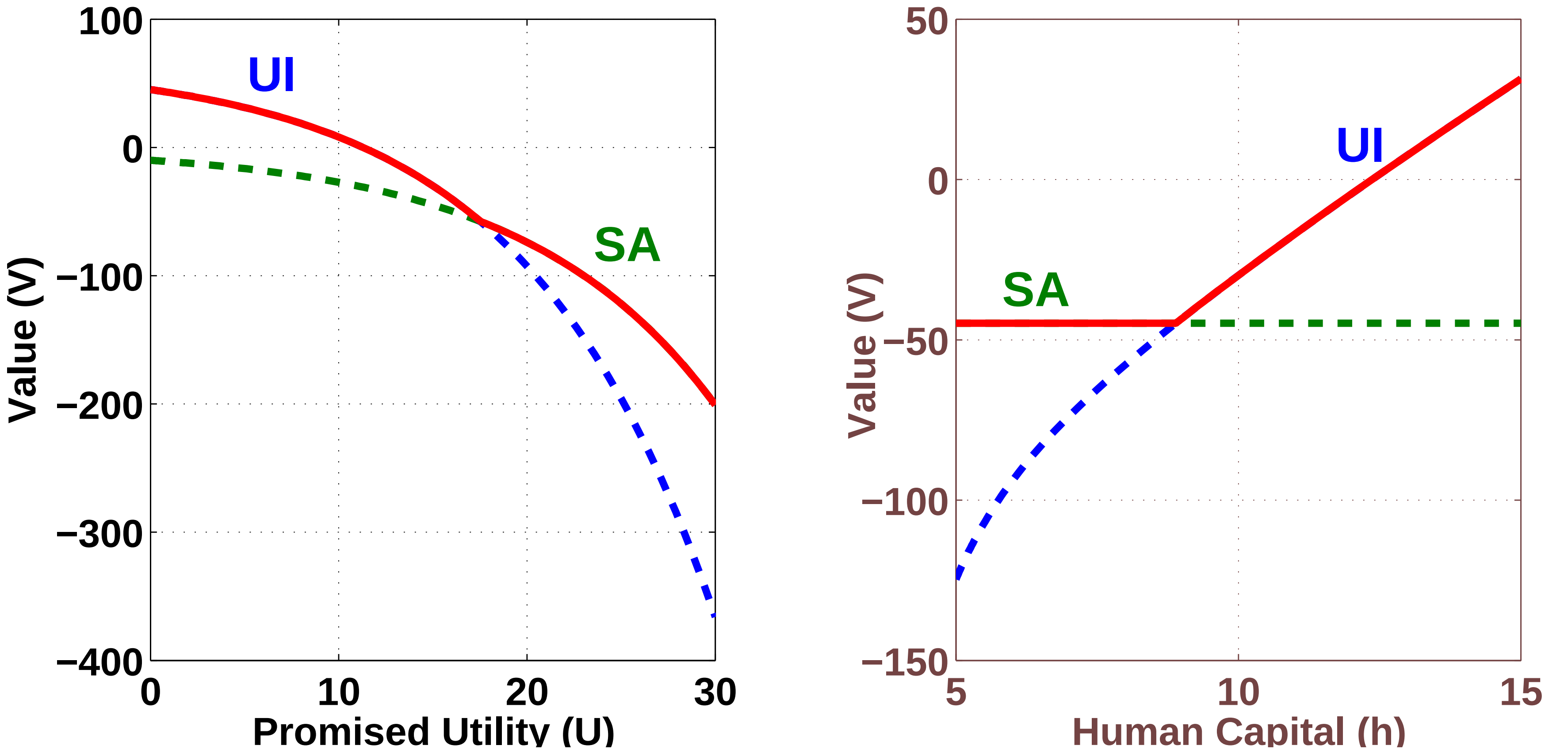
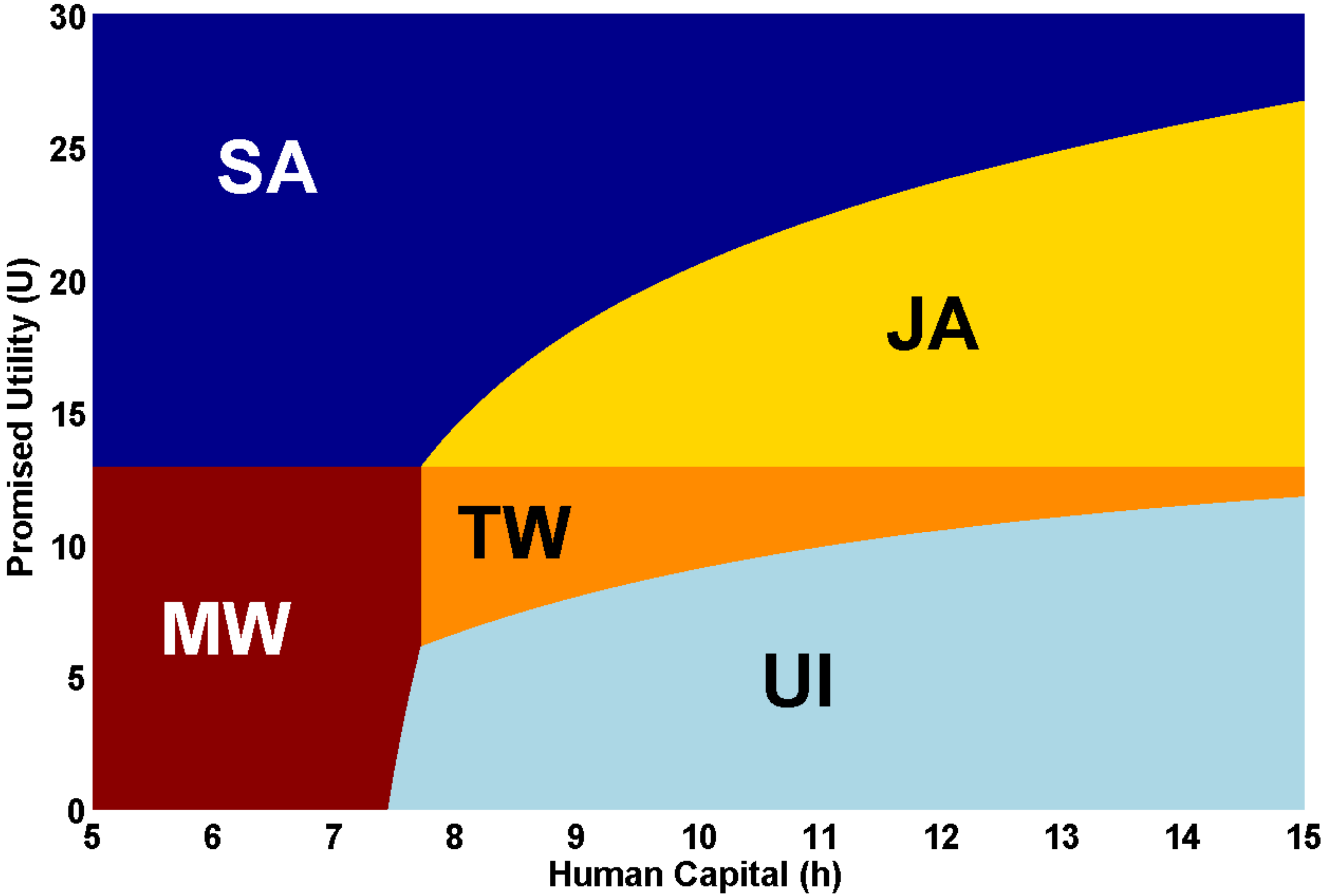
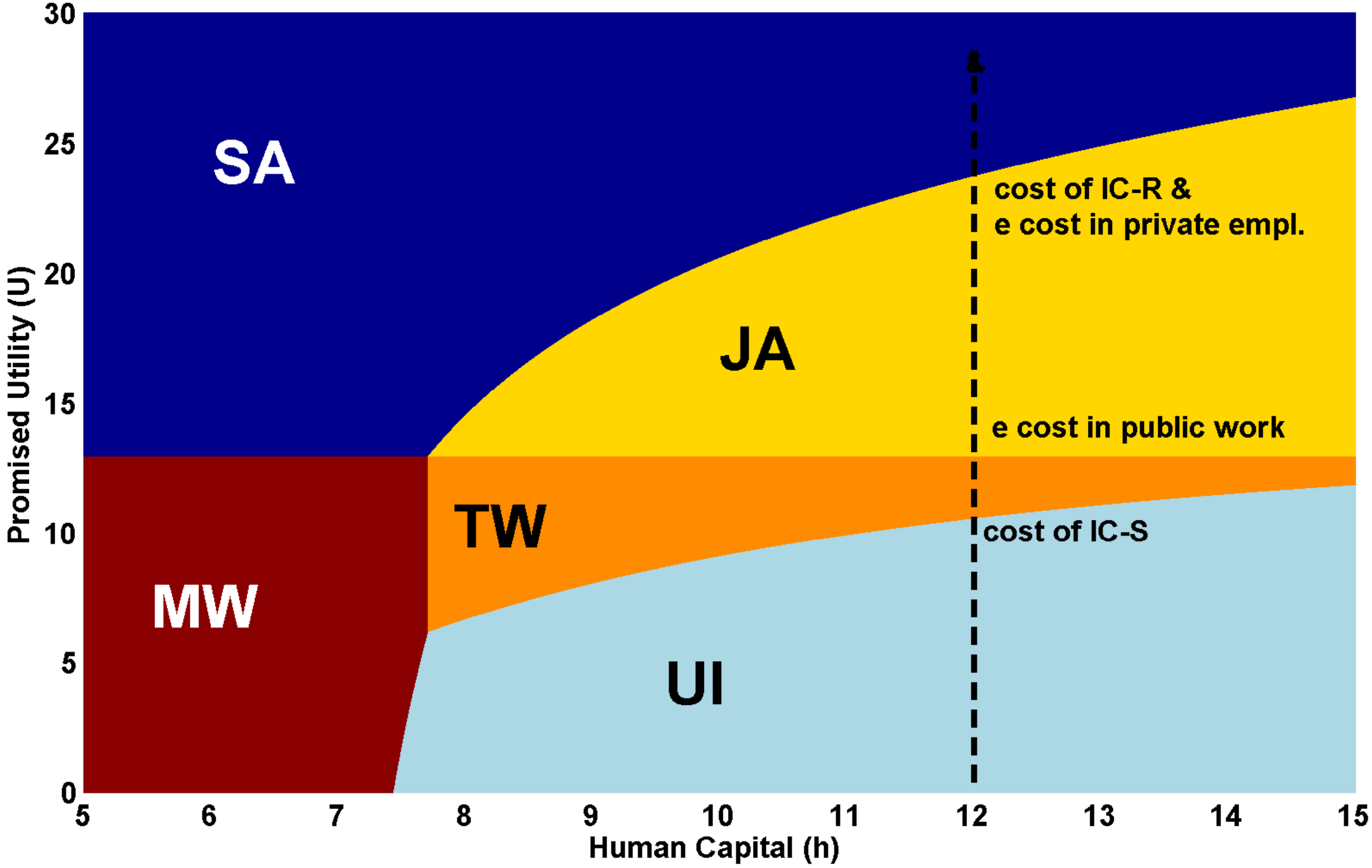


4. Optimal WTW Program

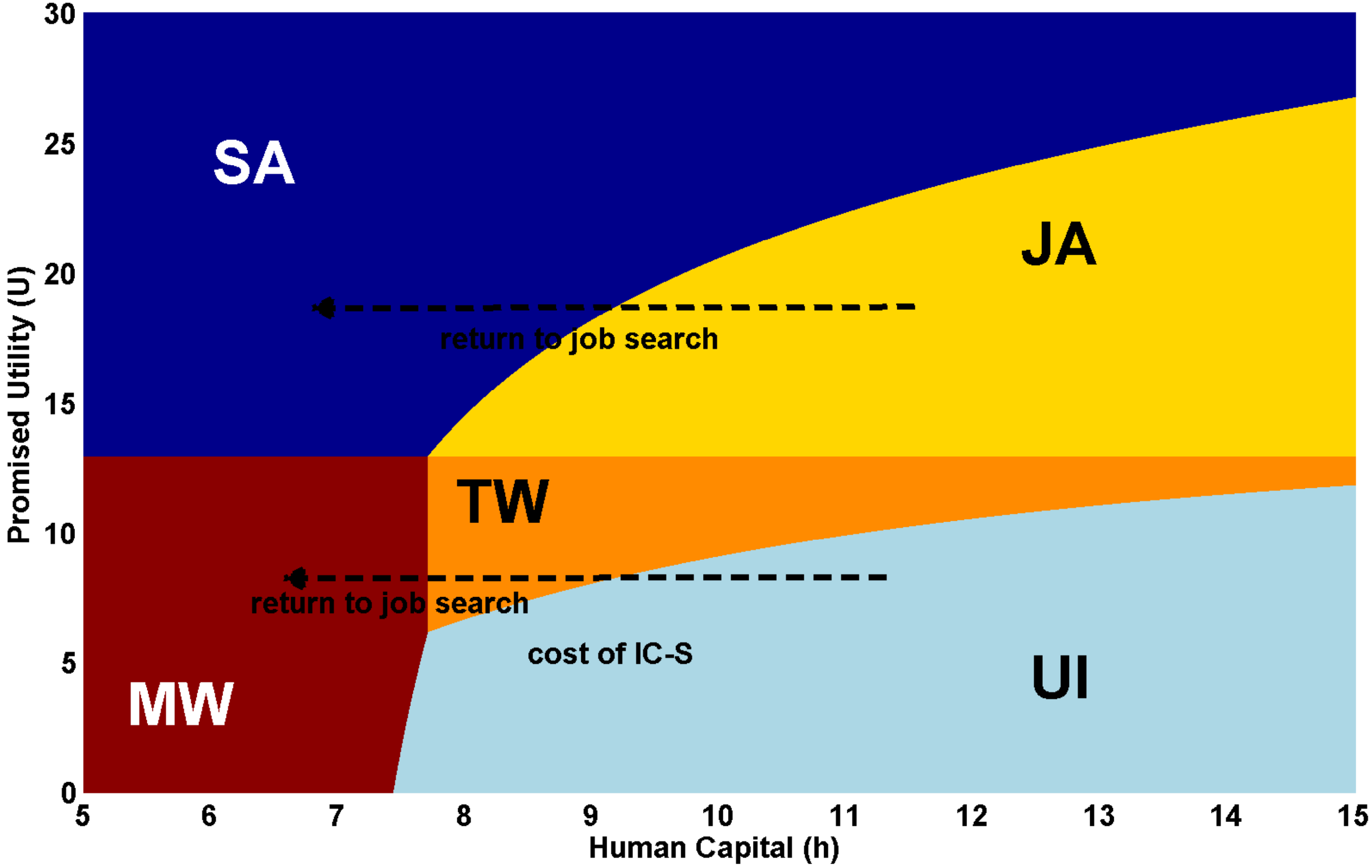
Optimal WTW program



Comparative statics wrt U



Comparative statics wrt h



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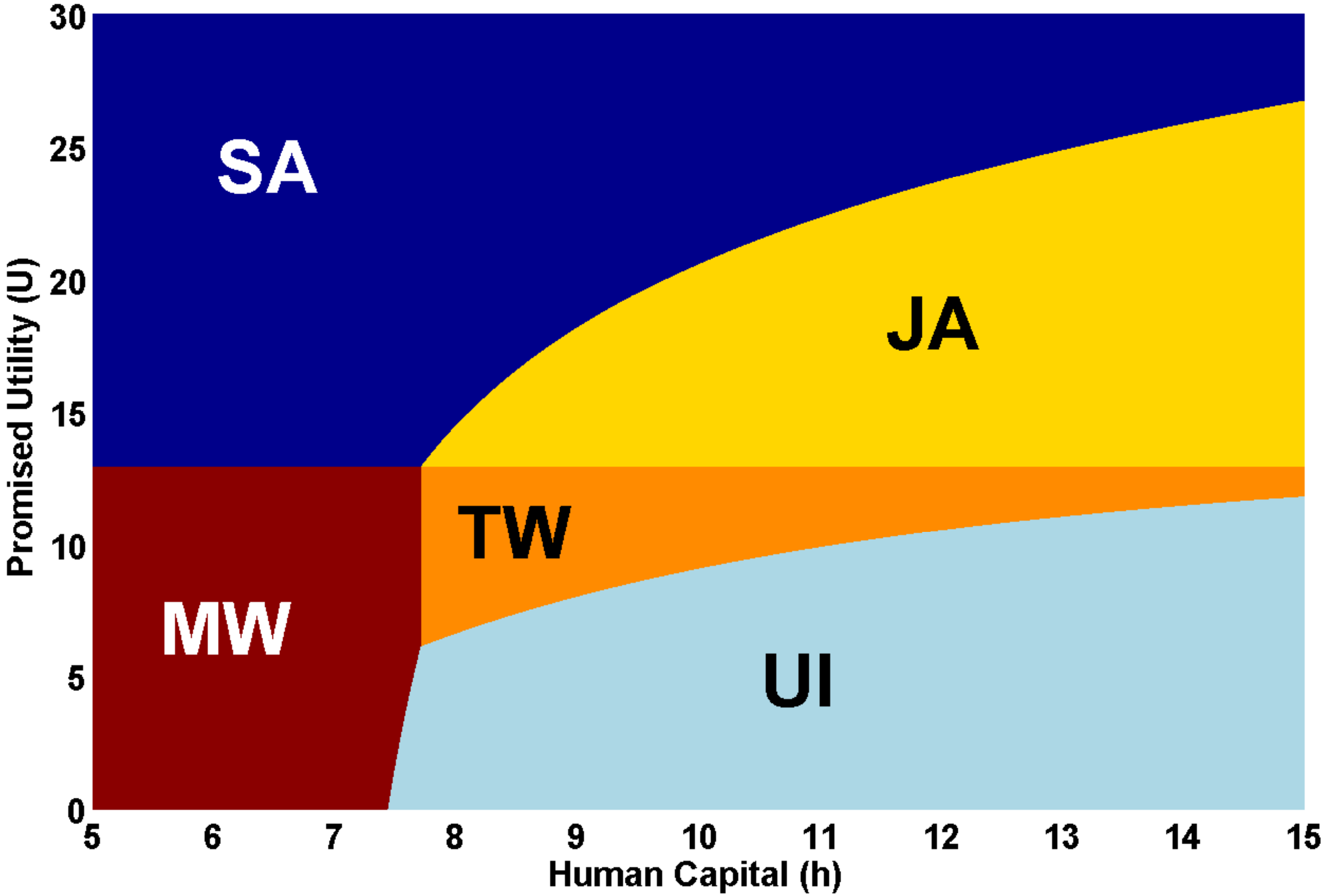

5. Human Capital Dynamics

Human capital depreciation

Two implications of h depreciation:

1. Skill depreciation (ω)
   - Jacobson-Lalonde-Sullivan (1993); Kletzer (1998); Couch-Placzek (2010)
   - Addison-Portugal (1989); Gregg (2001); Edin-Gustavsson (2008)
2. Duration dependence in unemployment (π)
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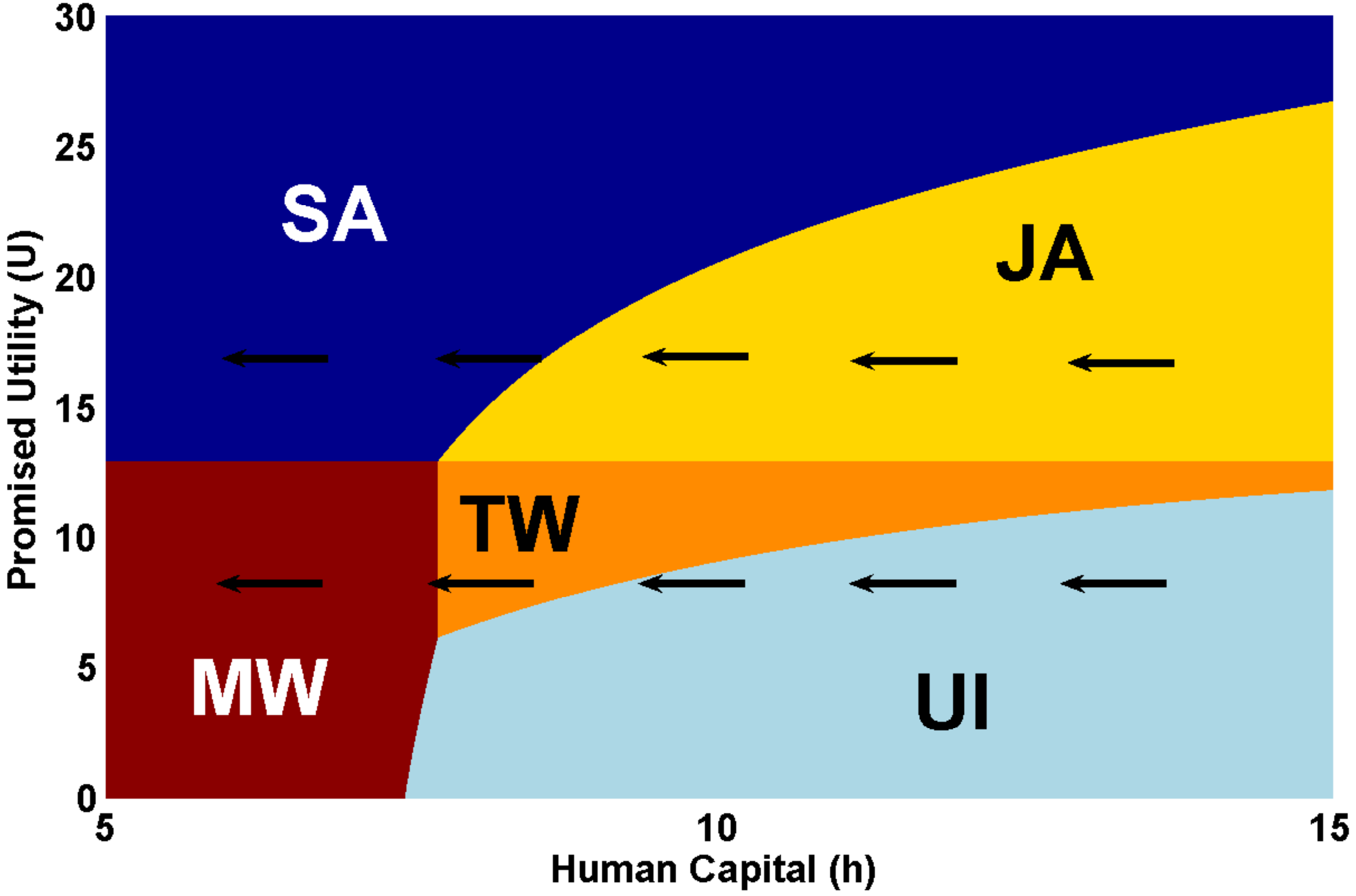
New feature of WTW program: transitions across policies

Optimal WTW program



Summary of optimal policy transitions

- Policy transitions induced by h dynamics

1. High generosity: $JA \rightarrow SA$

2. Low generosity: $UI \rightarrow TW \rightarrow MW$

... and all sub-transitions

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- Policy transitions induced by h dynamics

  1. High generosity: $JA \rightarrow SA$

  2. Low generosity: $UI \rightarrow TW \rightarrow MW$

  ... and all sub-transitions

- However, many transitions can be ruled out as sub-optimal:

  1. Any transition from SA or MW

  2. Any transition into UI

Additional technology: human capital accumulation

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- At cost κ^T, the agent is trained during the period
- With probability θ, training is successful and h jumps to $\overline{h}$
- Effort required and unobservable

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- With probability θ, training is successful and h jumps to $\overline{h}$
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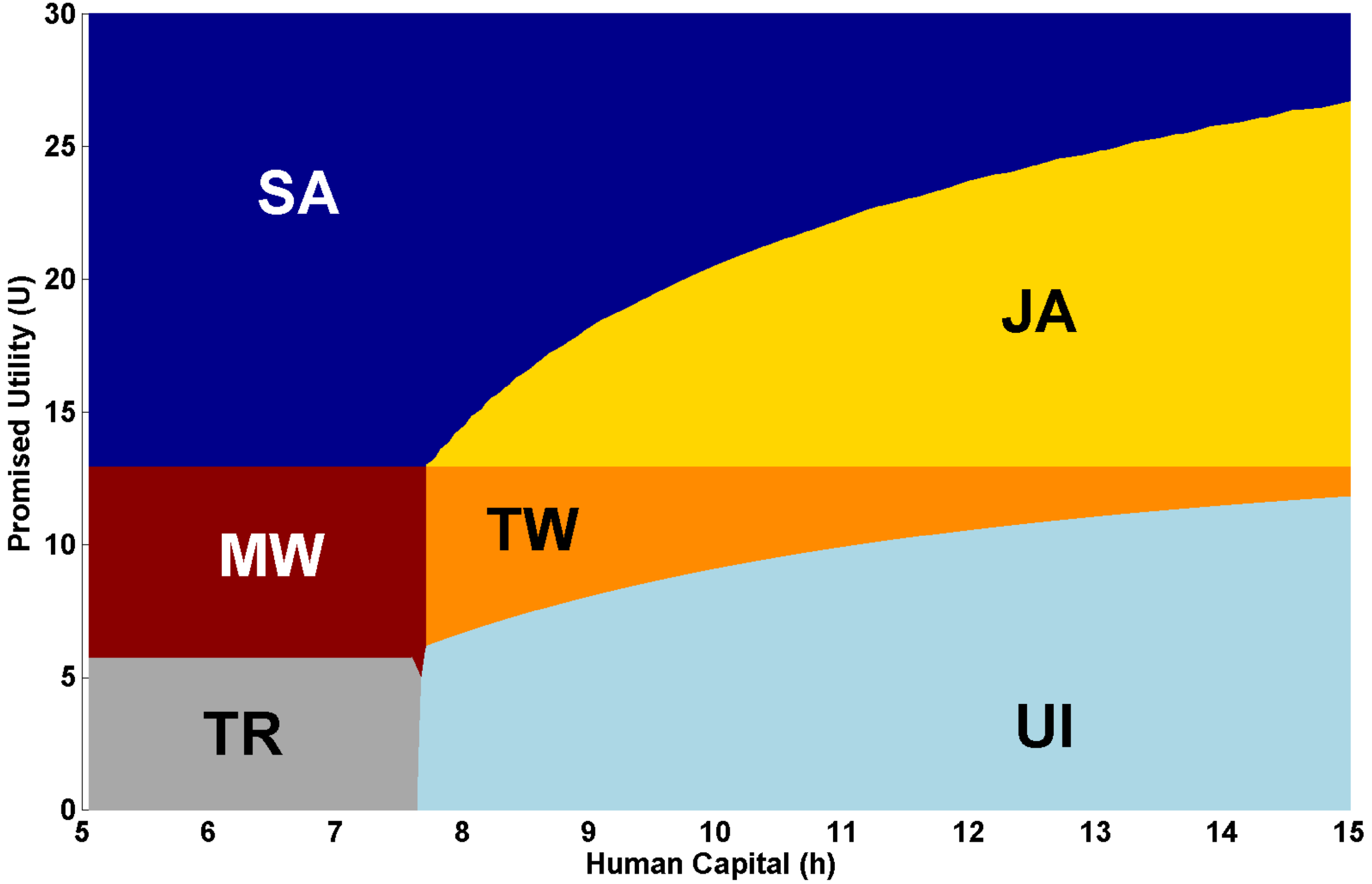
$$V^{TR}(U,h) = \max_{c,U^s} -c-\kappa^T+\beta\{\theta V(U^s,\overline{h})+(1-\theta)\,\mathbb{E}_h\left[V(U,h')\right]\}$$

s.t. :

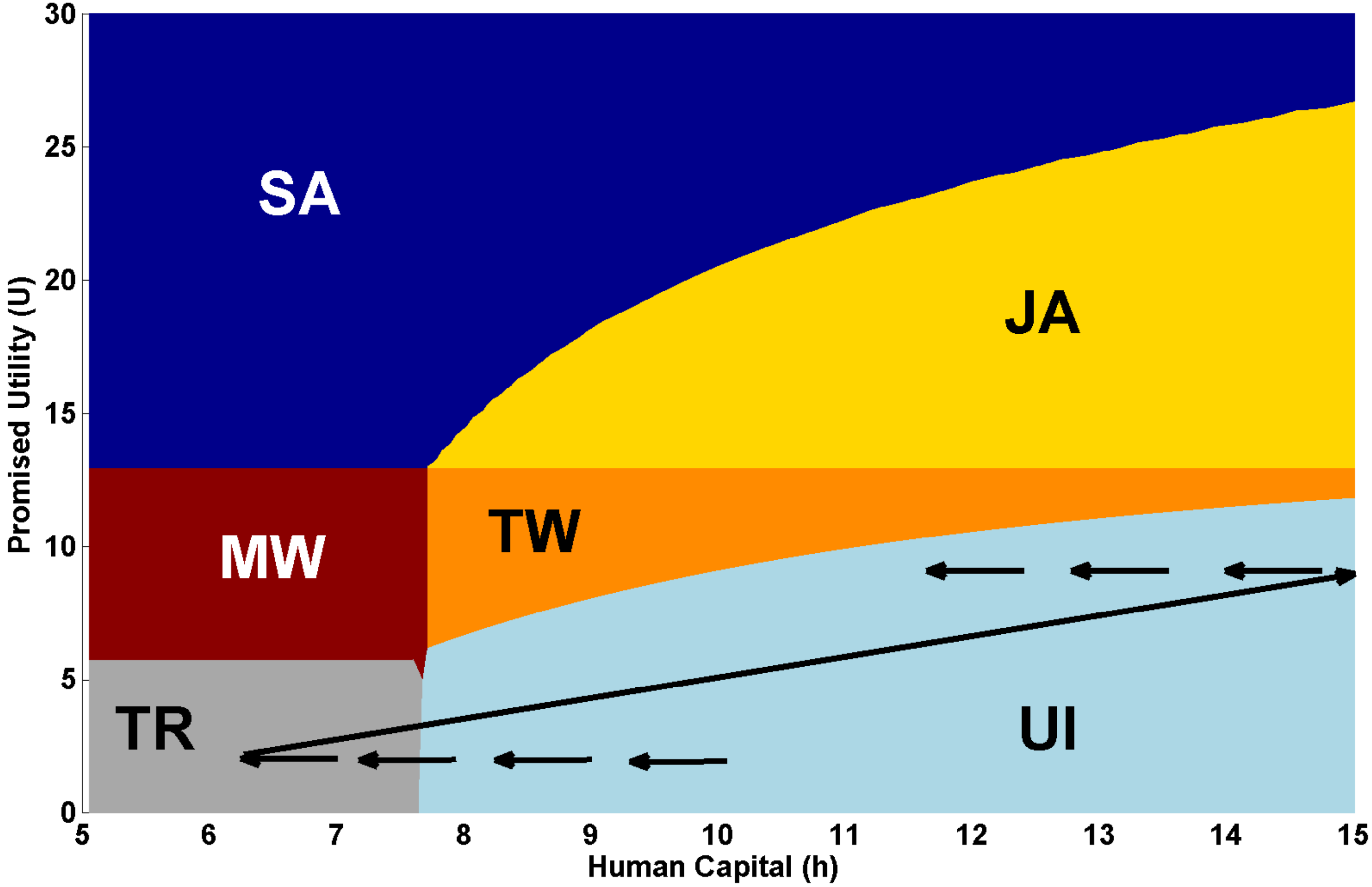
$$U = \log(c)-e+\beta\left[\theta U^s+(1-\theta)U\right] \qquad (PK)$$

$$U^s \geq U+\frac{e}{\beta\lambda} \qquad (IC-T)$$

Optimal WTW Program with training



Policy transitions with training



6. Dynamic Incentives

(h fixed)

Dynamic incentives

- Full history dependence allowed in the contract: U^f chosen
- Need to convexify the upper envelope $V(U,h) = \max_i V^i(U,h)$
  - Phelan-Stachetti (2001)

Dynamic incentives

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- Need to convexify the upper envelope $V(U,h) = \max_i V^i(U,h)$
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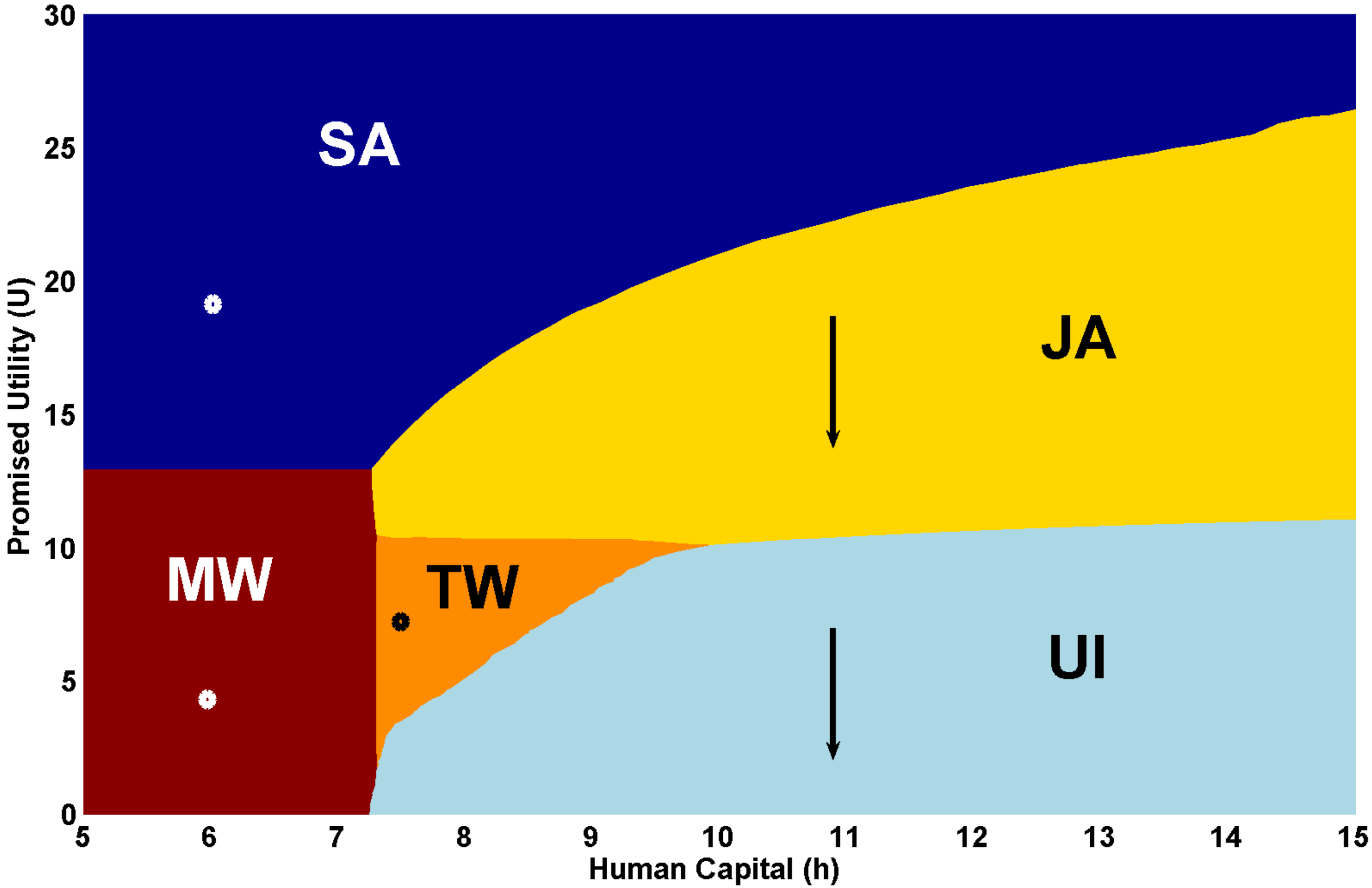
- U may change during unemployment spell
  - Never rises
  - Falls in policies with IC binding: UI and JA
  - Some new policy transitions due to dynamic incentives

Optimal WTW program



Three additional insights

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3. Work requirement used as punishment for failed job-search:

- $\downarrow U^f$ achieved with future work effort requirements instead of $\downarrow c$

- Better consumption smoothing

7. Policy Evaluation

Policy Evaluation

Aim: cost saving of switching from actual to optimal WTW program

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1. Parameterization

   - Labor market parameters: e, π, and h depreciation
   - Costs and returns of technologies: $\kappa^A, (\underline{\omega}, \kappa^P), (\kappa^T, \theta, \overline{h})$
     - Evaluation studies of randomized experiments

Policy Evaluation

Aim: cost saving of switching from actual to optimal WTW program

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    - Labor market parameters: e, π, and h depreciation
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2. Expected utility (U_0) and cost (K_0) implied by current programs

    - Benefits, time limits, sanctions, exemptions, policies

Policy Evaluation

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   - Labor market parameters: e, π, and h depreciation
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     - Evaluation studies of randomized experiments
2. Expected utility (U_0) and cost (K_0) implied by current programs
   - Benefits, time limits, sanctions, exemptions, policies
3. Expected cost (K_0^*) of optimal WTW program starting from U_0

Invariance of state-space to h depreciation

The optimal policy-space is invariant to h depreciation

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Sketch of proof (for UI/SA case):

Invariance of state-space to h depreciation

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Sketch of proof (for UI/SA case):

- UI evaluated at a point (U, h^*) on the policy-indifference curve:

$$\begin{aligned} V^{UI}(U,h^*) = & - \quad \exp((1-\beta)U) + \beta \left\{ \pi(h^*) W \left(U + \frac{e}{\beta \pi(h^*)}, h^* \right) \right. \\ & + \quad (1-\pi(h^*)) \left[(1-\delta) V^{UI}(U,h^*) + \delta V(U, h'(h^*)) \right] \left. \right\} \end{aligned}$$

Invariance of state-space to h depreciation

The optimal policy-space is invariant to h depreciation

Sketch of proof (for UI/SA case):

- UI evaluated at a point (U, h^*) on the policy-indifference curve:

$$\begin{aligned} V^{UI}(U,h^*) = & - \exp((1-\beta)U) + \beta \left\{ \pi(h^*) W \left(U + \frac{e}{\beta \pi(h^*)}, h^* \right) \right. \\ & + (1-\pi(h^*)) \left. \left[(1-\delta) V^{UI}(U,h^*) + \delta V(U, h'(h^*)) \right] \right\} \end{aligned}$$

- Compute the $\max$ across policies at $h'(h^*) < h^*$:

$$\begin{aligned} V(U, h'(h^*)) &= \max \left\{ V^{UI}(U, h'(h^*)), V^{MW}(U) \right\} \\ &= V^{MW}(U) = V^{UI}(U, h^*) \end{aligned}$$

8. Hidden Storage

Hidden storage

The WTW program remains IC even with hidden storage

Hidden storage

The WTW program remains IC even with hidden storage

Sketch of proof:

- With $R = \beta^{-1}$, the agent's Euler Equation commands $c_t = \mathbb{E}[c_{t+1}]$
- Payments are weakly increasing along the optimal WTW program
- Agent would like to borrow (and she can't), never save

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- Participation of non-employed TANF recipients

Activity	%
None	76.6
Community Work	8.2
Job Search	6.2
Education and Training	9.0

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- Generosity of US states towards TANF recipients

State	Max Monthly Benefits (family of three)	Time Limits (months)
New York	$753	60
Massachussets	$633	60
Arizona	$278	36
Florida	$303	48

Digression: u^{-1} convex first derivative?

- $\frac{1}{u'}$ is the marginal cost to the planner of promising an additional unit of utility U to the agent

- Definition [incentive cost]: extra cost in units of consumption of promising the agent a state-contingent utility lottery delivering U necessary to satisfy IC, relative to the cost of promising U with certainty

- If $\frac{1}{u'}$ is convex, then the incentive cost is increasing in U

- CARA or CRRA ($\gamma > 1/2$) $\Rightarrow \frac{1}{u'}$ convex