Redistribution and Disability Insurance

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1 Introduction

- Design of welfare programs
- Several types of insurance
- Insurance against permanent low ability shocks – redistribution.
- Disability insurance
- Incentives
- Analyze interaction in optimal design in simple model
- Evaluate consequences of lack of coordination (multiple agencies)

2 The model

- Two periods
- Two types of agents with productivities $\{x_l, x_h\}$, shares $(1-\pi), \pi$
- Agent's type private (Mirrlees.)
- No disutility of work first period.
- Second period independent shock to disutility of work $e\tilde{\ } F(e)$.
- Utilitarian Principal.

2.1 Design problem and incentives

- Contracts specify $\{c_{1h}, c_{2h}, c_{dh}\}, \{c_{1l}, c_{2l}, c_{dl}\}$.

- Employment decision in second period:

$$\begin{aligned} u(c_{2h}) - e_h &= u(c_{dh}) \\ u(c_{2l}) - e_l &= u(c_{dl}) \end{aligned}$$

- Simplified notation for second period utility:

$$\begin{aligned} U_2(c_2, c_d) &= \max_e \left(1 - F\left(e_j\right)\right) u(c_d) \\ &\quad + \int_0^e (u(c) - a) F(da) \end{aligned}$$

- Self selection constraint:

$$u(c_{1h}) + U_2(c_{2h}, c_{dh}) \geq u(c_{1l}) + U_2(c_{2l}, c_{dl})$$

2.2 The optimal contract

- For convenience take $\pi = \frac{1}{2}$

$$\max u\left(c_{1h}\right) + U_2\left(c_{2h}, c_{dh}\right) + u\left(c_{1l}\right) + U\left(c_{2l}, c_{dl}\right)$$

subject to:

$$u\left(c_{1h}\right) + U_2\left(c_{2h}, c_{dh}\right) \geq u\left(c_{1l}\right) + U_2\left(c_{2l}, c_{dl}\right)$$

$$\begin{aligned} 0 \leq\ & x_h - c_{1h} + \left(x_h - c_{2h}\right) F\left(e_h\right) - \left(1 - F\left(e_h\right)\right) c_{dh} \\ & + x_l - c_{1l} + \left(x_l - c_{2l}\right) F\left(e_l\right) - \left(1 - F\left(e_l\right)\right) c_{dl} \end{aligned}$$

2.3 Some results

- First order condition for first period consumption:

$$
\begin{aligned}
u'(c_{1h}) &= \lambda - \mu \\
u'(c_{1l}) &= \lambda + \mu
\end{aligned}
$$

- $c_{1l} < c_{1h}$ if and only if self-selection binds ($\mu > 0$).

- $e_h > e_l$

- If $\mu > 0$, then:

  1. $c_{2h} > c_{2l} > c_{dl} > c_{dh}$

  2. $U_{2h} < U_{2l}$

- Remark: with no second period incentive constraint $\rightarrow$ full insurance $\rightarrow$ all consumptions identical.

- Incentives for disability limit redistribution.

3 Numerical results

- Calibration (π, x_l, x_h, F, u)

    1. $\pi = 0.25$

    2. $x_h = 3x_l$

    3. $u(c) = \ln c$

    4. F exponential hazard rate $\lambda \in \{0.5, 1, 2\}$

Median Disutility of Effort
(equivalent % loss in wages)

Hazard	***disutility***
$\lambda = 0.5$	75%
$\lambda = 1$	50%
$\lambda = 2$	29%

Consumption
(Constrained/Optimal)

	$\lambda = 0.5$	$\lambda = 1$	$\lambda = 2$
C_1l	85	89	96
C_2l	127	118	110
C_dl	70	65	58
replacement	55%	55%	53%
C_1h	106	123	110
C_2h	169	135	110
C_dh	40	13	0
replacement	24%	9%	0%
Avg. Replacement	45%	50%	53%

- Limited replacement ratios
- Very low for H types.
- Less redistribution first period.
- Replacement rates decreasing with λ.

Employment and Disability

	$\lambda = 0.5$		$\lambda = 1$		$\lambda = 2$	
	Optimal	Constrained	Optimal	Constrained	Optimal	Constrained
F(e_l)	35.1%	25.8%	53.9%	45.1%	75.9%	72.3%
F(e_h)	72.7%	51.2%	90.2%	90.6%	98.6%	100.0%
% disabled	55.5%	67.8%	37.0%	43.5%	18.4%	20.7%
autharky		53%		22%		0%

- Lower employment of low types.

- Increase in % disabled.

- Much more than under autharky.

Welfare

	$\lambda = 0.5$	$\lambda = 1$	$\lambda = 2$
First Best	100.0	100.0	100.0
Constrained	92.7	95.4	98.3
Autharky	75.9	77.5	83.6

- Big gains relative to autharky.

- Considerable difference to first best for low λ.

4 Uncoordinated decisions

- Advantages of coordinated redistribution and disability policies.

- Two principals.

- First principal:

  1. Decides on wage taxes

  2. Budget for disability insurance office.

- Second principal – disability insurance office:

- Decides c_{dh} and c_{dl}.

4.1 Coordination problem

- Free riding on self-selection.

- Does not internalize changes in tax revenue.

- Dynamic game.

4.2 Disability insurance office

- Takes as given c_{2h}, c_{2l} (follows from taxes)

- Can discriminate between h, l.

- Offers c_{dh}, c_{dl} to solve:

$$
\begin{aligned}
& \max_{c_{dh}, c_{dl}} F(e_h)\, u(c_{2h}) - \int_0^{e_h} a f(a)\, da + (1 - F(e_h \\
& + F(e_l)\, u(c_{2l}) - \int_0^{e_l} a f(a)\, da + (1 - F(e_l))\, u(c \\
& \text{subject to}
\end{aligned}
$$

$$
\begin{aligned}
e_j &= u\left(c_{2j}\right) - u\left(c_{2j}\right),\ j = h, l \\
B &= F(e_h)\, c_{dh} + F(e_l)\, c_{dl}
\end{aligned}
$$

- Marginal cost of increasing c_{dj} :

$$\begin{aligned} & 1 - F\left(e_j\right) - f\left(e_j\right) c_{dj} \frac{\partial e_j}{\partial c_{dj}} \\ = \; & F\left(e_j\right) + f\left(e_j\right) c_{dj} u'\left(c_{dj}\right) \end{aligned}$$

- Marginal benefit: $F\left(e_j\right) u'\left(c_{dj}\right)$

- Optimal rule equate Mg benefit/Mg cost on both types.

$$\frac{\left(1 - F\left(e_j\right)\right) u'\left(c_{dj}\right)}{\left(1 - F\left(e_j\right)\right) + f\left(e_j\right) u'\left(c_{dj}\right) c_{dj}} = \lambda$$

where λ satisfies budget constraint.

4.3 First Principal's problem

- Same as before with the additional constraint:

$$\frac{(1-F(e_h))\,u'(c_{dh})}{(1-F(e_h))+f(e_h)\,u'(c_{dh})\,c_{dh}} = \frac{(1-F(e_l))\,u'(c_{dl})}{(1-F(e_l))+f(e_l)\,u'(c_{dl})\,c_{dl}}$$

- Rewriting:

$$\frac{1}{\frac{1}{u'(c_{dj})}+\frac{f(e_j)}{1-F(e_j)}c_{dj}} = \lambda$$

- Decreasing in c_{dj} and increasing (decreasing) in e_j if and only if hazard rate is decreasing (increasing).

- If F is exponential, then $c_{dh} = c_{dl}$ is only additional constraint. If hazard rate is increasing $c_{dh} < c_{dl}$ and $e_h > e_l$. If hazard rate is decreasing, opposite!

4.4 Two principals - numerical results

- Same case as before.

- F is exponential, so only add constraint $c_{dh} = c_{dl}$.

Consumption (two planners/one planner)

	$\lambda = 0.5$	$\lambda = 1$	$\lambda = 2$
C_1l	104	104	104
C_2l	93	96	94
C_dl	81	89	70
replacement	47.6	51.2	39.5
one planner	55%	55%	53%
C_1h	75	83	91
C_2h	117	109	116
C_dh	414	155	-
replacement	33%	34%	32%
one planner	24%	9%	0%
Avg. Replacement	42%	44%	37%
one planner	45%	50%	53%

- More redistribution first period (same consumption!)

- Replacement increases for h and decreases for l.

Employment and Disability

	$\lambda = 0.5$		$\lambda = 1$		$\lambda = 2$	
	Constrained	2 Principals	Constrained	2 Principals	Constrained	2 Principals
F(e_l)	25.8%	28.5%	45.1%	52.4%	72.3%	84.4%
F(e_h)	51.2%	41.8%	90.6%	66.5%	100.0%	89.9%
% disabled	67.8%	68.2%	43.5%	44.0%	20.7%	14.2%
autharky		53%		22%		0%

- e_l goes up and e_h goes down.

Welfare

	$\lambda = 0.5$	$\lambda = 1$	$\lambda = 2$
First Best	100.0	100.0	100.0
Constrained	92.7	95.4	98.3
Two Principals	91.7	93.1	96.5
Autharky	75.9	77.5	83.6

- Effects not negligible but small.

4.5 Redistribution and incentives

Redistribution (avg. Taxes on H)

	$\lambda = 0.5$	$\lambda = 1$	$\lambda = 2$
Optimal	55%	55%	53%
One planner	46%	44%	48%
two planners	45%	45%	46%

- Interaction with disability insurance incentives leads to lower income redistribution.
- Less so in later period.
- Disability much lower for high wage workers.
- Lack of coordination can lead to more equal disability.