DESIGNING OPTIMAL BENEFIT RULES FOR FLEXIBLE RETIREMENT

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1. Introduction

Macroformula for pensions:

$$\text{benefit} = \frac{\text{lifetime contribution}}{\text{remaining lifespan}}$$

i.e.

$$b = \frac{\tau R w}{t - R}$$

where
$w =$ total wage
$\tau =$ contribution rate
$b =$ benefit
$R =$ adult retirement age
$t =$ adult life span

Problem of 21st century

because life span increases,

- benefit/net wage decreases
- contribution rate increases
- retirement age increases (LECTURE)

How to deal with heterogeneity in LEXP
Flexible retirement

benefit depends on age at retirement

Naive proposal (NDC):

$$b = \frac{\tau R w}{m - R}$$

where $m = Et =$ average adult life span

but asymmetric information undermines the optimality

longer employment $\rightarrow$ longer lifespan

Memo: miner vs. professor

Table 0. Comparison of solutions

Benefits in terms of total wage
(1.25 net wage)
Retirement ages – 20 years
Yield–variance trade-off

Table 0. Summary results

	NDC	NEUT	EST
b_{50}	0.59	0.44	0.64
b_{55}	0.79	0.50	0.72
b_{60}	1.19	0.80	0.80
R_{50}	42.3	34.4	41.8
R_{55}	45.0	39.3	43.3
R_{60}	47.9	48.0	44.7
V	40.2	38.7	40.8
D^2	13.4	0	6.8

NDC unfair
NEUT low yield–no variance
EST optimal

Plan

1. Introduction
2. Theoretical background
3. Model
4. Redistribution vs. neutrality
5. First-best optimum
6. Second-best optimum
7. Numerical results
8. Conclusions

2. Theoretical Background

Optimum mechanism design

Two examples

- Optimal income tax (Mirrlees 1971)

makes people interested in working and paying taxes

asymmetric information calls for incentive compatibility: Nobel-prize

$\Rightarrow$ second best solution

- Insurance design (Rothschild–Stiglitz, 1976)

low risk must prove his type by accepting partial insurance

neutrality may be Pareto-inferior to redistribution

Optimal pension design

Diamond–Mirrlees (1978): opt. disability retirement

Now: Opt. old-age retirement incentives

Table 1. Models and assumptions

Author	Lifespan t	Labor disutility ε	Retirement age R	Benefit b
Fabel	2	fixed	contin.	arbitrary
Diamond	contin.	$\varepsilon(t)$	R_m, R_M	arbitrary
Simon.	contin.	arbitrary	contin.	linear
EST	discrete	fixed	contin.	arbitrary

3. Model

population: lifespan $t = S, \ldots, T$

mandatory pension system with life annuity

Table 2. Stages

Stage	worker	pensioner
consumption	$1 - \tau$	b_t
span	R_t	$t - R_t$
inst. utility	u	w

$u(x) = w(x) - \varepsilon$, τ fixed, $u = u(1-\tau)$

individual lifetime utility

$$v_t = R_t u + (t - R_t) w(b_t).$$

Lifetime balance: $z_t = \tau R_t - (t - R_t) b_t$

Budget constraint:

$$Z = \sum_{t=S}^{T} z_t f_t = 0$$

where $f_t =$ frequency of type t.

4. Redistribution vs. neutrality

Neutral: $z_t \equiv 0$:

$$R_t^N = \frac{b_t}{\tau + b_t} t, \qquad t = S, \ldots, T.$$

Inevitability of redistribution

Innocent assumption: increasing benefits: $b_{t+1} \geq b_t$

Additional plausible assumption

Moderate sensitivity to life expectancy:

$$R_{t+1} - R_t < \frac{b_t}{\tau + b_t} < 1$$

Strong form of redistribution

Decreasing balances:

$$z_S > \cdots > z_t > z_{t+1} > \cdots > z_T.$$

Theorem. Increasing benefits and moderate sensitivity $\rightarrow$
decreasing balances

Corollary: $z_S > 0 > z_T$

5. First-best optimum

- no asymmetric information

Two objective functions:

maximizing the average utility

and minimizing the variance of balances

unifi cation with penalty coeff. $\delta \geq 0$

- benevolent dictator

$$\max_{(b_t, R_t)_t} \sum_{t=S}^{T} [v_t - \delta z_t^2] f_t$$

subject to

$$\begin{aligned} v_t &= [u - w(b_t)]R_t + w(b_t)t, \\ z_t &= (\tau + b_t)R_t - tb_t, \end{aligned}$$

$$\sum^{T} z_t f_t = 0$$

First-best optimum

Theorem. First-best benefit: $b_t^* \equiv b^*$:

$$F(b^*) = 0.$$

First-best retirement age:

a) no penalty

$$R_t^* = R^* = \frac{b^*}{\tau + b^*} m.$$

b) penalty

$$R_t^N = \frac{b^*}{\tau + b^*} t.$$

R_t^N also no-penalty first-best but is not second-best, because

the govt. does not know $t \longrightarrow$

individuals underreport t

6. Second-best optimum

First-best problem

with incentive compatibility (IC) constraints:

(D) type $t+1$ prefers (b_{t+1}, R_{t+1}) to (b_t, R_t),

(U) type t prefers (b_t, R_t) to (b_{t+1}, R_{t+1}),

Corollary [Monotonicity]:

$$b_t \leq b_{t+1}, \qquad R_t \leq R_{t+1}.$$

(U) dropped and (D) reduced to (D=)

Simple optimal isoperimetric control problem:

$$v_{t+1} = v_t + w(b_t), \qquad t = S, \ldots, T-1$$

$v =$ state, $b =$ control

Two cases are distinguished:

(i) No penalty for redistribution (Utilitarian)
(ii) Penalty for redistribution

(i) No penalty

Theorem. Inflexible plan:

$$\hat{b}_t = b^* \quad \text{and} \quad \hat{R}_t = R^*$$

and second-best is first-best

(ii) Penalty

now first-best is not socially optimal:

too much redistribution from the short-lived to the long-lived
Corollary: $b_T = b^*$ (first-best).

Typical for second-best

Lagrange multipliers: λ to Z and μ_t to $\mathrm{IC_t}$

Theorem. Necessary First-Order Conditions

7. Numerical results

NFOC easy to solve numerically but this problem has many stationary solutions for $n > 3$

Run 1. Three types: $S = 50$ and $T = 60$, uniform.

No penalty: $R^* = 44$ years, $b^* = 0.8$

Run 2. Equivalent solutions, no penalty

Table 3. Equivalence

v_{50}	v_{55}	v_{60}	b_{50}	b_{55}	R_{50}
31.7	41.0	50.3	0.8	0.8	44.0
31.9	40.9	50.2	0.76	0.8	43.2

From now on positive penalty

- Run 3 Comparisons

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- analysis of imperfect benefit formulas
- more analytical results are needed