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Means-tested or Flat Pension? Pension Credit

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Abstract

Pension systems fight myopia and reduce old-age poverty. Our simple model introduces heterogeneous wages, flexible labor supply, progressive personal income tax and pension credit. The socially optimal transfer system is close to the means-tested one proposed by Feldstein (1987).

Keywords: myopia, flat-plus pension, means-tested pension, pension credit

JEL classification: H55, D91

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Rászorultsági vagy alapnyugdíj? Nyugdíjjóváírás!

Simonovits András

Összefoglaló

A nyugdíjrendszerek a jobban keresők rövidlátását és a rosszabbul keresők időskori szegénységét tompítják. Egyszerű modellünk heterogén béreket, rugalmas munkakínálatot, progresszív személyi jövedelemadót és *nyugdíjjóváírást* vizsgál. A társadalmilag optimális transzferrendszer közel van a Feldstein (1987) cikkben javasolt rászorultsági rendszerhez.

Tárgyszavak: rövidlátás, alapnyugdíj, rászorultsági nyugdíj, nyugdíjjóváírás

JEL kódok: H55, D91

1. Introduction

Mandatory pension systems have a number of functions. To name only two of the most important functions: these systems (i) force myopic workers to save for their old-age and (ii) alleviate old-age poverty of the low-earners. Evidently, contributions into a mandatory system diminish voluntary savings of life-cycler workers and influence the labor supply of myopic and life-cycler workers. A socially optimal pension system must harmonize these features carefully. In this paper we will study the socially optimal pension systems; distinguishing among proportional, means-tested, flat-plus and pension credit systems.

A universal flat pension alleviates old-age poverty with modest mandatory contributions but requires complementary proportional benefits to replace the income of the high-earner workers. A benefit proportional to lifetime contributions (contributive system) provides a generous relative pension for everybody but requires quite high mandatory contribution rate. If the benefit is the sum of the two pure benefits, then the resulting *flat-plus system* may correspond to both functions. Here the lower-paid retain their incentives to work and save but the higher-paid may not. Another solution is *means-testing*. Here the flat part is conditional and if the proportional benefit (in the income-tested variant) or the asset (in the asset-tested variant) is lower than the critical value, then the benefit is topped up to the minimum. In such a system, the high-earners retain the strong incentives to work and save, but the low-earners may have quite weak incentives to do so. To extend old-age income redistribution to young-age, a progressive personal income tax is introduced.

All these systems have a common generalization: *pension credit* or tapering (Clark and Emmerson, 2003). For a low proportional benefit (due to low earnings), only a fraction of it is added (i.e. credited) to the flat one, until the total benefit falls short of the proportional benefit, then this latter gives the total benefit. If the taper rate is either 0 or 1, then we have either a flat-plus or a means-tested system, respectively.

The issue of universal flat versus means-tested pensions was already discussed by Friedman and Cohen (1972): they suggested the replacement of the former by the latter, thus reducing the size of the welfare program. In his pioneering work, Feldstein (1987) analyzed a two-type model with fully myope and life-cycler types. For simplicity, he neglected wage heterogeneity and labor supply flexibility, thus the flat-plus benefit reduces to a flat benefit, and the asset-based means-tested benefit becomes zero for the life-cyclers. The government determines the socially optimal parameter values of the flat or means-tested pension system by maximizing a utilitarian social welfare function. Correcting for myopia, the government eliminates the discount factors when maximizes its paternalistic social welfare function. Feldstein found that the optimal means-tested system is typically welfare superior to the flat one. (For a refined version, see also Docquier, 2001.)

Cremer, De Donder, Maldonaldo and Pestieau (2008) generalized Feldstein (1987) by introducing flexible labor supply and wage heterogeneity. These factors, especially the latter call for universal flat-plus benefits, adding a proportional part to the flat part. For the sake of simplicity, the authors assumed that the distributions of wages and of the discount factors are independent and they concentrated their attention on the impact of the share of myopes in the population. They considered affluency-testing rather than means-testing and received interesting results on the structure of optimal flat-plus systems. (We do not adopt their adjective *linear* for our *flat-plus* because linear benefit can be mistaken for its special case, namely the proportional benefit.)

In a very sophisticated model, Sefton, van de Ven and Weale (2008) considered the pension credit and demonstrated: this innovation raises the savings of the low-earner but reduces the others', only modestly improving the overall situation.

In the present model, we combine and modify Feldstein's and Cremer et al.'s models in the following way: we assume flexible labor supply, wage heterogeneity, progressive income tax and implied earnings-related benefits, and compare proportional, means-tested, flat-plus and pension credit systems. Having a proportional pension component, we apply the means-testing and pension tapering to it rather than to the private savings.

At certain stages, analytical complications also compel us to apply numerical calculations. Our two-type result refine Feldstein's: means-testing may reduce the size of the optimal pension system and raise the social welfare.

Like the mentioned papers, ours also neglects the insurance function of the pension system. Varian (1980) and others strongly underlined the insurance provided by the flat-plus pension system, when the future earnings are uncertain at the start.

The structure of the paper is the following: Section 2 presents the analytical results. Section 3 numerically explores our findings. Section 4 concludes.

2. Analytical results

We start with the core of the model and then derive closed-form solutions for conditional optimal decisions. The section closes with the outline of the macroeconomic and welfare economic framework.

The core of the model

The population is stationary and the individual earnings are stationary. Every young person works and every old person is retired. A worker is employed for a unit time period and a pensioner enjoys his retirement for another period of the length μ, $0 < \mu \leq 1$. His total wage cost rate, for short, wage rate is a positive real w. We assume that his labor supply is a variable l, a real between 0 and T, therefore his lifetime earning is equal to wl. Denoting the (pension) contribution rate by τ, his lifetime contribution is equal to $\tau wl > 0$ and his benefit is b to be defined below. The pension system is balanced, i.e. its revenues are equal to its expenditures.

We assume that in addition to his pension contribution, a worker pays a proportional personal income tax θw and receives a cash-back $\iota > 0$, resulting in a progressive income tax with marginal tax rate θ. The total marginal tax rate is equal to $t = \tau + \theta$. In addition, the worker saves $s \ge 0$. Due to a private saving technology, as a pensioner, he will have capital $\mu^{-1}Rs$ to dissave, where $R > 1$.

Obviously, the individual's young- and old-age consumption intensities are respectively

$$c = (1-t)wl - s + \iota \quad \text{and} \quad d = b + \mu^{-1}Rs.$$

We shall need the lifetime budget constraint, free from private saving:

$$c + \mu R^{-1}d = (1-t)wl + \iota + \mu R^{-1}b.$$

First we introduce the special systems of flat-plus and means-tested pensions: $b = \alpha + \beta wl$ and $b = \max[\alpha, \beta wl]$ respectively. Next we define the generalized system, called *pension credit*. We assume that a given share of the proportional benefit βwl is deducted from the flat benefit α until the residual drops to zero. Denoting the *taper rate* (or 1–pension credit rate) by ε, $0 \le \varepsilon \le 1$, and using x_+ for the positive part of x: $x_+ = x$ if $x \ge 0$, $x_+ = 0$ otherwise, we have the formula

$$b(wl) = [\alpha - \varepsilon\beta wl]_+ + \beta wl.$$

It is worth rewriting the formula as follows:

$$b(wl) = \max[\alpha + (1-\varepsilon)\beta wl, \beta wl].$$

In words: the benefit is equal to the maximum of two quantities: (i) the flat plus the reduced proportional benefits and (ii) the proportional benefit.

To get rid of the notational complexities of branches, we shall introduce the simplifying notations

$$b(wl) = \tilde{\alpha} + \tilde{\beta}wl,$$

where

$$\tilde{\alpha} = \alpha \quad \text{and} \quad \tilde{\beta} = (1-\varepsilon)\beta \quad \text{if} \quad \alpha > \varepsilon\beta wl: \quad \text{flat-plus}$$

and

$$\tilde{\alpha} = 0 \quad \text{and} \quad \tilde{\beta} = \beta \quad \text{if} \quad \alpha \le \varepsilon\beta wl: \quad \text{proportional.}$$

Now the lifetime budget constraint becomes

$$c + \mu R^{-1}d = (1-t)wl + \iota + \mu R^{-1}(\tilde{\alpha} + \tilde{\beta}wl).$$

As was already mentioned in the Introduction, for $\varepsilon = 0$, the benefit reduces to a flat-plus benefit, while for $\varepsilon = 1$, the benefit rule simplifies to means-testing.

Optimal decisions

In this subsection, we shall determine the conditional optimal decisions. An individual's *subjective* lifetime utility function consists of two parts: (i) the worker's utility $u(c,l)$ and (ii) the pensioner's utility $\delta u(d,0)$, where δ is the discount factor, $0 \le \delta \le 1$. In formula,

$$Z(c,l,d) = u(c,l) + \mu\delta u(d,0).$$

To simplify the calculations, we shall use Cobb–Douglas utility functions:

$$u(c,l) = \log c + \xi \log(T-l) \quad \text{and} \quad u(d,0) = \log d + \xi \log T.$$

At this point, we shall separate the slack and binding credit constraints: $s > 0$ and $s = 0$. We shall start with the former and continue with the latter.

Slack credit constraint

If a type has a slack credit constraint, he decides on two variables, namely s and l. Insert the formulas for c and d into Z. Looking for the subjective optimum, take the partial derivatives of

$$Z = \log((1-t)wl - s + \iota) + \xi\log(T-l) + \mu\delta\log(\tilde{\alpha} + \tilde{\beta}wl + \mu^{-1}Rs)$$

with respect to s and l and equate them to zero. Returning to c and d yields

$$Z_s = \frac{-1}{c} + \frac{\delta R}{d} = 0$$

and

$$Z_l = \frac{(1-t)w}{c} - \frac{\xi}{T-l} + \frac{\mu\delta\tilde{\beta}w}{d} = 0.$$

$Z_s = 0$ implies $d = \delta Rc$. Substituting it into $Z_l = 0$ and using the lifetime budget constraint provides the optimal variables respectively. In details, introducing notation

$$\pi = 1 - t + \mu\tilde{\beta}R^{-1}$$

equation $Z_l = 0$ reduces to

$$\frac{\pi w}{c} = \frac{\xi}{T-l}.$$

Using $d = \delta Rc$ again and introducing notation $\iota^* = \iota + \mu R^{-1}\tilde{\alpha}$, we obtain

$$(1+\mu\delta)c = \pi wl + \iota^*.$$

Substituting the optimal labor supply l into the last equation, c can also be eliminated:

$$l^{\mathrm{S}} = \frac{(1+\mu\delta)\pi T - \xi\iota^*/w}{(1+\mu\delta+\xi)\pi}.$$

Hence c and d obtain.

Binding credit constraints

Now the worker has only a single variable l to optimize with the constraint $d \geq \delta R c$. Taking the derivative of

$$Z = \log((1-t)wl + \iota) + \xi \log(T - l) + \mu\delta \log(\tilde{\alpha} + \tilde{\beta} wl)$$

with respect to l and equate it to zero yields

$$Z_l = \frac{(1-t)w}{(1-t)wl + \iota} - \frac{\xi}{T - l} + \frac{\mu\delta\tilde{\beta}w}{\tilde{\alpha} + \tilde{\beta}wl} = 0.$$

In general, we obtain a quadratic equation $Al^2 + Bl + C = 0$ for l^{B} with coefficients

$$A = (1-t)\tilde{\beta}w^2(1 + \mu\delta + \xi),$$

$$B = (1-t)(1+\xi)\tilde{\alpha}w + \xi\iota\tilde{\beta}w - (1-t)(1+\mu\delta)T\tilde{\beta}w^2 + \mu\delta\tilde{\beta}w\iota$$

and

$$C = \xi\iota\tilde{\alpha} - \mu\delta\tilde{\beta}w\iota T - (1-t)w\tilde{\alpha}T.$$

Note that B stands for binding, while B is a coefficient in the quadratic equation.

For suitable parameter values, the optimal decisions are feasible: $s \geq 0$ and $0 < l < 1$. For given parameter values, one must find out whether a given worker has a slack or a binding credit constraint.

Macroeconomy and social welfare maximization

Having solved the individual optimization problems, we turn to the macrovariables. Let $\mathbf{P}$ be the joint probability distribution of types and $\mathbf{E}$ be the corresponding expectation operator. The average wage rate, the average labor supply, the average labor income and average benefit are respectively equal to

$$\overline{w} = \mathbf{E}w, \qquad \bar{l} = \mathbf{E}l, \qquad \overline{wl} = \mathbf{E}(wl), \qquad \bar{b} = \mathbf{E}b.$$

We shall normalize the average wage rate: $\overline{w} = 1$, then the absolute constants ι and α will be given in natural units.

The pension and the tax systems are balanced if

$$\tau\overline{wl} = \mu\bar{b} \quad \text{and} \quad \theta\overline{wl} = \iota.$$

The existence of general equilibrium in this simple model is not easy to prove, especially because one type may have a slack credit constraint and another one may have a binding one.

Finally, we outline the government's welfare maximizing task. As a starting point, we define a *paternalistic* utility function for a typical individual as

$$U(c, l, d) = u(c, l) + \mu u(d, 0),$$

where the myopic discounting is eliminated.

The utilitarian social welfare function is defined as the average of the paternalistic utilities:

$$V = \mathbf{E}U(c, l, d).$$

The government looks for policy parameter values such that maximize the social welfare function. Since the numerical value of this function has no economic meaning, it is customary to compare two systems, say X and Y as follows. System Y has efficiency e (a positive scalar) with respect to system X, if multiplying the wages uniformly by e in X, then the two welfares become equal: $V_X(e) = V_Y$.

3. Numerical explorations

Since we have too few analytic results, we explore our findings numerically. That way we obtain new qualitative results and illustrate our earlier findings. We choose the following arbitrary parameter values: $T = 1.6$, $R = 1.3$ and $\xi = 1.5$. We start the discussion with the representative worker and then move to the case of two types.

In the case of the representative worker, with $\delta = 0.7$, the labor supply is $l^{\mathrm{o}} = 0.758$, the socially optimal solution is $\tau^{\mathrm{o}} = 1/3$, with the consumption pair $c^{\mathrm{o}} = d^{\mathrm{o}} = 0.505$.

We turn to the case of two types: $I = 2$ with low-earner: L and high-earner: H. Assume $w_L < w_H$. In conformity with reality, low-earners have a lower discount factor than the high-earners: $0 < \delta_L < \delta_H \leq 1$. As a standardization, we assume that $\overline{w} = 1$. We shall use the parameter values: $\delta_L = 0.5$ and $\delta_H = 0.7$; $f_L = 3/4$, and $w_L = 0.5$, $w_H = 2.5$. Tables 1 and 2 display the endogenous parameter values and the subjective optimal outcomes of the socially optimal pension credit system (row 1) and of the suboptimal means-tested system (row 2) and flat-plus one (row 3).

Table 1 displays the optimal parameter values. Note that the optimal pension credit rate (approximately 0.75) is much closer to the means-tested value (1) than to the flat-plus (0). The former's efficiency is almost equal to the optimal one, while the latter's is much lower: wages must be uniformly increased by 5% in the flat-plus system to achieve the same social welfare as the pension credit. The contribution rate oscillates: it is lowest for the means-tested system, but the efficiency is highest for the pension credit. Note the significant role of the personal income tax (neglected by the other elementary models): $\theta \approx 0.23$ and $\iota \approx 0.13$. However, the price paid for the strong redistribution is quite high: the aggregate labor supply $\overline{wl} = 0.57$ is quite low.

Table 1. *Parameters of the optimal systems: two types*

Type	Pension credit rate ε	Marginal accrual rate β	Flat part α	Contribution rate τ	Cash-back ι	Marginal income tax rate θ	Reciprocal efficiency e
pension credit	0.75	0.22	0.25	0.250	0.14	0.245	1.000
means-tested	1	0.15	0.25	0.219	0.13	0.224	1.005
flat-plus	0	0.10	0.23	0.250	0.13	0.234	1.051

Table 2 displays the individual outcomes: with the pension credit, the low-earner's labor supply is very low: $l_L = 0.32$, while that of the high-earner's is quite high: $l_H = 0.71$. With the means-tested system, the low-earner's labor supply is larger (0.36), while the high-earner's labor supply is roughly the same (0.71). With the flat-plus system, the low-earner's labor supply remains (0.36), while the high-earner's labor supply is less (0.67). The consumption pairs vary similarly and even the low-paid's old-age consumption d_L is quite high with respect to the own share $w_L l_L/(1+\mu)$, namely $0.25 \gg 0.5 \times 0.32/1.5 \approx 0.1$.

Table 2. *Outcomes in optimal systems: two types*

		Low-earner		High-earner			
Type	labor l_L	young consumption c_L	old consumption d_L	labor l_H	saving s_H	young consumption c_H	old consumption d_H
pension credit	0.319	0.221	0.259	0.708	0.157	0.877	0.798
means-tested	0.360	0.230	0.250	0.713	0.215	0.909	0.827
flat-plus	0.360	0.223	0.248	0.675	0.146	0.856	0.779

For other parameter values, the numbers vary, but we expect the ranking remains the same.

4. Conclusions

We have introduced flexible labor supply, wage heterogeneity, progressive income tax and proportional benefit component into Feldstein's model and obtained similar qualitative results, at least for our parameter sets. Evidently, the main advantage of the means-tested pension system over the flat-plus one lies in its ability to redistribute income from the life-cyclers to the myopes, without undermining the life-cyclers' labor supply and old-age saving. It needs further theoretical and numerical work to corroborate the result: *an optimal means-tested pension system is socially superior to an optimal flat-plus pension system. Tapering* (i.e. using pension credit) is a common generalization of both systems, and as such, its social optimum produces outcomes which should be *superior to both means-tested and flat-plus systems.*

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