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Means-tested or Flat Pension? Pension Credit*

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Abstract

In a pioneering model, where workers only differ in their discount factors, Feldstein (1987) found that typically if not always, the socially optimal means-tested pension is welfare-superior to the corresponding flat pension. In this paper, we introduce flexible labor supply, heterogeneity of wages and add proportional (contributive) pensions. We corroborate Feldstein's result and extend the analysis to pension credit, where the benefit is the maximum of the flat plus the tapered proportional benefit and the full proportional benefit.

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1. Introduction

Mandatory pension systems have a number of functions. To name only two of the most important functions: (i) mandatory pension systems force myopic workers to save for their old-age and (ii) these systems alleviate old-age poverty. 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: proportional, means-tested, flat plus and pension credit systems.

A universal flat pension (e.g. the Dutch and the original British systems) alleviates old-age poverty with modest mandatory contributions but requires complementary benefits. (Note, however, that the Dutch flat benefit is only proportional to the number of years *spent* in the Netherlands, while the British flat benefit is proportional to the number of years *worked* Great Britain.) A benefit proportional to lifetime contributions (contributive system, e.g. the German 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 *flat plus system* may correspond to both functions (e.g. the American or the Swiss system). Another solution is *means-testing.* 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 minimum value, then the benefit is topped up to the minimum (e.g. the second part of the British basic pension, introduced in 1997). In such a system, the higher-paid retains the strong incentives to work and save, but the lower-paid may have quite weak incentives to do so.

All these systems have a common generalization: *pension credit* or tapering. For a low proportional benefit, 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. Such systems operate in Sweden, Finland etc. For example, the second part of the British public pension was relaxed by the introduction of a pension credit in 2003 (Clark and Emmerson, 2003). If the taper rate is either 0 or 1, then we have either a flat plus or a means-tested system, respectively. In fact, the pension credit is a generalized means-tested system, or more usually, means-testing with a fixed minimum could be called *pure* means-testing.

The issue of universal 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 and a three-type model (Parts I and II, respectively) with fully myope, life-cycler and partially myope types. For simplicity, he neglected wage heterogeneity and labor supply flexibility, thus the flat plus benefit reduces to a flat benefit, and the means-tested benefit is zero for the life-cyclers. At a higher level, 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. Feldstein found that the optimal means-tested system is welfare superior to the flat one. Turning to the exceptions: a means-tested pension can be socially inferior to a universal one, because (i) the former "may induce some utility-maximizing workers to save nothing" or (ii) to avoid problem (i), the means-tested benefit is set lower than socially optimal. (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) introduced the pension credit and demonstrated: it raises the savings of the lower-paid but reduces the others', only modestly improving the overall situation. Similar issues have surfaced in the reform of Chile's means-tested pension system (Barr and Diamond, 2008, Section 13.2). Finally, Simonovits (2009) and Valdés-Prieto (2009) extended the analysis to a very important case, where workers can underreport their true earnings by choosing self-employment, albeit with reduced enjoyment or labor productivity, respectively.

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 and implied earnings-related benefits, and compare proportional, means-tested, flat plus and pension credit systems. Even the replacement of fully myopes with partially myopes do not make pension credit socially optimal unless we strengthen the incentive compatibility constraint: the flat benefit should be definitely lower than the life-cyclers' proportional one.

At certain points, analytical complications also compel us to apply numerical calculations. Our two-type results corroborate Feldstein's: means-testing generally reduces the size of the optimal pension system and always makes it welfare superior to the optimal flat plus system.

Like the mentioned papers, ours also neglects the insurance function of the pension system. Varian (1980) and Barr and Diamond (2008, Chapter 7) strongly underlined the insurance provided by the flat plus pension system, when the future earnings are uncertain at the start. Following this line of thought, Fehr and Habermann (2008) created a computable general equilibrium model with individual risk of career paths and life spans and determined numerically the key parameters of the socially optimal "progressive pension arrangement" without considering means-testing or pension credit. Their optimum is a strongly progressive system.

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

2. Analytical results

We start with the core of the model and then discuss two cases: the first type is either fully or partially myopic, while the second type is always life-cycler.

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 same length. 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 1, 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 saves $s \geq 0$. Due to a saving technology, as a pensioner, he will have capital Rs to dissave, where $R > 1$.

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

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

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, $0 \leq \delta \leq 1$. In formula,

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

We consider the following two types: myopes and life-cyclers with population shares f_M and $f_L = 1 - f_M$, respectively, $0 < f_M < 1$. As a realistic simplification, we assume that the myopes' wage rate is at most as high as the life-cyclers': $w_M \leq w_L$. (A fuller treatment would also introduce low-paid life-cyclers and high-paid myopes but without using Cremer et al.'s independence assumption.) The myopes' discount factor δ_M lies between 0 and 1.

Having solved the individual optimization, we turn to the macrovariables. The average wage rate, the average labor supply, the average labor income and average benefit are respectively equal to

$$\overline{w} = f_M w_M + f_L w_L, \qquad \bar{l} = f_M l_M + f_L l_L$$

and

$$\overline{wl} = f_M w_M l_M + f_L w_L l_L, \qquad \bar{b} = f_M b_M + f_L b_L.$$

The pension system is balanced if

$$\tau \overline{wl} = \bar{b}.$$

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

$$U(c_i, l_i, d_i) = u(c_i, l_i) + u(d_i, 0), \qquad i = M, L,$$

where the myopic discounting is eliminated. For type L, the paternalistic utility is identical to the subjective one: $U_L = Z_L$.

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

$$V = f_M U(c_M, l_M, d_M) + f_L U(c_L, l_L, d_L).$$

The government looks for policy parameter values such that maximize the social welfare function.

To simplify 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 simpler and the more complicated cases: the fully myopes and the partially myopes.

Fully myopes

For the fully myopes, $\delta_M = 0$, $s_M = 0$ and taking the derivative of

$$Z_M = \log((1-\tau)w_M l_M) + \xi \log(T - l_M)$$

with respect to l_M and equate it to zero yields

$$\frac{1}{l_M} - \frac{\xi}{T - l_M} = 0.$$

Hence

$$l_M = \frac{T}{1+\xi}, \qquad c_M = (1-\tau)w_M l_M \quad \text{and} \quad d_M = b_M.$$

For the life-cyclers, $\delta_L = 1$ and the determination of the optimal saving $s_L > 0$ yields $d_L = Rc_L$, at least for sufficiently low contribution rates.

To determine the life-cyclers' optimal labor supply, we must study each of the three pension systems separately. Let us start with the *proportional system:* $b = \beta w l$, where $\beta \geq 0$ is the accrual rate.

Note that the lifetime budget constraint

$$c_L + R^{-1} d_L = (1-\tau) w_L l_L + R^{-1} \beta w_L l_L$$

simplifies with notation $\pi = 1 - \tau + R^{-1}\beta$ and $d_L = Rc_L$ to $2c_L = \pi w_L l_L$.

Taking the derivative of

$$Z_L = \log((1-\tau)w_L l_L - s_L) + \xi \log(T - l_L) + \log(\beta w_L l_L + R s_L)$$

with respect to l_L and equate it to zero yields

$$\frac{(1-\tau)w_L}{c_L} - \frac{\xi}{T - l_L} + \frac{\beta w_L}{d_L} = 0.$$

Substituting $d_L = Rc_L$ into our last equation and using the simplified budget constraint provides the optimal L-variables respectively

$$l_L = \frac{2T}{2+\xi} \quad \text{and} \quad c_L = \pi w_L \xi^{-1}(T - l_L) = \frac{\pi T w_L}{2+\xi}.$$

The balance condition is simply $\beta = \tau$. Because of $R > 1$, the higher τ is, the lower is π, i.e. c_L and d_L. To raise the myopes' old-age consumption $d_M = \tau w_M l_M$, however, τ should be so high that only small if any room is left for private saving of L. Note that $l_L > l_M$.

One way of relaxing the tension arising in a proportional system is to *means-test* the benefits, i.e. to top up insufficient benefits to a minimum $\gamma\overline{w}$, where γ is a positive real: $b_i = \max(\gamma\overline{w}, \beta w_i l_i)$. (In Feldstein's asset-tested variant, $\beta = 0$, therefore $b_M = \gamma\overline{w}$ and $b_L = 0$, and the saving s_L excludes help. Note, however, that mimicking the myopes, the life-cyclers may not save if saving is against their own interest.) Here we simply assume that the life-cycler's pension is at least as high as that of the means-tested benefit: $\beta w_L l_L \geq \gamma\bar{w}$.

For any given τ, in the means-tested system, l_L and c_L are the same functions as in the proportional one. Now the balance equation is

$$f_M \tau \frac{w_M T}{1+\xi} + f_L(\tau - \beta)\frac{2w_L T}{2+\xi} = f_M \gamma\overline{w}.$$

Here γ is a linear function of τ and β, making the qualitative analysis easy, at least in principle.

Another improvement on the proportional system is to introduce a *flat plus system*; benefit b consists of two parts: a universal flat benefit $\alpha\overline{w} \geq 0$, and a proportional benefit: βwl, where β is the *marginal* rather than average accrual rate. Therefore $b = \alpha\overline{w} + \beta wl$. Then the life-cycler's labor supply turns into

$$l_L = \frac{2T}{2+\xi} - \frac{\xi R^{-1}\alpha\overline{w}}{\pi w_L(2+\xi)},$$

the formulas $c_L = \pi\xi^{-1}(T - l_L)w_L$, $d_L = Rc_L$ remain valid and the balance condition becomes

$$(\tau - \beta)\left[f_M \frac{w_M T}{1+\xi} + f_L \frac{2w_L T}{2+\xi}\right] = \alpha\overline{w}\left[f_L \frac{(\tau-\beta)\xi R^{-1}}{\pi(2+\xi)} + 1\right].$$

Note that here α is a nonlinear function of τ and β, making the qualitative analysis quite difficult. Anyway, for a fixed τ, raising α diminishes β, increases π, hence diminishes l_L.

Both modified pension formulas are progressive in the sense that the ratio of benefit to lifetime earning is a decreasing function of the latter.

We have two *conjectures: (i) the size of the optimal means-tested system is smaller than the optimal flat plus one's but it provides higher social welfare; (ii) the weaker the wage inequality, the stronger is the link between contributions and benefits in the optimal flat plus system.*

The calculation of the welfare e equivalence is extremely simple. Let $V_P(E)$ be the social welfare as a function of the uniform wage coefficient E of the proportional system, and let V_G be the social welfare function provided by the progressive system with unit average wages. Also, $V_P = V_P(1)$. The efficiency of the latter in terms of the former is defined by the implicit function $V_P(E_G) = V_G$. Since the individual optimal consumptions in the proportional system are also proportional to the wages, while the labor supplies are independent of them, $V_P(E_G) = V_P + 2\log E_G$, i.e. $E_G = e^{(V_G - V_P)/2}$. Similarly for the means-tested system, $E_M = e^{(V_M - V_P)/2}$.

Partially myopes with pension credit

For the partially myopes, $0 < \delta_M < 1$, $s_M = 0$ and the analysis is more involved. To save space, we immediately jump to the generalized system called *pension credit*. We assume that a given share of the proportional benefit is deducted from the flat benefit until the residual drops to zero. Denoting the *taper 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

$$b = [\alpha\bar{w} - \varepsilon\beta wl]_+ + \beta wl.$$

It is worth rewriting the formula as follows:

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

As was already mentioned in the Introduction, for $\varepsilon = 0$, the benefit reduces to a flat plus benefit: $b = \alpha\bar{w} + \beta wl$, while for $\varepsilon = 1$, the benefit rule simplifies to means-testing: $b = \max[\alpha\bar{w},\ \beta wl]$.

We assume that the parameter values of the system are such that M enjoys the pension credit, while L does not:

$$b_M = \alpha\bar{w} + (1-\varepsilon)\beta w_M l_M > \beta w_M l_M \quad \text{and} \quad b_L = \beta w_L l_L > \alpha\bar{w} + (1-\varepsilon)\beta w_L l_L.$$

The partially myopes' optimal labor supply becomes

$$l_M = \frac{(1+\delta_M)T}{1+\delta_M+\xi}.$$

The formulas for the life-cycler obtained for the proportional benefit remain in force, but the formulas for the myope are new. Taking the derivative of

$$Z_M = \log((1-\tau)w_M l_M) + \xi\log(T - l_M) + \delta_M \log(\alpha\bar{w} + (1-\varepsilon)\beta w_M l_M)$$

with respect to l_M and equate it to zero yields

$$\frac{1}{l_M} - \frac{\xi}{T - l_M} + \frac{\delta_M(1-\varepsilon)\beta w_M}{\alpha\bar{w} + (1-\varepsilon)\beta w_M l_M} = 0.$$

In general, we obtain a quadratic equation $Al_M^2 + Bl_M + C = 0$ for l_M with coefficients

$$A = (1+\delta_M+\xi)(1-\varepsilon)\beta w_M, \quad B = -(1+\delta_M)(1-\varepsilon)\beta w_M T - \alpha\bar{w}(1+\xi), \quad C = -\alpha\bar{w}T.$$

This determines c_L and d_L.

Continuing our conjectures, we note that the optimal taper rate may depend on the parameter values of the system in a very complex way. It can even occur that the optimal taper rate is equal to 1, i.e. the system simplifies to means-testing.

3. Numerical illustrations

Since we have too few analytic results, we illustrate our findings numerically. We shall use a modest value for the interest factor: $R = 1.3$. Here we choose $T = 1.6$ and $\xi = 1.5$. As a standardization, we assume that $\overline{w} = 1$. We shall start with the case when the myope is fully myope: $\delta_M = 0$, no pension credit is needed, and close with the case when the myope is only partly myopic, then pension credit is needed.

Fully myopes

We study the impact of the relative frequency f_M and relative wage rate w_M of myopes on the three pension systems without pension credit. To obtain simple results, f_M is either 0.5 or 0.75, while w_M is either 0.5 or 1, yielding $w_L = 1.5$ or 1 or 2.5 or 1, respectively.

In the proportional system, $\beta = \tau$, therefore the former is omitted from the Table 1. The excessive values are direct consequences of our simplifying assumption, namely making the length of the retirement period equal to the working period. The optimal contribution rate increases with the myopes' frequency but is independent of the degree of wage inequality (Table 1). Since we calculate the relative efficiencies in terms of the proportional system, the efficiency values are now uniformly equal to unity. Note that the third row is italicized here as well as in Tables 2 and 3, since they will be reused in Table 4.

Table 1.
The impact of myopes' frequency and wage inequality on a proportional system

Frequency of myopes f_M	Wage of myopes w_M	Contribution rate τ	Average labor supply $\bar{l}$	Efficiency E
0.50	0.5	0.437	0.777	1
0.50	1.0	0.437	0.777	1
0.75	*0.5*	*0.478*	*0.709*	*1*
0.75	1.0	0.478	0.709	1

Table 2 presents the optimal parameter values of the means-tested system. Note that the labor supplies remain as before, but due to redistribution, the means-tested system is smaller and more efficient than its proportional counterpart, especially for wage heterogeneity.

Table 2.

The impact of myopes' frequency and wage inequality on a means-tested system

Frequency of myopes f_M	Wage w_M	Contribution rate τ	Marginal accrual rate β	Relative minimum benefit γ	Average labor supply $\bar{l}$	Efficiency E
0.50	0.5	0.347	0.214	0.293	0.777	1.191
0.50	1.0	0.400	0.340	0.311	0.777	1.021
0.75	*0.5*	*0.414*	*0.147*	*0.336*	*0.709*	*1.320*
0.75	1.0	0.458	0.355	0.325	0.709	1.014

Finally, Table 3 documents that in the flat plus system, with the rise of the myopes' share, the socially optimal contribution rate also rises but the L-labor supply sinks. For homogeneous wages, the efficiency of the flat plus system is practically equal the proportional system's. For heterogeneous wages, the flat plus system reduces to pure flat system and its efficiency is 16.4% or 29.3% higher than the proportional one's if the frequency is symmetric or asymmetric, respectively (cf. Tables 1 and 3).

Table 3.

The impact of myopes' frequency and wage inequality on a flat plus system

Frequency of myopes f_M	Wage w_M	Contribution rate τ	Marginal accrual rate β	Relative flat benefit α	Average labor supply $\bar{l}$	Efficiency E
0.50	0.5	0.317	0	0.249	0.737	1.164
0.50	1.0	0.417	0.250	0.125	0.750	1.005
0.75	*0.5*	*0.392*	*0*	*0.302*	*0.692*	*1.293*
0.75	1.0	0.469	0.287	0.126	0.695	1.004

Comparing the two modifications of the proportional system, we see that in all the four cases, the optimal means-tested system is more efficient than its flat plus counterpart, while its size is comparable to the other's (cf. Tables 2 and 3).

Next we display the optimal consumption pairs and labor supplies for the three socially optimal systems in the case of the italicized cases, namely when $f_M = 0.75$ and $w_M = 0.5$.

Table 4. *Characteristics of three socially optimal systems*

Type	labor supply l_M	Myopic young consumption c_M	old d_M	labor supply l_L	Life-cycler saving s_L	young consumption c_L	old d_L
Proportional	0.640	0.167	0.153	0.914	0.176	1.017	1.322
Means-tested	0.640	0.188	0.336	0.914	0.540	0.799	1.039
Flat plus	0.640	0.195	0.302	0.849	0.529	0.761	0.990

Remark. $f_M = 0.75$ and $w_M = 0.5$.

Note that the myopes' labor supply is independent of the pension system, but the life-cyclers' labor supply is much lower in the flat plus system than in the proportional or the means-tested one: $0.849 < 0.914$. This is the main weakness of the flat plus system with respect to the means-tested: not only the myopes' old-age consumption is lower but the life-cyclers' young- and old-age consumption, too.

Partially myopes

To make room for the pension credit, we raise the discount factor from 0 to 0.5 to transform the fully myopic into a partially myopic type. We shall consider two cases: the fixed benefit $\alpha\bar{w}$ is a) unconstrained and b) constrained. For lack of space, we confine the calculations to our preferred case $f_M = 0.75$ and $w_M = 0.5$.

Tables 5 and 6 display the results. To obtain a new base, we also recalculate the optimal proportional system with $\delta_M = 0.5$. Due to the myope's increased labor supply $(0.8 > 0.64)$, the partially myope's consumption increases in both periods in the proportional system.

In the socially optimal unconstrained pension credit system the taper rate is equal to 1, i.e. we end up with means-testing. The efficiency gain is 24%! Note, however, that the two benefits are almost equal to each other: $b_M \approx b_L \approx 0.32$, just satisfying the incentive compatibility constraint: $\alpha\bar{w} \approx \beta w_L$. Therefore we constrain the flat benefit to 0.25. In this case, the marginal accrual rate rises from 0.14 to 0.19; and the benefits diverge: $0.275 < 0.434$. Though the efficiency gain drops to 19.7%, but the system becomes robust.

Table 5. Optimal parameter values of three selected systems

Type	Contri-bution rate τ	Marginal accrual rate β	Relative flat benefit α	Taper rate ε	Efficiency E
Proportional	0.450	0.450	0	0	1
Unconstrained	0.394	0.140	0.320	1	1.240
Constrained	0.385	0.190	0.250	0.6	1.197

Table 6. *Characteristics of three selected systems*

	Myopic			Life-cycler			
Type	labor supply l_M	young consumption c_M	old consumption d_M	labor supply l_L	saving s_L	young consumption c_L	old consumption d_L
Proportional	0.800	0.220	0.180	0.914	0.233	1.024	1.331
Unconstrained	0.640	0.194	0.320	0.914	0.569	0.815	1.060
Constrained	0.657	0.202	0.275	0.914	0.536	0.870	1.131

4. Conclusions

We have introduced flexible labor supply, wage heterogeneity and proportional benefit component into Feldstein's model and obtained the same 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* (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.*

At the end, we note that the lack of redistribution in the working period may distort the picture. If we introduced progressive income taxation, then probably the optimal degree of redistribution in the pension system would be weaker than without it. But this is a task of a next paper.

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