



Boston 2008 Joint International Colloquium

THE BASICS OF PENSION FINANCE

- * the demography (longevity) of pension finance
- * the economics of pension finance

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The algebra of pension plan finance

DEMOGRAPHY (LONGEVITY) and PENSIONS

An utmost simple approach is used,

‘Average’ participant, who enters the plan at age a (f.i. 25), works T years (f.i. 40). Pension age 65 and length of pension period p years.

Pension result α (f.i. 0.7) of final income S_{65} ; interest rate r
(= discount rate)

growth rate earnings g and pension benefits are indexed to prices (w).



The algebra of pension plan finance

The contribution rate under funding

With,

g earning growth rate

r interest rate

w indexation rate of pension payment

T period of contribution payment

p period of pension payment

α pension result (: 0.7)

$$\text{Pr}^{\text{funding}} = \alpha \cdot \left(\frac{g-r}{w-r} \right) \cdot \frac{e^{(w-r)p} - 1}{1 - e^{(r-g)T}}$$



The algebra of pension plan finance

The contribution rate under pay-as-you-go

With,

T period of contribution payment

p period of pension payment

α pension result (: 0.7)

n (stable) population growth rate

$$\text{Pr}^{\text{payg}} = \alpha \cdot 1 \cdot \frac{e^{np} - 1}{e^{np} \cdot (e^{nT} - 1)}$$



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Table 1. Premium under funding versus real interest rate and length of retirement period ($\text{age}^{\text{ret}} = 65$)

$p \setminus r$	-1%	0%	1%	2%	4%	6%
10	22.3	17.5	13.5	10.4	5.8	3.2
15 (present situation)	34.4	26.3	19.8	14.8	8.0	4.1
20	47.0	35.0	25.8	18.8	9.8	4.9
30	74.8	52.5	36.9	25.8	12.4	5.8



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Table 1. Premium under funding versus real interest rate ($p=15$), cont.

age^{ret} \ r (real)	-1%	0%	1%	2%	4%	6%
60	38.4	30.0	23.3	17.9	10.3	5.8
65 (present situation)	34.4	26.3	19.8	14.8	8.0	4.1
70	31.3	23.3	17.2	12.4	6.3	3.0



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P_r^{funding} , real interest rate and longevity

Concluding: it appears that contribution levels under funding are much more sensitive to capital returns than to longevity or to the age of retirement

e.g. given $p=15$ premium rises from 14.8% to 19.8% when real interest rate falls from 2% to 1% and further to 26.3% when real interest rate is zero. More than doubling.

Equivalent to a rise of the contribution rate from 14.8% to 25.8% as a result of a doubling of the pension period from 15 to 30 years (with $r = 2\%$)



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Table 2. Premium under funding versus real interest rate and indexation of current pensions ($T=40$, $p=15$)

$r^{(\text{real})}$	<u>fully indexed</u>	<u>no indexation</u>			
		$r=5\%$, $g=4\%$	$r=4\%$, $g=3\%$	$r=3\%$, $g=2\%$	$r=2\%$, $g=1\%$
1%	19.8	15.0	16.1	17.2	18.4
2%	14.8	$r=6\%$, $g=4\%$	$r=5\%$, $g=3\%$	$r=4\%$, $g=2\%$	$r=3\%$, $g=1\%$
		11.3	12.1	12.9	13.8



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Table 2. Premium under funding versus real interest rate and indexation of current pensions ($T=40$, $p=15$), cont.

$r^{(\text{real})}$	<u>fully indexed</u>	<u>no indexation</u>			
		$r=5\%$, $g=4\%$	$r=4\%$, $g=3\%$	$r=3\%$, $g=2\%$	$r=2\%$, $g=1\%$
1%	19.8	15.0	16.1	17.2	18.4
4%	8.0	$r=8\%$, $g=4\%$	$r=7\%$, $g=3\%$	$r=6\%$, $g=2\%$	$r=5\%$, $g=1\%$
		6.2	6.6	7.0	7.5



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P_r^{funding} , real interest rate and longevity

Concluding: it appears that contribution levels under funding can be decreased more considerably if current pensions are not indexed when the earnings growth rate is fairly high.

e.g. given real interest = 2%, the premium falls from 14.8% to 13.8% when $\{g=1\%, r=3\%\}$ and to 11.3% when $\{g=4\%, r=6\%\}$



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Table 3. Premium under **payg** versus population growth rate and length of retirement period and working period ($\text{age}^{\text{ret}} = 65$; $T=40$)

$p \setminus n$	2%	1%	0%	-1%
10	10.4	13.5	17.5	22.3
15	14.8	19.8	26.3	34.4
20	18.8	25.8	35.0	47.0
30	25.8	36.9	52.5	74.3



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Table 3. Premium under **payg** versus population growth rate and length of retirement period and working period (entry age 25) Cont.

p \ n	2%	1%	0%	-1%
10 (retir. age 70)	8.7	11.7	16.5	20.3
15 (present situation: retir. age 65)	14.8	19.8	26.3	34.4
13 (retir. age 67)	12.2	16.3	21.7	28.3
20 (retir. age 60)	22.8	30.3	40.0	52.5
30 (retir. age 60)	31.2	43.3	60.0	82.9



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Concluding: under pay-as-you-go the growth rate of population and longevity are crucial variables, like real capital return is under funding.

e.g. with $p=15$ premium is 19.8% when real interest rate is 1% or population growth rate is 1% ($p=15$).

In European countries with aging and a population growth rate towards zero (or less) the payg contribution rate cet. par. rises from about 20% to 40%.



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ECONOMICS OF PENSIONS

In respect of pension finance there appears to be

- * 2 real issues
- * 2 misunderstandings



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FIRST REAL ISSUE [on a national level]

The sustainability of future pension payments depends on the future productive capacity

→ a larger pie gives bigger slices for all

Relative changes between age groups, but
more welfare for all



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THE COSTS OF A PENSION PLAN

the resources forgone

or: that part of total income used to support
the retired population



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FIRST MISUNDERSTANDING

- no redistribution over time on a national level
(micro- versus macro-level)
- due to a fallacy of composition



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FALLACY OF COMPOSITION

“ to assume that because something is true for an individual, it is (necessarily) true on aggregate “



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ANOTHER MECHANISM

- no redistribution over time on a national level
- there appears to be another mechanism:
more investment → larger resource base



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CONSEQUENCES

- more pension savings and more national savings
 → higher capital intensity
- relative abundance of capital and scarcity of labour
- lower interest rates and higher wage rates



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SECOND REAL ISSUE [on a personal level]

funding as an instrument

- to save more today and to dissave (consume) more tomorrow
- for securing accrued pension rights



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SECOND MISUNDERSTANDING

under funding no controversy between pensioners
and workers

- production function, $Y_t = K_t^\alpha \cdot L_t^{1-\alpha} \cdot e^{mt}$
- psychological / political point of view



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the nature of pensions: **NOTE THAT**

- pension rights = claim on future output
- ownership of pension capital = resource base of
the retired
- pay-as-you-go = the willingness and ability of the
current labour force



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PENSION as a CLAIM on FUTURE PRODUCT

- funding : an economic claim;
adequate capital returns are guarantee
- payg : strength of the social contract between
generations



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NONETHELESS RISKS REMAIN

if total demand $>$ total output

then, 1) price inflation of goods and services,

2) prices of securities may go down,
thereby reducing the claim on current output



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CONCLUDING (1)

capital income arising from the (ownership of the)
capital stock generally provides a better (but not complete)
guarantee than promises made under a payg-system.



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CONCLUDING (2)

the effect of capital returns on contribution levels under a funded system is much higher than the effect of longevity

under a payg-system the effect of longevity can only be compensated by a higher growth rate of the size of the working population.