Social Security and Retirement - Lectures

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Outline

	Men	Women
Australia	84	87
Belgium	84	87
France	84	88
Germany	83	87
Italy	83	87
Mexico	81	85
Spain	83	87
UK	83	86
USA	84	87
OECD	83	87

OECD (2005)

Life expectancy at 65, 2040

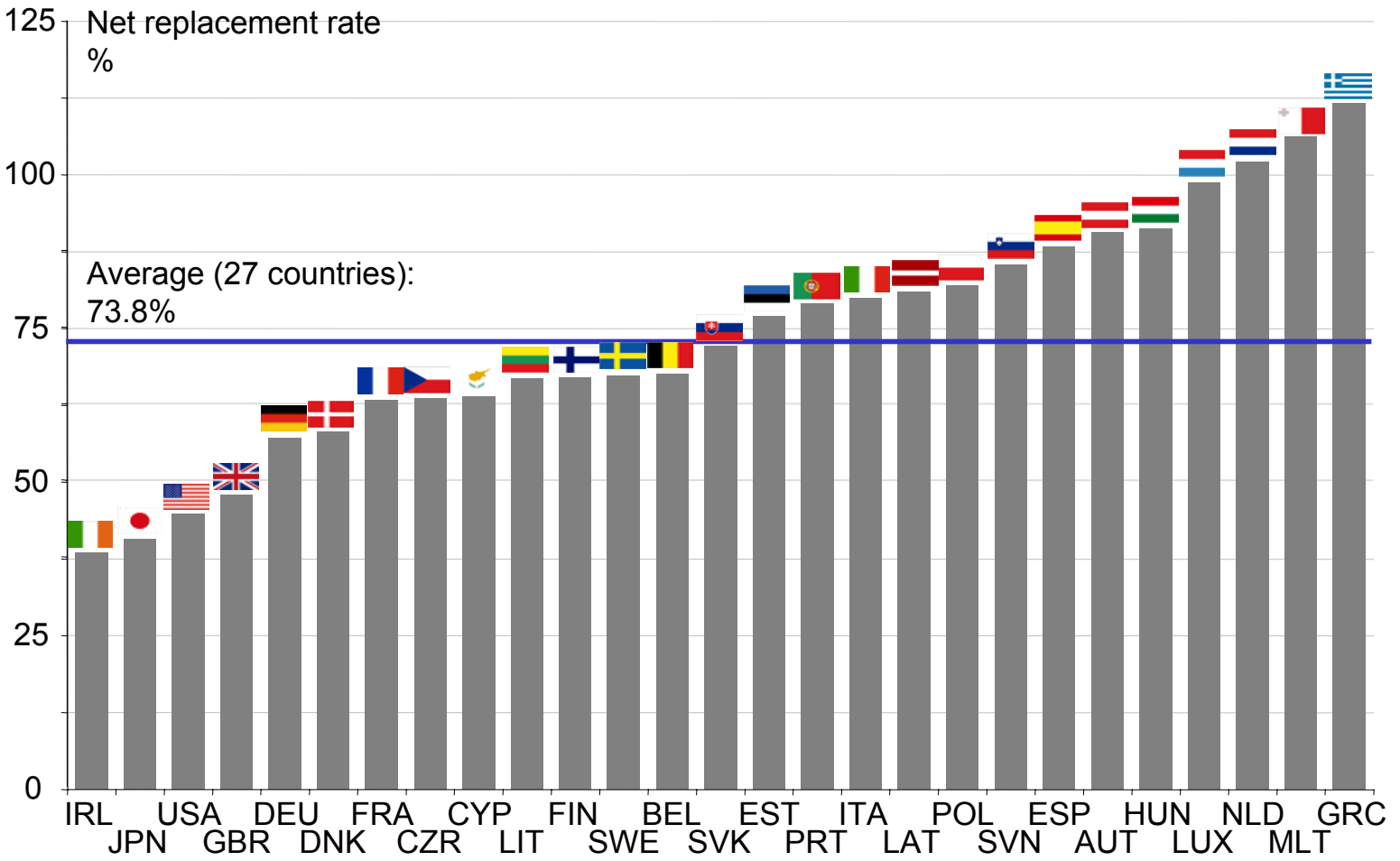
	Elderly dependency ratio			
	1975	2000	2025	2050
Belgium	22	25	36	43
France	22	25	37	47
Germany	23	23	34	52
Italy	19	26	41	69
Spain	16	24	35	66
United Kingdom	22	24	66	39
Turkey	8	9	14	30
Japan	12	24	43	56
United States	16	19	29	35
OECD average	17	21	32	42
Africa average	6	6	7	12
Arab states average	6	5	8	13
Asia and Pacific average	7	9	14	24
Central and Eastern Europe and Central Asia average	14	17	24	34
Latin America and the Caribbean average	8	9	14	26
World total	10	11	15	23

	Individual earnings (% average)		
	0.5	1	2
Australia	77	52	37
Belgium	83	63	43
France	98	67	59
Germany	62	72	67
Italy	89	89	89
Mexico	50	45	44
Spain	89	88	83
UK	78	48	30
USA	61	51	39
OECD average	84	69	59

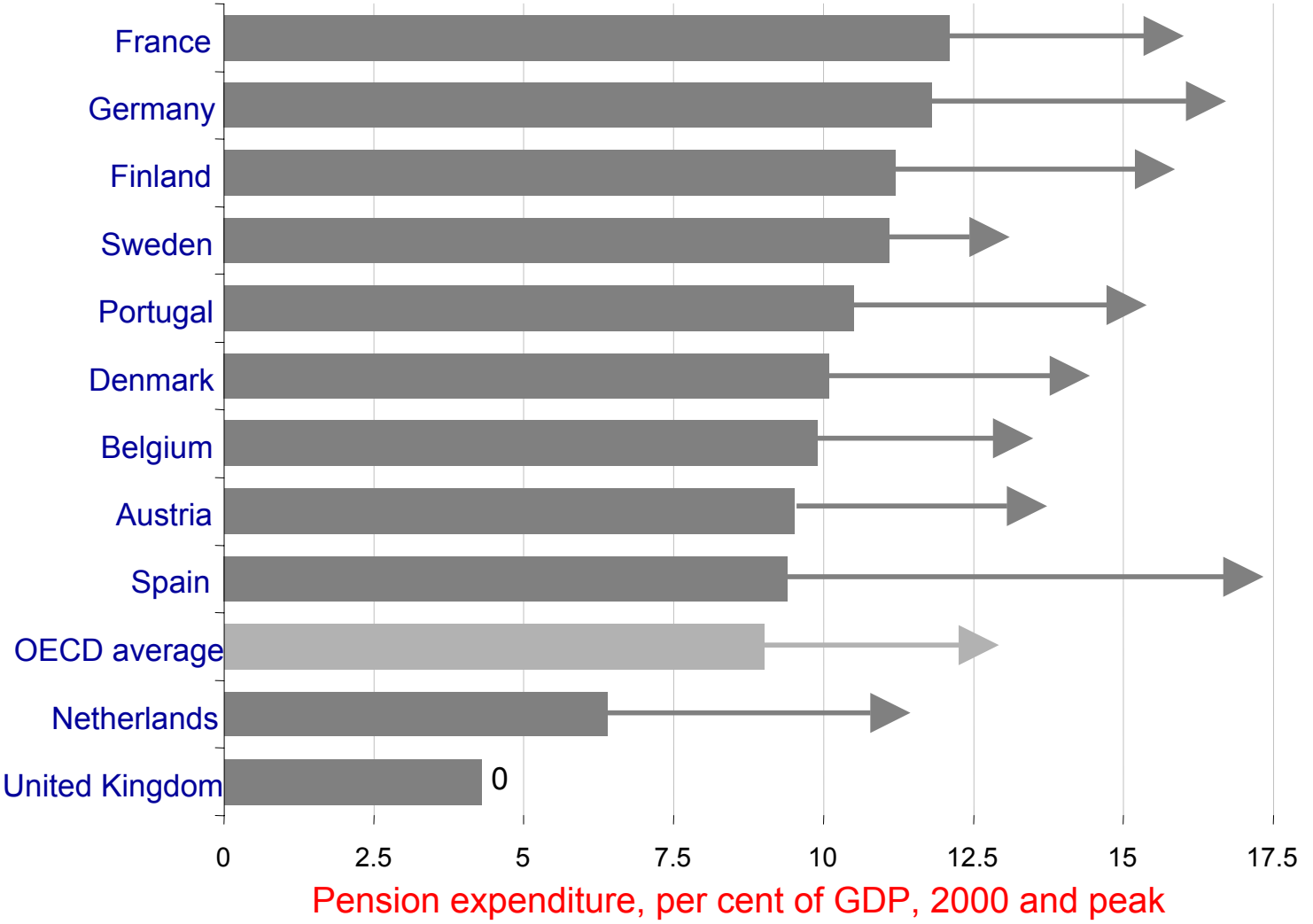
OECD (2005)

Net replacement rates

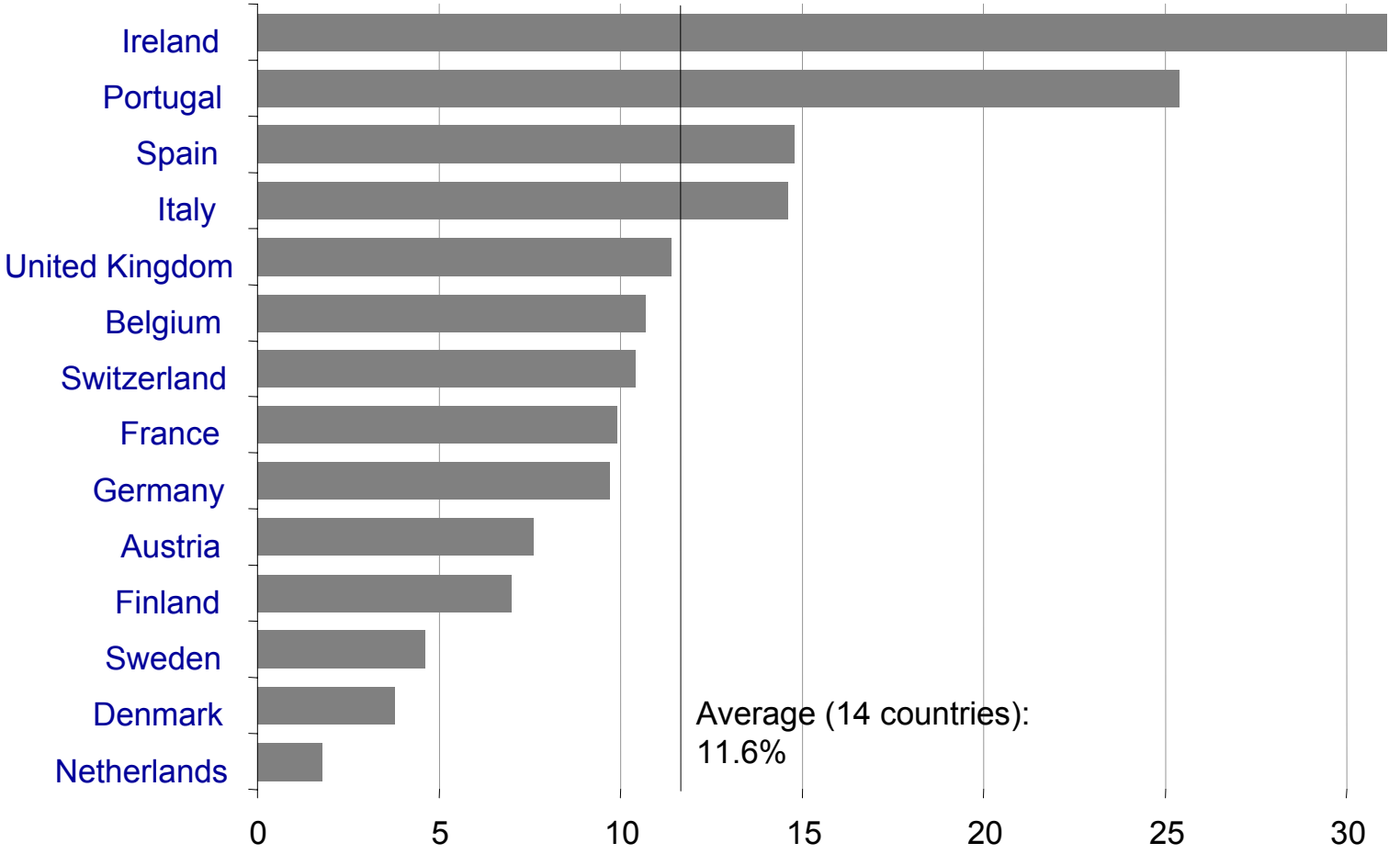
Net replacement rate, average earner



Public pension spending: projections

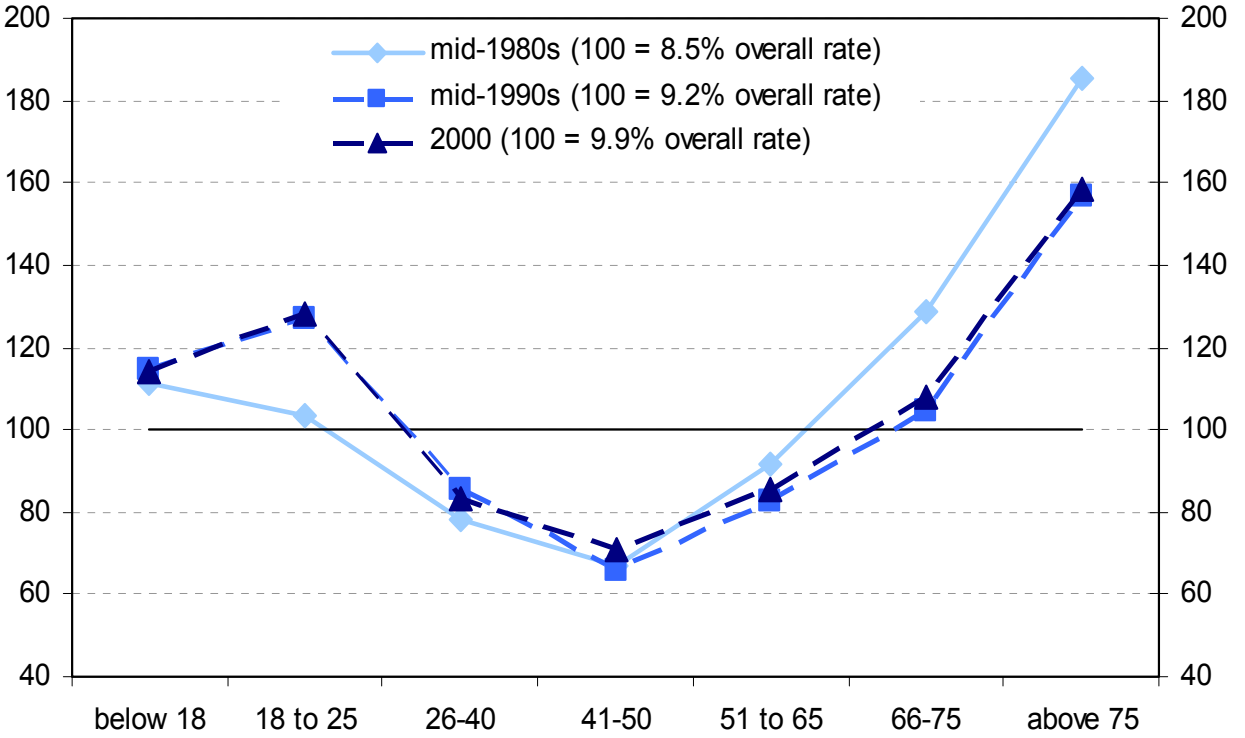


Old-age poverty



The significant improvement in old-age poverty came to an halt

Age-specific poverty risks (poverty rate of entire population = 100), OECD average

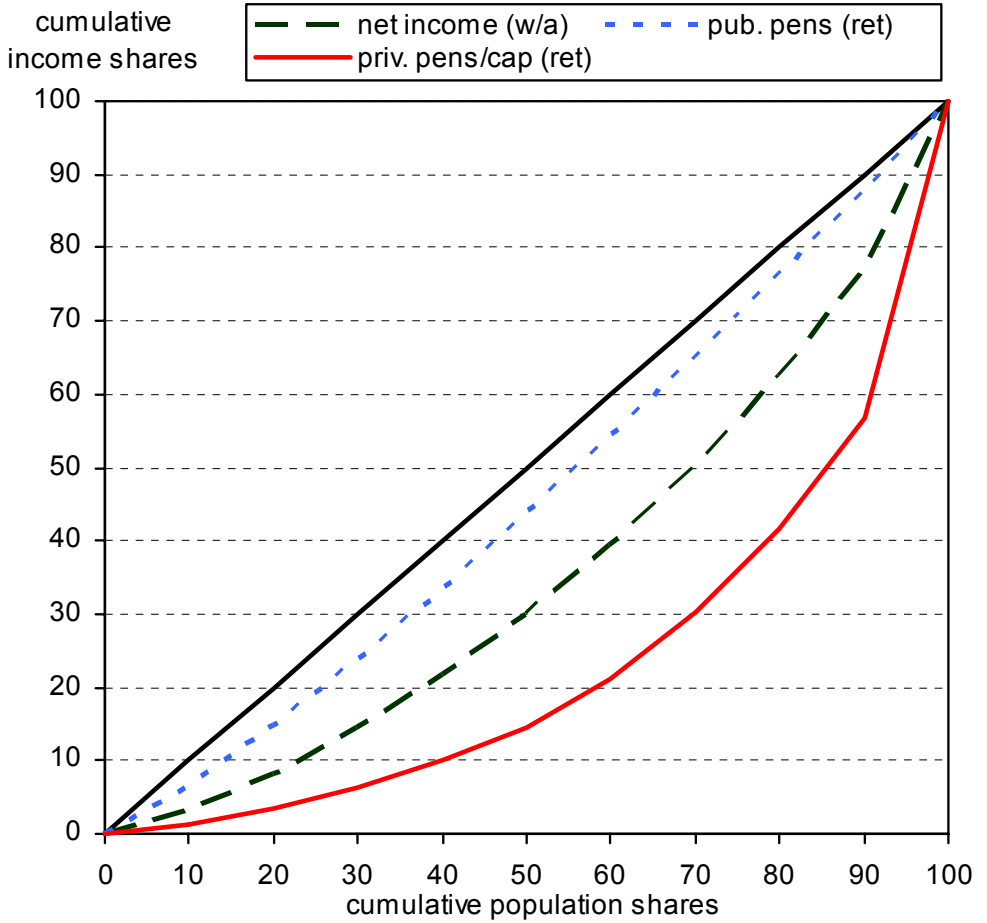


Source: OECD 2005

Note: Relative poverty risk defined as age-specific poverty rate divided by total poverty rate *100.
Poverty rates defined as percentage of persons below 50% of median disposable income of the entire population

Public pensions are distributed more equally than other income sources of older people

Distribution of public pensions, capital income and private pensions for the retirement-age population, and net income for the working-age population, OECD average, 2000



Source: OECD 2005

	Coverage rate		Poverty (1/2 median OECD)		
	Urban	Rural	No pension	Current situation	Min. Pension
BOL	24	5	46	38	10
BRA	85	92	62	9	6
CHI	68	45	37	7	5
COL	27	6	40	31	15
CRI	45	23	53	34	7
ECU	22	5	44	40	14
MEX	29	5	44	31	8
NIC	7	2	32	19	10
PAN	59	21	52	22	12
PAR	26	11	31	24	7
PER	34	4	31	19	7
RDO	16	4	44	41	11

Pensions in Latin America (2000-2003) 65+

1. Data and concepts

Rationales

- Rationales behind public pension
  - forced saving: myopia (dual self) or prodigality
  - redistribution: political economy
  - uncertainty: disability, mortality.
- Rationales behind PAYG
  - intergenerational redistribution
  - aftermath of WWII

Concepts and taxonomy

- Bismarckian (contributory or earnings related) versus Beveridgean (redistributive).

- Actuarially neutral or not: this pertains to the comparison between the present value of contribution and that of benefits.

- Actuarially neutral at the margin: this pertains to whether of not the decision to retire is distorted.

- Defined benefits or defined contributions: this implies that either the replacement rates or the payroll tax is fixed implying that the other variable has to adjust.

- Distortionary or not: the way the pension system is financed (wage tax, consumption tax, ...) implies different allocative inefficiencies.

- State managed or managed by paritary bargaining between unions and management.

- Exit in annuities or in lump-sum compensation.

French/German	Chilean
PAYG	FF
Bismarckian	Bismarckian
Defined benefits	Defined contribution
Annuities	Optional
Paritarian management	Public regulation
Non neutral/distortionary	Quite neutral
Minimum pension (means tested)	Minimum pension (means tested)

2. OLG model. Shift from PAYG to FF

Basic OLG model

$$Max\ \mathcal{L} = u\left(w\left(1-\tau\right)-s\right)+\beta\ u\left(wz\left(1-\tau\right)+\left(1+r\right)s+p-v\left(z\right)\right)$$

where $p = \tau\left\{\left[\overline{wz}+\left(1+n\right)\bar{w}\right]\left(1-\alpha\right)+\left[wz+\left(1+n\right)w\right]\alpha\right\}$.

The FOC are simply:

$$v'\left(z\right) = w\left(1-\tau\left(1-\alpha\right)\right)$$
$$-u'\left(c\right)+\beta\left(1+r\right)u'\left(d\right) = 0.$$

There is not distortion on the choice of z as long as $\alpha = 1$.

Quite often we will assume that $z = 0$ to go back to the traditional OLG model.

Aggregate output: CRS production function

$$Y_t = F(K_t, L_t) = K_t^{\alpha} \cdot L_t^{1-\alpha}$$

or

$$y_t = f(k_t) = k_t^{\alpha}$$

with

$$1 + r_t = R_t = f'(k_t) = \alpha k_t^{\alpha-1} \quad \text{and} \quad w_t = f(k_t) - f'(k_t)\, k_t = (1-\alpha)\, k_t^{\alpha}.$$

Population: size of generation t

$$N_t = (1+n)\, N_{t+1}.$$

Total population in t:

$$N_t + N_{t-1} = N_{t-1}(2+n).$$

Resource constraint:

$$f\left(k_t\right) = c_t + \frac{d_t}{1+n} + \left(1+n\right) k_{t+1}.$$

Individual utility function:

$$u\left(c_t, d_{t+1}\right) = \ln\ c_t + \beta\ \ln\ d_{t+1}.$$

Budget constraint:

$$c_t + \frac{d_{t+1}}{R_{t+1}} = w_t.$$

Demand function:

$$c_t = \frac{1}{1+\beta}\frac{w_t}{2} \quad \text{and} \quad d_{t+1} = \frac{\beta}{1+\beta}\frac{w}{2}R_{t+1}.$$

Saving (independent of r_{t+1}):

$$s_t = \frac{\beta}{1+\beta}w_{t+1}.$$

Equilibrium conditions:

$$\begin{aligned} L_t &= N_t \quad \text{and} \quad K_{t+1} = N_t s_t \\ w_t &= \omega\left(k_t\right) \quad \text{and} \quad R_t = \varrho\left(k_t\right). \end{aligned}$$

Dynamics with perfect forecast:

$$\left(1+n\right) k_{t+1} = \frac{\beta}{1+\beta}\left(1-\alpha\right) k_t^{\alpha}$$

with a unique steady-state solution (with a Cobb-Douglas)

$$k^* = \left[\frac{\beta\left(1-\alpha\right)}{\left(1+\beta\right)\left(1+n\right)}\right]^{\frac{1}{1-\alpha}}.$$

Golden rule optimality:

$$Max \quad u\left(f\left(k\right)-\left(1+n\right)k-\frac{1}{\left(1+n\right)}d,d\right)$$

$$\therefore \quad \frac{u_c}{u_d}=f'\left(\hat{k}\right)=1+n$$

$$\therefore \qquad \hat{k}=\left(\frac{\alpha}{1+n}\right)^{\frac{1}{1-\alpha}}$$

Market equilibrium and optimality

$$k^*\gtrless\hat{k} \qquad \Longleftrightarrow \qquad \frac{\beta}{1+\beta}\gtrless\frac{\alpha}{1-\alpha}.$$

Example 1 $\alpha=1/3$ *and* $\beta=1$ *implies* $k^*=\hat{k}$.

Equivalence between PAYG and FF with compensation for the transition generation

Optimal PAYG pension

PAYG:

$$p_t L_{t+1} = \tau_t L_t$$

$$p_t = \tau_t (1 + n)$$

Time 0: introduction of a pension

$$d_0 = s_{-1} (1 + r_0) + (1 + n) \tau$$

where: $(1 + n) \tau$ is the so-called free lunch.

For $t > 0$

$$
\begin{aligned}
c_t &= w_t - \tau - s_t \\
d_{t+1} &= (1 + r_{t+1})\, s_t + p_{t+1} \\
s_t &= \frac{\beta}{1+\beta}\left[w_t - \tau \frac{(1+r_t)\,\beta + (1+n)}{(1+r_t)\,\beta}\right] \\
(1+n)\, k_{t+1} &= s_t = \frac{\beta}{1+\beta}\left[(1-\alpha)\, k_t^{\alpha} - \tau + \frac{\tau\,(1+n)}{\alpha\beta} k_{t+1}^{1-\alpha}\right].
\end{aligned}
$$

Value of τ for which $1+n = 1+r = \alpha\ \hat{k}^{\alpha-1}$ or $\hat{k} = \left(\dfrac{1+n}{\alpha}\right)^{\frac{1}{\alpha-1}}$.

$$\tau = \alpha\ \hat{k}^{\alpha}\left[\frac{(1-\alpha)\,\beta}{(1+\beta)\,\alpha} - 1\right].$$

Debt and pension

Time 0:

$$d_0 = s_{-1}(1 + r_0) + p + b$$

where the free lunch is now $p + b$.

For $t \geqslant 0$,

$$\begin{aligned} c_t &= w_t - \tau - s_t \\ d_{t+1} &= (1 + r_{t+1})\, s_t + p_{t+1} - v_{t+1} \end{aligned}$$

where $v_{t+1} = (r_{t+1} - n)\, b$.[1]

[1] In each t, the government has to pay $(1 + r_t)\, bL_t$ and issue a new debt: bL_{t+1}. The difference is the *per capita* duty.

Now we have:

$$s_t = \frac{\beta_t}{1+\beta}[w_t - \tau\frac{\beta\left(1+r_{t+1}\right)+\left(1+n\right)}{\beta\left(1-r_{t+1}\right)} + \frac{b\left(r_{t+1}-n\right)}{\beta\left(1-r_{t+1}\right)}]$$

and

$$\left(1+n\right)k_{t+1} = s_t - b.$$

Combining these two equations, we obtain:

$$\left(1+n\right)k_{t+1} = \frac{\beta}{1+\beta}[w_t + \left(b+\tau\right)\frac{\beta\left(1+r_{t+1}\right)+\left(1+r\right)}{\beta\left(1-r_{t+1}\right)}].$$

3. Voting on social security. Second generation models. Heterogeneous individuals

The model

Small open one sector economy with given interest rate, r, and wage $\bar{w}$.

Continuous variable w with mean $\bar{w}$, median w_m and support (w_-, w_+).

Individual with productivity w maximizes

$$u = u(c) + \beta u(d) \tag{3.1}$$

subject to:

$$w(1-\tau) = c + s \tag{3.2}$$

and

$$d = (1+r)s + p(w), \tag{3.3}$$

$$p(w) = (1+n)\tau(\alpha w + (1-\alpha)\bar{w}) \tag{3.4}$$

where α is the Bismarckian factor.

- Dynamic efficiency: $r \geqslant n > 0$.
- σ (elasticity of substitution between c and d) < 1.
- Individual votes for τ believing that the value of τ chosen by the majority will hold for ever.
- No tax distortion.

The retirees

τ^R maximizes:

$$d = (1+r)\, s + (1+n)\, \tau \left(\alpha w + (1-\alpha)\, \bar{w}\right).$$

$$\tau^R = \bar{\tau} \leqslant 1.$$

The workers

$\tau^A(w)$ maximizes:

$$w(\tau; w) = u\left(w(1-\tau) - s^*\right) + \beta u(1+r)\, s^* + \left((1+n)\, \tau \left(\alpha w + (1-\alpha)\, \bar{w}\right)\right)$$

where $s^* \geqslant 0$.

In favor of a zero tax if:

$$1 + r > (\alpha + (1 - \alpha)\,\bar{w}/w)\,(1 + n)\,.$$

or

$$w \gtrless \hat{w} = \frac{1 - \alpha}{\dfrac{1 + r}{1 + n} - \alpha}\bar{w} \leqslant \bar{w}. \tag{3.4}$$

with $\dfrac{\partial \hat{w}}{\partial n} > 0$ and $\dfrac{\partial \hat{w}}{\partial \alpha} < 0$.

Proposition 1

(i) $\tau^A(w) = 0$ if $w > \hat{w}$ and $\tau^A(w) > 0$ if $w \leqslant \hat{w}$;

(ii) $Max \;\; \tau^A(w) \leqslant \bar{\tau}$;

(iii) $Max \;\; \tau^A(w) = \tau^A(\hat{w}) \leqslant \tau^R$

(iv) $\dfrac{\partial \tau^A(w)}{\partial w} > 0$ if $w \leqslant \hat{w}$.

Majority equilibrium tax rate

Proposition 2 *The majority voting equilibrium tax rate τ^* is the rate preferred by the workers with earning $\tilde{w}$ defined as follows:*

$$\int_{\tilde{w}}^{\hat{w}} f(w)\, dw = \frac{n}{2(1+n)}.$$

Comparative statics:

$$\underset{?}{\frac{d\tau^*}{d\alpha}} = \underset{+}{\frac{d\tau^*}{\partial\alpha}} + \underset{+}{\frac{d\tau^*}{\partial\tilde{w}}}\underset{-}{\frac{d\tilde{w}}{d\alpha}}$$

$$\underset{?}{\frac{d\tau^*}{dn}} = \underset{-}{\frac{d\tau^*}{\partial n}} + \underset{+}{\frac{d\tau^*}{\partial\tilde{w}}}\underset{?}{\frac{d\tilde{w}}{dn}}$$

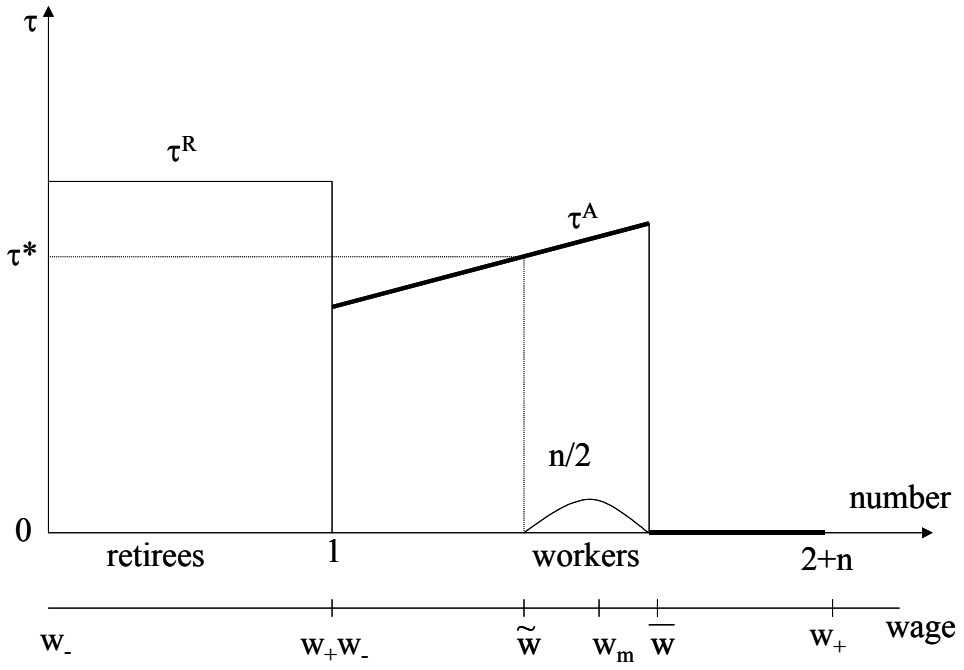


Figure 4 - $r = n$, no distortion

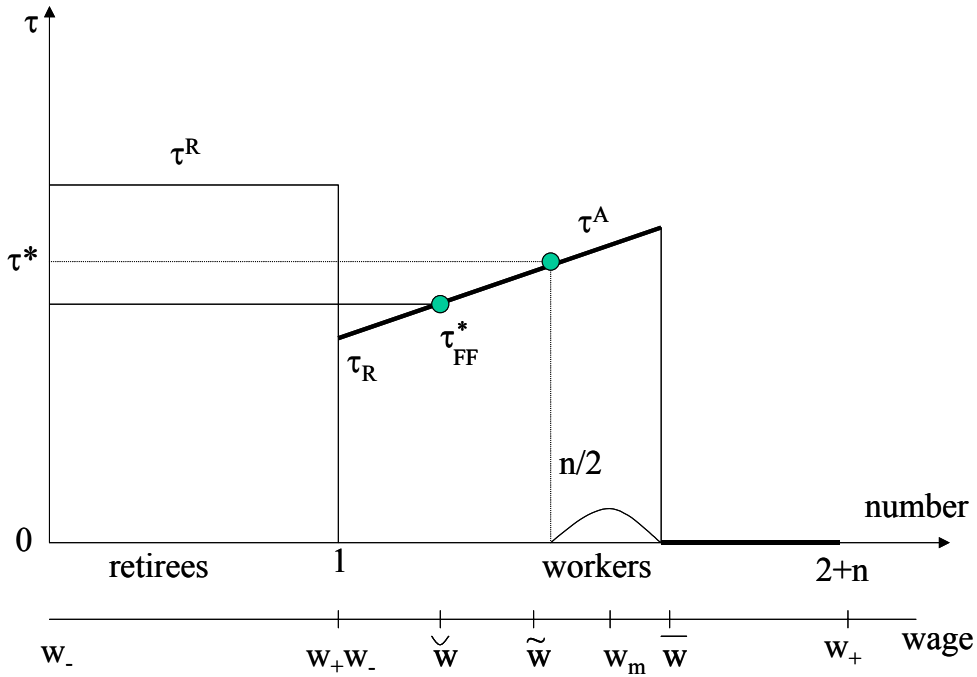


Figure 5 - $r = n$: PAYG versus FF

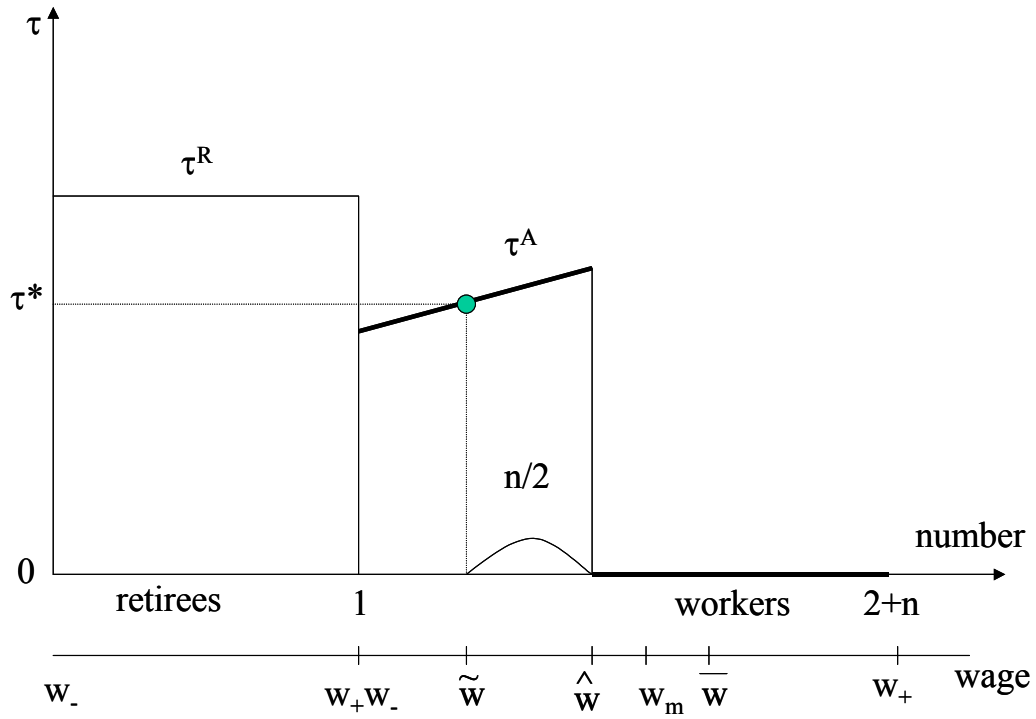


Figure 6 - $r > n$, no distortion

PAYGO *versus* fully funded

Assumption $r = n > 0$

same benefit rule.

With FF, the decisive voter is that with earning $\breve{w}$ such that

$$\int_{\breve{w}}^{\bar{w}} f(w)\, dw = 1/2.$$

Proposition 3 *The majority voting equilibrium for social security is higher with a PAYG than with a fully funded scheme.*

Social welfare:

- Rawlsian criterion: FF dominates the PAYG
- Utilitarian criterion: comparison ambiguous.

See Figure 2.

Determining α and τ

Up to now α was taken as given.

One can consider sequential vote on α and then τ or a simultaneous vote.

It yields a positive relation between α and τ.

This is confirmed by some evidence.

"Programs for the poor are poor programs.'

4. Social security and retirement

- Trend towards early retirement in Europe.
- Explained by incentive structure of social protection: implicit tax.
- Design of retirement systems and in particular incentive provided for retirement decision.

Questions

- Do biases towards early retirement result from bad policy or can they be vindicated on equity and efficiency grounds?
- Can the political process at work in Europe explain that today in so many countries workers retire much before the "normal" age of retirement?
- As a corollary: why is it so difficult to reform the system now that all governments agree that something has to be done?

- To understand policy implications, results have to be put in a proper perspective.
- One can show that some downward distortions in the retirement decision are unavoidable in a second best setting.
- However, this does **not** justify the ridiculous activity rates of elderly workers in countries such as France or Germany.
- There is not doubt that in these countries raising the age of retirement is desirable.

Main point

- While retirement systems induce an excessive bias towards early retirement in many countries a complete elimination of this bias (i.e., a switch to an actuarially fair system) is not the right answer.
- Two reasons
  - normative argument: some distortions are second-best optimal.
  - on the positive side: the elimination of the bias might be problematic from political perspective. It may either not be feasible or alternatively it may tend to undermine the political support for the pension system itself.

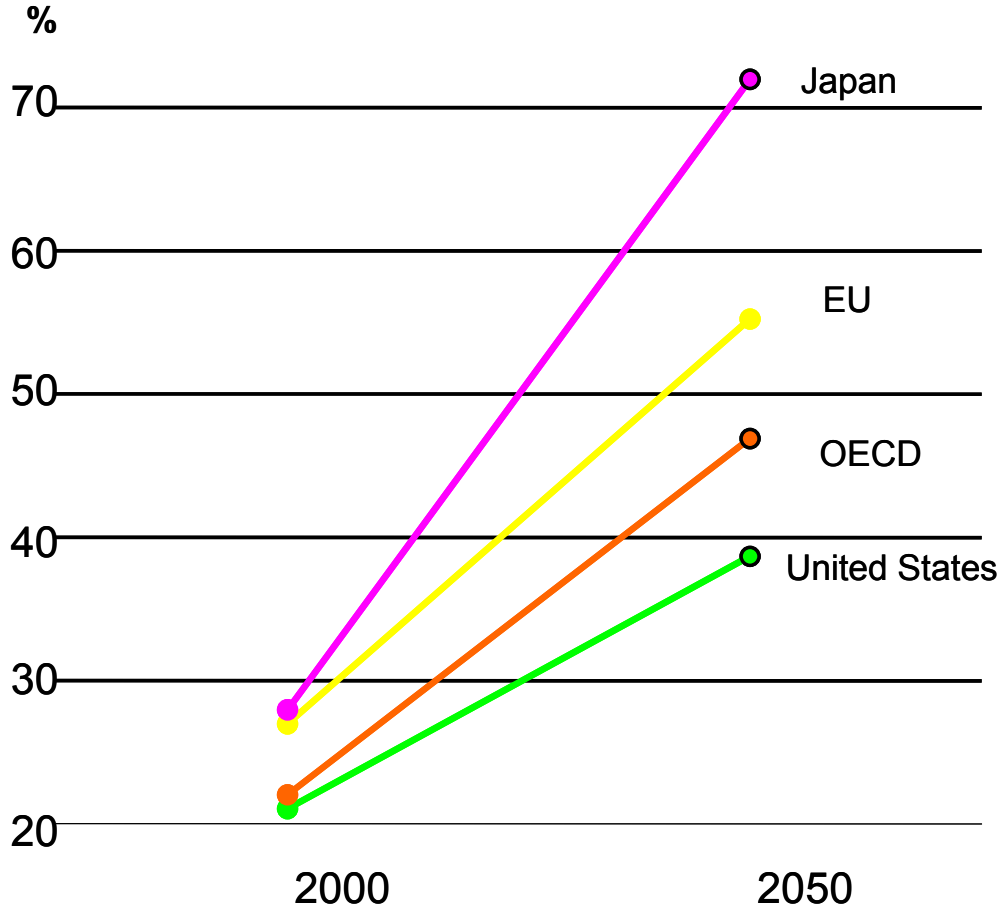
Evidence

- EU will face acceleration of demographic aging, three main factors
  - retirement of baby-boomers,
  - increase in life expectancy,
  - decline in fertility.

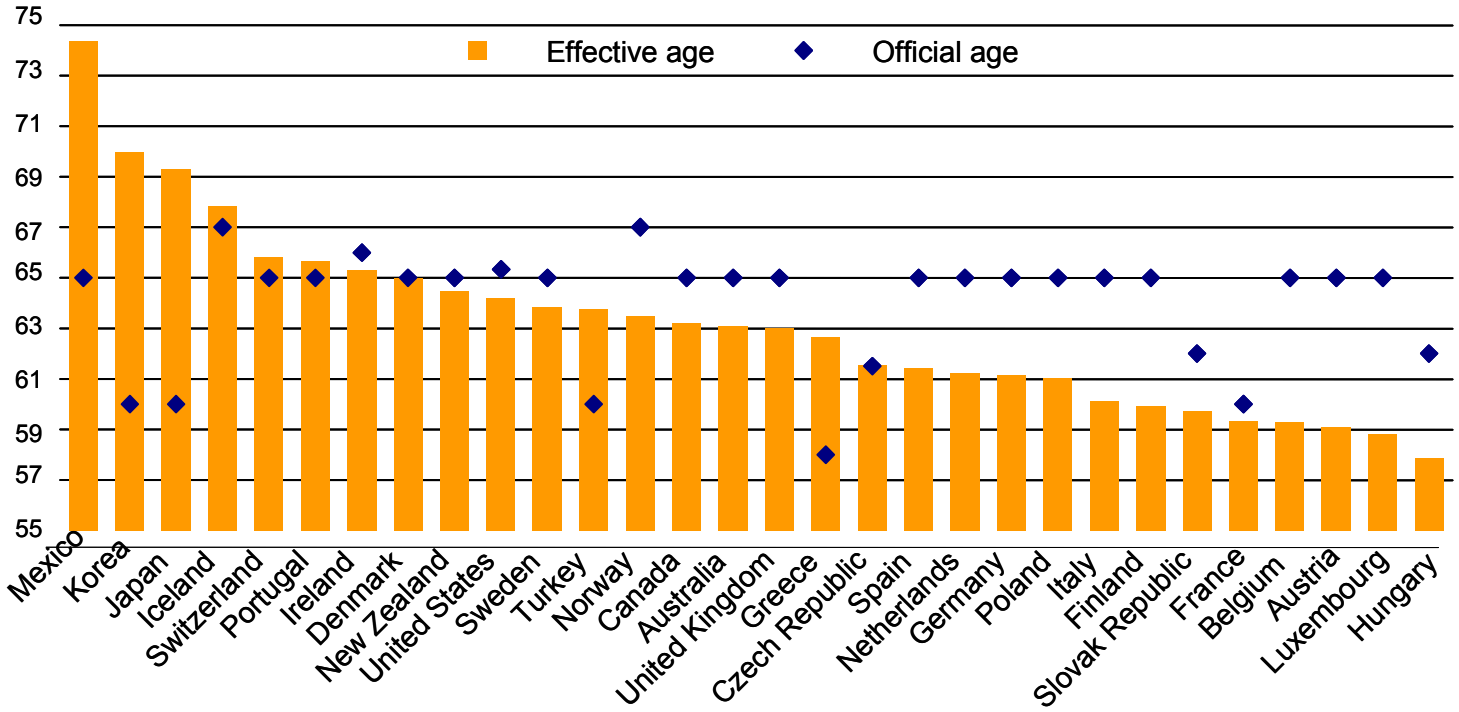
- For example:
  - In 2000 those over 65's represented 25% the working age population in the EU25.
  - By 2050, this figure will be nearly 50%.
- "Normal reaction" (laissez faire and first-best): increase age of retirement.
- Observed trend: exactly in the opposite direction.

Life expectancy and retirement, OECD averages

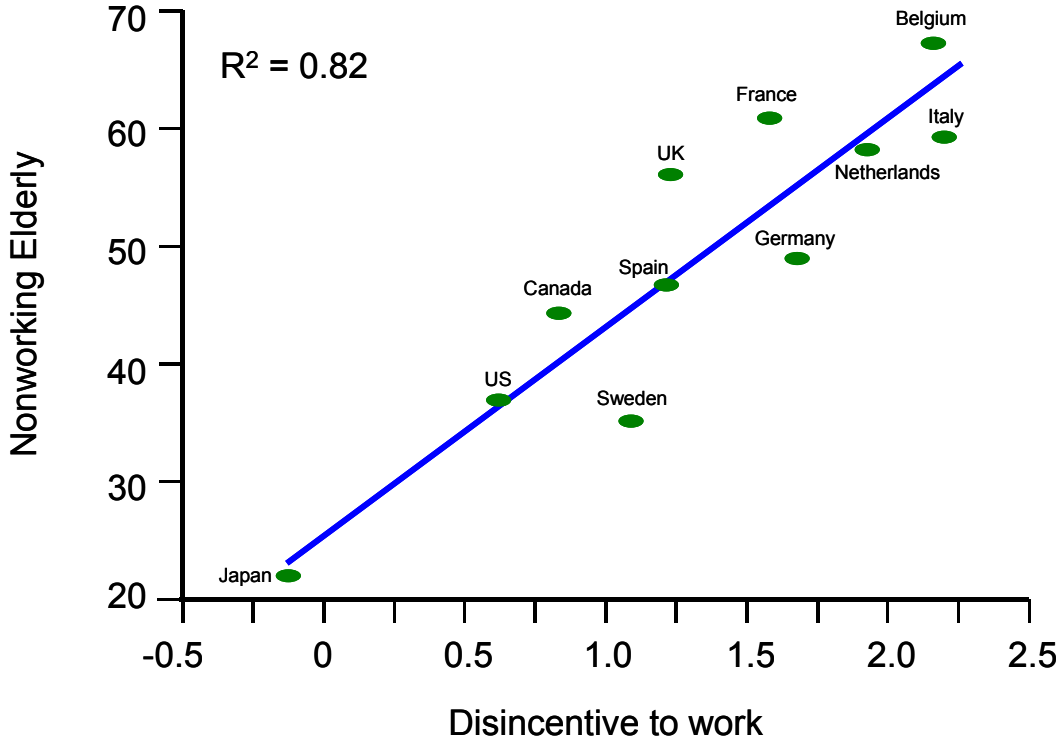
Ratio of the population aged 65+ to the working age population (20-64)



Effective age of retirement and the official age, 1999-2004



- Trend explained in part by design of pension systems: implicit tax $\Longrightarrow$ incentives to retire early (Gruber and Wise).
- Reform to make systems more actuarially neutral in some countries, but failed in others.
- Also: labor market considerations:
  - persistent perception that older workers should "make room" for younger ones,
- lifetime profile of wages: firm often have incentive to incite elderly workers to "retire".


70
60
50
40
30
20
Nonworking Elderly
R2 = 0.82
Belgium
France
Italy
UK
Netherlands
Germany
Spain
Canada
US
Sweden
Japan
-0.5
0
0.5
1.0
1.5
2.0
2.5
Disincentive to work

$$\mathcal{L} = \sum n_i \left[u\left(w_i\left(1-\tau\right) - s_i\right) + u\left(Rs_i + \frac{w_i^2\left(1-\tau\right)^2}{2}\right) + \bar{p} \right]$$

where

$$\begin{aligned} \bar{p} = &\ \tau \sum n_i w_i \left(1 + w_i\left(1-\tau\right)\right) \\ = &\ \tau\left[\bar{w} + \left(1-\tau\right) Ew^2\right]. \end{aligned}$$

Choice of s_i: $u'\left(c_i\right) = u'\left(x_i\right) R = u'\left(x_i\right)$ with $R = 1$.

$$\begin{aligned} \frac{\partial \mathcal{L}}{\partial \tau} &= -E\left[u'\left(c\right) w + u'\left(d\right)\left(w^2\left(1-\tau\right) - \bar{w}\right) - 1\left(1-2\tau\right) Ew^2\right]^* = 0. \\ &\therefore \\ \tau &= \frac{cov\left(u'\left(c\right), w + w^2\right)}{cov\left(u'\left(c\right), w^2\right) - Ew^2 Eu'\left(c\right)}. \end{aligned}$$

Model

$$u\left(w_i\left(1-\tau\right)-s_i\right)+u\left(Rs_i+w_i\left(1-\tau\right)z_i-z_i^2/2+p_i\right).$$

First-best

$$\sum n_i\left[u\left(c_i\right)+u\left(d_i-z_i^2/2\right)-\mu\left(c_i+d_i-w_i-w_iz_i\right)\right]$$

$$u'\left(c_i\right)=u'\left(x_i\right)=\mu$$
$$u'\left(x_i\right)z_i=\mu w_i$$
$$\therefore\ \ z_i=w_i$$

This can be decentralized with individualized lump sum tansfers without distortions on the choice of z.

Second-best

The only redistributive instruments is a linear tax on earnings financing a flat tax.

Assume no liquidity constraint.

5. The annuity puzzle with variable longevity

Annuities and individual welfare

Most public policy, public education and financial planning with regard to retirement are focused on the "accumulation phase":

- how much to save?
- tax planning
- portfolio allocation.

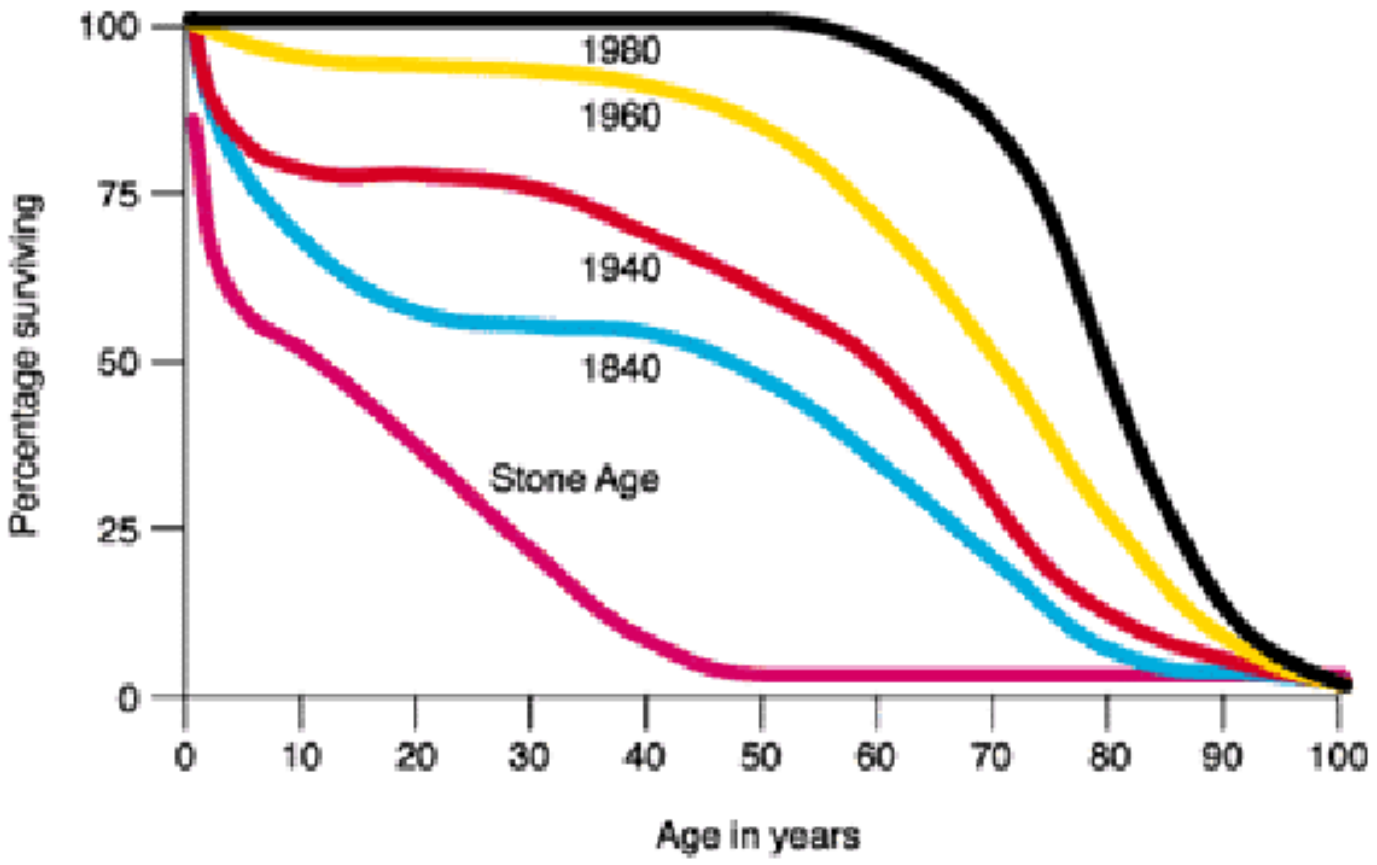
Years of life expectation at birth (average for both sexes)

	1820	1900	1950	1999
France	37	47	65	78
Germany	41	47	67	77
UK	40	50	69	77
US	39	47	68	77
Japan	34	44	61	81
India	21	24	32	60
Brazil	27	36	45	67

Sources: Angus Maddison (2001): *The World Economy: a Millenial Perspective*

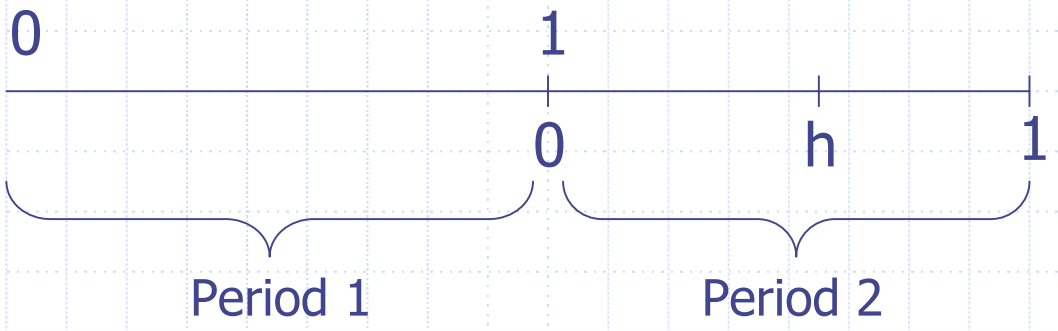
- Source of increased longevity: deplacement of the survival curve
- Rectangularization or increasing maximum life span

Rectangularisation of survival curves in humans



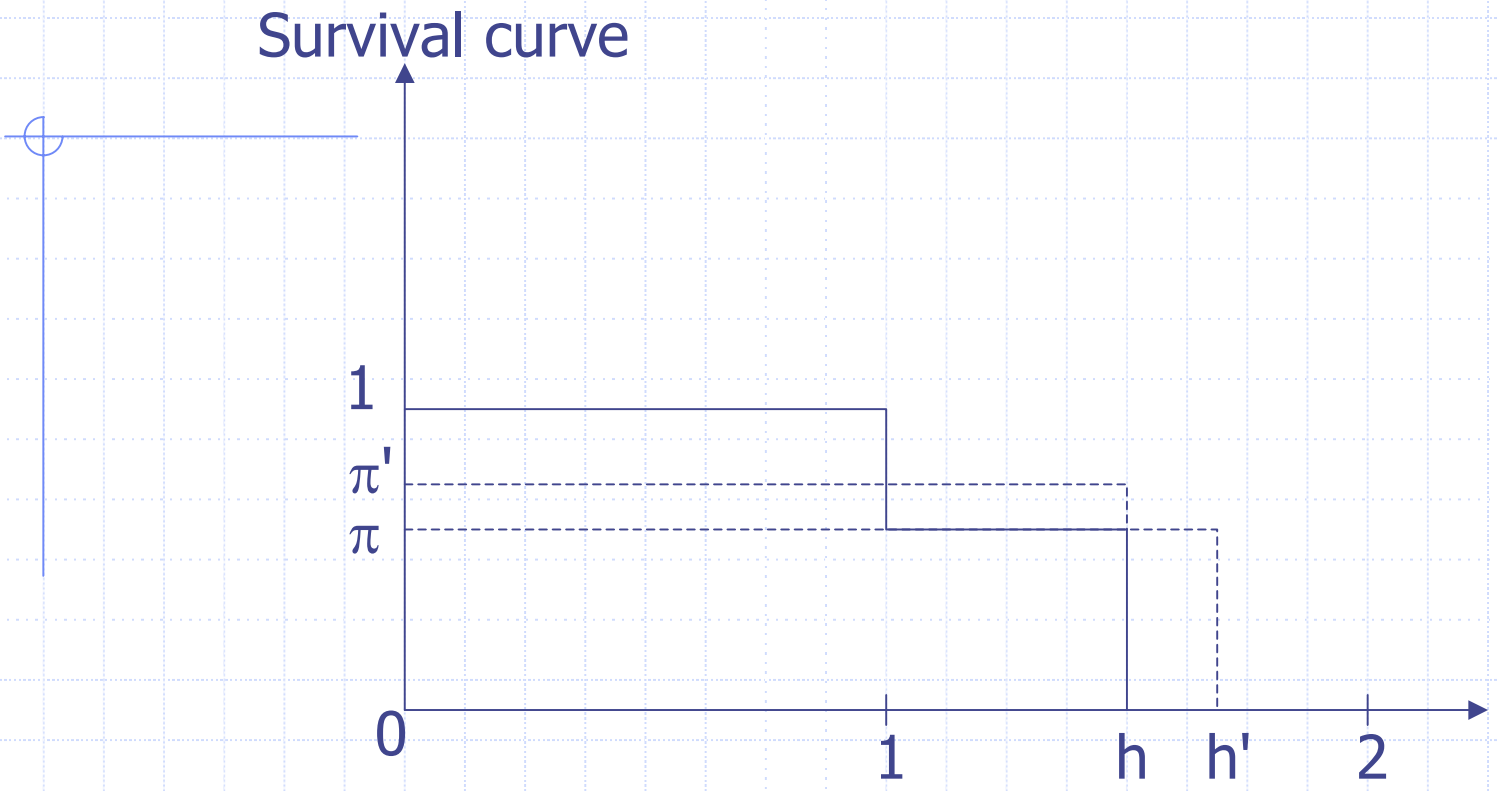
Formal presentation

OLG model



Probability π of reaching h
$1 - \pi$ of dying at the end of first period

LE: $1 + \pi h$



Two ways of increasing LE: $1 + \pi h' = 1 + \pi' h$

Which way do we prefer?

The "forgotten half" of retirement security is carefully planning the "payout phase":

- how fast to consume?
- tax planning
- portfolio allocation
- how make resources last a lifetime?

Financial planning would be easy if we knew with certainty how long we each would live.

But length of life is highly uncertain.

Uncertainty forces one to trade-off two risks

- if consume too aggressively, you will "run out of resources" before you die.
- if consume too frugally, you lower your standard of living.

Life annuities as the solution

Individual trades a stock of wealth for a flow of income that lasts as long as individual lives.

An annuity can provide a higher level of sustainable income than can be achieved from a non-annuitized asset.

Is it magic?

No, "there is no free lunch".

Annuities pay a higher return when alive in exchange for giving up right to wealth upon death.

Advantages of annuities:

- higher return while living,
- guaranteed income as long as you live.

Disadvantages of annuities:

- cannot bequeath the money (no inheritances),
- if annuity market are poorly developed, and thus there are concerns about:
  - pricing,
  - liquidity.

Economic theory of life annuities

Yaari (1965): under certain conditions, individuals should convert 100% of their wealth to annuities:

- no bequest motives,
- actuarially fair annuities,
- Von Neumann-Morgenstern expected utility,
- exponential discounting,
- utility of consumption is additively separable over time,
- no uncertainty other than date of death.

Illustration

$$u(c) + \pi\beta\ u(d).$$

We assume $\beta(1+r) = 1$ and define the rate of return on the annuity: $\varrho = \dfrac{1+r}{\pi} - 1.$

$$Max \quad u(w-s) + \pi\beta\ u\left(s\frac{1+r}{\pi}\right)$$

$$\therefore \qquad u'(c) = u'(d).$$

If there is no annuity:

$$u'(c) = u'(d)\,\pi.$$

Take $u = \ln$, $\pi = 1/2$, $r = 0$.

With annuity, $c = d = \dfrac{2}{3}w$

Without annuity $c = \dfrac{2}{3}w \ \ ; \ \ d = \dfrac{1}{3}w.$

- Davidoff, Brown and Diamond (2005) show that, with complete markets, sufficient conditions for optimality of full annuitization are:
- no bequest motives,
- annuity return to survivors $>$ conventional asset return.

If markets are complete, the optimality of full annuitization survives the extension of the problem to many time periods and many states.

With incomplete markets, result can fail:

- if there is a severe mismatch between the desired consumption path and the annuity income stream, full annuitization sub-optimal,
- example: some forms of expenditure shocks (i.e., medical shocks early in life).

Key issue - relative liquidity and ability to match desired consumption path.

With complete markets and no bequests, full annuitization is optimal.

Even with incomplete markets, full annuitization often optimal.

Result breaks down only when there is a severe mismatch between desired consumption path, and the income path available from annuities.

Even in these cases, optimal level of annuitization remains quite high (e.g., one-half to two-thirds of total wealth).

What does this mean in practice?

Consumers ought to be annuitizing a large fraction of their wealth.

Consumer welfare would increase if more asset types were offered in an annuitized form.

If individuals fail to adequately annuitize on their own, it may justify government intervention:

- social security,
- mandatory annuitization in private plans.

What is the reality?

Traditionally, only substantial source of life annuitization came from two sources:

- employer provided defined benefit pensions,
- social security.

Individual market for life annuities in most countries is actually quite small.

The annuity puzzle

Economic theory says annuities are quite valuable and that retirees ought to hold most of their portfolio in this form.

Empirical evidence is that most individuals do not voluntarily annuitize their resources.

Why?

- bequests,
- high prices (adverse selection or administrative costs),
- families as substitutes,
- high discount rates,
- uninsured medical expenditure shocks.

Conclusion

Why public and not private ?

- myopia: insufficient saving
- redistribution: poverty and inequality
- uncertainty:
  - *risk of dependency*
  - *uncertain lifetime*
  - *disability*
  - *financial risks*
  - *fertility*

Why unfunded?

- Intergenerational redistribution: solidarity
- Compensation in the aftermath of WWII.
- Does it work? See generational accounts: one way redistribution.

Where is the main problem?

- Aging and the financial perspectives given the parameters
- Retirement age.
- Inability to reform in a changing environment:
  - *resistance to reforms,*
  - *increasing opportunism,*
  - *tax competition*

Some evidence

- Dependency ratio 2000-2050
  - OECD: 21-42
  - LA: 9-26
- Spending (% GDP) 2000-2050
  - OECD 9-13 (Spain: 9.5-17)
- Poverty
  - OECD: 11.6
  - CO: 31
- Longevity and retirement 1960-1990 *France*
  - Men: 67.6-74.2 and 64.5-59.2
  - Women: 74.5-82 and 65.8-58.3

Where to go from here?

- Focus on redistribution
- Make the system actuarially fair towards retirement
- Market failures versus government failures.