

Intergenerational fairness: Statistical analysis, assumptions and actuarial models

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Intergenerational relationships

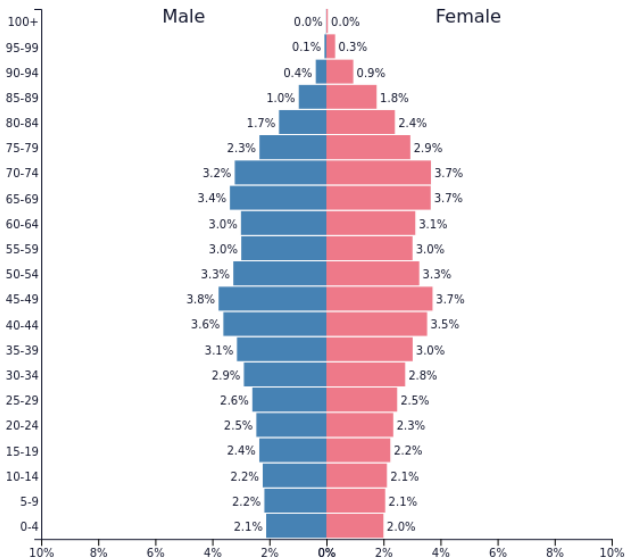
- Reciprocity
- Stewardship
- Goals:
 - No poverty,
 - good health,
 - education,
 - work,
 - infrastructure,
 - peace

Role of statistics and demography?

Generations: Japan 2018

(PNG Image, 575 x 581 pixels)

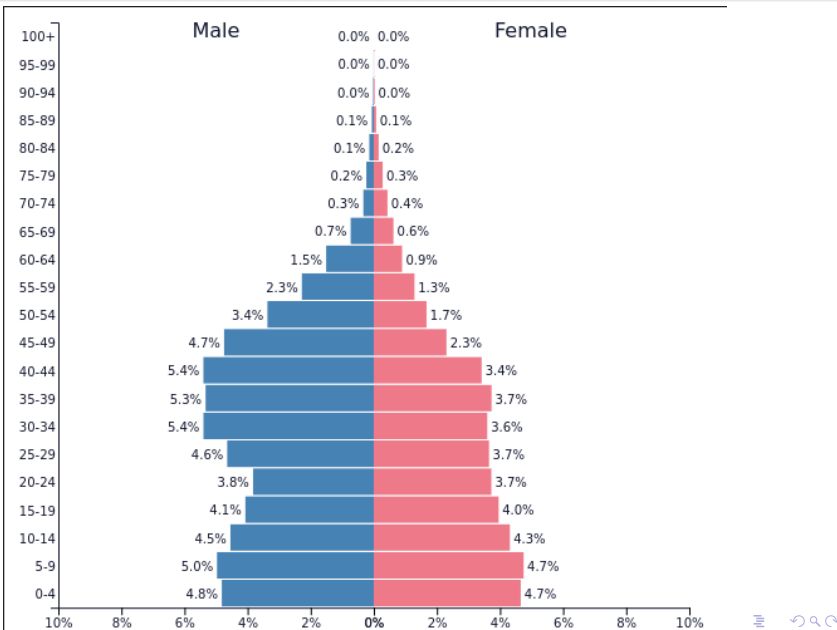
<https://images.populationpyramid.net/capture/11/>



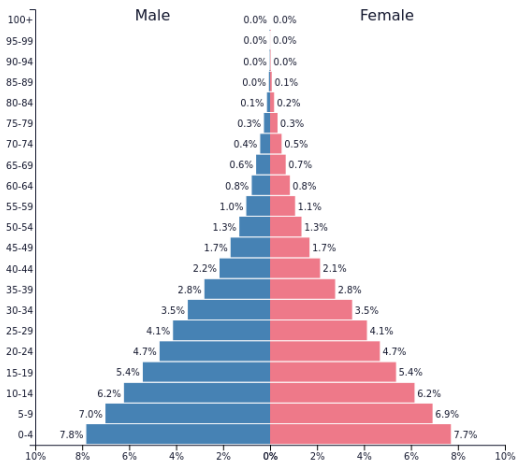
Japan 2018



Generations: Saudi 2017



Generations: Cameroon 2018



PopulationPyramid.net

Cameroon - 2018
Population: 25,111,718

NB: Prof Dorrington's contribution today

Provision for old age

Honour your father and your mother, that your days may be long in the land that the Lord your God is giving you.

Torah, Exodus 20:12, 15th century BC

As they serve their fathers, so they serve their mothers, and they love them equally. As they serve their fathers, so they serve their rulers, and they reverence them equally.

Classic of Filial Piety, 4th century BC

We made a covenant with the Children of Israel: You shall not worship except GOD. You shall honor your parents and regard the relatives, the orphans, and the poor.

Quran 2:83, 7th century CE

Provision for old age

Education, social networks and material goods

- Extended families
- Religious houses, alms houses
- Guilds, friendly societies, occupational pension funds

Government provision for old age:

Exhort.

Encourage: tax incentives

Compel:

- tax to pay general old age pensions,
- increase regulation of occupational pension funds,
- increase regulation of commercial annuity provision

NB: Mr Colin Wilson, Prof Jon Forster earlier today

NB: Dr Catherine Donnelly's contribution tomorrow

Occupational pension funds: who benefits?

Large funds, long-term investments.

For example:

- housing
- infrastructure: roads, ports, dams
- agricultural investment
- commercial investment

In country and Intergenerational investment.

NB: Dr Anna Tilba's contribution tomorrow

Occupational pension funds

How much?

Amount of money per year for a standard of living?

For how many years?

What controls?

Canada: costs and benefits for multiple stakeholders of Defined Benefits (DB) and Defined Contributions (DC)

In the UK, have defined benefit pensions been killed by government kindness? Pensions Acts 1986, 1995, 2004,

Unintended consequences?

No!

Logical implications of decisions ignored by the lazy or foolish.
and Pensions Act 2014.

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Occupational pension funds

UK Pensions Regulator: either 'adequate' provision for DB or go to DC = shift all risk to individuals?

How do we estimate what to provide?

First consider what is provided to whom.

Then consider how to balance

present and future expenditure; or
risks, costs, benefits to different groups

Good estimates to judge whether the balance is fair

Best estimates: statistical inference

Bias, precision, consistency, robustness, invariance

General demographic assumptions

Age distribution of current, deferred and pensioner members

- 1 withdrawal rates
- 2 ill-health retirement rate (partial or full) incapacity
- 3 mortality rate for ill-health pensioners
- 4 death in service
- 5 retirement age distribution
- 6 marriage rates
- 7 age difference between spouses
- 8 mortality rates and life expectancy

Retirement rates

Age	Number of members			Retirement rates %		
	Women	Men	Both	Women	Men	Both ?
60	700	1000	1700	28	23	30
61	504	770	1190	13	7	10
62	438	716	1071	16	11	15
63	368	637	910	17	10	15
64	306	574	774	18	15	20
65	251	488	619	100	100	100

Does the rounding in the last column matter?

GCSE exam expectation: keep all digits until final answer.

Dublin court: life expectancy on balance of probability ...

Does the rounding in the last column matter?

Early retirement rates

Age	Retirement rates %			Number of Pensioners			
	Women	Men	Both ?	Women	Men	Total	Both?
60	28	23	30	196	230	426	510
61	13	7	10	66	54	119	119
62	16	11	15	70	79	149	161
63	17	10	15	63	64	126	137
64	18	15	20	55	86	141	155

Estimated cost of early retirement

UK 2016 low life expectancy: age 60 women 26.0 men 23.6

women get £15K, men £25K, Both £20K

Cost Both £535M > Women + Men £454M **18%**

UK 2016 high life expectancy: Both 60 26.0 years: **24%**

Retirement rates

Does the rounding in the last column matter?

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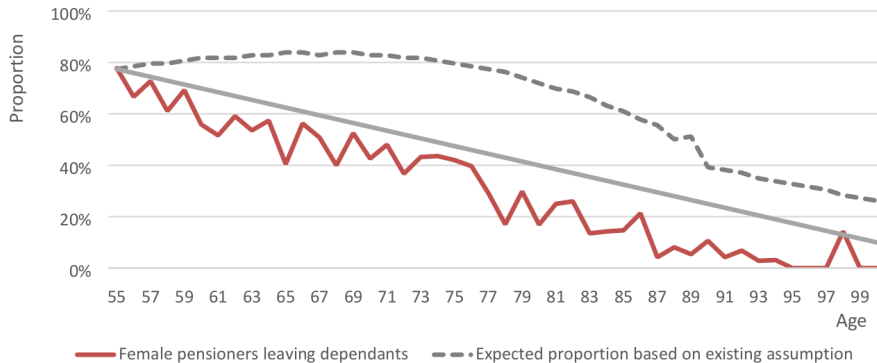
women get £15K, men £25K, Both £20K

Cost Both / Women + Men **3.3%**

UK 2016 high life expectancy: both age 60 26.0 years: **9.2%**



Marriage rates for women



Best estimate? Only 12% too high on average.

Can you guess what the dotted gray line represents?

How might we choose a level of prudence?

What do accountants regard at a material difference:

- for valuation, say 1% of a pension scheme's net assets.
- for company accounts, say 0.5% of administrative costs.

What does this imply for **separate** assumptions used in actuarial models?

Prudence: general demographic assumptions

- 1 withdrawal rates
- 2 ill-health retirement rate (partial or full) incapacity
- 3 mortality rate for ill-health pensioners
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- 5 retirement age distribution
- 6 marriage rates
- 7 age difference between spouses

Allow $0.002 = 0.2\%$ 'prudence', or even 0.15%
i.e. over-estimation of liabilities in 1-7
what is the combined impact?

About $7 \times 0.2\% = 1.4\%$; or $7 \times 0.15\% = 1.05\%$.

What about differences between women and men

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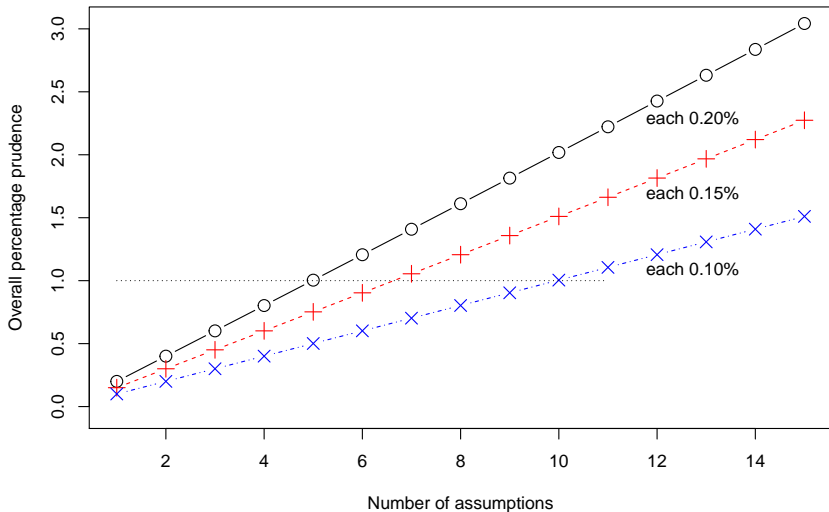
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Prudence: general demographic assumptions

Cumulative effect of prudent assumptions



Not quite best **separate** assumptions used.

'Prudent best' estimates treated as if independent.

e.g. mortality for ill-health retired assumed same as normal.

Mortality for spouses assumed independent (CT5). However,
marriage is protective for men, not women;
there is evidence for a widowhood effect.

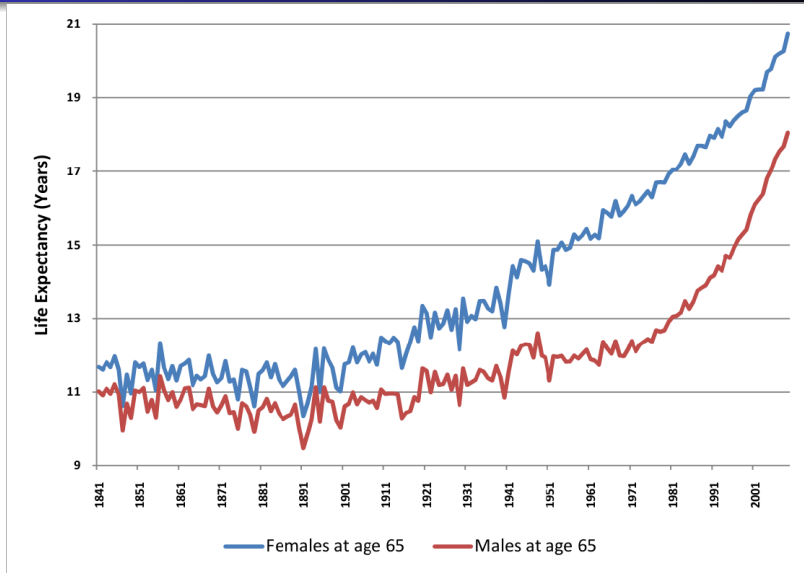
Ignoring selective reporting of outcomes in medical research
results in major bias ([Hutton et al 2000](#)).

Now guidelines to reduce selection bias & ongoing research.

Large pension scheme → good **multivariate** estimates of rates.

Add 'prudent' life expectancy and economic assumptions ...

Life expectancy E & W from age 65: 1841-2009



Human Mortality Database



Implications of reckless prudence

Add 'prudent' life expectancy and economic assumptions to biased demographic assumptions:

- good for profit if selling annuities;
- over-estimate deficit for DB schemes.

Implications for DB schemes:

- divert money from investment
- bankrupt company
- close DB scheme and shift risk to individuals in DC

Shifting Public Sector DB Plans to DC

The experience so far and implications for Canada.

Robert L. Brown, PhD, FCIA, FSA, ACAS and Craig McInnes
October 2014.

What are impacts and implications of converting DB to DC?

“broad array of stakeholders . . . : public sector employers and governments, employees and their dependants, taxpayers, future generations and society at large”

- Perceived advantages for private sector (off-loading costs) do not translate.
- Same value DC costs 77% > efficient large DB plan.
- 45% of benefit from investment returns c.f 75%.

Shifting Public Sector DB Plans to DC

- Many decades of *increased* financial risk from closed DB
- Shifting to DC *increases* costs
- Other plan options to reduce risk without sacrificing efficiency
- Converting to DC does not address past-service liability.
- Converting to DC increases risks and difficulties w.r.t past-service liability.
- Two USA states DB → DC → DB.

Implications for government departments

Treasury: Quantitative easing and value of gilts.

The apparent aim of quantitative easing is to encourage investment in infrastructure and industry, rather than in bonds. Approach to 'de-risking' of pension funds by transferring assets into gilts acts in the opposite direction.

National statistical and actuarial offices:

Accuracy of ill-health, marriage rates, mortality estimates . . .

Social provision:

Increase in demand for support:
unemployment due to closure of business or people not retiring
inadequate income in old age

Health:

Mental and physical health impacts of unemployment,
inadequate income and social networks in old age

UK Government Actuaries Department:

Value of annuities which a lump sum can buy:

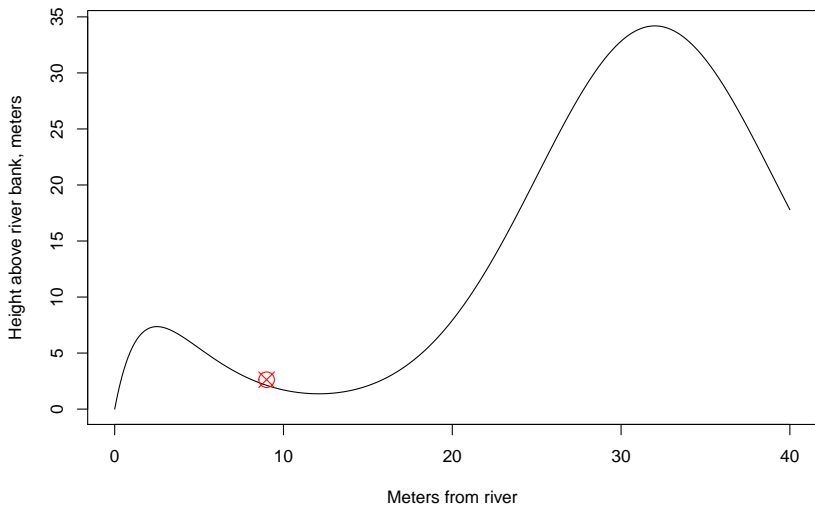
"... in practice, the "risk free" portfolio is likely to be only a theoretical construct and even a portfolio invested in 100% ILGs would not lead to "risk free" claimant outcomes.

The likely over- and under-compensation arising from different strategies are pertinent to other long-term financial strategies such as pensions."

"... even a very risk averse claimant might be inclined, and indeed advised, to accept more investment risk as a protection against longevity."

Life is not 1-D nor unimodal

A flood – go up!



Millennial goals

- Is increasing life expectancy good?
- Is smaller family size good?
- Is it unfair of our parents to live longer?
- Is it unfair to expect us to care for the older generation?
- How might a society reduce the cost of old age provision?
 - Self-sacrifice?
 - export - encourage emigration?
 - right to kill old people?

What are people that you are mindful of them,
human beings that you care for them?

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A Pensions Strategy which prioritised protecting pension annuities, rather than only considering the size of a lump sum or protecting a Pension Protection Fund, would pay serious attention to the inefficiency of DC schemes, and the implications of changes for all sectors of society.