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# Longevity Risk and Annuities in Singapore

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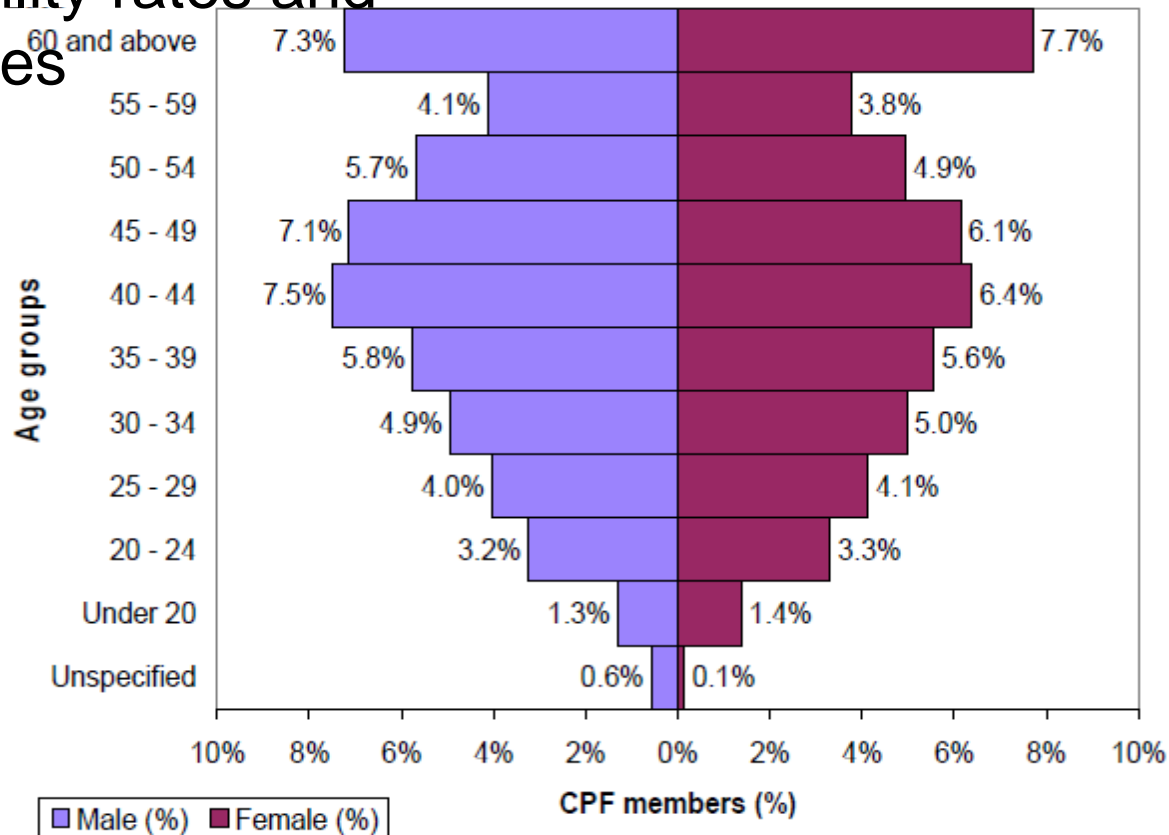
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# Rapid aging of CPF participants (2005)

- Spore's baby boomers start to retire.
- 23% are 55+ (5.5% in 1985)
- 9% age 24 or below (25% in 1985)
- One of the lowest fertility rates and longest life expectancies

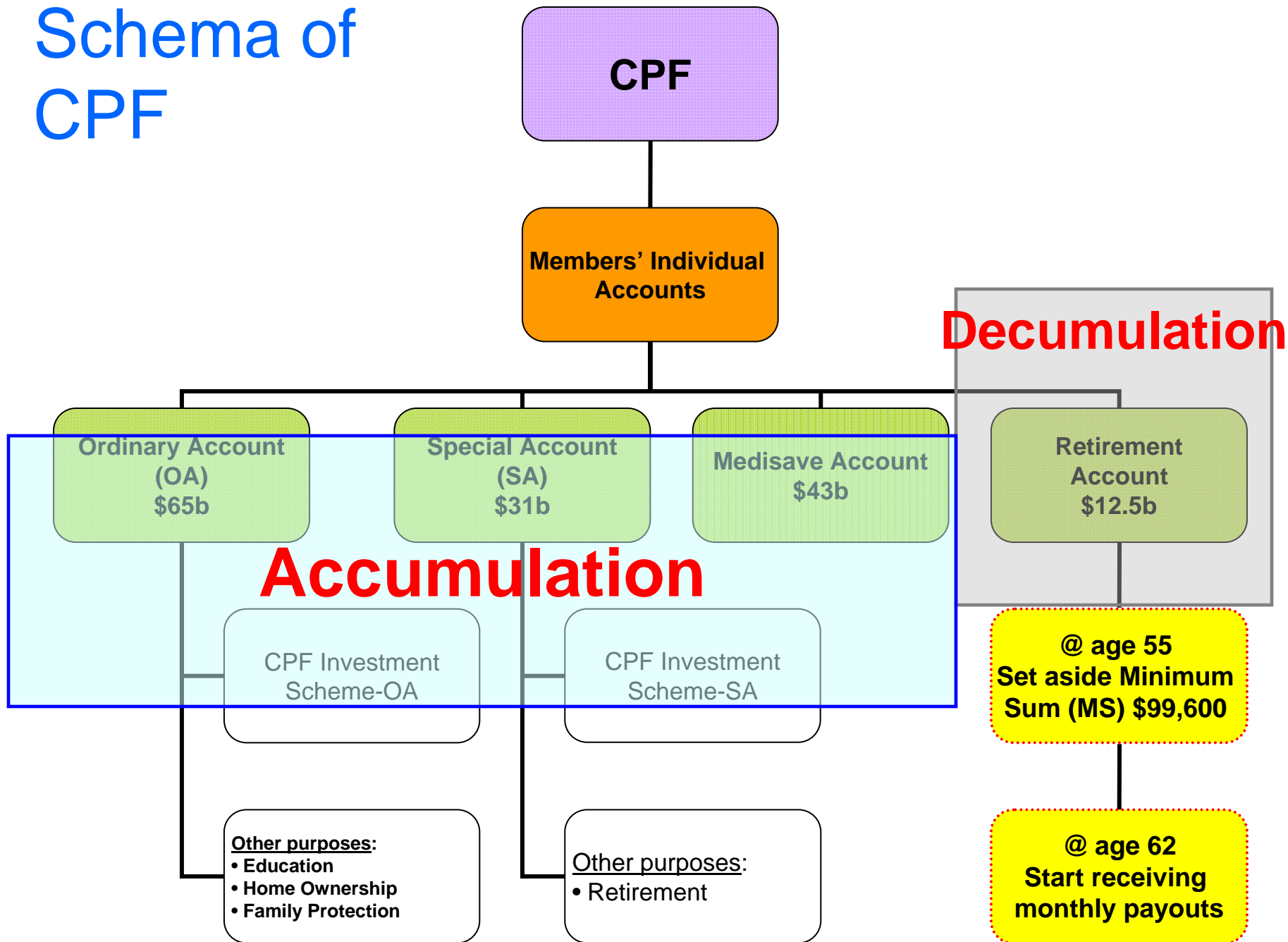
👉 As system matures, attention now turning to payout phase.



# Brief History of CPF pension scheme

- Established in 1955 as a mandatory, national saving program.
- One of the world's oldest retirement schemes. Many Asian nations look to Singapore for some inspiration [*Malaysia, Hong Kong, China,...*].
- **Currently: wide-ranging social security system**
  - 3.2 million CPF members; self-employed included.
  - total member balances S\$151 billion.
  - Defined contribution plan financed by mandatory levies of 10-34.5% of pay (depends on age) with ceiling at \$4,500/mth. High contributions promote saving.
  - Contributions channeled into 4 main accounts.

# Schema of CPF



# Payout menu @ age 62 (Decumulation Phase)

- **Phased Withdrawal (default)**

- Quantum depends on Minimum Sum (MS) retirement balance set aside @ age 55.
- Typically last about 20 years ~ \$790/mth.
- Administered by CPF Board / private banks.
- Opportunity for bequest.

- **Life Annuity**

- Sold by *participating* private insurers (e.g. AIA, Prudential, NTUC Income).
- Participant must have full Min. Sum \$99,600 = premium.
- Flat lifetime annuity payouts (sex-specific)  
~ \$480/mth (F); \$520/mth (M).
- Offers longevity protection. But not inflation-indexed.
- ‘Guaranteed amount’ feature allows bequest.

# Empirical observations

- Bulk of participants choose default option of phased withdrawal. Possible reasons:
  - ④ Inertia.
  - ④ Unable to set aside full Min. Sum @ age 55; retirement wealth tied up in housing equity.
  - ④ Small selection of life annuities under scheme; not all private insurers participate.
  - ④ Perhaps low returns / high costs associated with the life annuities? Adverse selection costs?
- And why is this a problem?

# Defining money's worth ratio (MWR)

- Apply the money's worth framework
  - ❖ US : Mitchell, Poterba, Warshawsky, & Brown (1999)
  - ❖ UK : Finkelstein and Poterba (2002, 2004)
  - ❖ Chile: Thorburn, Rocha, and Morales (2005)
  - ❖ Singapore / Australia: Fong WM (2002). Also Doyle, Mitchell, & Piggott (2004)
- But standard model will not work here.

$$MWR = EPDV[benefits] / K$$

$$= \left( \sum_{t=1}^{\infty} \frac{{}_t P_a \cdot A_a}{(1+i_t)^t} \right) / K$$

A: annuity payout (for entry age a)

K: premium

i: interest rate

${}_t p_a$ : cumulative survival probability



# Model – extending previous work

- Must account for specific refund characteristics.
  - Refund is lump-sum (thus standard MWR model for joint-and-survivor annuity does not apply)
  - ‘Guaranteed amount’ upon death:
    - @ 55 – 62: full premium refunded.
    - @ 62 onwards: refund =  $\max[0, \text{premium} - \text{payouts}]$ .
- Yield curve constructed using 20-yr bonds compared to flat interest rate or 10-yr bonds.
- Further Actuarial adjustments:
  - Extrapolate population life table to age 117 (to match with limiting age of annuitant group).
  - Uniform distribution of deaths assumption. Deviate from typical constant force of mortality assumption.

# Model

$$\text{EPDV} = \sum_{t=1}^{83} \frac{{}_{(t-1)}p_a \cdot q_{a+(t-1)} \cdot K}{(1+i_t)^t} + \sum_{t=84}^{\infty} \frac{{}_t p_a \cdot A_a + {}_{(t-1)}p_a \cdot q_{a+(t-1)} \cdot \max[0, K - \sum_{s=0}^{t-84} A_{a,s}]}{(1+i_t)^t}$$

- 3 key inputs:
  1. Pricing quotes of the life annuities offered by participating private insurers for Jul 2007.
    - Sex-specific payouts  $A_a$
    - Premium  $K$
  2. Mortality data for population and annuitant groups.
    - actuarial  $p$  and  $q$
  3. Riskless term structure of interest rates  $i_t$
- Compute MWR for each of the 9 annuities.

# Premium & sex-specific payouts

- Annuities offered are rather similar across insurers.
- 9 annuities in Jul 2007
- Single Premium = \$99,600 (varies yearly with stipulated MS)
- Annuity purchased at age 55; monthly payout starts at 62 (7-year deferred).
- Level payouts; no inflation-index.
- 2 annuities offer annual bonus participation.

Insurer	Male	Female
Asia Life	S\$505.47	S\$454.47
Prudential	518.44	449.87
AIA	530.87	513.94
NTUC Income*	523.50 (591.08)	490.25 (557.83)
⋮	⋮	⋮
⋮	⋮	⋮
<b>Average w/o bonus</b>	<b>519.58</b>	<b>476.98</b>
<b>Average w bonus</b>	<b>534.60</b>	<b>492.00</b>

# Mortality

- **Population group**

- New 2007 population period tables from Singstat.
- Limiting age 100; extrapolate to 117.

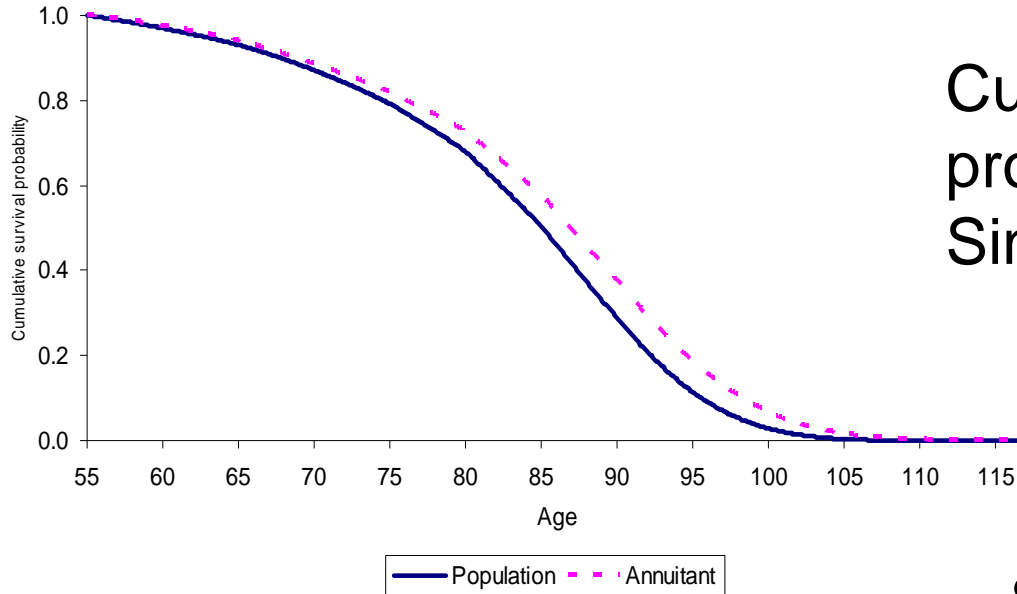
- **Annuitant group**

- Annuitant period tables not available in Singapore.
- Industry uses United Kingdom a(1990) ultimate tables with 5-year setback to proxy annuitant experience.
- Same treatment in prior empirical studies.

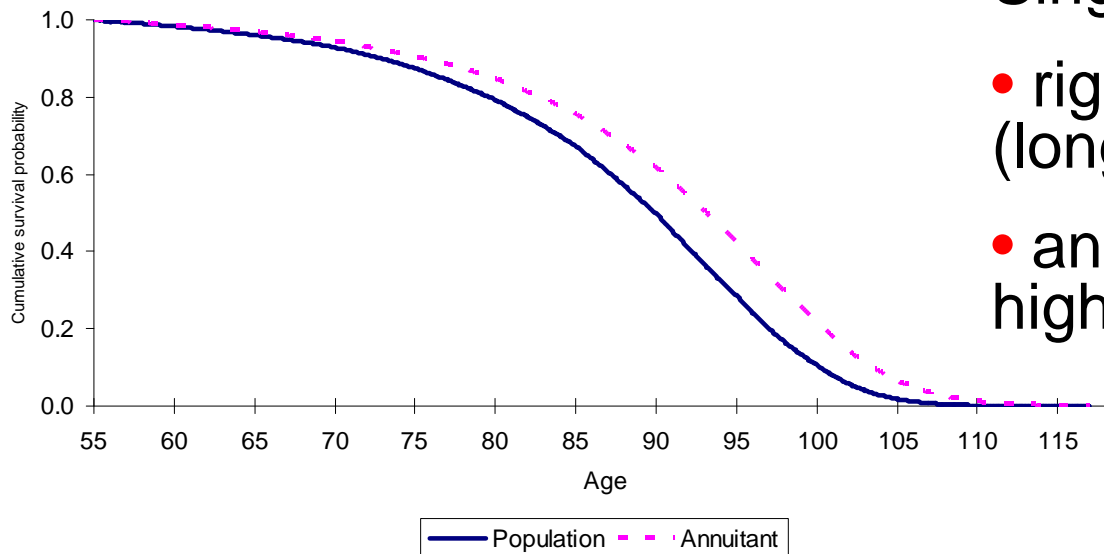
- Applied 15-yr mortality improvement factors to 'cohortize' tables

→ obtained 1952 cohort tables = 2007-55.

# Mortality graphs (Population vs annuitants; 2007)



Cumulative survival probability for Singaporean males (2007)



Singaporean females

- right-tail is fatter (longevity risk higher)
- annuitant curve lies higher above popn. curve

# Findings (55-yr-old; July 2007; riskless term structure)

	Population	Annuitant	Adverse Selection
Male	0.853	0.883	3.01%
Female	0.855	0.898	4.34%

1. Every \$1 premium generate \$0.85 in expected annuity income.
2. Cross-country comparison:

	data	MWR	AS
US: Mitchell et al (99)	1995	0.816	10.0%
UK: Finkelstein & Poterba (02)	1998	0.865	4.6%
Singapore: Doyle et al (04)	2000	0.945	0.3%
Singapore: Fong (02)	2000	0.986	1.1%

# Conclusion

- MWR \$0.85, Low AS → good value-for-money annuities from private insurers. Low take-up likely due to participants' inertia / financial illiteracy.
- AS accounts for small proportion of total loadings.
- **So what might introducing mandatory annuitization do?**
  - May do little to further eliminate AS.
  - Govt as the public annuity provider can hold down admin. costs → MWR Govt-offered annuity ≈ \$1 (?)
  - Participants stand to benefit from more attractive payouts / greater choice.
  - Spur growth of overall annuity market.

# The way forward: mandate annuitization

- Proposal to mandate annuitization of the CPF retirement balance
  - Just announced in mid-2008.
  - Auto-inclusion of members will start in 2013.
  - No phased withdrawal allowed.
  - Made mandatory to reduce adverse selection.
- Default: Newly-launched CPF LIFE annuities offered by CPF Board. *[details not finalized...]*
- Alternative: Life annuities from private insurers (possible crowd-out?).