FEASIBILITY AND WELFARE IMPACT OF FLEXIBLE TONTINE DESIGN

Presented by Adam Butt, Associate Professor of Actuarial Studies, Australian National University

Research by Adam Butt, Gaurav Khemka and Eugene Tan

Presented to the 32nd Colloquium on Pensions and Retirement Research
UNSW 27-28 November 2024

Australian National University

Agenda

Annuity puzzle

Background & Motivation

- Lifetime income products have little market penetration in Australia (the “annuity puzzle”); most Australian retirees use an account-based pension
- One reason proposed in the literature is cost and inflexibility of annuities
- The “Retirement Income Covenant” (2022) requires superannuation funds to develop strategies that (among other things) manage “expected risks to the sustainability and stability of retirement income”

Australian market for lifetime income products

Background & Motivation

- Life annuities have been sold for decades with little market penetration
- Investment-linked annuities have more recently been introduced; e.g. Allianz, AMP, Challenger, Generation Life/Optimum, etc.
- Australia lacks products with the variety of guarantees offered as in the U.S.
- Q-Super (now ART) offer a pooled product (tontine) where payouts depend on mortality experience of the pool

Lifetime income product structure

Background & Motivation

B_0 = initial investment at age x

$$P_t = B_t \,/\, a_{x+t,AIR}$$

$$a_{x+t,AIR} = \sum_s {}_sp_{x+t}(1+AIR)^{-s}$$

${}_sp_{x+t}$ = survival probability from age x+t to age x+t+s

$$B_{t+1} = (B_t - P_t) \times (1+i_t) \times (1+r_t)$$

i = investment return / r = mortality credit

$$E[r_t] = \frac{q_{x+t}}{1-q_{x+t}}$$

q_{x+t} = death probability for age x+t

Tontine structure

Background & Motivation

$$1 + r_t = (1 + E[r_t])(1 + m_t) - 1$$

$$m_t = \frac{\begin{pmatrix}\text{Pool member deaths balances} - \\ \text{Pool member survivals} \\ \text{expected mortality credits}\end{pmatrix}}{\text{Pool member survivals balances}}$$

Research question

Background & Motivation

- Investigate feasibility and pool impacts of allowing flexible payouts in a tontine.
- Measure the impact of potential adverse selection in such a structure.

Model structure

Model structure & Assumptions

Element	Details
Number of simulations	10,000
Pool size	1,000 members with run-in from the mortality model
Mortality rates	Stochastic simulations from Cairns-Blake-Dowd model on Australian data from the Human Mortality Database
Balance	Initial balance at age 67 randomly determined from a Gamma distribution with scale parameter 100,000 and shape parameter 1.5; average balance = $150,000; standard deviation = $122,474

Model structure

Model structure & Assumptions

Element	Details
Deaths	Randomly determined from the mortality model, underlying mortality rates assumed to be known one year before deaths
New entrants	For each death a new entrant of age 67 enters the pool
Investment returns	Modelling in real terms. Risk-free return 1% p.a. Risky return per annum normal with mean 6.5% and standard deviation 17.4%.
Asset allocation	50/50 risky/risk-free
AIR	3.4%

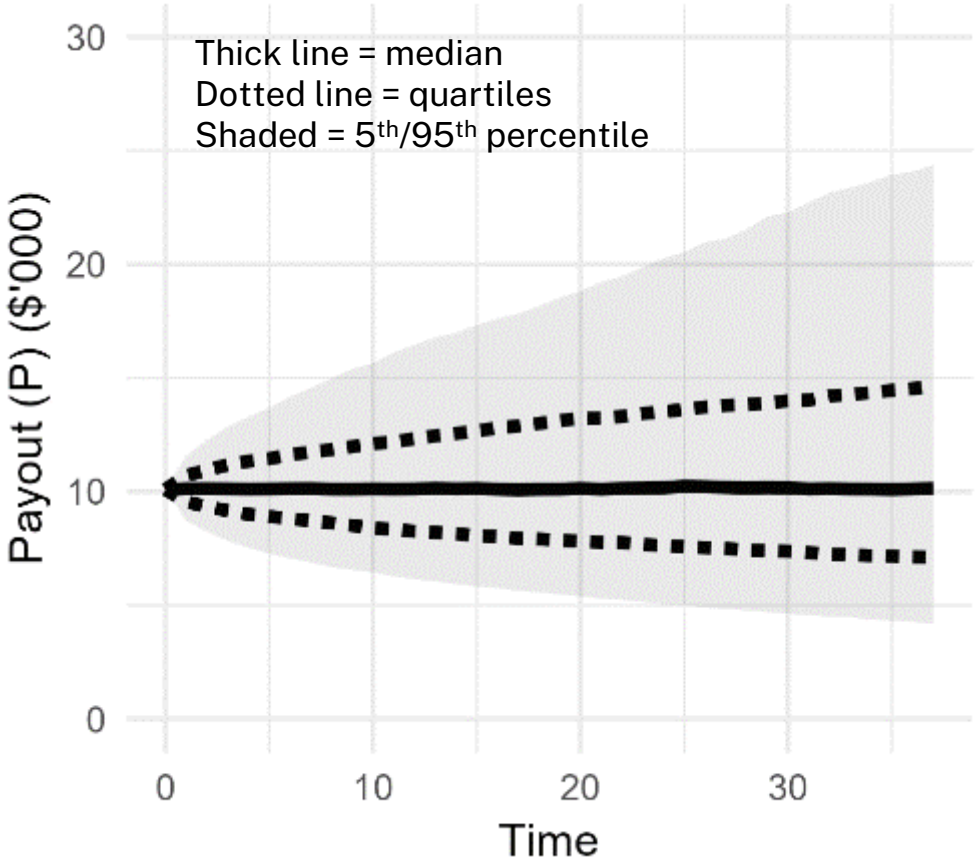
Model member analysis

Model structure & Assumptions

- A model member is introduced, who has an initial balance of $150,000 at age 67, is assumed to live throughout the investigation period, and experiences the same tontine performance as the pool
- We split the proportionate tontine payout adjustment (PA) from one period to the next into three components:
  - Interest adjustment (IA)
  - Assumption adjustment (AA)
  - Mortality adjustment (MA)

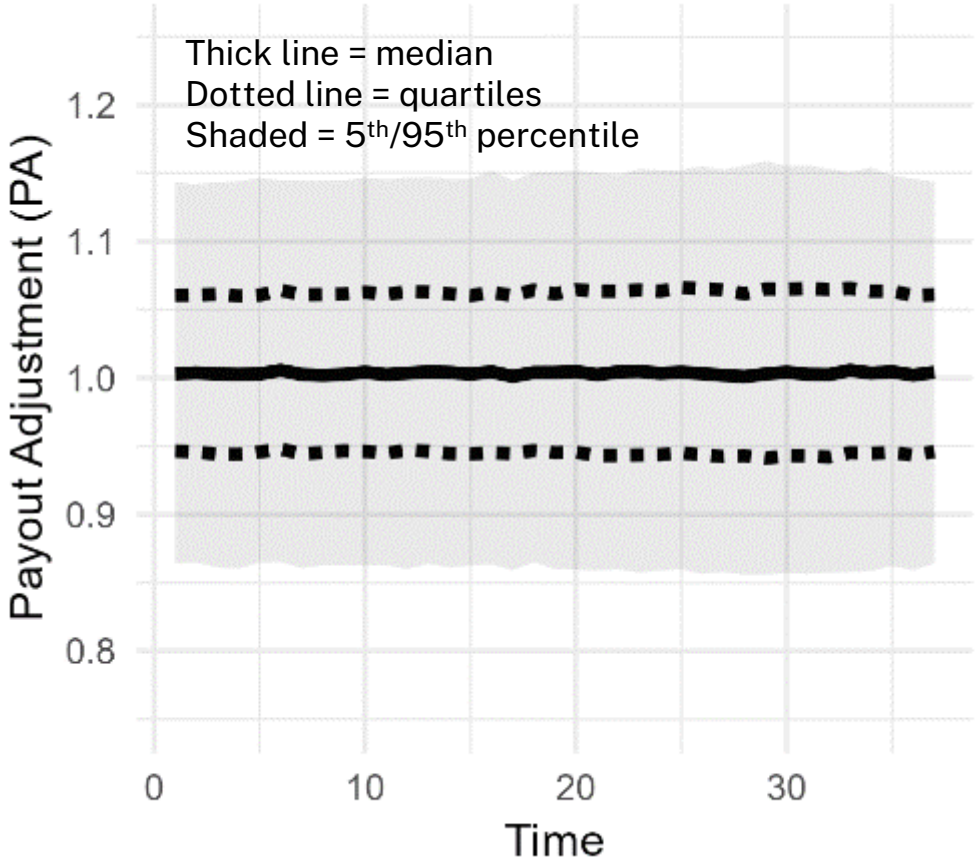
Payout distribution

Base results



Payout adjustment distribution

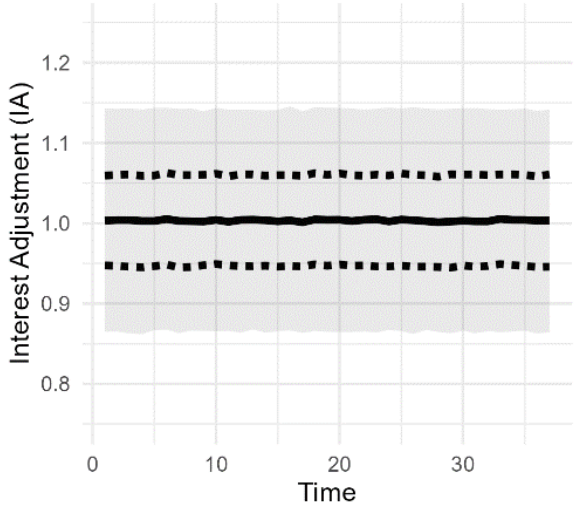
Base results

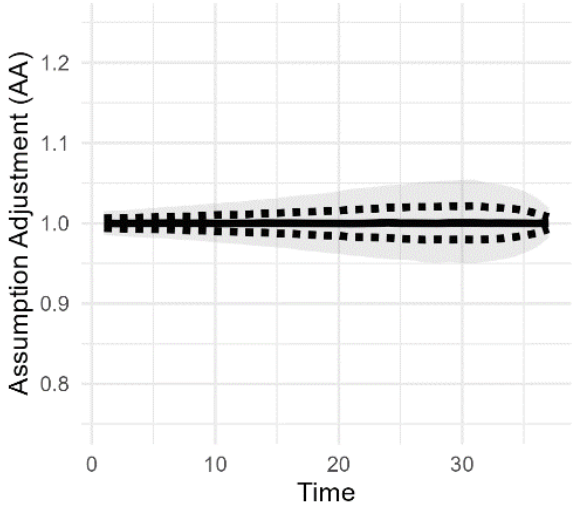


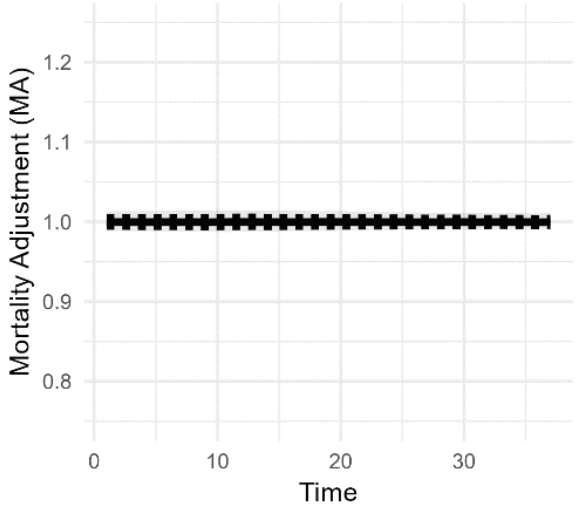
Components of adjustment distribution

Thick line = median
Dotted line = quartiles
Shaded = 5th/95th percentile

Base results







Certainty equivalent payout comparisons

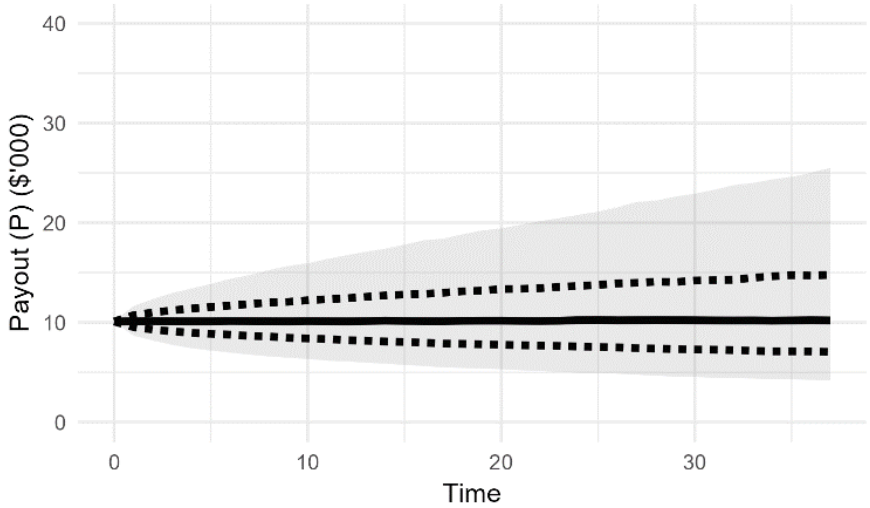
Pool heterogeneity and flexible payout comparisons

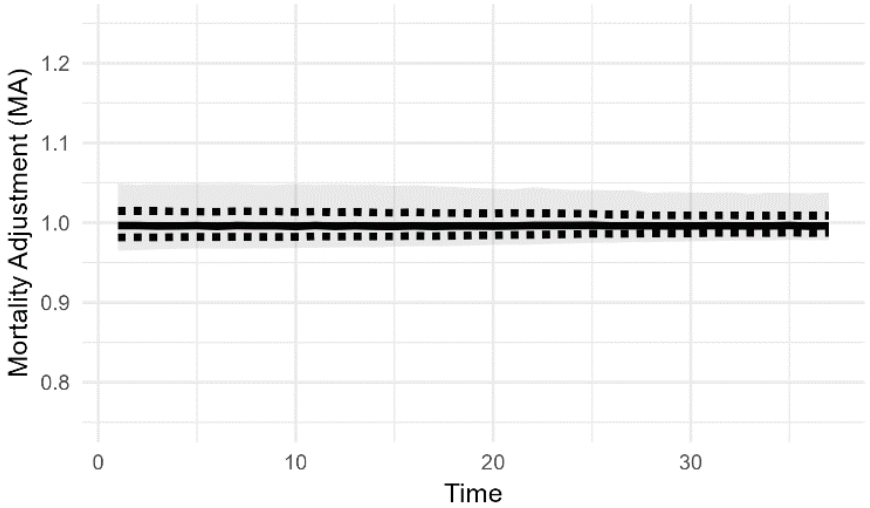
Structure	*CEP* Tontine ($)	*CEP* Annuity ($)	Difference (%)
Base	**9,192**	**9,235**	**0.47**
100% risk-free	7,846	7,883	0.47
100% risky	7,581	7,679	1.28
Half pool defers payments	9,195	9,235	0.43
Pool size = 100	9,078	9,235	1.70
Pool size = 500	9,184	9,235	0.55
Double wealth variability	9,185	9,235	0.54

Pool size =100

Pool heterogeneity and flexible payout comparisons

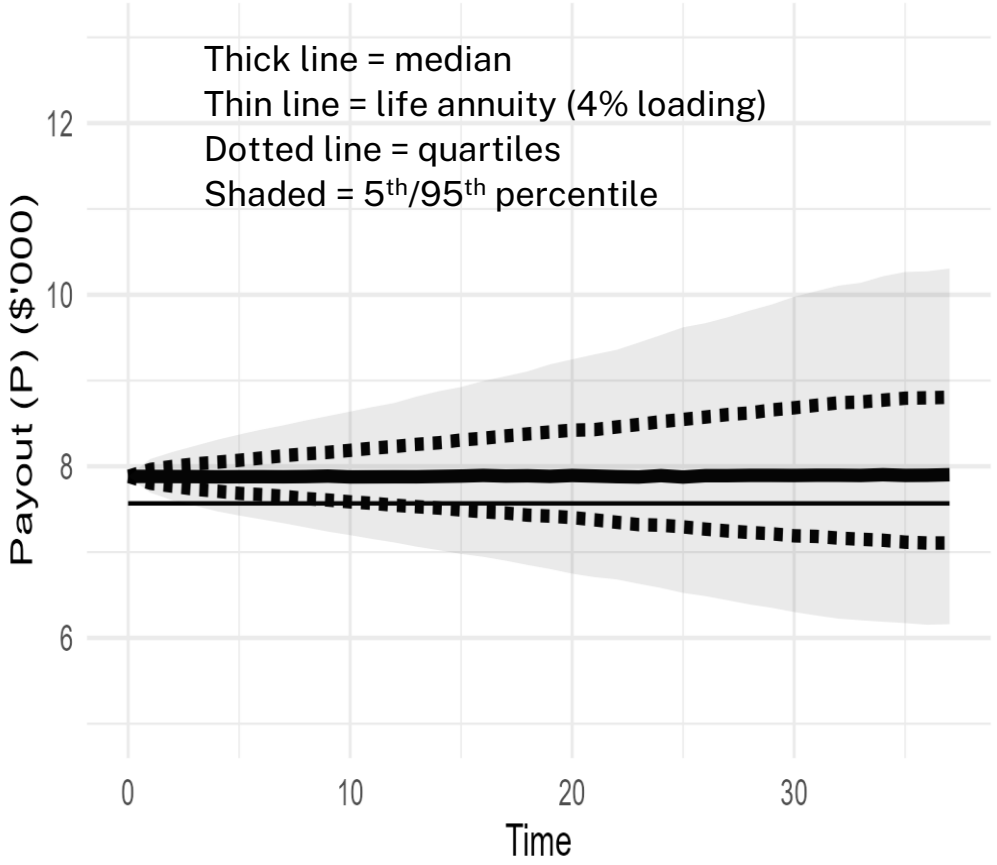
Thick line = median
Dotted line = quartiles
Shaded = 5th/95th percentile





Comparing tontines to life annuities (100% risk-free asset allocation)

Pool heterogeneity and flexible payout comparisons



Scenario set up

Selection effects and flexible payout comparisons

- A member can forecast their death n years into the future and hence chooses a payout at the maximum AIR level for those n years
- Test values of n of 1, 2, 3 years and maximum AIR values of 5% and 10%

Certainty equivalent payout comparisons

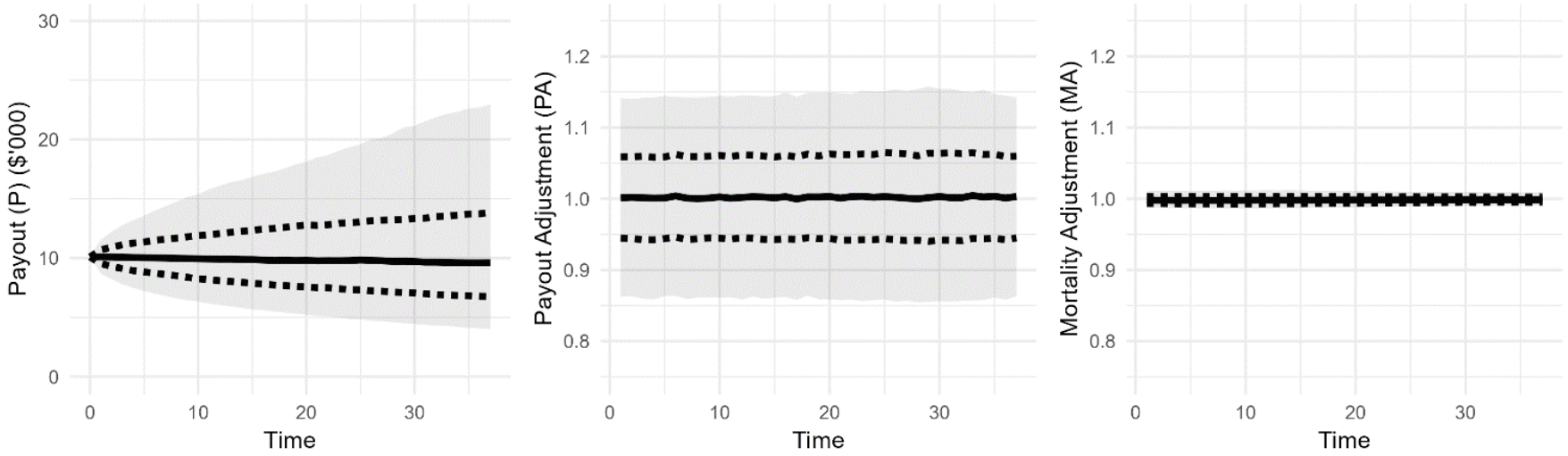
Selection effects and flexible payout comparisons

Structure	*CEP* Tontine ($)	*CEP* Annuity ($)	Difference (%)
Base	**9,192**	**9,235**	**0.47**
Max AIR = 5% / n = 1	9,150		0.92
Max AIR = 5% / n = 2	9,112		1.33
Max AIR = 5% / n = 3	9,082		1.66
Max AIR = 10% / n = 1	9,005		2.49
Max AIR = 10% / n = 2	8,855		4.11
Max AIR = 10% / n = 3	8,741		5.35

A closer look at max AIR = 10% / n = 1

Selection effects and flexible payout comparisons

Thick line = median
Dotted line = quartiles
Shaded = 5th/95th percentile



Conclusions

Conclusions & Future research

- Flexible payment structures have no impact on welfare in tontines if there are no selection effects.
- Selection effects from flexible payment structures can have a sizable impact on welfare, although can be mitigated through sensible constraints
- There is potential for flexible payment structures in future product design, noting regulatory restrictions as well

Future research

Conclusions & Future research

- Multi-state models and selection effects
- Mortality mis-specification
- Optimal frequency of adjustment of assumed mortality rates

THANK YOU

Contact Us

Research School of Finance, Actuarial Studies and Statistics
adam.butt@anu.edu.au
rsfas.anu.edu.au

Australian National University