How can people share their longevity risks?

Catherine Donnelly
Risk Insight Lab, Heriot-Watt University

Joint work with Thomas Bernhardt (Heriot-Watt), Montserrat Guillén (U.Barcelona), Jens Perch Nielsen (Cass) and John Young.

The ‘Minimising Longevity and Investment Risk while Optimising Future Pension Plans’ research programme is being funded by the Actuarial Research Centre.

26 March 2019
Question for audience

• Which option best describes tontines?

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
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<tbody>
<tr>
<td>Option A</td>
<td>Aren’t they illegal?</td>
</tr>
<tr>
<td>Option B</td>
<td>Last survivor takes all - watch your back!</td>
</tr>
<tr>
<td>Option C</td>
<td>Higher retirement income than drawdown.</td>
</tr>
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<td>Option D</td>
<td>Never heard of them.</td>
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Tontines, by other names

Collected Defined Contribution

Mercer LifetimePlus

On average, more than half of all Australians today will outlive their retirement savings. Yet despite recommendations from the 2014 Financial Systems Inquiry, the market for self-funded retirement products has been slow to evolve.

Mercer LifetimePlus is an award-winning investment solution that tackles longevity risk in a new way by providing genuine income for life that grows as people age.
What is a tontine?

• A tontine is a structure to pool longevity risk.

• A pure tontine has no guarantees – the pool of people bear the longevity risk.

• The purpose of modern tontines is to pay an income for life.
Imagine yourself...
What to do?
Seeking advice…

Retirement options kiosk
## Age 70 with £100K pot

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<td><strong>Annual income</strong></td>
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Life annuity contract

Insurance company
Life annuity contract

Insurance company
Life annuity contract
Life annuity contract
Life annuity contract
Life annuity feature

• Life annuity gives higher income than income drawdown,
  – if follow same investment strategy, and
  – ignore fees, costs, taxes, etc.

• Why? Pool longevity risk.

• We can pool longevity risk without buying life annuities.
Life annuity contract
Tontine
Modern tontines

• Aim: retirement income, not a life-death gamble.

• Various tontines structures have been proposed.

• Focus on [DGN] method of pooling longevity risk
Pure modern tontine – individual account structure

- Longevity credits
- Investment returns
- Participant’s account
- Withdrawals
Pure modern tontine

Account shared among tontine participants

Alive or dead?

Dead

Investment returns

Account value

Alive

Longevity credits

Investment returns

Account value

Withdrawals
Calculating longevity credits [DGN]

Pool risk over lifetime

Individuals make their own investment decisions

Individuals withdraw income from their own accounts

However, when someone dies at time $T$...
Calculating longevity credits [DGN]

Share out account value of Bob.

\( \lambda^{(i)} \) = Instantaneous chance of dying of \( i^{th} \) member at time \( T \)

\( W^{(i)} \) = Account value of \( i^{th} \) member at time \( T \).

Longevity credit to \( i^{th} \) member

\[
\frac{\lambda^{(i)} \times W^{(i)}}{\sum_{k \in \text{Group}} \lambda^{(k)} \times W^{(k)}} \times \{\text{Bob's account value}\}.
\]
Calculating longevity credits [DGN]

• Total account value of group is unchanged by pooling.

• Expected actuarial gain = 0, for all members at all times.
  • i.e. the pool is actuarially fair at all times

• There will always be some volatility in the longevity credit:
  • But longevity credit ≥ 0, i.e. never negative.
  • Loss occurs only upon death.

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Calculating longevity credits [DGN]

• Mitigates longevity risk, but does not eliminate it.

• Update chances of death to reflect new information on longevity.

• Anti-selection risk remains, as for life annuity. Waiting period?

• “Cost” is paid upon death, not upfront like life annuity.
  - Could consider, e.g. housing (Donnelly & Young 2017).
Other methods of longevity credits, for finite groups

• [DGN] rule works for any group:
  • Actuarial fairness holds for any group composition, but
  • Requires a (small) payment to estate of recently deceased.

• [Sabin] proposes a survivor-only, actuarially fair payment. However, it requires restrictions on membership.

• Implicit tontines pay an income rather than longevity credits
  • Group Self-Annuitization Scheme of [Piggott et al], enabled by Australian Government.
  • Milevsky and Salisbury (2015).
Modern tontine with bequest

• Here, present potential new product with bequest.
• Based on Bernhardt & Donnelly (2019).
Modern tontine with bequest

Split pension savings into two accounts, 80% in tontine account

- Tontine account
- Bequest account

80% of pension savings

20% of pension savings
Modern tontine with bequest

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Modern tontine with bequest

Re-balance accounts (re-distribute longevity credits)

- Re-balanced tontine account: 80% of pension savings
- Re-balanced bequest account: 20% of pension savings
Modern tontine with bequest

Tontine account shared among tontine participants, Bequest account paid to estate

Investment returns

Previous tontine & bequest accounts value

Account

Alive or dead?

Alive

Dead

Longevity credits

Investment returns

Previous tontine & bequest accounts value

Withdrawals
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Bequest account vs Drawdown bequest

![Graph showing the comparison between Bequest account value and Drawdown bequest over age at death (years).]
Bequest account vs Drawdown bequest

`Tontine with bequest’ gives higher bequest after age 87

Drawdown account hits zero by age 88
Research question

What percentage of pension savings should you put in the tontine account?

• Allow for desire for income, bequest motive and risk aversion.
• Found that, for (normal) risk aversion, percentage is fairly stable and high.
• Results are in theoretical model.
• Next step is to look at more realistic model.
Modern tontines - summary

• Reduce risk of running out of money in retirement.
• Should be structured to provide a stable, fairly constant income (not increasing exponentially with the longevity credit!).
• Provide a higher income than living off investment returns alone.
• Can seek higher investment returns than life annuity, though implies more volatility.
• Can incorporate bequests.
Modern tontines - applications

• Potential innovation in retirement products, e.g.
  • allow for bequest: ‘modern tontine with bequest’ – see Donnelly & Bernhardt (2019).
  • provide downside protection that too few deaths occur (minimum income) – see Donnelly & Young (2017).
  • allow less liquid assets such as pensioner’s house.

• Foundation for collective DC plans
  • Provides income without buying life annuities.
  • Could be integrated into DC plans as post-retirement option.
The views expressed in this presentation are those of the presenter.
Bibliography and further reading


Bibliography and further reading


