21st century retirement: Modern tontines

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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.
Question 1 for audience

• Which option best describes tontines?

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<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>
<tr>
<td>Option D</td>
<td>Never heard of them.</td>
</tr>
</tbody>
</table>
Tontines, by other names

Collective Defined Contribution (CDC) schemes

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

<table>
<thead>
<tr>
<th>Pure modern tontine</th>
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<tbody>
<tr>
<td><strong>Annual income</strong></td>
<td>£7,100</td>
</tr>
<tr>
<td><strong>Age at which out-live savings</strong></td>
<td>120 years</td>
</tr>
<tr>
<td><strong>Money left to heirs</strong></td>
<td>Nothing</td>
</tr>
<tr>
<td><strong>Basis</strong></td>
<td>(Mortality, Investment returns), [allocation to tontine], [income if use unadjusted table]</td>
</tr>
<tr>
<td></td>
<td>(S1PMA-2, 2% p.a.), [100% allocation], [£7,700 on S1PMA]</td>
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## Age 70 with £100K pot

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<td><strong>Annual income</strong></td>
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### Basis

- *(Mortality, Investment returns), [allocation to tontine], [income if use unadjusted table]*
  - *(S1PMA-2, 2% p.a.), [100% allocation], £7,700 on S1PMA*
  - *(S1PMA-2, 2% p.a.), [80% allocation], £7,100 on S1PMA*
## Age 70 with £100K pot

<table>
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<tr>
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<th>Life annuity</th>
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<tr>
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<tr>
<td><strong>Age at which out-live savings</strong></td>
<td>120 years</td>
<td>120 years</td>
<td>Never</td>
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**Basis**

- *(Mortality, Investment returns), [allocation to tontine],[income if use unadjusted table]*
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  - *(S1PMA-4, UK yield curve), equivalently (S1PMA-2, -0.3% p.a.)*

3 October 2018
### Age 70 with £100K pot

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<th>Money left to heirs</th>
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<td>£6,600</td>
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</tr>
<tr>
<td>Never</td>
<td>Whatever left in pot at death</td>
<td>(S1PMA, 2% p.a.)</td>
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Question 2 for audience

Which do you want to know more about

(currently age 70, £100K pot)?

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<tr>
<th>Option</th>
<th>Annual income</th>
<th>Beneficiaries get…</th>
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<tbody>
<tr>
<td>Option A – pure tontine</td>
<td>£7,100 p.a. until age 120.</td>
<td>Nothing.</td>
</tr>
<tr>
<td>Option B – modern tontine with bequest</td>
<td>£6,600 p.a. until age 120.</td>
<td>20% of pot at death.</td>
</tr>
<tr>
<td>Option D – income drawdown</td>
<td>£6,600 p.a. until age 87.</td>
<td>Whatever is left in pot at death.</td>
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</tbody>
</table>
Life annuity contract
Life annuity contract
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.


- 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

Investment returns
Account value

Alive or dead?

Investment returns
Account value

Withdrawals

Dead

Longevity credits
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.

\[
\lambda(i) = \text{Force of mortality of } i^{th} \text{ member at time } T
\]

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

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.
Calculating longevity credits [DGN]

• Mitigates longevity risk, but does not eliminate it.
• Update forces of mortality 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.
Minimising Longevity and Investment Risk while Optimising Future Pension Plans

Recent project presentations

• Sessional Research Event in May 2018:
  

• Here, present work with Thomas Bernhardt, Risk Insight Lab, Heriot-Watt University
Modern tontine with bequest

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

- **Tontine account**: 80% of pension savings
- **Bequest account**: 20% of pension savings
## Modern tontine with bequest

<table>
<thead>
<tr>
<th>Longevity credits</th>
<th>Investment returns</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tontine account</strong></td>
<td><strong>Bequest account</strong></td>
</tr>
<tr>
<td><strong>Withdrawal</strong></td>
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Modern tontine with bequest

Rebalance accounts (re-distribute longevity credits)

<table>
<thead>
<tr>
<th>Re-balanced tontine account</th>
<th>Re-balanced bequest account</th>
</tr>
</thead>
<tbody>
<tr>
<td>80% of pension savings</td>
<td>20% of pension savings</td>
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Modern tontine with bequest

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

Alive or dead?

Investment returns
Previous tontine & bequest accounts value

Dead

Longevity credits
Investment returns
Previous tontine & bequest accounts value

Alive

Withdrawals
## Age 70 with £100K pot

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<td>87 years</td>
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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.
• Harder to say for risk-seekers.
• 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.
• Can incorporate bequests.
Modern tontines - applications

• Innovation in retirement products
  • e.g. allow for bequest: ‘modern tontine with bequest’.
  • e.g. provide downside protection that too few deaths occur (minimum income) – see Donnelly & Young (2017).
  • e.g. 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.
Question 3 for audience

Which would you choose (currently age 70, £100K pot)?

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Question 4 for audience [Word cloud]

Type in three distinct key words that you take away from this webinar
Bibliography and further reading


Bibliography and further reading


