Wharton University of Pennsylvania Pension Research Council

Spring Symposium

Managing Longevity Risk: New Roles for Public/Private Engagement

7 May 2020

State-Sponsored Pensions for Private Sector Workers: The Case for Pooled Annuities and Tontines

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Nuova Longevità Research

The University of Oklahoma · Civi et Reipublicae · 1890

Background

Many retirees are underprepared for retirement

- Lack of access to retirement saving programs
- Under-saving
- Lack of financial literacy and knowledge

Defined contribution (DC) plans are typically savings oriented…

…but retirees need a way to transform that savings into lifetime income

…and traditional withdrawal strategies are highly uncertain (longevity risk)

…and people tend not to purchase annuities on their own (annuity puzzle)

Motivation

States have begun to address these issues by introducing State-sponsored retirement saving programs (e.g., 'Secure Choice' plans)

These programs address the *access* and u*nder-saving* problems…

…but not the problem of transforming savings into *lifetime income*

We propose *Lifetime Assurance Funds* as a solution

- State-sponsored (but might also be privately sponsored)
- Operations can be outsourced to private companies
- Efficient, low-cost
- Assured lifetime income

What is an assurance fund?

Structured as an open-ended perpetual tontine or pooled annuity

Adheres to a strict budget constraint (must always remain fully funded)

Like a mutual fund, but:

- Mortality-risk pooled, and therefore irrevocable to enforce the risk-sharing arrangement
- Account balances are forfeited upon death
- Forfeitures are redistributed to survivors in the form of mortality credits
- Pays out in the form of lifetime income

Like a commercial life annuity, but:

- Is actuarially-fair
- Payouts levels are in no way guaranteed
- Investors share systematic mortality risk

Why assurance funds?

Lifetime income

- Well-suited to the DC model (individual accounts, investment options)
- Lifetime income is assured (to some maximum age, such as 120)

Efficiency

- Participants enjoy higher returns than with mutual funds (due to mortality credits)
- Lower cost structure than conventional annuities (no insurance or risk transfer costs)

Sustainability

- Fully funded and self-correcting (due to the budget constraint)
- Fully sustainable… forever

Consider a State-sponsored retirement saving/pension plan

Eligible employees enrolled automatically at a default contribution rate (can opt out)

The plan offers:

- Two types of accounts: regular accounts that are invested in mutual funds (the default) and assurance fund accounts
- A few investment options – e.g., a target-date fund, an equity fund, and a bond fund

Assurance funds payout starting at age 65, with two payout options:

- Lifetime uniform (expected growth rate of 0) – initial payout is higher
- Lifetime escalating (expected growth rate of 2.5% per year) – initial payout is lower, but will grow

Simplistic example

35-year-old male

Salary is $50,000 per year, growing at 4% per year

Contributes 10% of salary

- 5% into a regular account
- 5% into an assurance fund account
- Invests in the same underlying portfolio in both accounts

Deterministic assumptions:

- Investment return is exactly 7% each year
- People die and forfeit balances exactly as expected by the mortality table

Pre-retirement savings accumulation

		Regular Investment Account		Assurance Fund Account		
Age	Contribution to Each Account	Investment Return	Ending Balance	Investment Return	Mortality Credit	Ending Balance
35	$2,500	$86	$2,586	$86	$2	$2,588
36	2,600	270	5,457	271	4	5,463
37	2,704	475	8,635	475	7	8,649
38	2,812	701	12,149	702	10	12,174
39	2,925	951	16,025	953	14	16,066
40	3,042	1,226	20,293	1,229	19	20,356
⋮	⋮	⋮	⋮	⋮	⋮	⋮
59	6,408	15,360	238,051	15,910	1,275	247,726
60	6,665	16,893	261,609	17,570	1,549	273,510
61	6,931	18,551	287,091	19,384	1,882	301,707
62	7,208	20,344	314,644	21,367	2,279	332,562
63	7,497	22,283	344,424	23,537	2,751	366,347
64	7,797	24,378	376,598	25,913	3,316	403,372
	140,212	236,386		244,385	18,775	

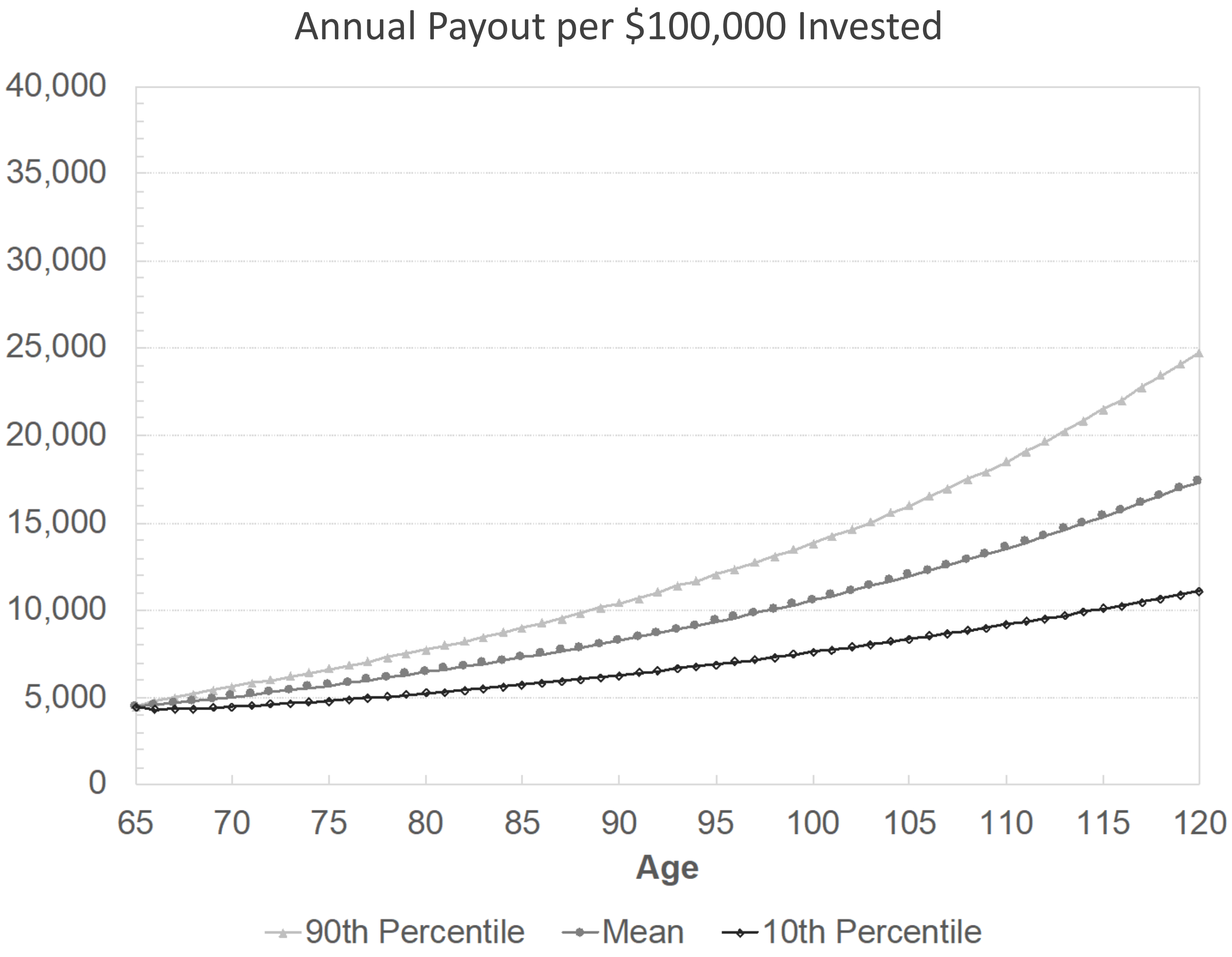
7.1% higher

Assurance fund payouts: uniform payout option

Age	Beginning Balance	Payout	Investment Return	Mortality Credit	Ending Balance
65	$403,372	$36,264	$25,698	$3,570	$396,376
66	396,376	36,264	25,208	3,694	389,014
67	389,014	36,264	24,693	3,845	381,288
68	381,288	36,264	24,152	4,026	373,201
69	373,201	36,264	23,586	4,240	364,763
70	364,763	36,264	22,995	4,492	355,987
⋮	⋮	⋮	⋮	⋮	⋮
117	74,396	36,264	2,669	27,201	68,002
118	68,002	36,264	2,222	22,640	56,599
119	56,599	36,264	1,423	14,506	36,264
120	36,264	36,264	0	0	0
		2,030,783	578,571	1,048,840	

A regular account with the same payouts would run out of money at age 84

Simulation: Bond portfolio*
Escalating payout option

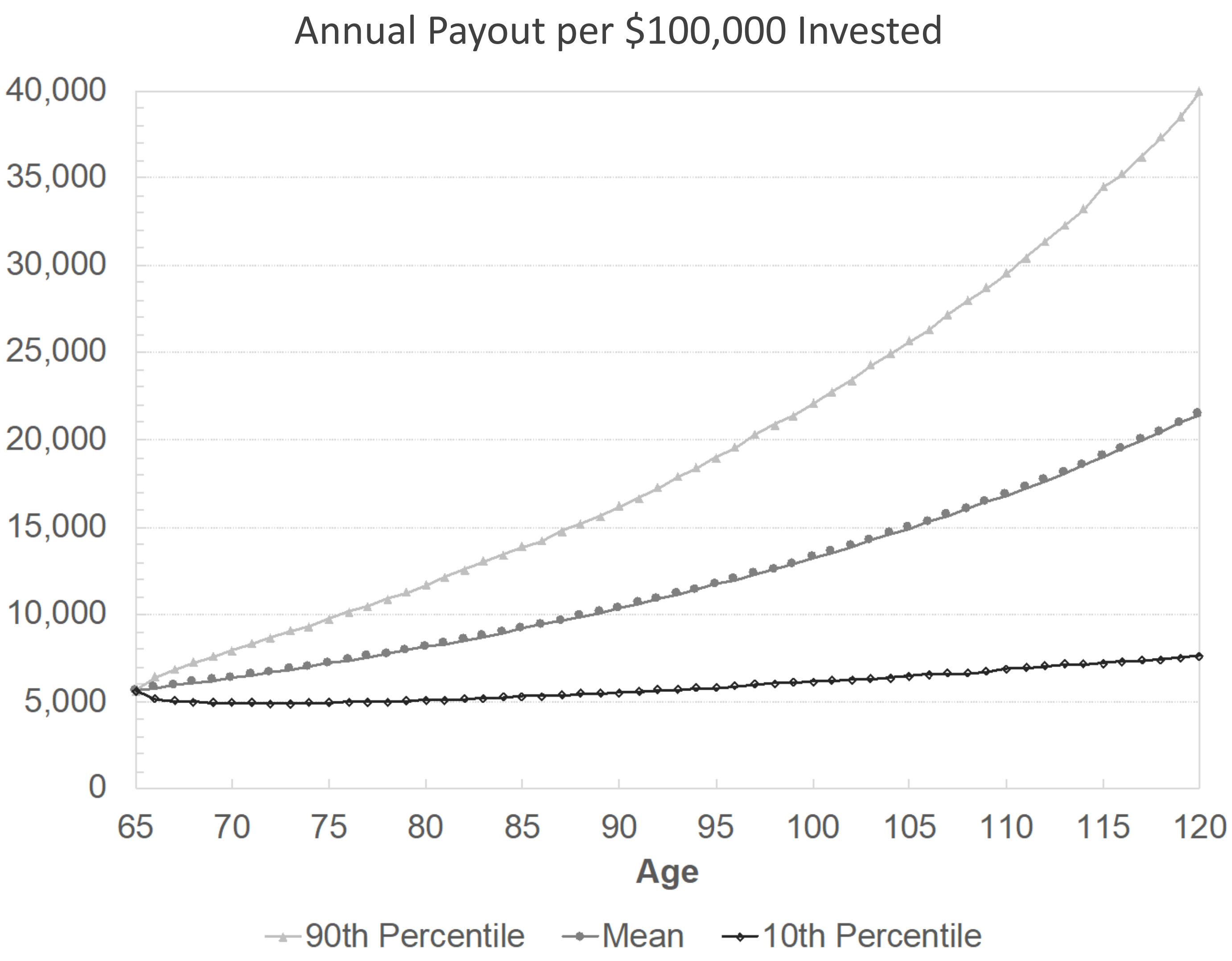


Initial payout: $4,462

* (3% expected return and 4% volatility)

Simulation: Blended 50% equity portfolio and 50% bond portfolio*
Escalating payout option

Initial payout: $5,655



* (5% expected return and 8.73% volatility)

Concluding remarks

State-sponsored assurance funds:

- Are self-correcting and therefore fully sustainable, forever
- Offer low-cost universal access to pension-like lifetime income
- Offer freedom of portfolio selection
- Offer freedom to choose from a variety of payout options
- Represent a partial remedy to the annuity puzzle
  - Lower cost
  - Greater transparency

Payout volatility can be minimized by:

- Encouraging a large membership pool (the law of large numbers)
- Using a more conservative, or risk-hedged, investment portfolio
- Using asset/liability management techniques

Appendix

The life-cycle model

Menahem Yaari† showed that for risk-averse utility-maximizing individuals:

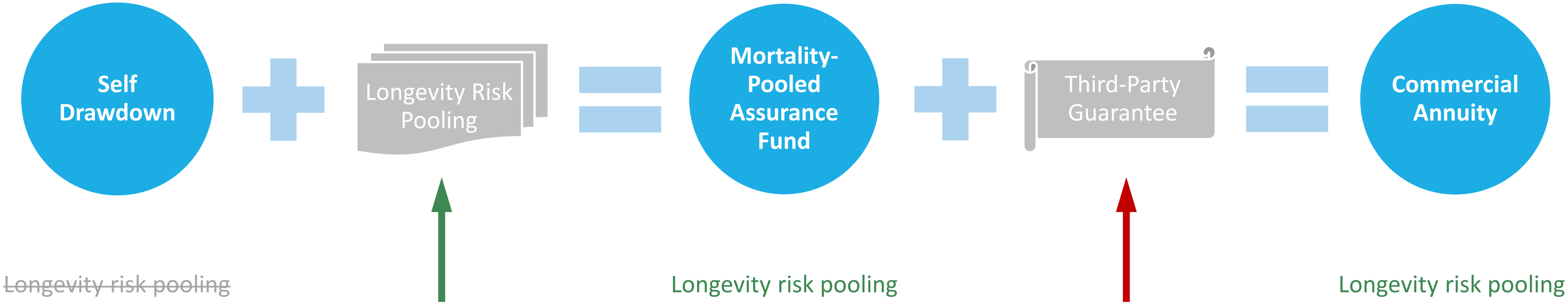
- Actuarially-fair life annuities are optimal
- Those with bequest motives might only partially annuitize

Insured annuities are not actuarially-fair

  - Reserve requirements
  - Hedging costs
  - Other expenses and profit margins

† Yaari, M.E. (1965), Uncertain Lifetime, Life Insurance and the Theory of the Consumer, *The Review of Economic Studies*, Vol. 32(2), pg. 137-150

An attractive alternative to self-drawdown and annuities



~~Longevity risk pooling~~
~~Mortality credits~~
~~Third-party guarantee~~

~~Irrevocable~~
~~Guarantee costs~~
~~Counterparty risk~~

Utility Maximizing for most ☺

Longevity risk pooling
Mortality credits
~~Third-party guarantee~~

Irrevocable
~~Guarantee costs~~
~~Counterparty risk~~

Opaquely Priced & Costly

☹

Longevity risk pooling
Mortality credits
Third-party guarantee

Irrevocable
Guarantee costs
Counterparty risk

Assurance fund payouts: escalating payout option

Age	Beginning Balance	Payout	Investment Return	Mortality Credit	Ending Balance
65	$403,372	$29,195	$26,192	$3,639	$404,008
66	404,008	29,925	26,186	3,838	404,107
67	404,107	30,673	26,140	4,071	403,644
68	403,644	31,440	26,054	4,343	402,601
69	402,601	32,226	25,926	4,661	400,963
70	400,963	33,032	25,755	5,031	398,717
⋮	⋮	⋮	⋮	⋮	⋮
117	220,871	105,427	8,081	82,349	205,873
118	205,873	108,063	6,847	69,771	174,429
119	174,429	110,765	4,456	45,414	113,534
120	113,534	113,534	0	0	0
		3,487,075	833,586	2,250,117	

The escalating payout exceeds that of the uniform option starting at age 74

A regular account with the same payouts would run out of money at age 85

Monte Carlo simulation

The variability of a tontine's payouts are a function of:

- The size of the tontine pool (the law of large numbers)
- The variability of the underlying investment returns

We develop a simulation model, with randomly drawn:

- Membership characteristics (age, gender, account size, portfolio selection)
- Portfolio returns
- Times of death*

10,000-person membership pool

10,000 simulation runs

*Mortality rates are based on the 2012 IAM mortality table projected forward using scale G2

Payout computation

Life annuity payout at the beginning of each year is computed as:

$$\frac{s}{\ddot{a}_x},$$

where s is the participant's current account balance, and

$\ddot{a}_x$ is the participant's current life annuity due factor, computed as:

$$\ddot{a}_x = 1 + \sum_{t=1}^{\infty} {}_t p_x \left((1+r)/(1+g)\right)^{-t},$$

where $(1+r)/(1+g)$ represents an assumed interest rate, in which:

${}_t p_x$ represents the probability that a person age x lives t more years,

r is the expected return on the investment portfolio, and

g is the expected payout growth rate (either 0 or 0.025).