The future is not guaranteed

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Outline

- Landscape
- Why buy a life annuity?
- Alternatives
  - Annuity Overlay Fund
  - Group Self-Annuitization Scheme
- Comparison

Landscape

- Decline of DB schemes
- Cost of life annuities
- Annuity puzzle

Retirement choices

Drawdown

Life annuity

Retirement choices

Drawdown

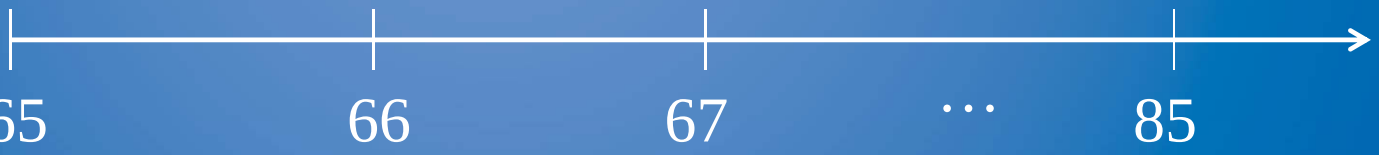
Life annuity

Alternatives

Drawdown (2% p.a.)

Assets $100

Consumption



Drawdown (2% p.a.)

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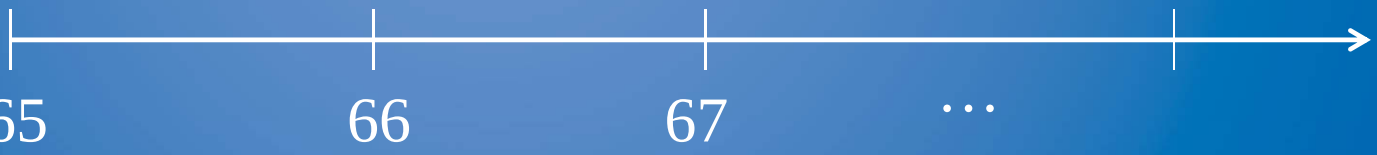
Life annuity (2% p.a.)

With 12% loading over fair value.

Pay insurer $100

Consumption



Life annuity (2% p.a.)

With 12% loading over fair value.

Pay insurer $100

Consumption $6 $6 ⋯ >+0

Age 65 66 67 ⋯ 65+T

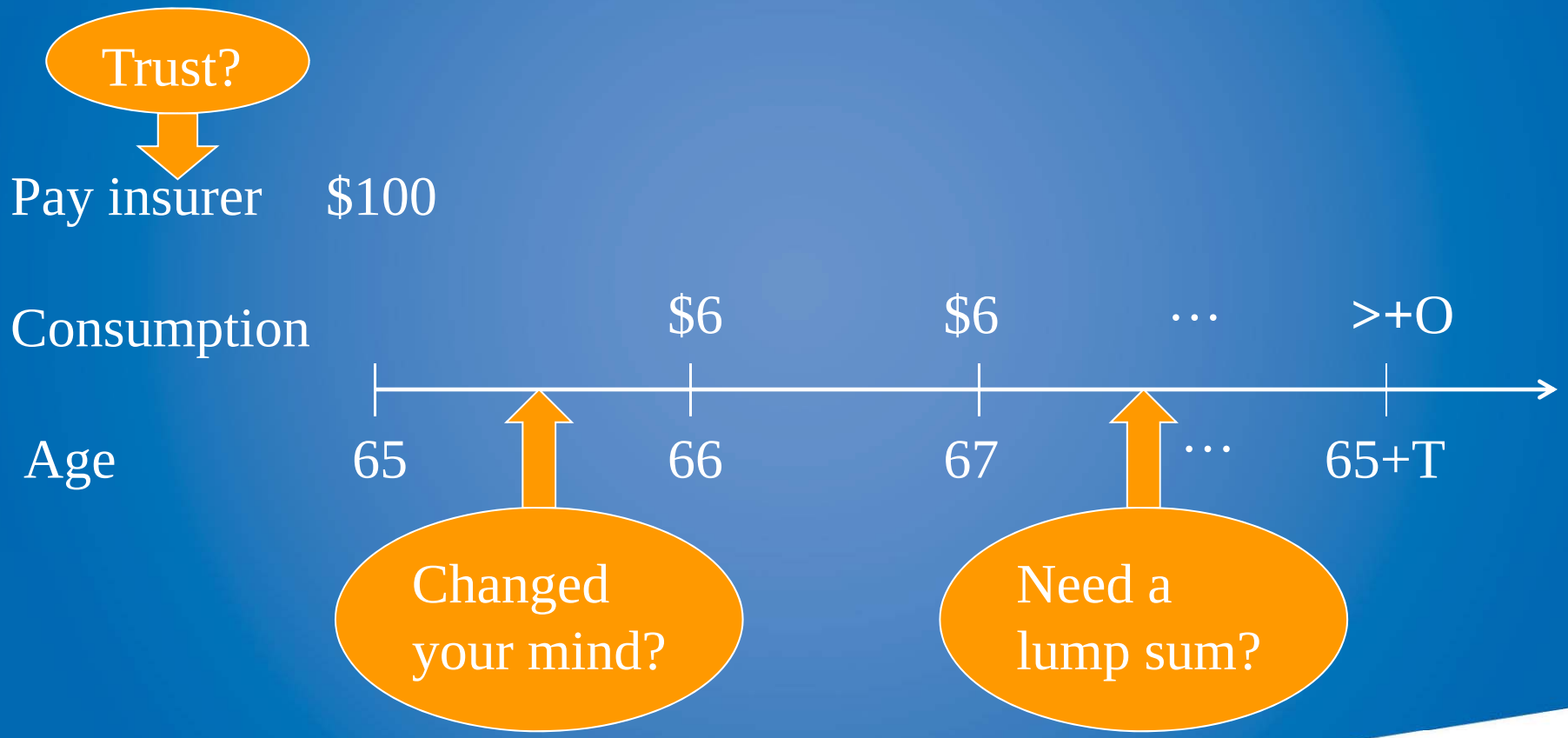
Life annuity (2% p.a.)

With 12% loading

Fair cost?

Pay insurer $100

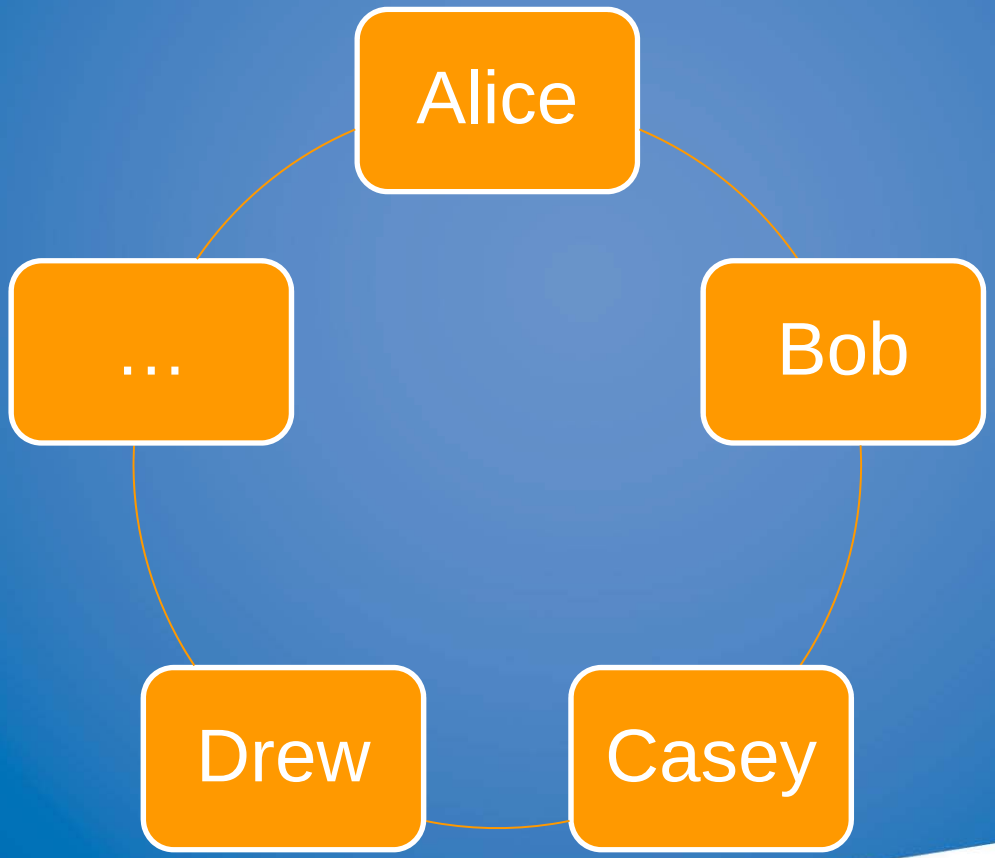
Life annuity



Life annuity

- Attractive for some, but not for all.
- Can people still benefit from sharing mortality risk without buying a life annuity?

Annuity overlay fund
(Donnelly, Guillén, Nielsen 2013)

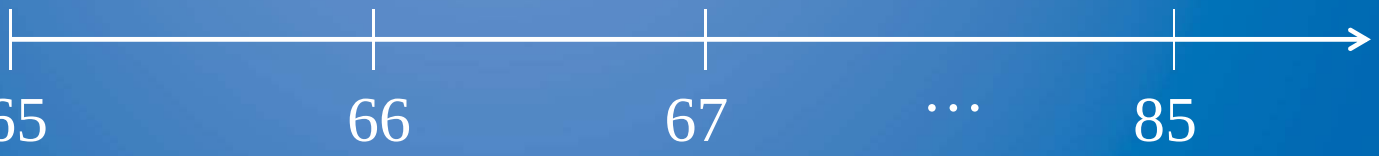


Annuity overlay fund (2% p.a.)

Assets $100

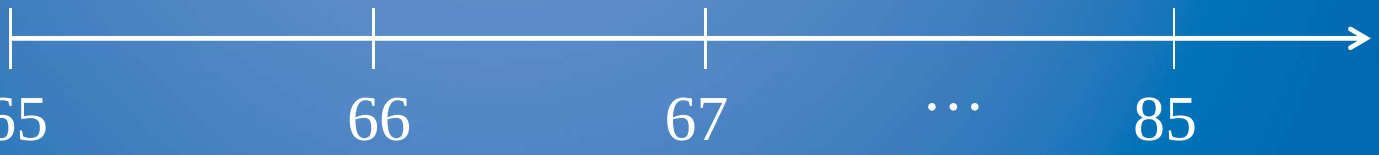
Mortality credit

Consumption



Annuity overlay fund (2% p.a.)

Assets	$100	$102
Mortality credit		$0.78
Consumption		$6.72



Annuity overlay fund (2% p.a.)

Assets	$100	$102	$97.98	…	$34.91
Mortality credit		$0.78	$0.87	…	
Consumption		$6.72	$6.72	…	
Age	65	66	67	…	85

Choose consumption

Leave when you want

Mortality credit

Mortality credit

Proportional to:

Instantaneous probability of death

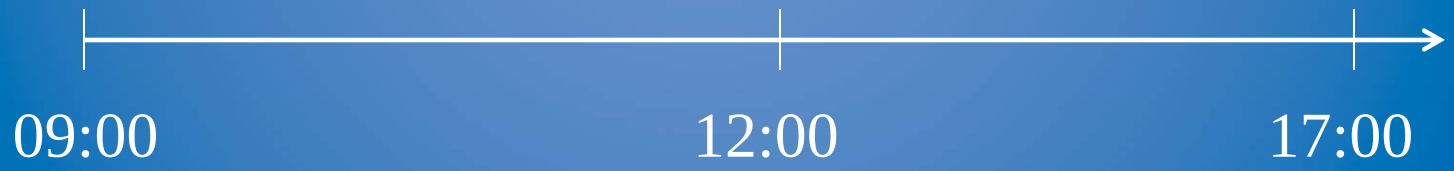
x

Fund value

Mortality credit

Alice $100

Bob $300



Mortality credit

Alice $100 >+0

Bob $300 0+^

09:00 12:00 17:00

Mortality credit

Alice $100 >+0

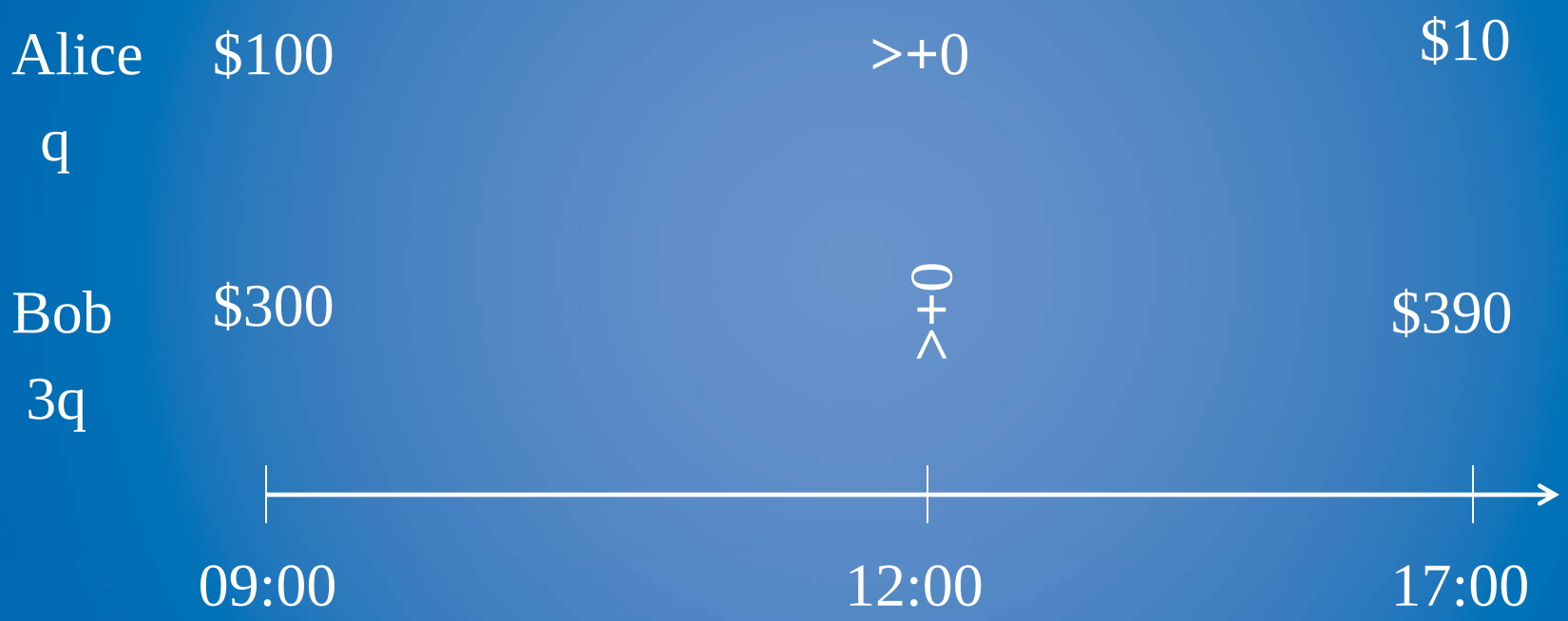
q

Bob $300 0+^

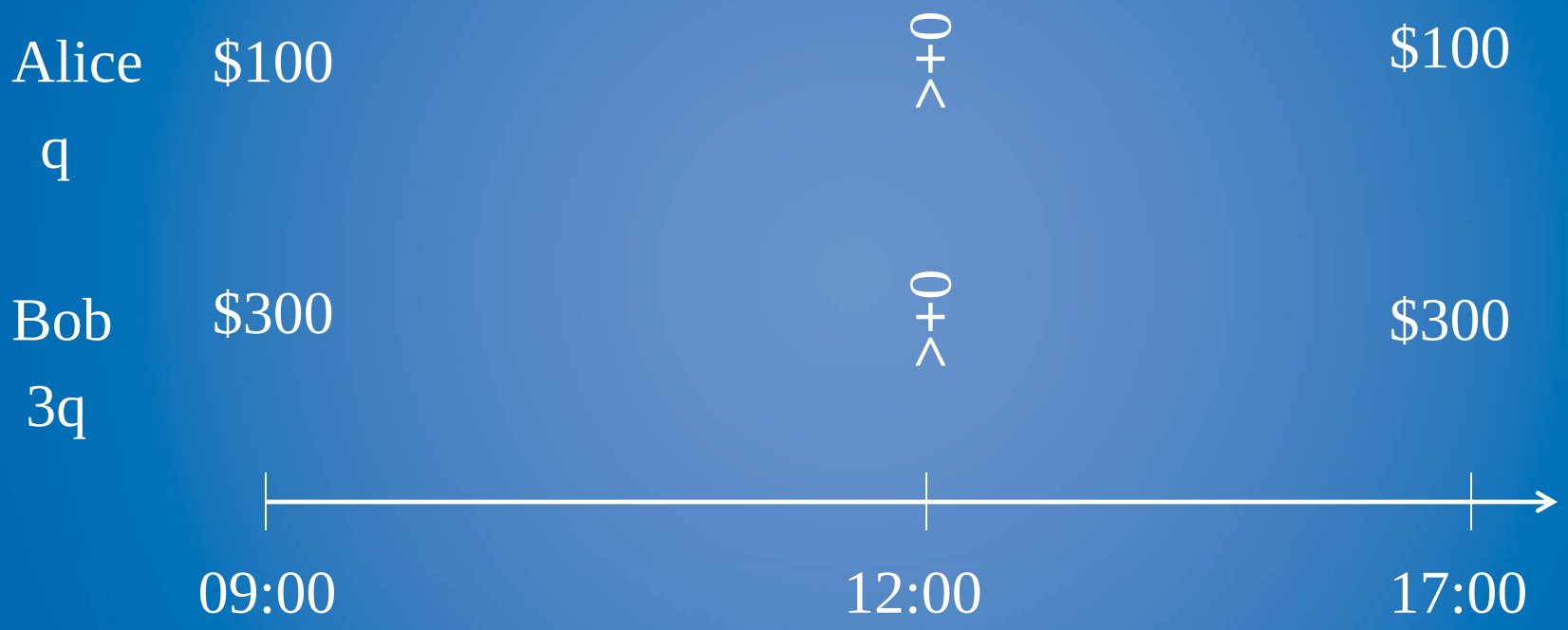
3q

09:00 12:00 17:00

Mortality credit



Mortality credit



Mortality credit

- Amount and frequency depends on the group.
- Mortality credit always non-negative for survivors.

Annuity overlay fund - features

- Any heterogeneous group
- Contribution upon death
- Actuarially fair at all times

Annuity overlay fund - implications

- Individuals retain investment control
- Individuals decide how much to consume
- Split investment from mortality: cost transparency

Numerical experiments

- How willing are you to accept the mortality credit volatility?

- Assume Black-Scholes financial market:
  - Risk-free interest rate $r > 0$.
  - Risky asset price dynamics:

$$dS_t = \mu S_t \, dt + \sigma S_t \, dZ_t$$

Numerical experiments

$$dW_t = \left(r + \pi_t(\mu - r)\right) W_{t-}\, dt + \sigma \pi_t\, dZ_t + dG_t$$

Numerical experiments

$$dW_t = \left(r + \pi_t(\mu - r)\right) W_{t-}\, dt + \sigma \pi_t\, dZ_t + dG_t$$

Small change in wealth

Return due to investment in financial market

Return due to mortality risk sharing

Numerical experiments

As number of members becomes infinite,

$$dW_t = \left(r + \pi_t(\mu - r)\right) W_{t-}\, dt + \sigma \pi_t\, dZ_t + dG_t$$

Small change in wealth

Return due to investment in financial market

Return due to mortality risk sharing

Numerical experiments

As number of members becomes infinite,

Instantaneous probability of death

$$dW_t = \left(r + \pi_t(\mu - r)\right)W_{t-}\,dt + \sigma\pi_t\,dZ_t + \lambda_t W_{t-}dt$$

Small change in wealth

Return due to investment in financial market

Return due to mortality risk sharing

Numerical experiments

Insurer's equivalent to infinite fund

Cost

$$dW_t = \left(r + \pi_t(\mu - r)\right)W_{t-}\,dt + \sigma\pi_t\,dZ_t + \lambda_t(1 - a_t)W_{t-}dt$$

Small change in wealth

Return due to investment in financial market

Return due to mortality pooling

Numerical experiments

Finite annuity overlay fund:

$$dW_t = \left(r + \pi_t(\mu - r)\right)W_{t-}\,dt + \sigma\pi_t\,dZ_t + dG_t$$

Insurer equivalent to infinite annuity overlay fund:

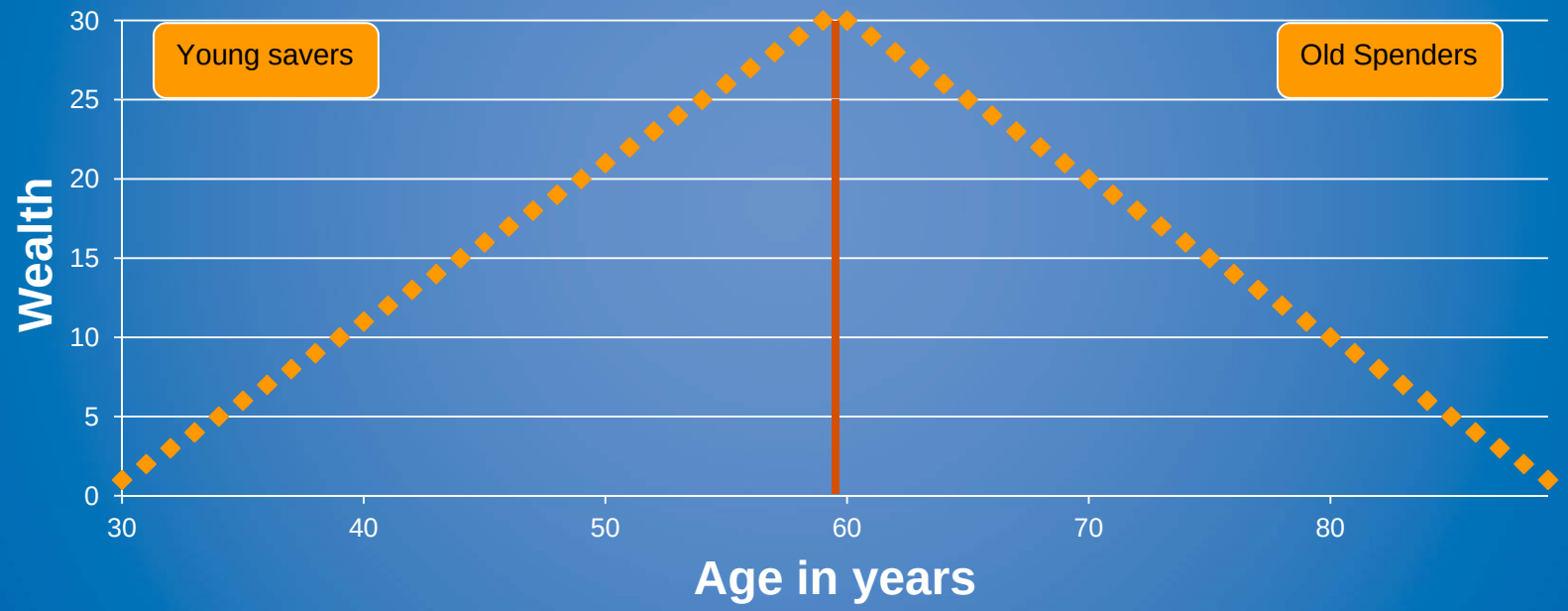
$$d\,W_t^{\infty} = \left(r + \pi_t^{\infty}(\mu - r)\right)W_{t-}^{\infty}dt + \sigma\pi_t^{\infty}dZ_t + \lambda_t(1 - a_t)W_{t-}^{\infty}dt$$

Choose π_t^{∞} so same volatility of return on wealth.
Then equate expected returns to find breakeven costs a_t^*.

Numerical experiments

- Financial market parameters: $r = 0.02$, $\mu = 0.06$, $\sigma = 0.20$.
- Gompertz mortality law: $\lambda_x = \frac{1}{9.98} e^{(x-86.85)/9.98}$
- Invest 25% of wealth in risky asset in finite annuity overlay fund.

Numerical experiments



Numerical experiments

Participants	Total number of participants in fund	Breakeven costs (% of wealth)
Old Spenders	300	<0.5% p.a.
Young Savers	300	<0.05% p.a.
Combined portfolio	300	< 0.75% p.a.

Practical questions

- Purpose of the fund?
- Conditions on fund exit and/or withdrawals?
- Conditions on investment strategies?
- Determination of mortality probabilities.
- Asset sales upon death – legal issues/time.
- Asset valuations – e.g. illiquid assets.

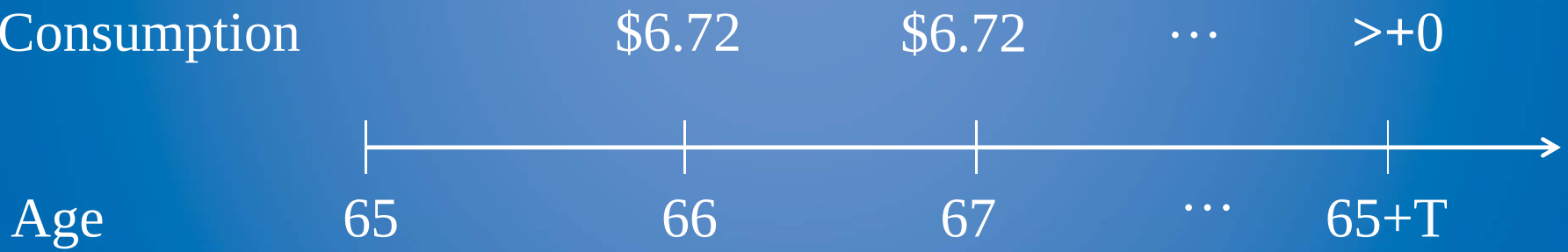
Group self-annuitization (GSA) scheme (Piggott, Valdez and Detzel 2005)

- Purpose: provide consumption stream to participants.
- Similar to a life annuity, without the guarantee.

GSA

GSA – participant's view

Pay scheme $100



GSA– scheme perspective

Assets	$10,000	$10,200	$9,723	…	$1,618
Payments out		$667	$662	…	$281
Age	65	66	67	…	85

GSA

- Share mortality risk.
- Same investment strategy for all participants.

GSA calculation

For each participant,

This year's consumption payment

=

Last year's consumption payment

x

Mortality adjustment

x

Investment return adjustment

GSA calculation

For each participant,

This year's consumption payment

=

Last year's consumption payment

x

Mortality adjustment

x

Investment return adjustment

Same adjustment for all participants

GSA calculation

- Adjustments compare actual experience over the year to expected experience over the year

GSA - features

- Any heterogeneous group
- Contribution upfront: pays consumption stream
- Not actuarially fair but may be only significant for highly heterogeneous groups (Sabin 2010, Donnelly 2013).

GSA - implications

- Assets centrally managed
- Consumption calculation pre-determined
- Cost transparency

Quick comparison

- Life annuity contract
- Annuity overlay fund
- Group self-annuitization (GSA) scheme

Quick comparison

	Life annuity	GSA	Annuity overlay
Who bears mortality risk?	Insurer	Group	Group
Mortality pooling?	✓ (Indirect)	✓ (Direct)	✓ (Direct)
Mortality guarantee?	✓	✗	✗

Quick comparison

	Life annuity	GSA	Annuity overlay
Who bears investment risk?	Insurer	Individual	Individual
Investment guarantee?	✓	×	×
Premium/ contribution paid	Upfront	Upfront	Upon death

Quick comparison

	Life annuity	GSA	Annuity overlay
Consumption stream?	✓	✓	✓ (individual's choice)
Lump sum withdrawals?	✗	✗	✓
Exit before death?	✗	✗	✓

Quick comparison

	Life annuity	GSA	Annuity overlay
Costs transparent?	✗	✓	✓
Individual investment control	✗	✗	✓
Actuarially fair?	?	✗	✓

Conclusion

- Practical implementation.
- Further questions: can we share investment risk across time?
- Challenge: construct robust, transparent, easy-to-understand pension schemes.

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Thank you!

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