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# Reinventing the life annuity

Catherine Donnelly  
Risk Insight Lab, Heriot-Watt University

<http://risk-insight-lab.com>

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

15 November 2017

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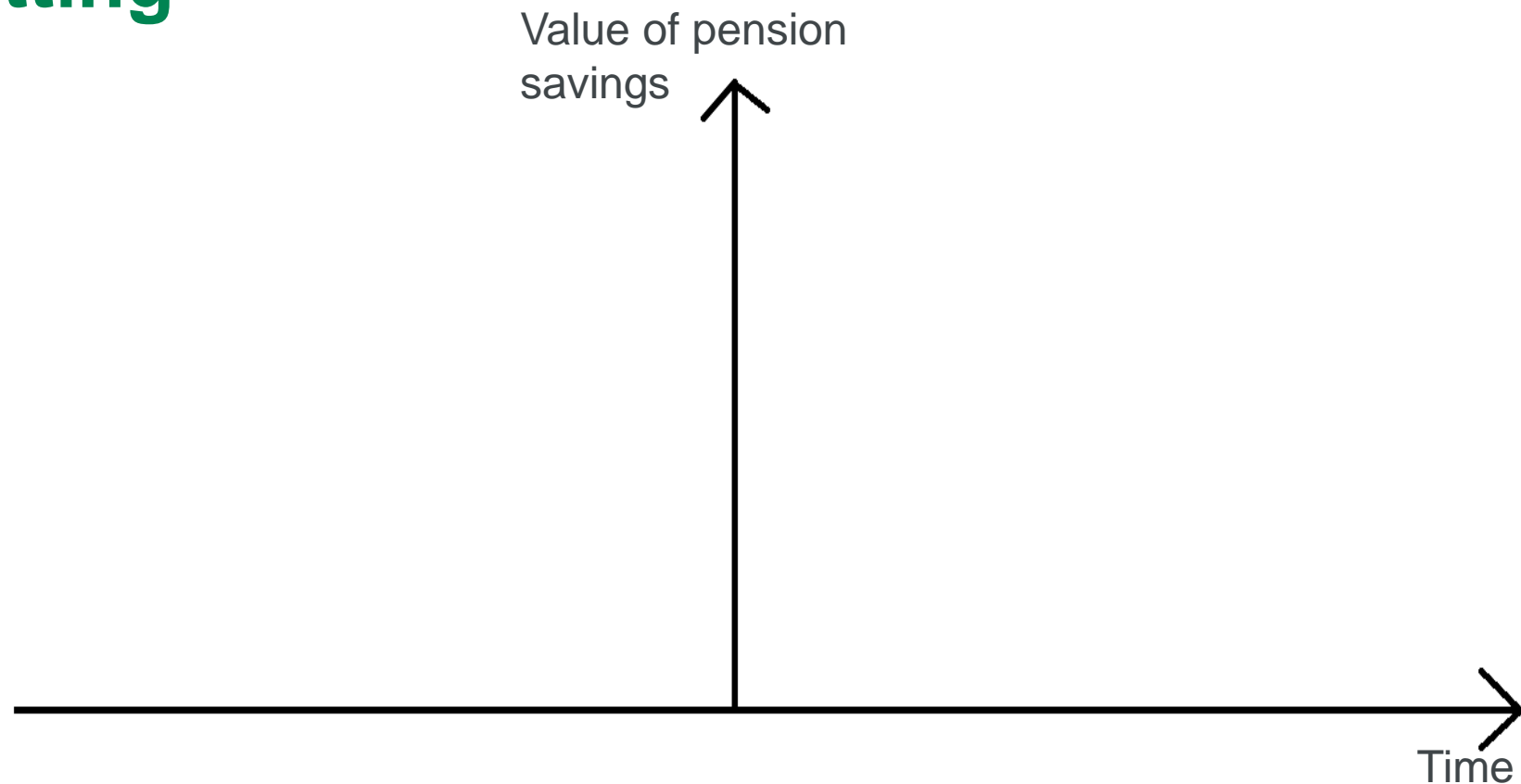


# Overview

- Background
- Focus on life annuity
- Mortality risk pooling
- Work in progress

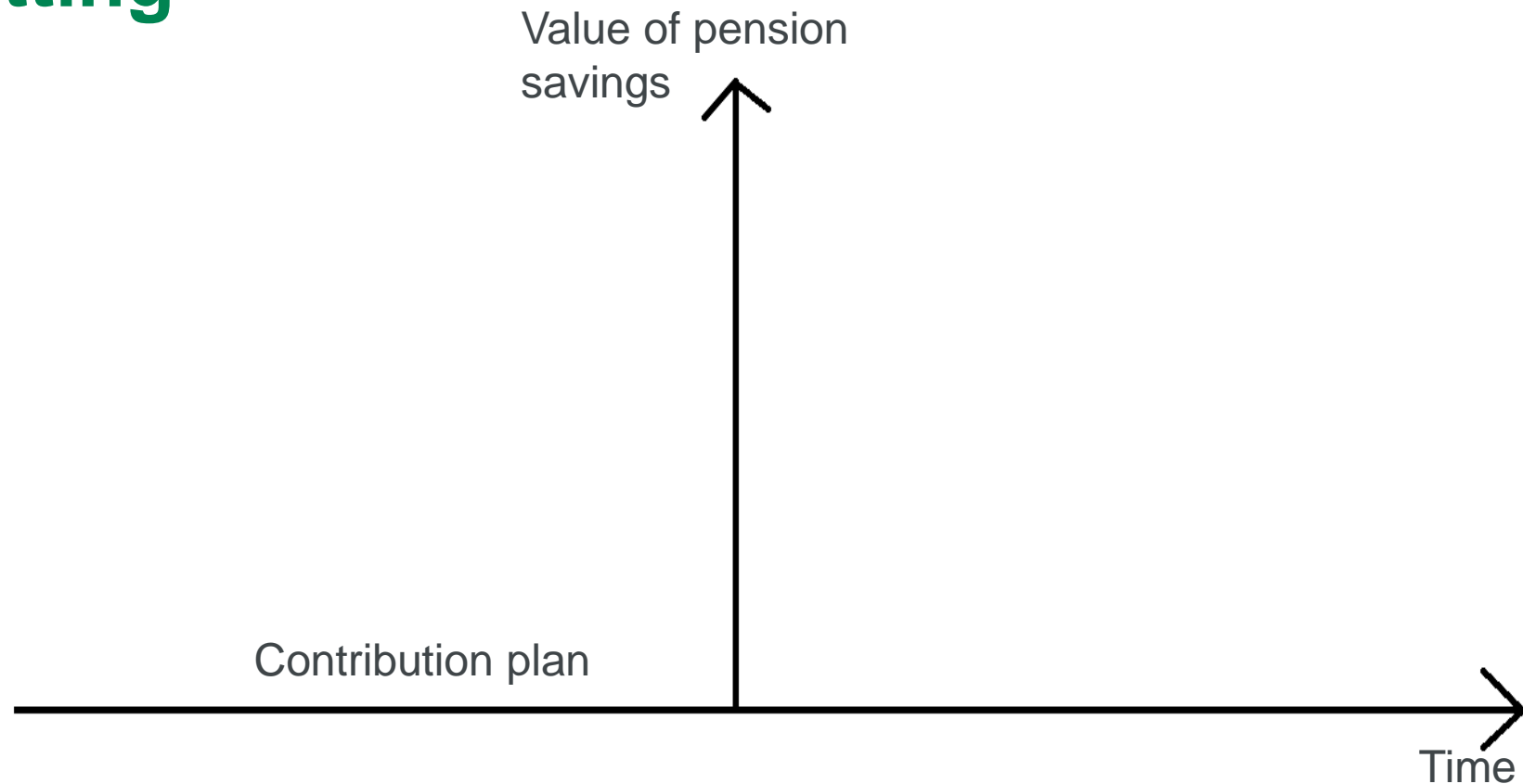


# Setting



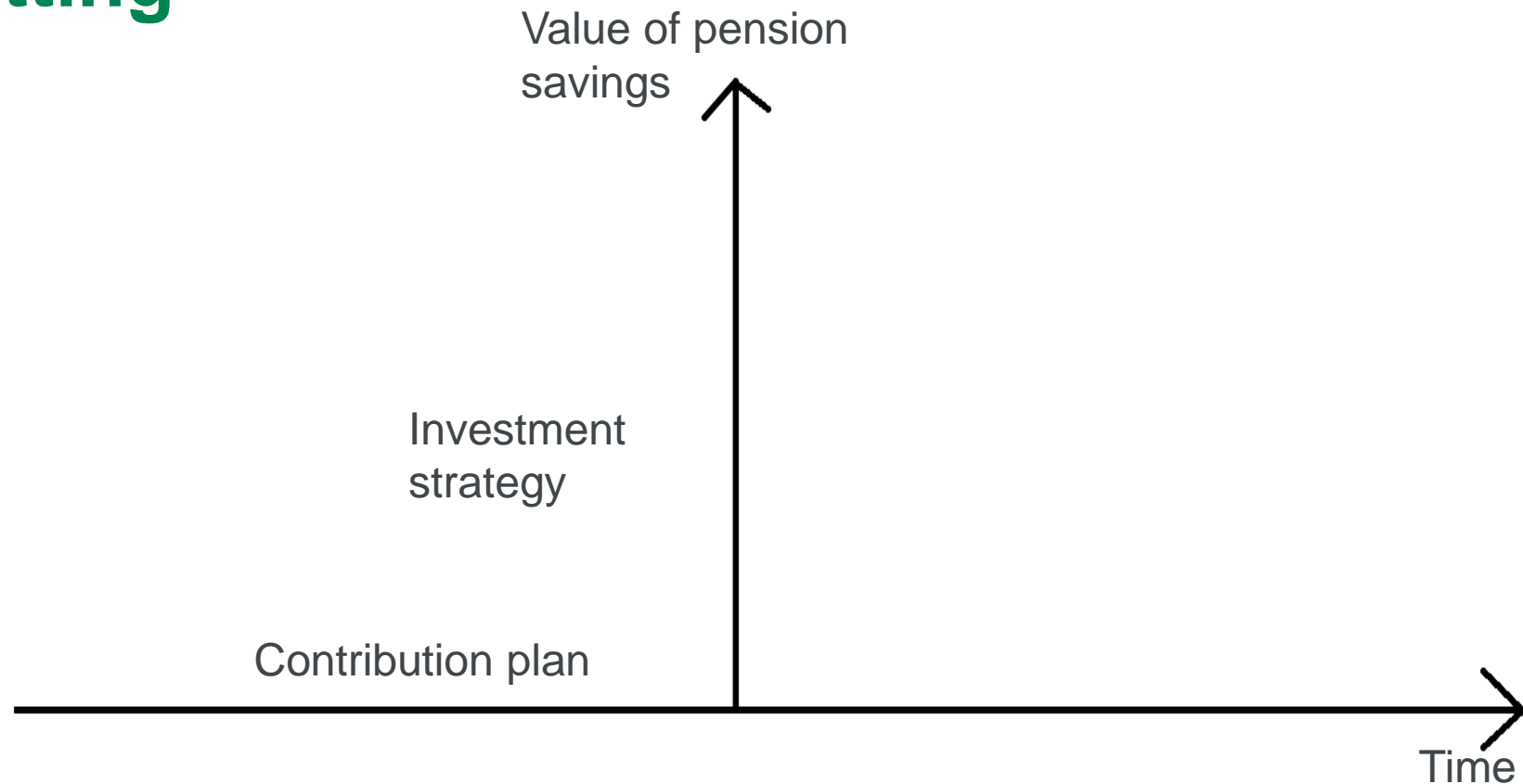
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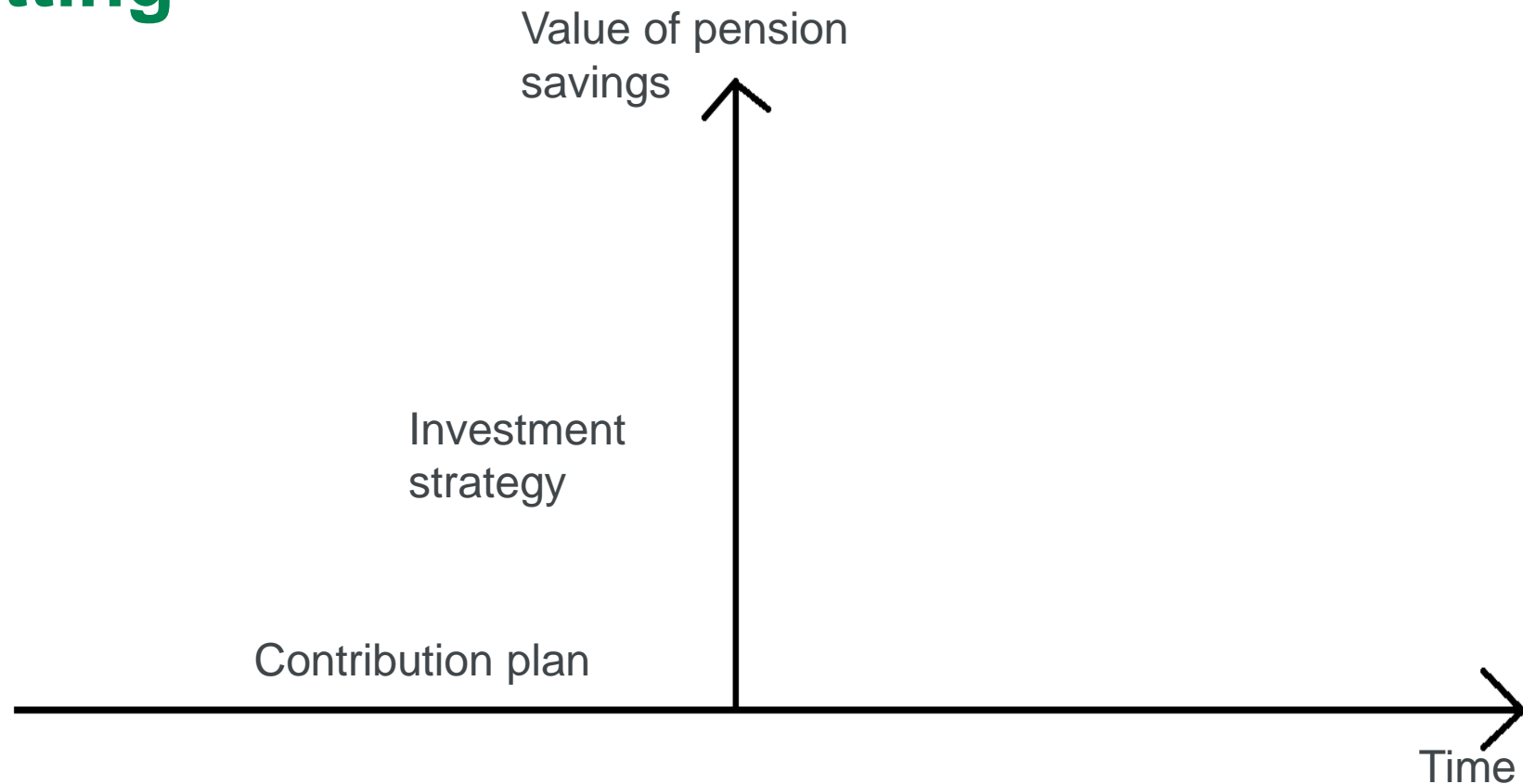
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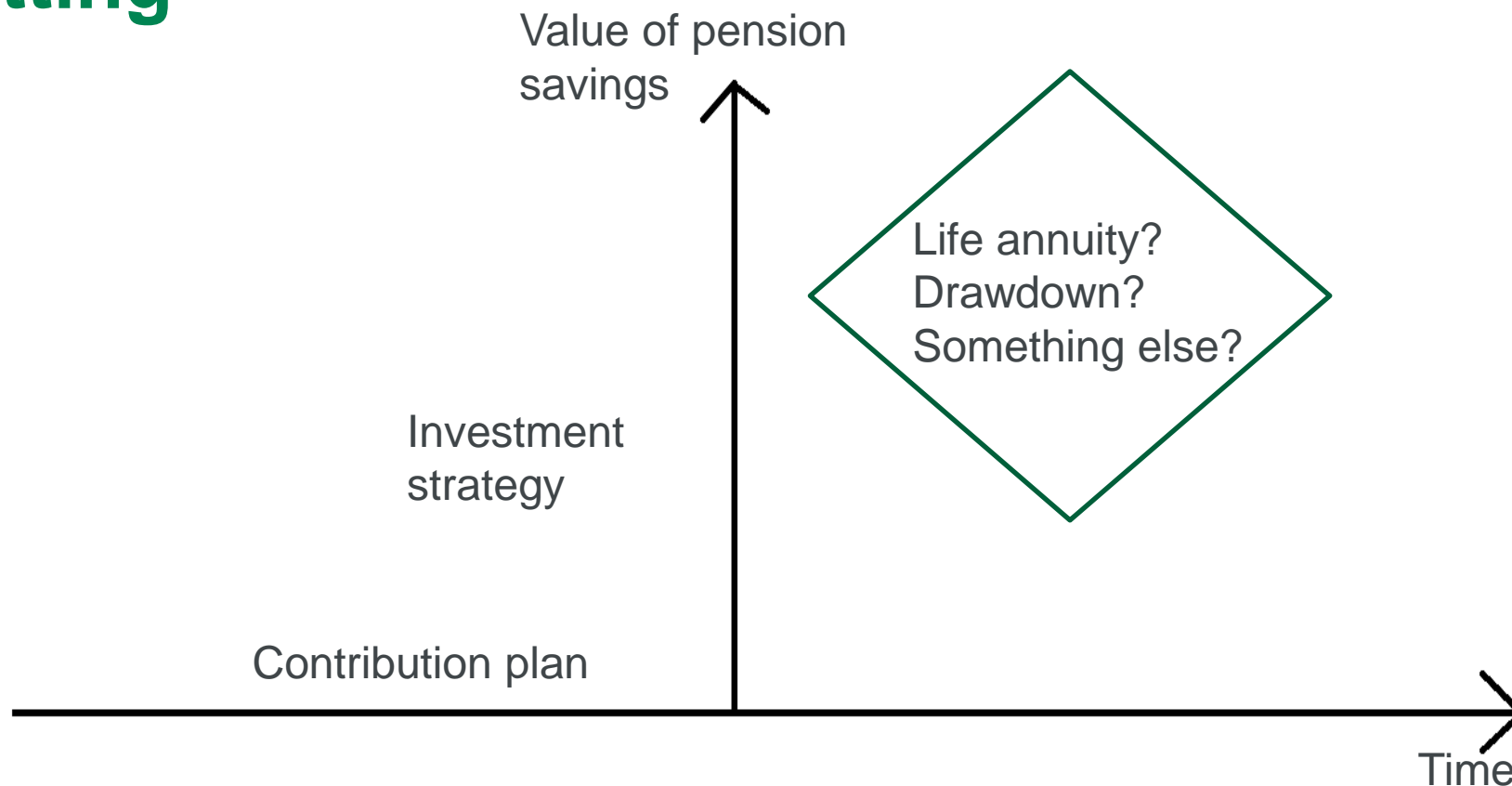
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# Setting



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# Setting



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# The present in the UK – DC on the rise

- DB plans are closing (87% are closed in 2016 in UK).
- Most people are now actively in defined contribution plans, or similar arrangement (97% of new hires in FTSE350).
- Contribution rates are much lower in DC plans  
(~21% for DB vs 4% for DC, total, albeit DB includes deficit correcting contributions).





# Size of pension fund assets in 2016

(Willis Towers Watson)

Country	Value of pension fund assets (USD billion)	As percentage of GDP	Of which DC asset value (USD billion)
USA	22'480	121.1%	13'488
UK	2'868	108.2%	516
Japan	2'808	59.4%	112
Australia	1'583	126.0%	1'377
Canada	1'575	102.8%	79
Netherlands	1'296	168.3%	78

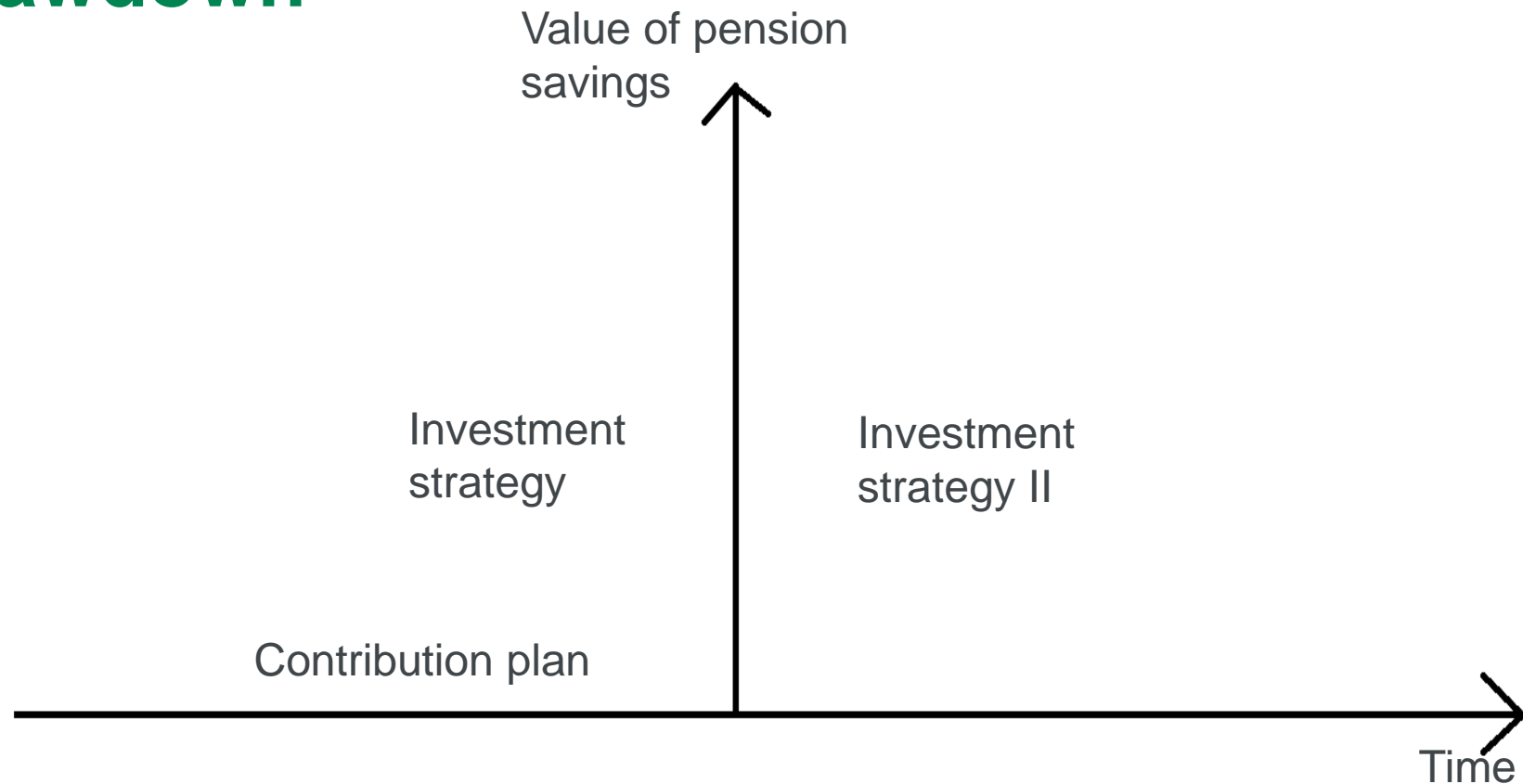


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# Income drawdown

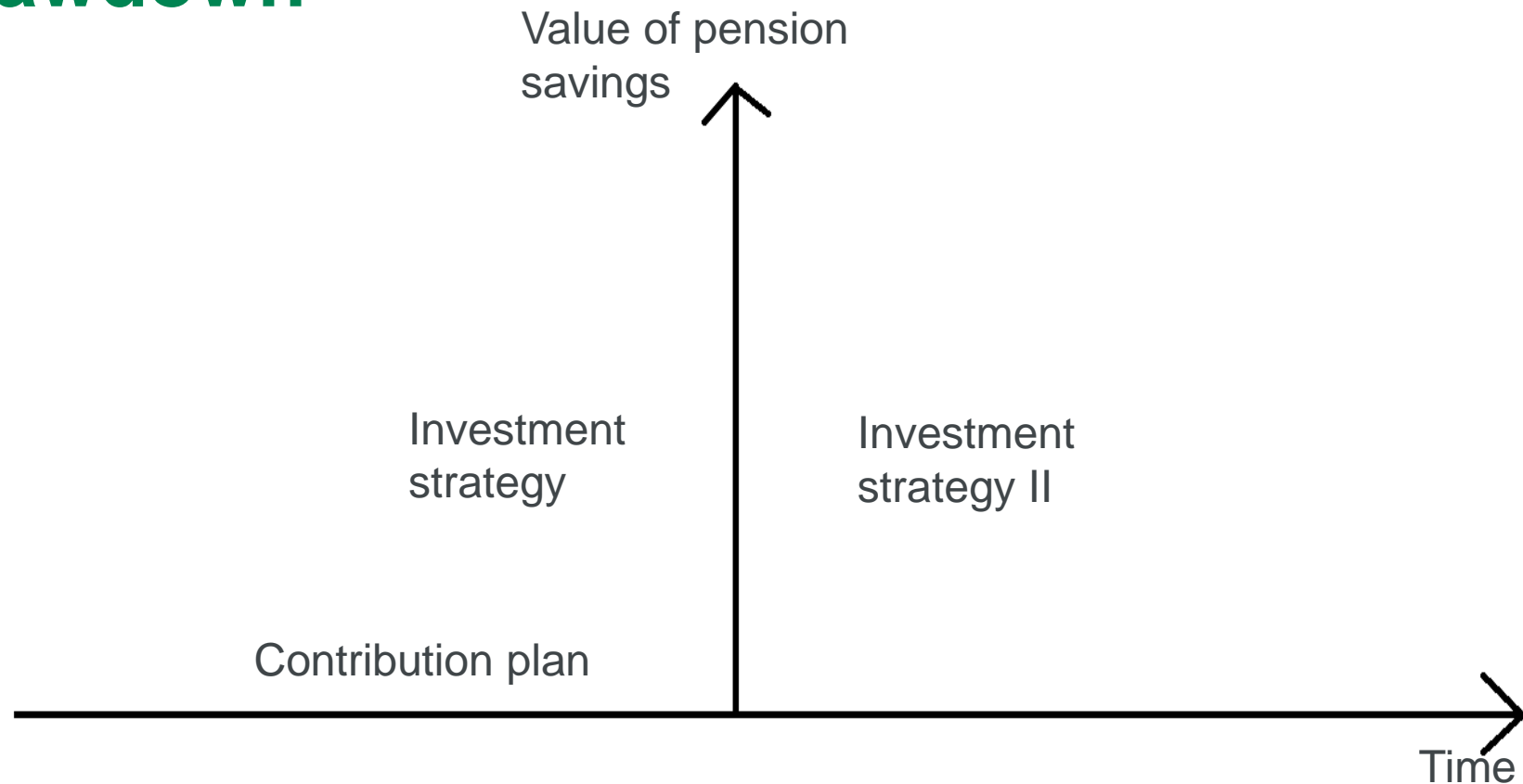


# Drawdown



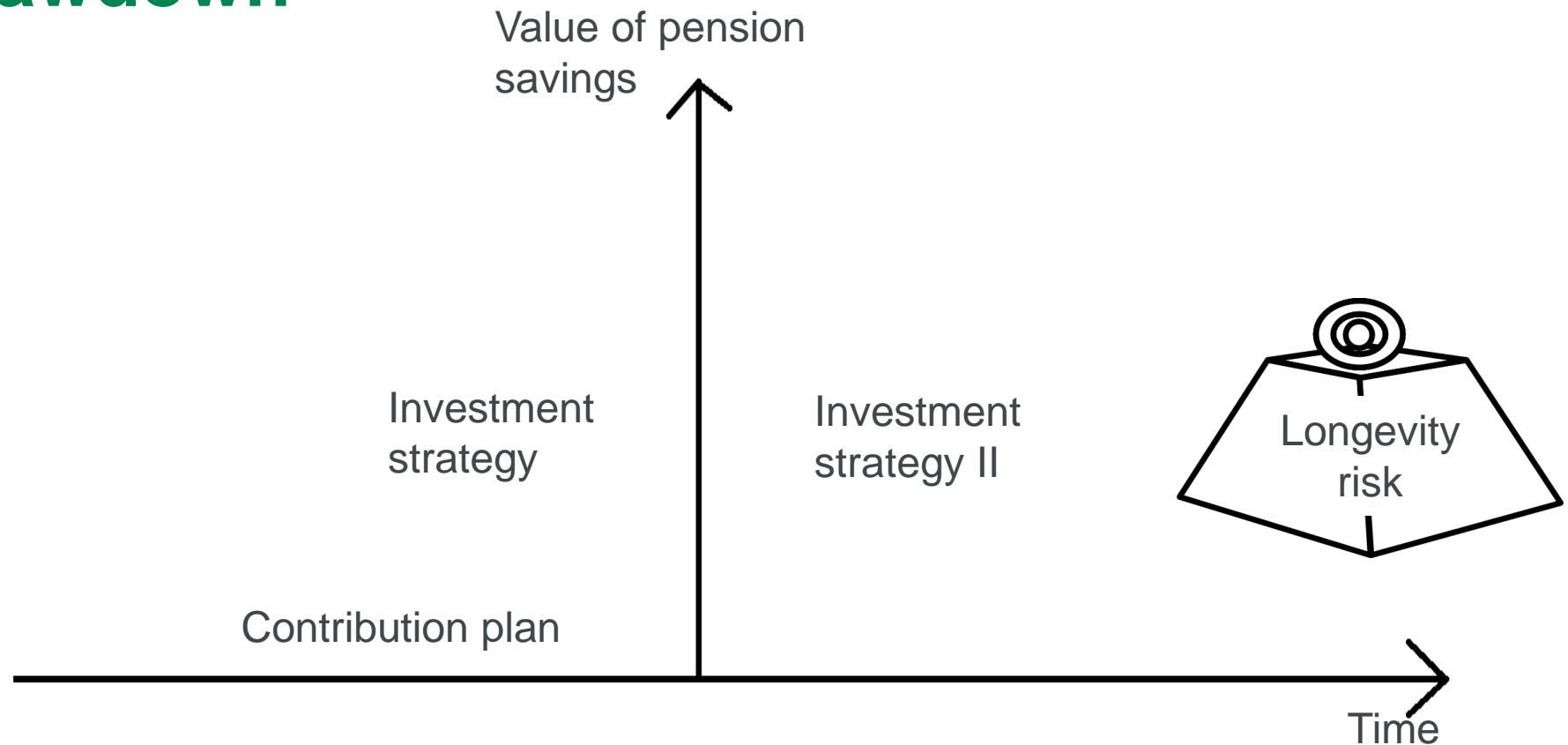
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# Drawdown



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# Drawdown

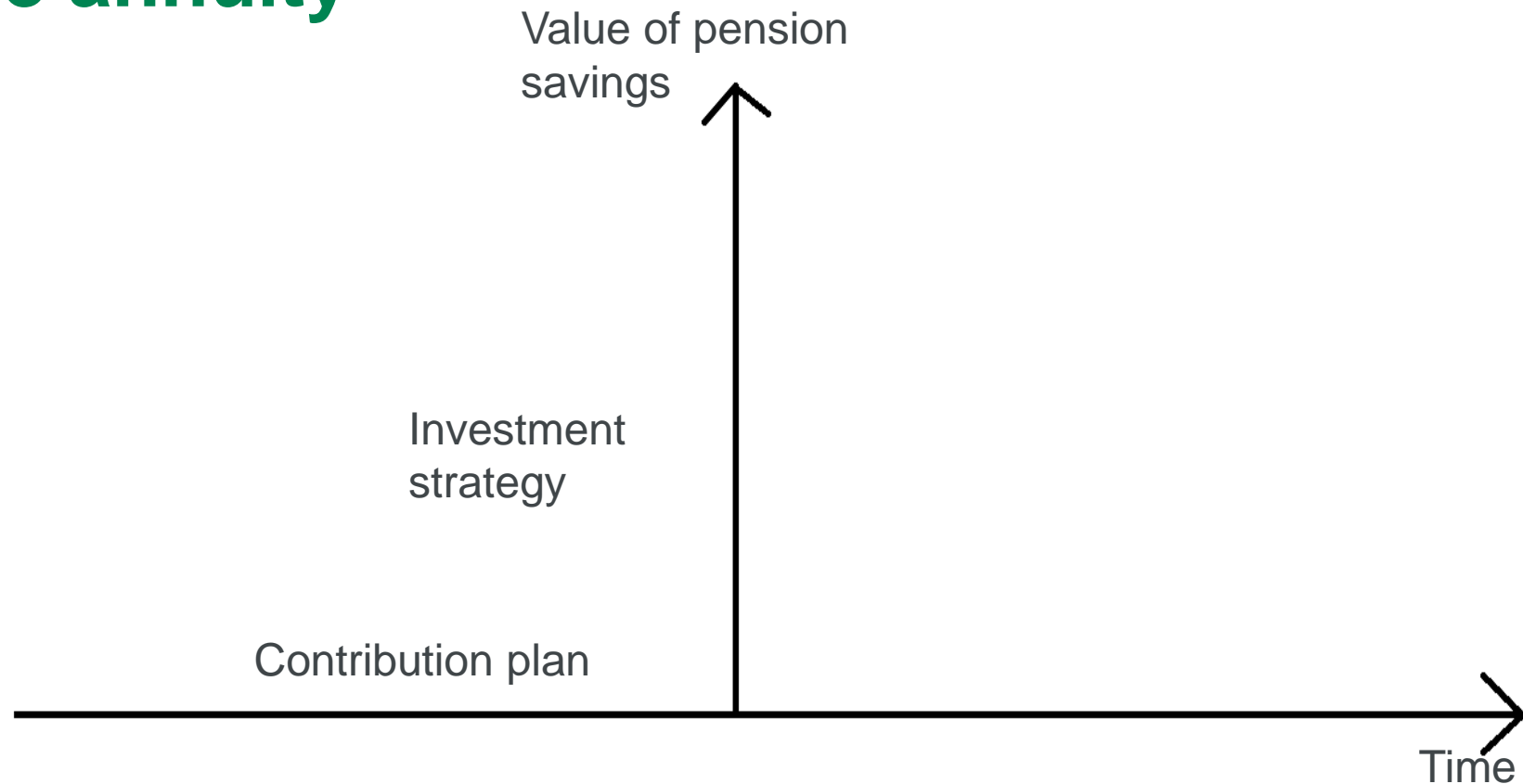


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# Life annuity

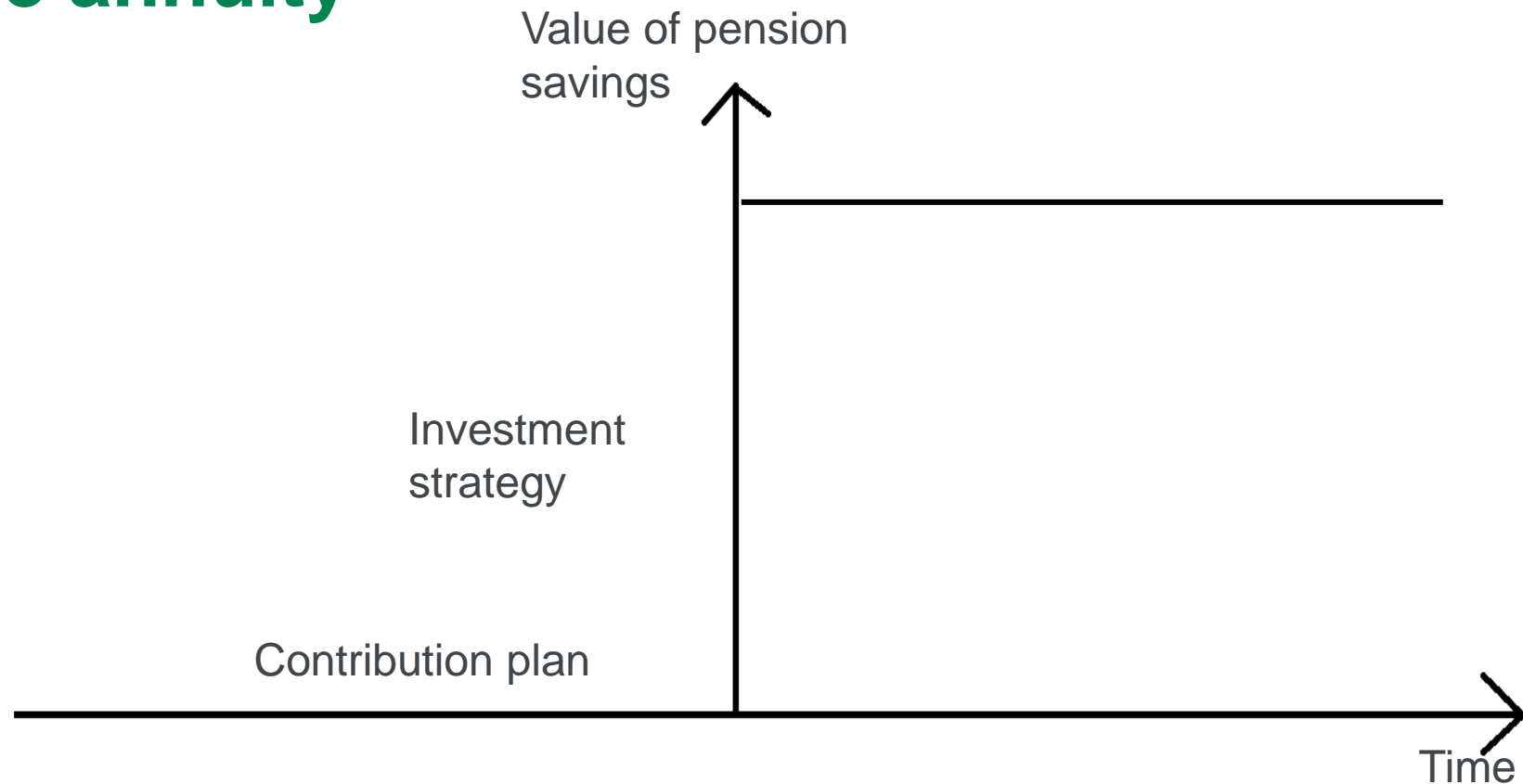


# Life annuity



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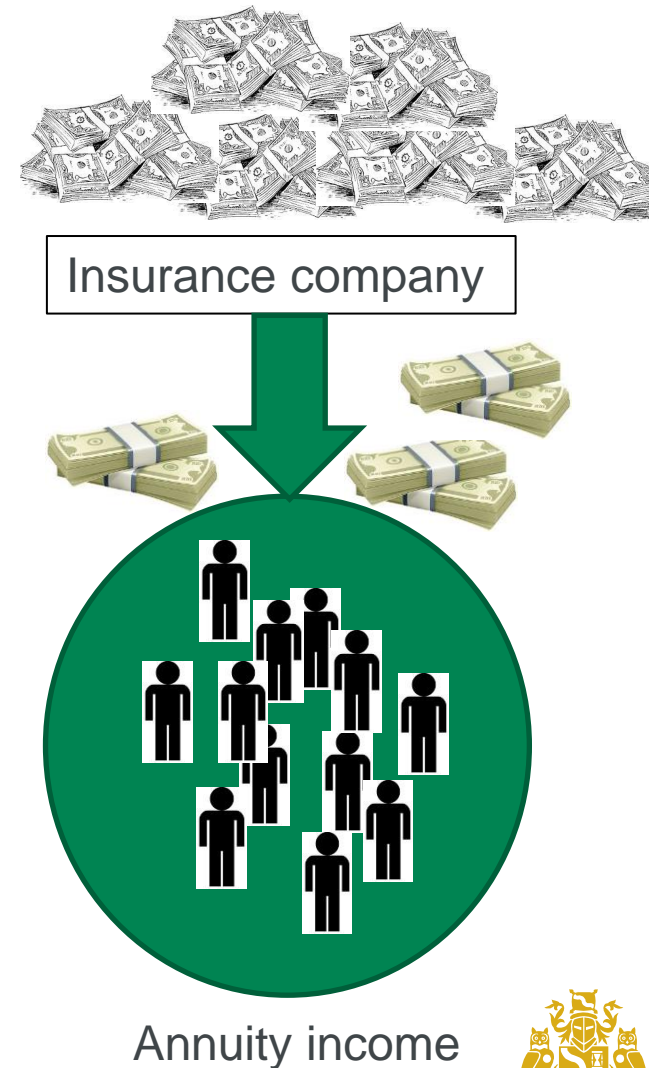
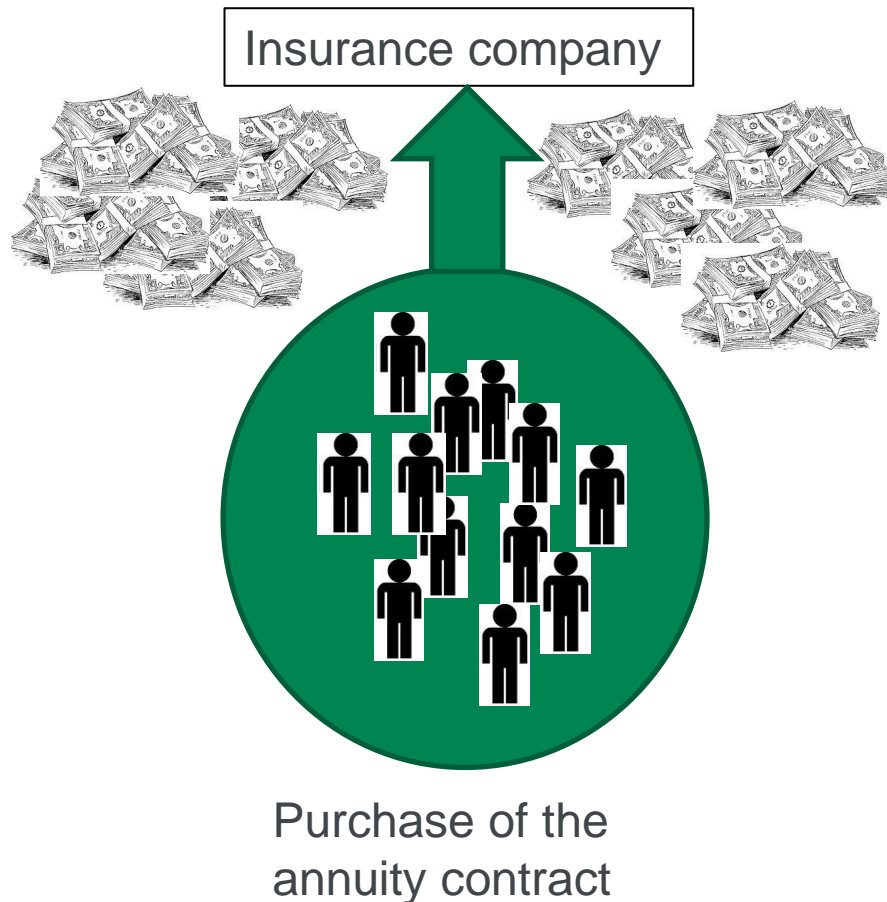
# Life annuity



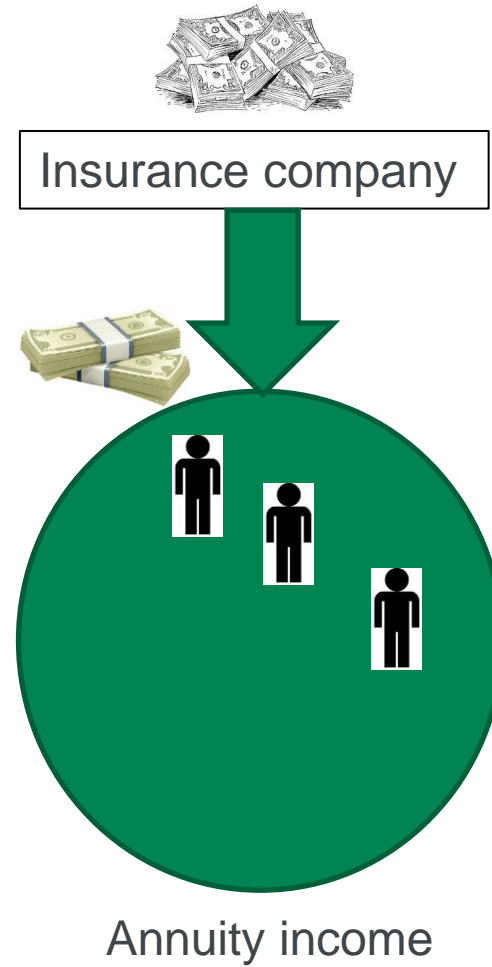
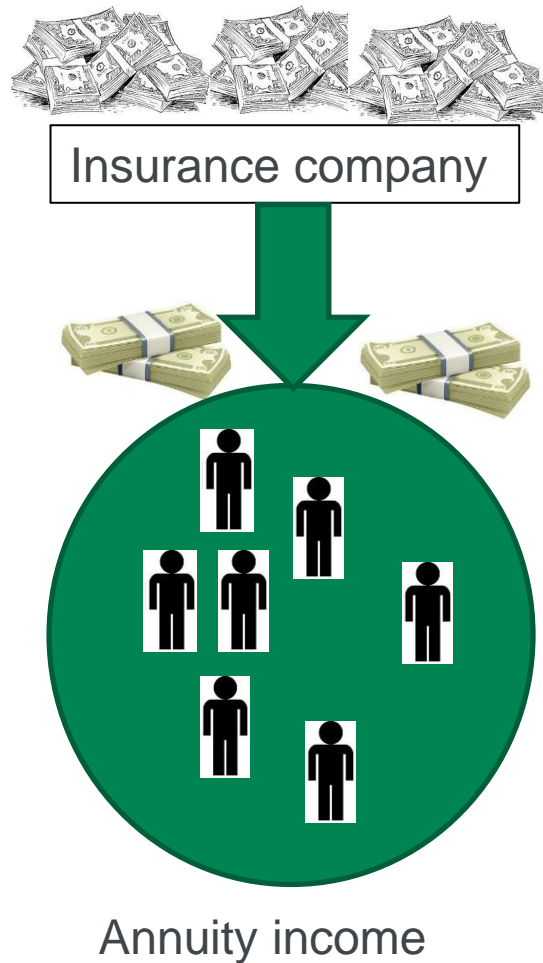
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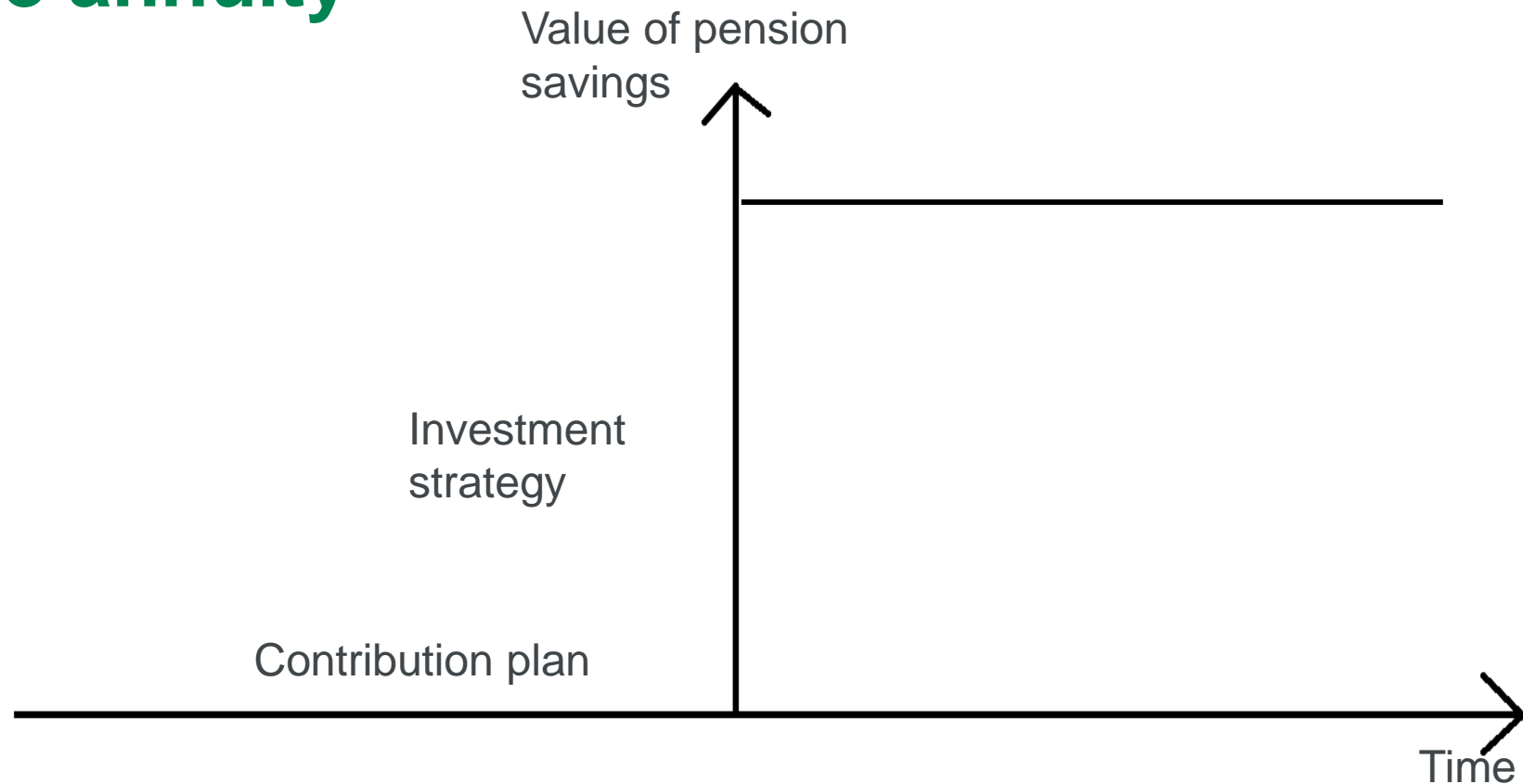
# Life annuity contract



# Life annuity contract

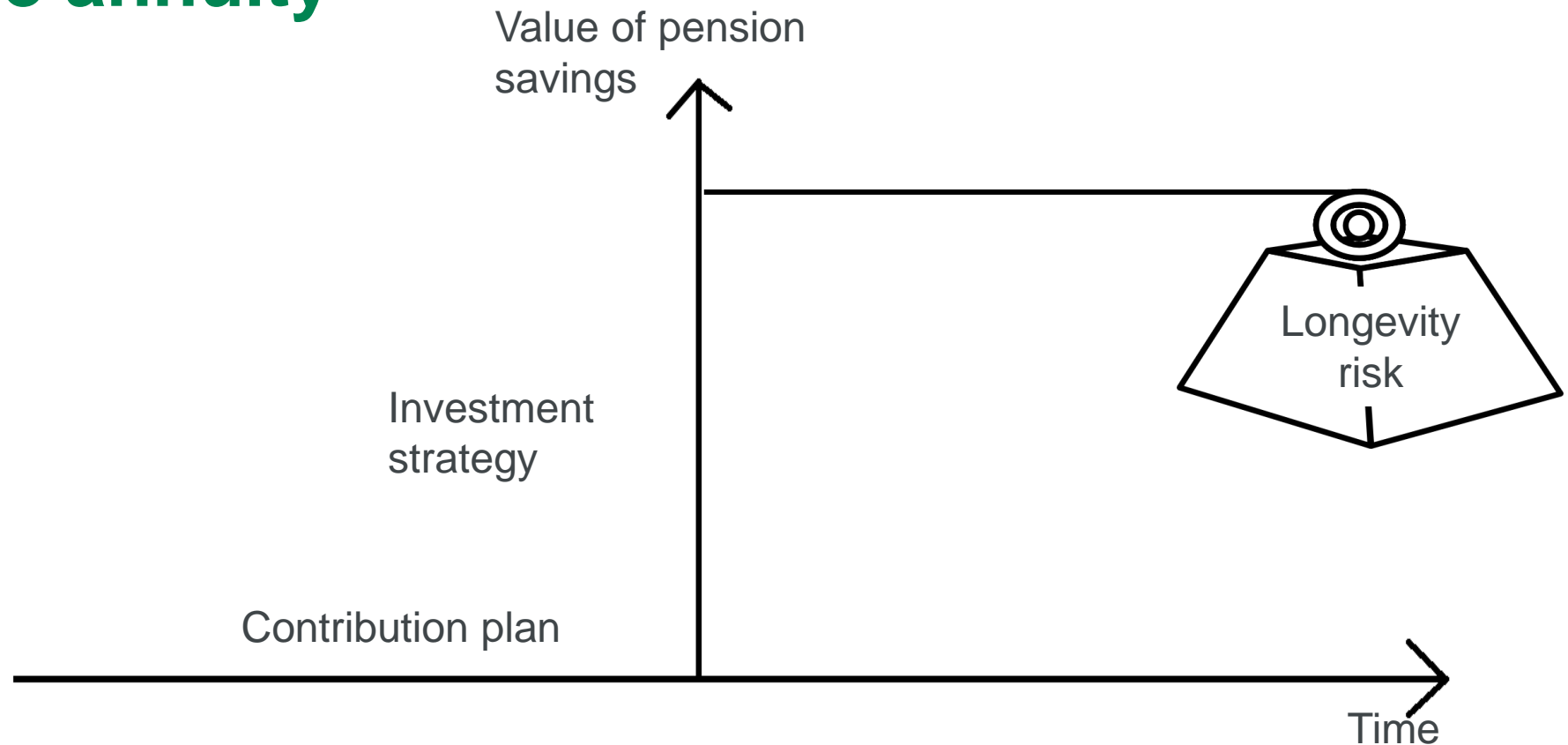


# Life annuity



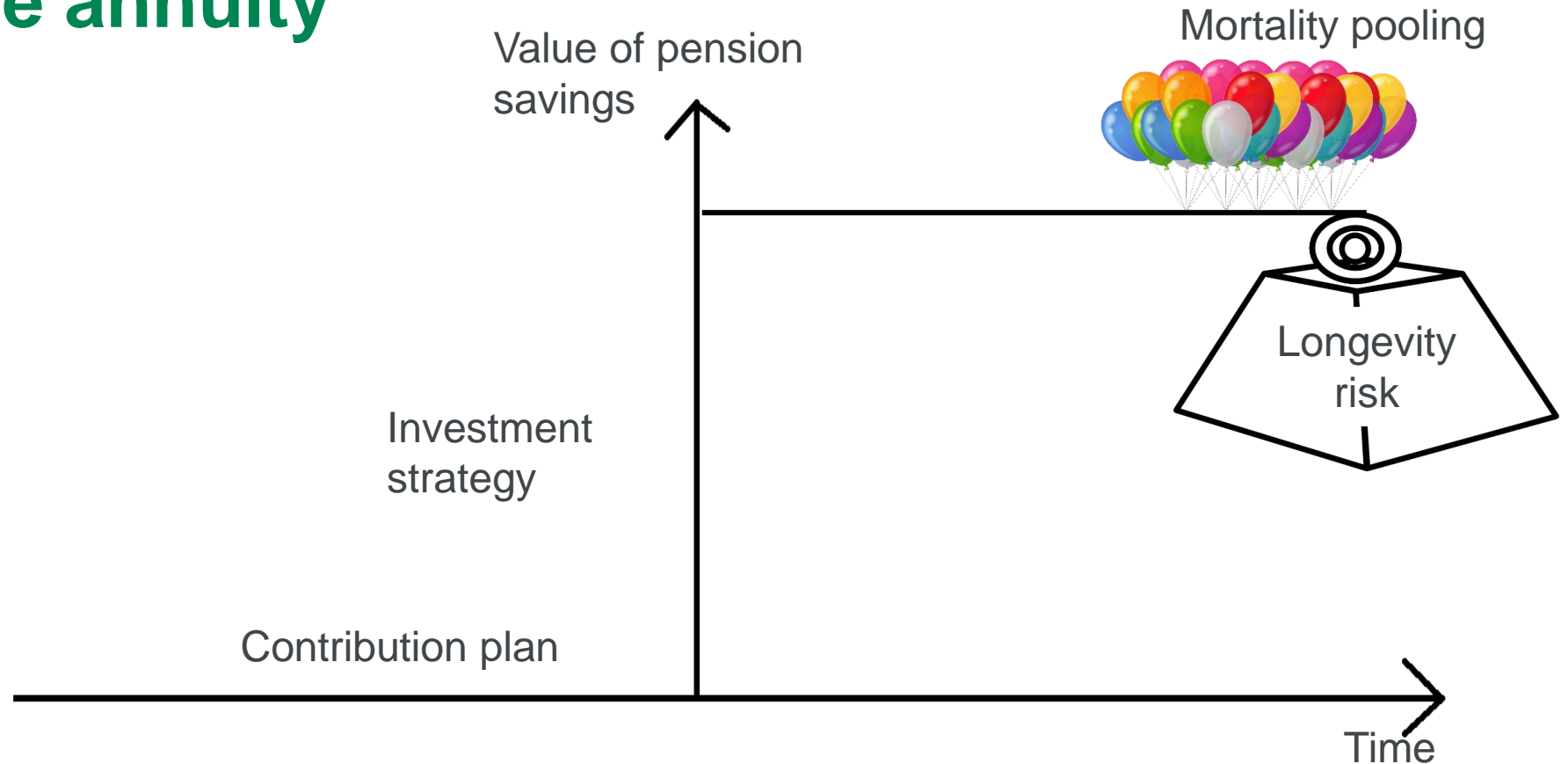
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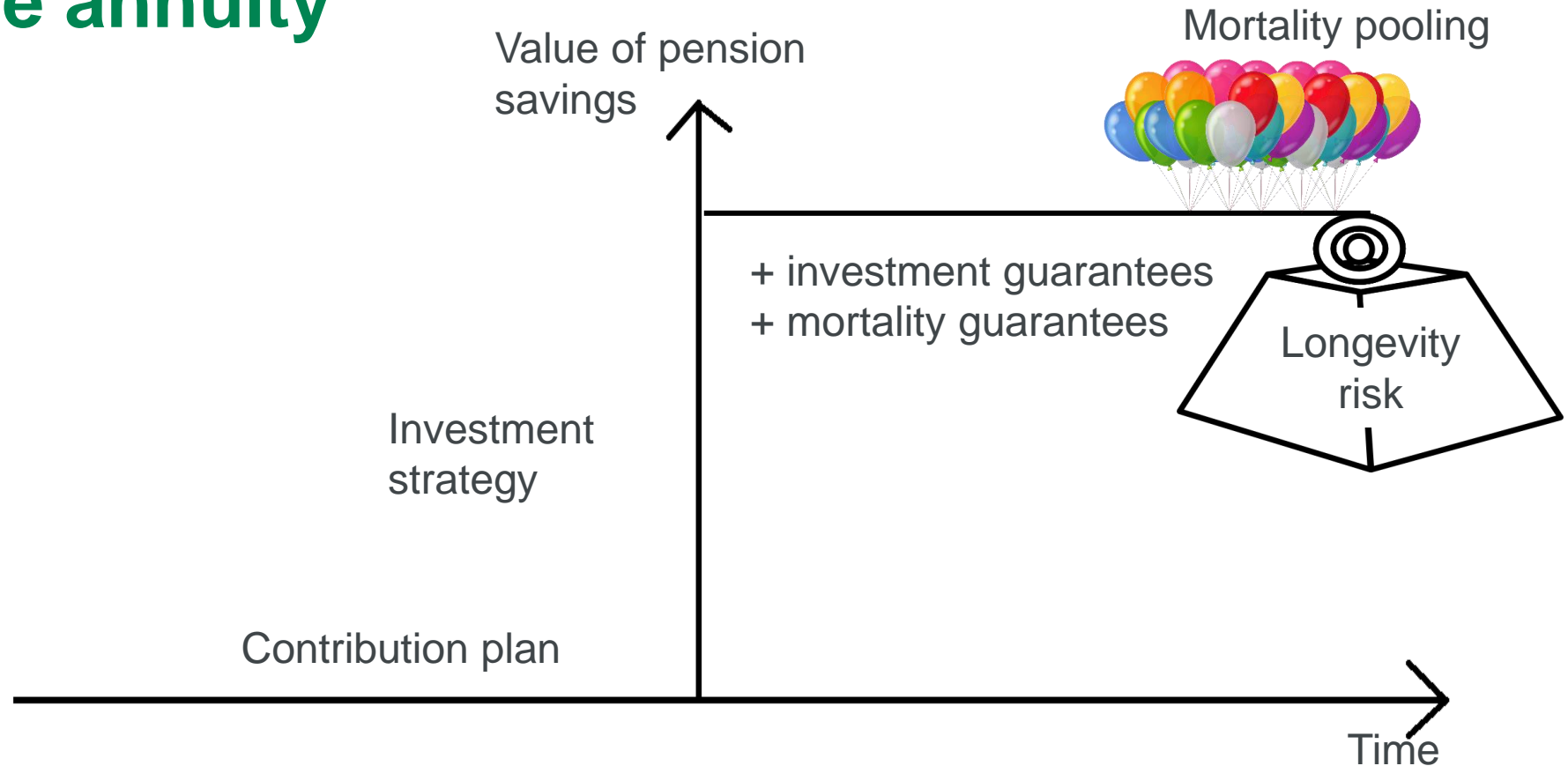
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# Life annuity



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# Life annuity



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# Life annuity contract

- Income drawdown vs life annuity: if follow same investment strategy then life annuity gives higher income\*

\*ignoring fees, costs, taxes, etc.

- Pooling mortality gives a higher income.
- Everyone in the group becomes the beneficiaries of each other, indirectly.



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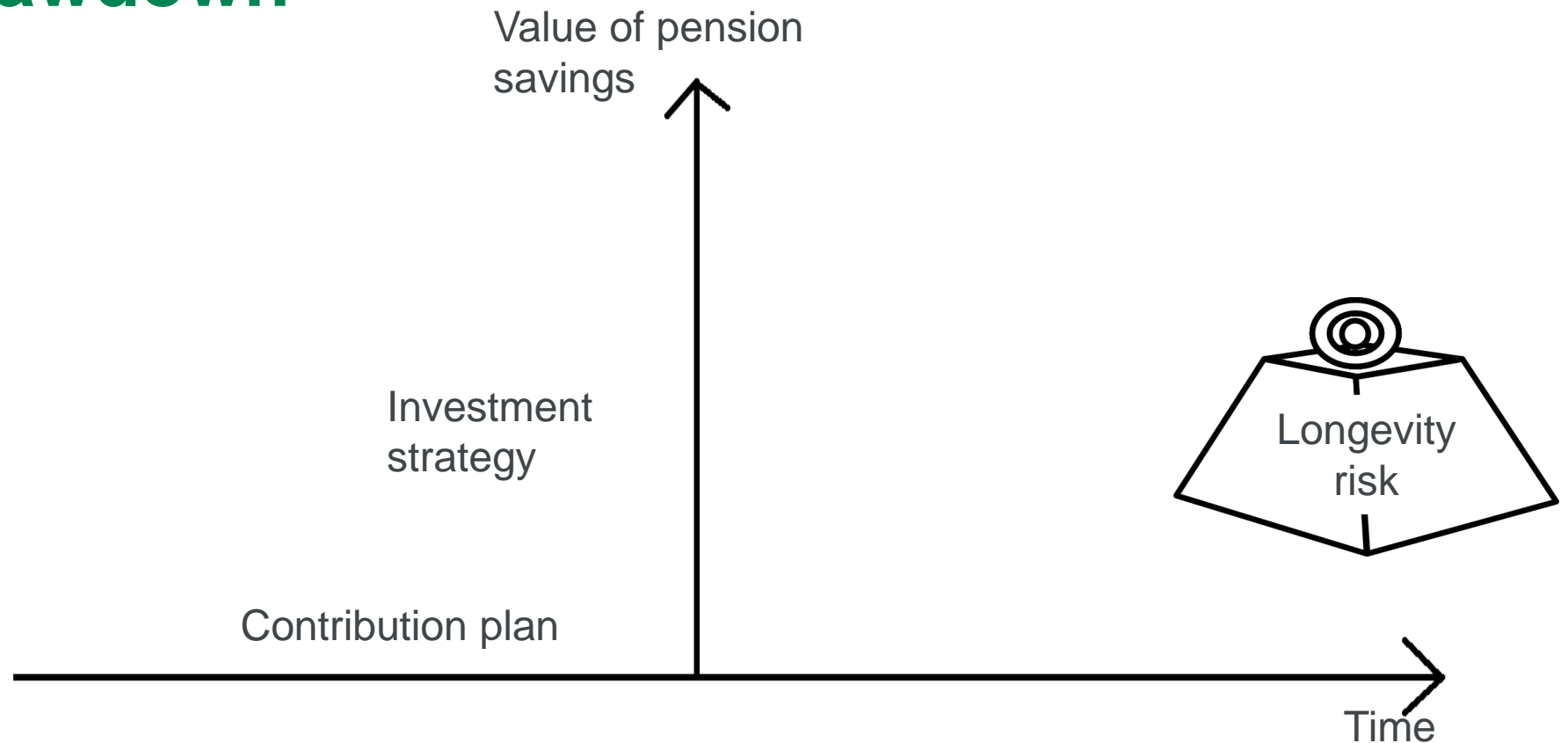
# Annuity puzzle

- Why don't people annuitize?
- Can we get the benefits of life annuities, without the full contract?
- Focus on mortality pooling.



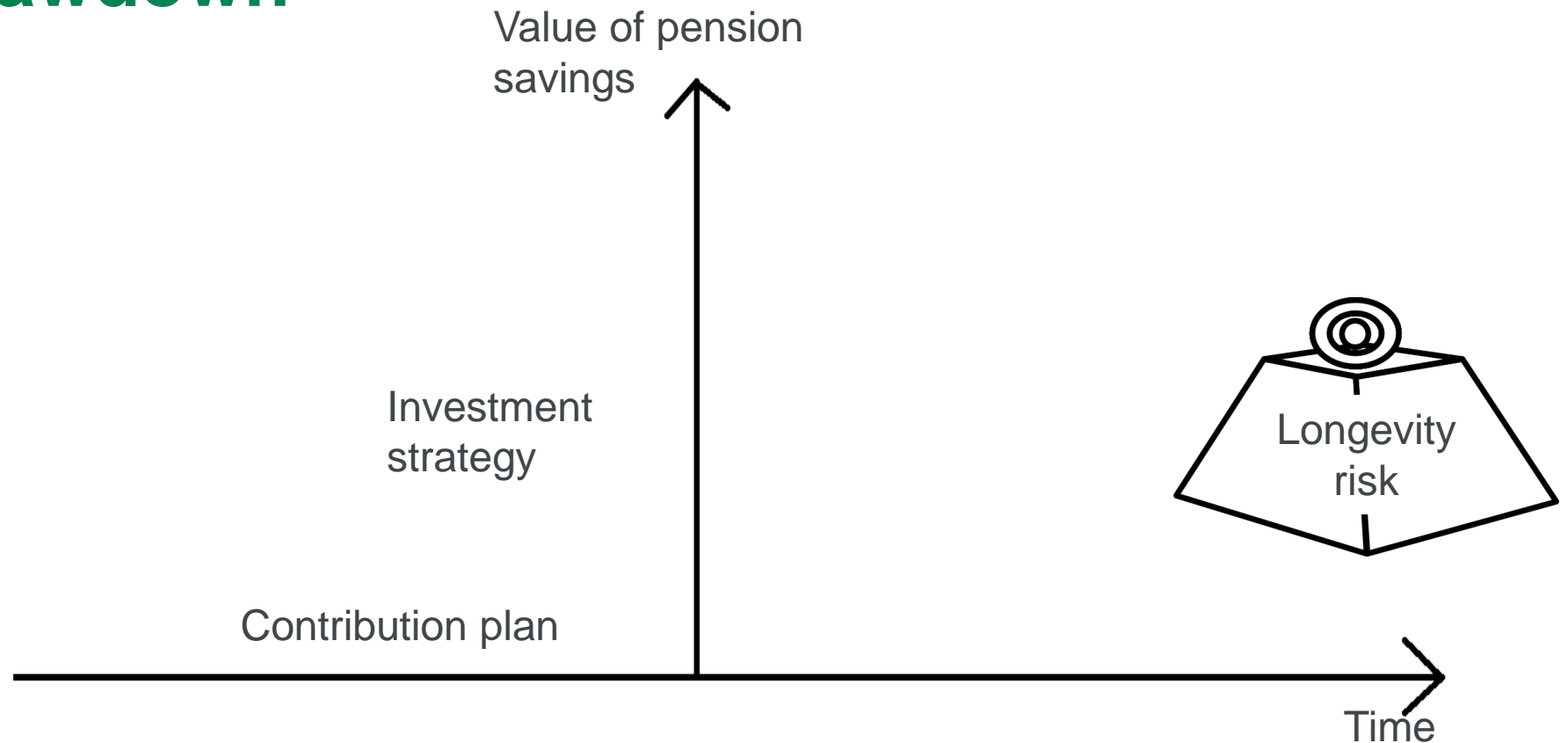


# Drawdown

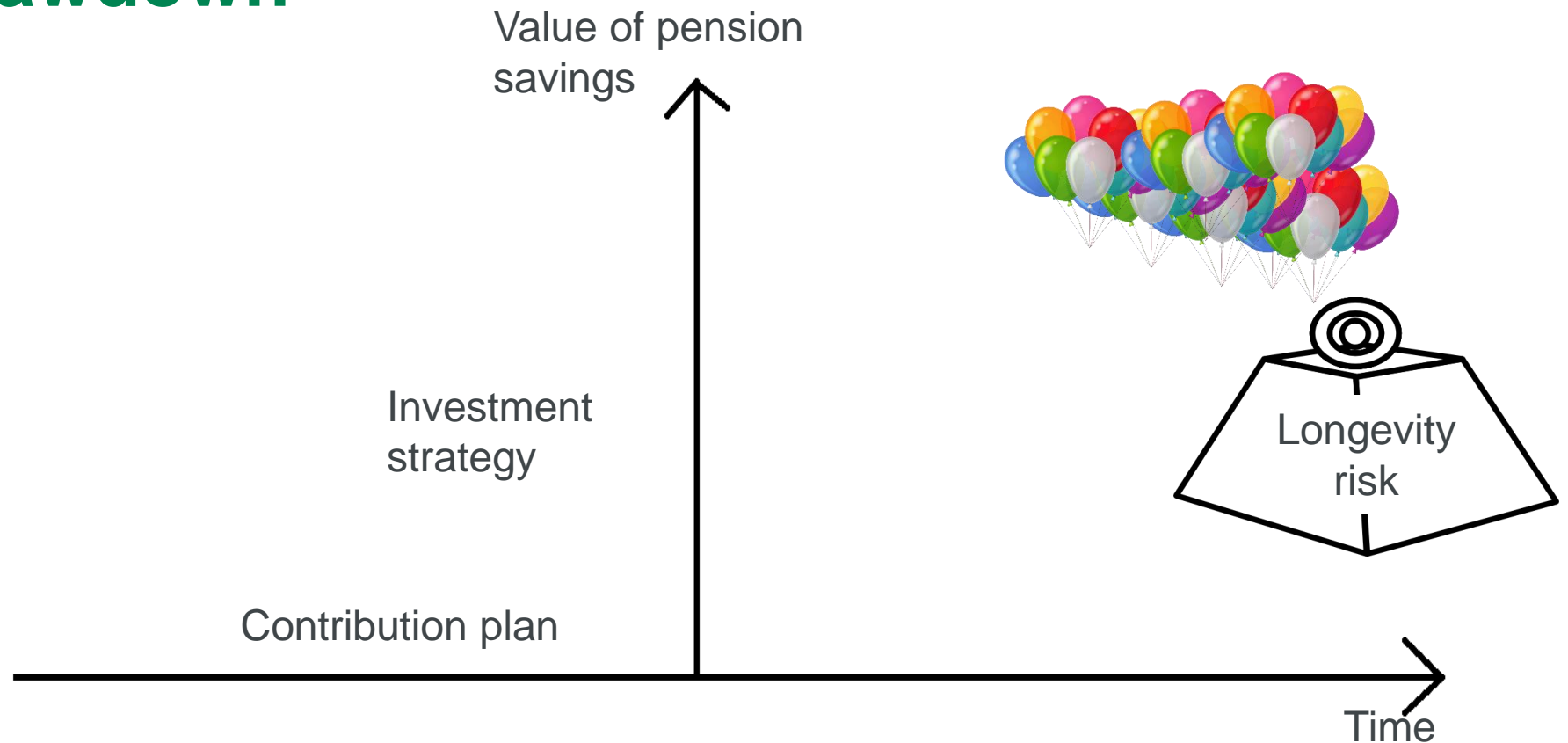


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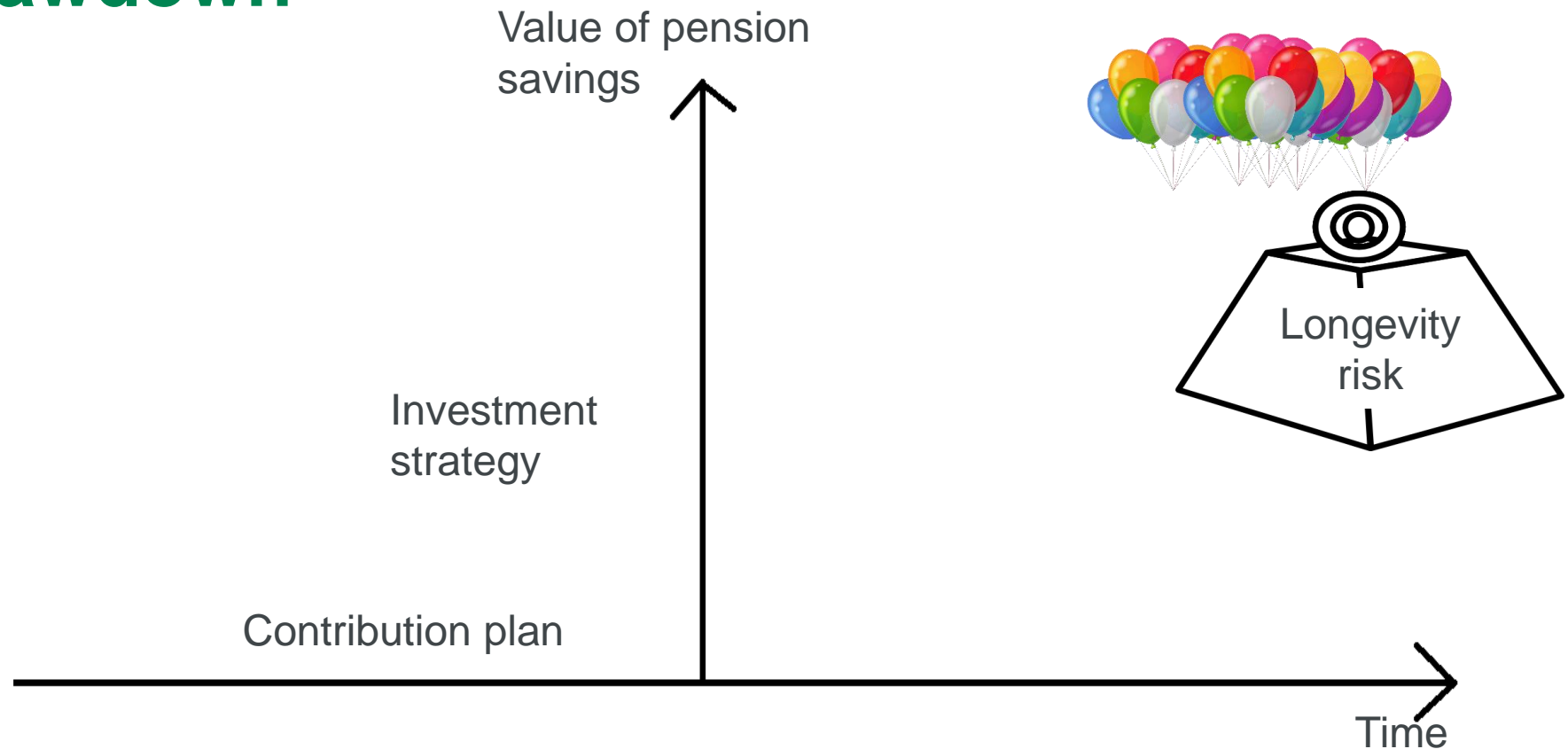


# Drawdown



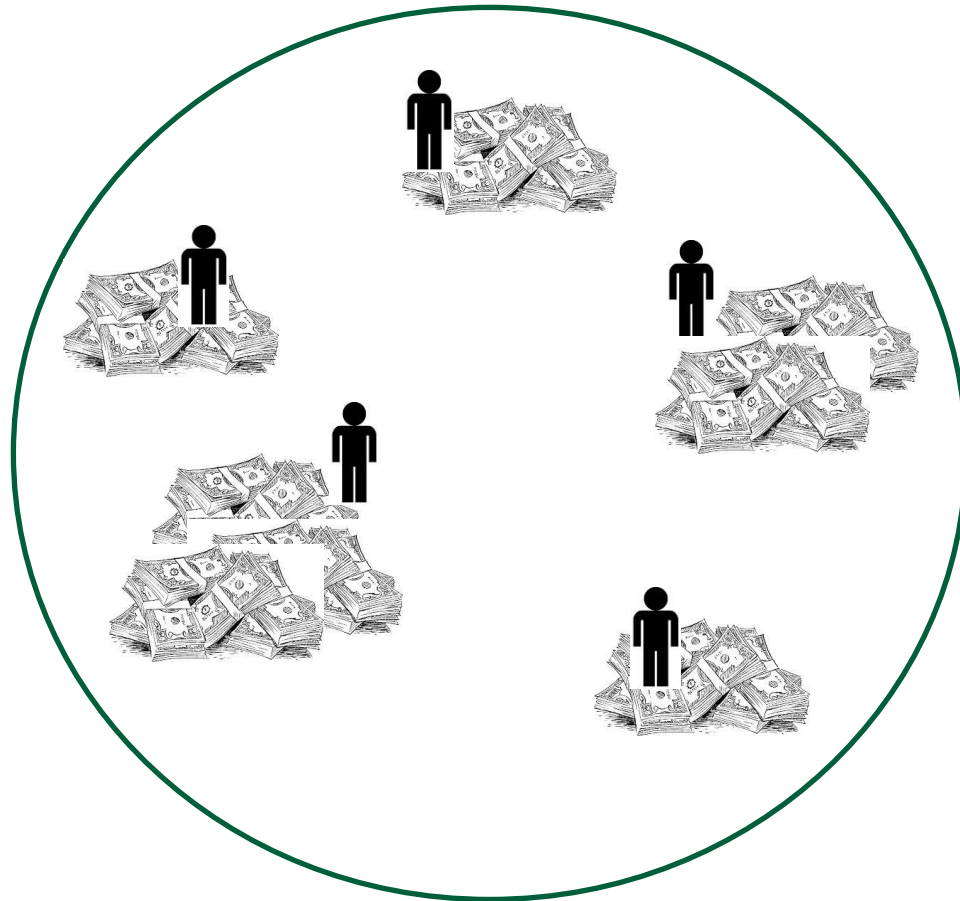
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# Drawdown



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# Mortality risk pooling



Pool risk over 10 years

Individuals make their own investment decisions

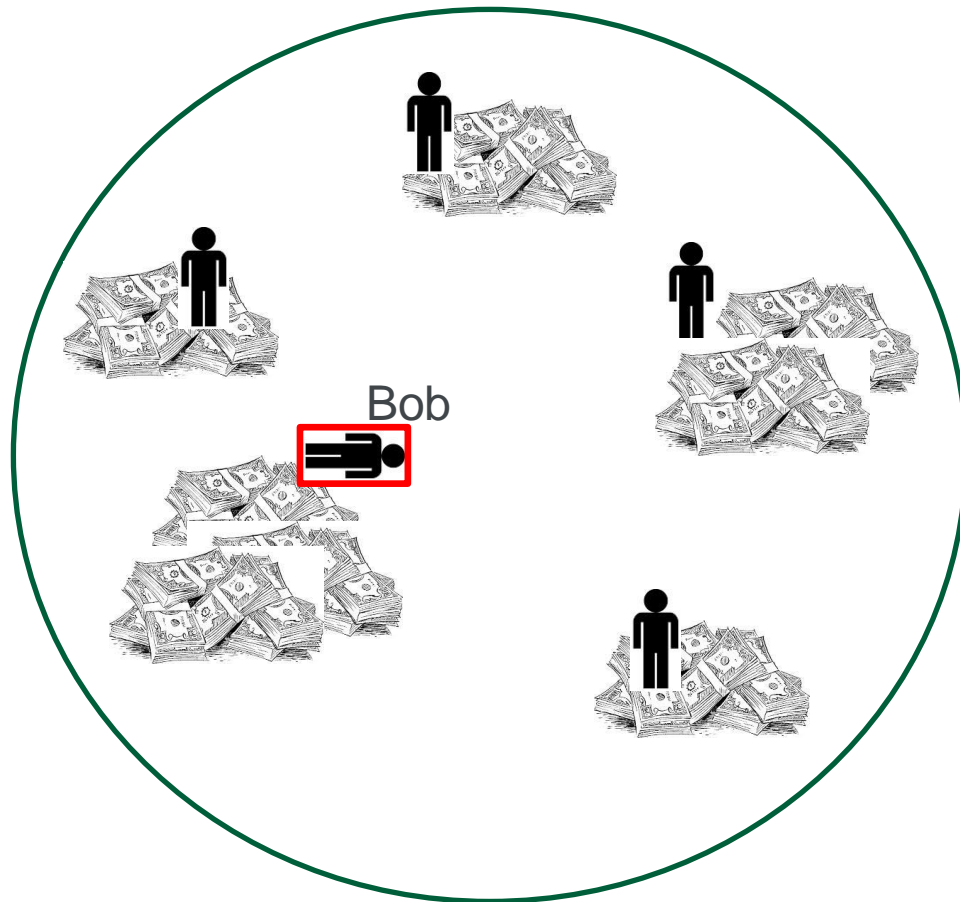
Individuals withdraw income from their own funds

However, when someone dies at time  $T$ ...



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# Mortality risk pooling



Share out remaining funds of Bob.



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# Mortality risk pooling – [DGN]

- $\lambda^{(i)}$  = Force of mortality of  $i^{\text{th}}$  member at time  $T$ .
- $W^{(i)}$  = Fund value of  $i^{\text{th}}$  member at time  $T$ .
- Payment (mortality credit) to  $i^{\text{th}}$  member:

$$\frac{\lambda^{(i)} \times W^{(i)}}{\sum_{k \in \text{Group}} \lambda^{(k)} \times W^{(k)}} \times \{\text{Bob's remaining fund value}\}$$



# Mortality risk pooling - features

- Increase expected lifetime income
- Reduce risk of running out of money before death
- Non-negative return, except on death
- Update force of mortality, periodically.





# Mortality risk pooling - features

- Actuarially fair for any group of people (via payment to Bob, too)
- ``Cost'' is paid upon death, not upfront like life annuity.
- Mitigates longevity risk, but does not eliminate it.
- Anti-selection risk remains, as for life annuity.



# Mortality risk pooling - features

- Under certain conditions\*, can re-create a life annuity.

\*e.g. correct forces of mortality, Law of Large Numbers holds,...

- Comparing:
  - a) Mortality risk pooling, versus
  - b)  $\lambda^{(i)} \times W^{(i)}$  less Fees,

Fees have to be  $< 0.75\% \times W^{(i)}$  for b) to have higher expected return in a moderately-sized, heterogeneous group [DGN].



# Mortality risk pooling - features

- Splits investment return from mortality “return” – enable:
  - Fee transparency,
  - Product innovation.



# Mortality risk pooling – some ideas

- Insurer removes some of the mortality credit volatility, e.g. guarantees a minimum payment for a fee [DY].
- Allow house as an asset – monetize without having to sell it before death [DY].
- Run it like a life annuity, except:
  - Each customer has a ring-fenced fund value,
  - More income flexibility,
  - Update forces of mortality periodically,
  - Explicitly show investment returns and mortality credits on annual statements.



# Summary

- Simple rule to pool mortality risk
- Motivation is to provide a higher income in retirement
- Mitigates longevity risk
- Transparency may encourage more people to “annuitise”





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# The Actuarial Research Centre (ARC)

A gateway to global actuarial research

The Actuarial Research Centre (ARC) is the Institute and Faculty of Actuaries' (IFoA) network of actuarial researchers around the world.

The ARC seeks to deliver cutting-edge research programmes that address some of the significant, global challenges in actuarial science, through a partnership of the actuarial profession, the academic community and practitioners.

The '**Minimising Longevity and Investment Risk while Optimising Future Pension Plans**' research programme is being funded by the ARC.

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# Bibliography

- [DGN] Donnelly, C, Guillén, M. and Nielsen, J.P. (2014). [Bringing cost transparency to the life annuity market.](#) *Insurance: Mathematics and Economics*, 56, pp14-27.
- [DY] Donnelly, C. and Young (2017). J. [Product options for enhanced retirement income.](#) *British Actuarial Journal*, 22(3).
- [ONS Statistical bulletin: Occupational Pension Schemes Survey, UK: 2015](#)
- [Purple Book 2016, Pension Protection Fund, UK](#)
- Willis Towers Watson. [Global Pensions Assets Study 2017.](#)



# Questions

# Comments

The views expressed in this presentation are those of the presenter.



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