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A customer-focused investment product

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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.

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Overview

- Very broad overview of the project
- Improving communication by product design – preliminary work
- A closer look at the mathematics and wealth distribution
- Discussion in groups

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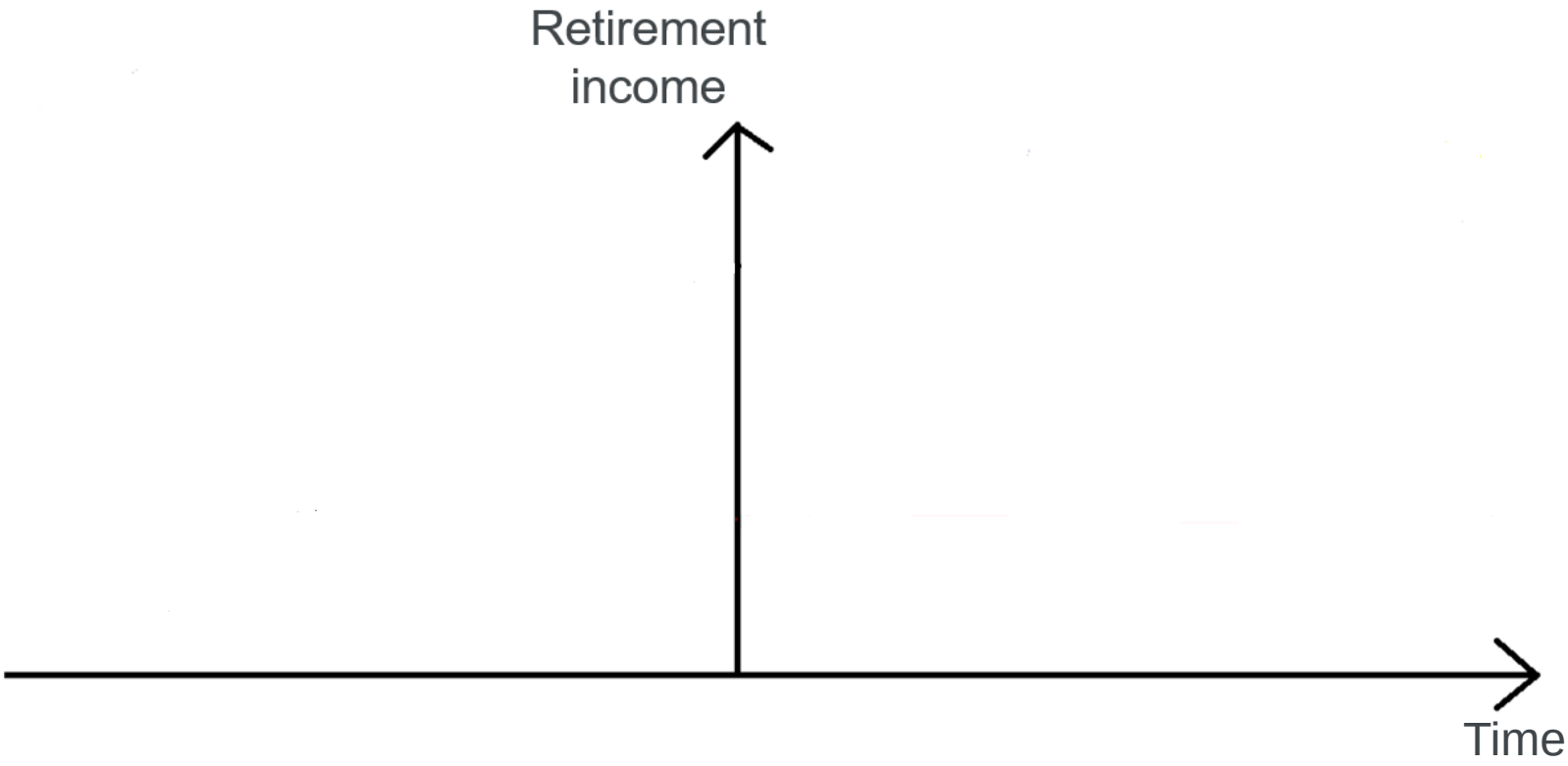
Typical current DC situation



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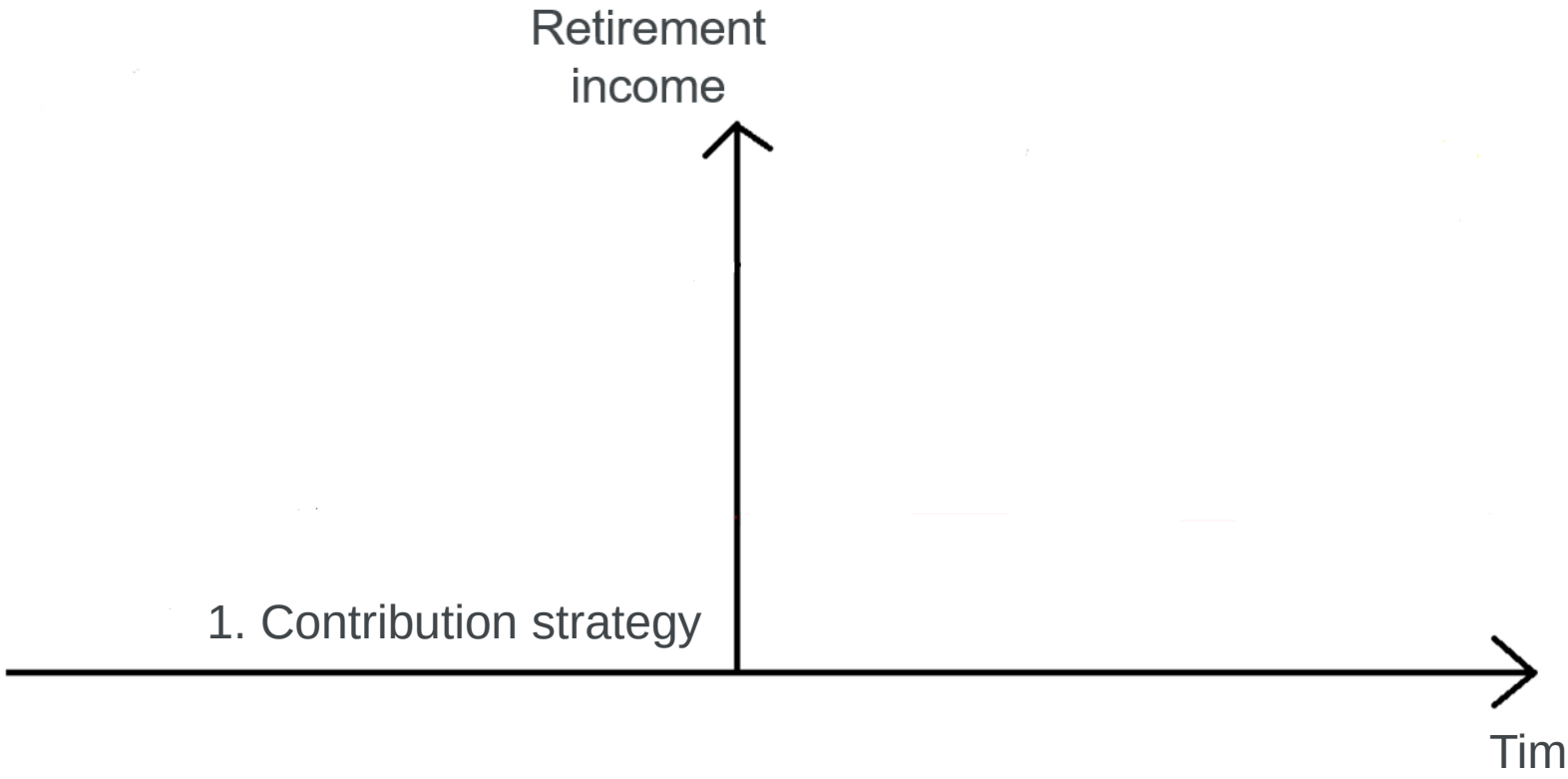

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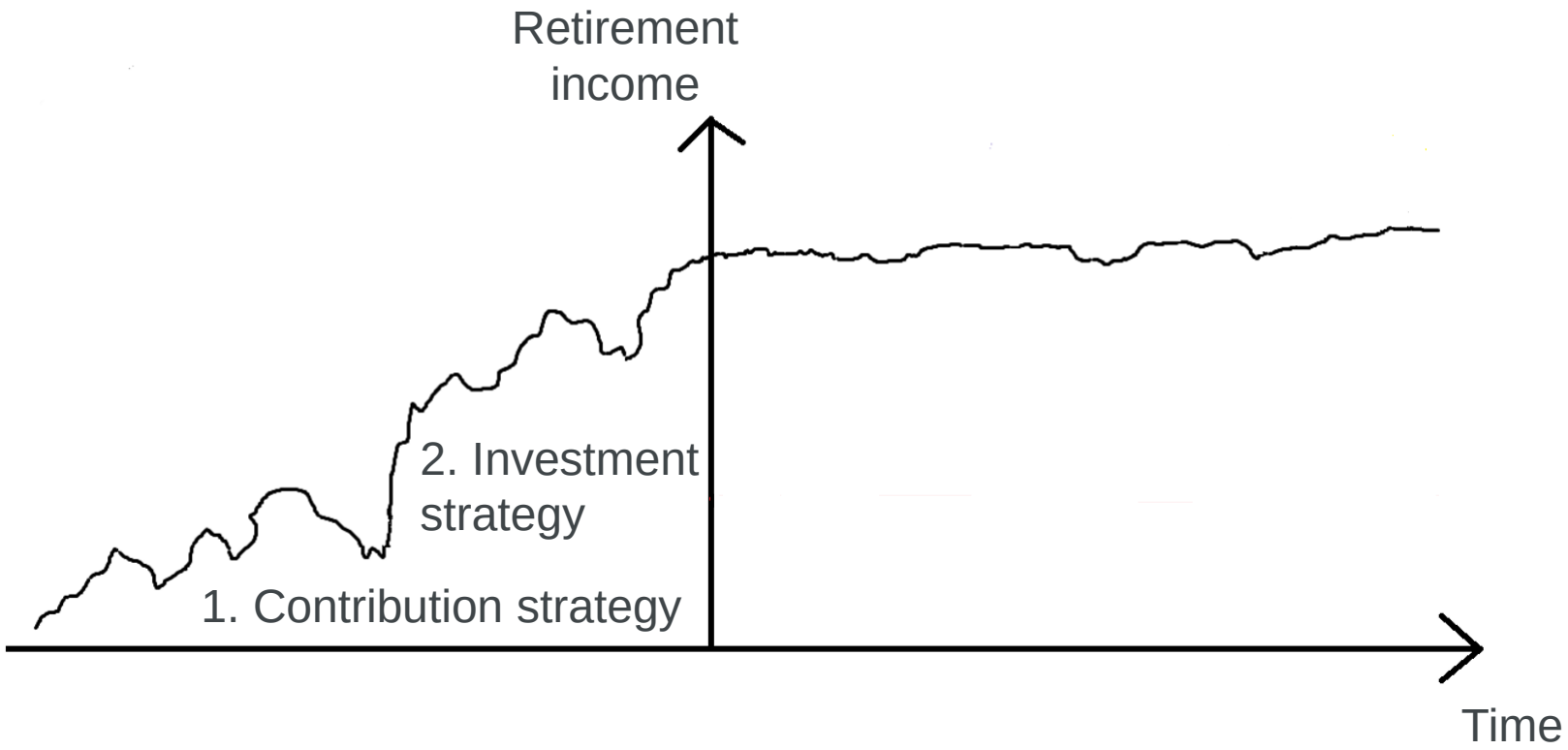

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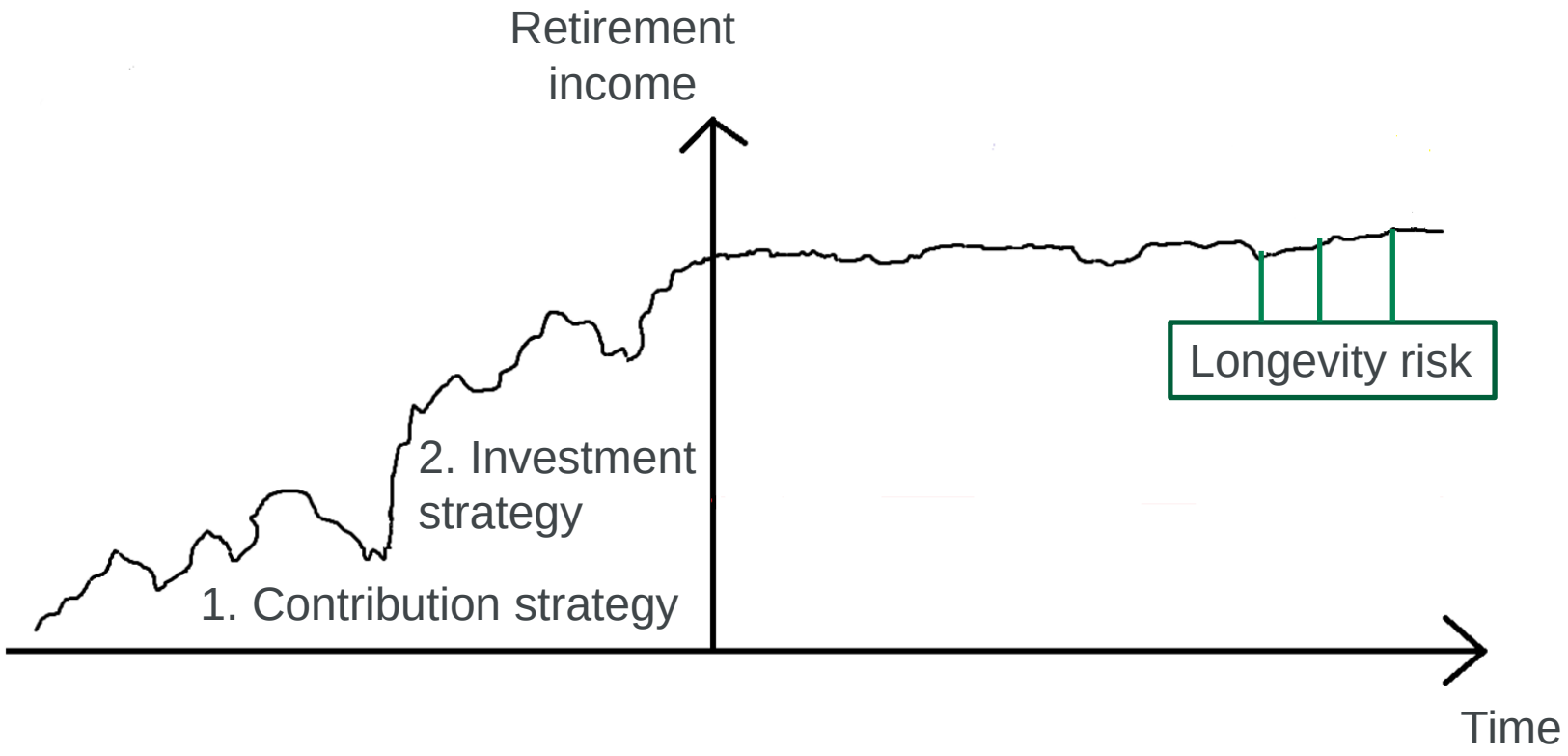

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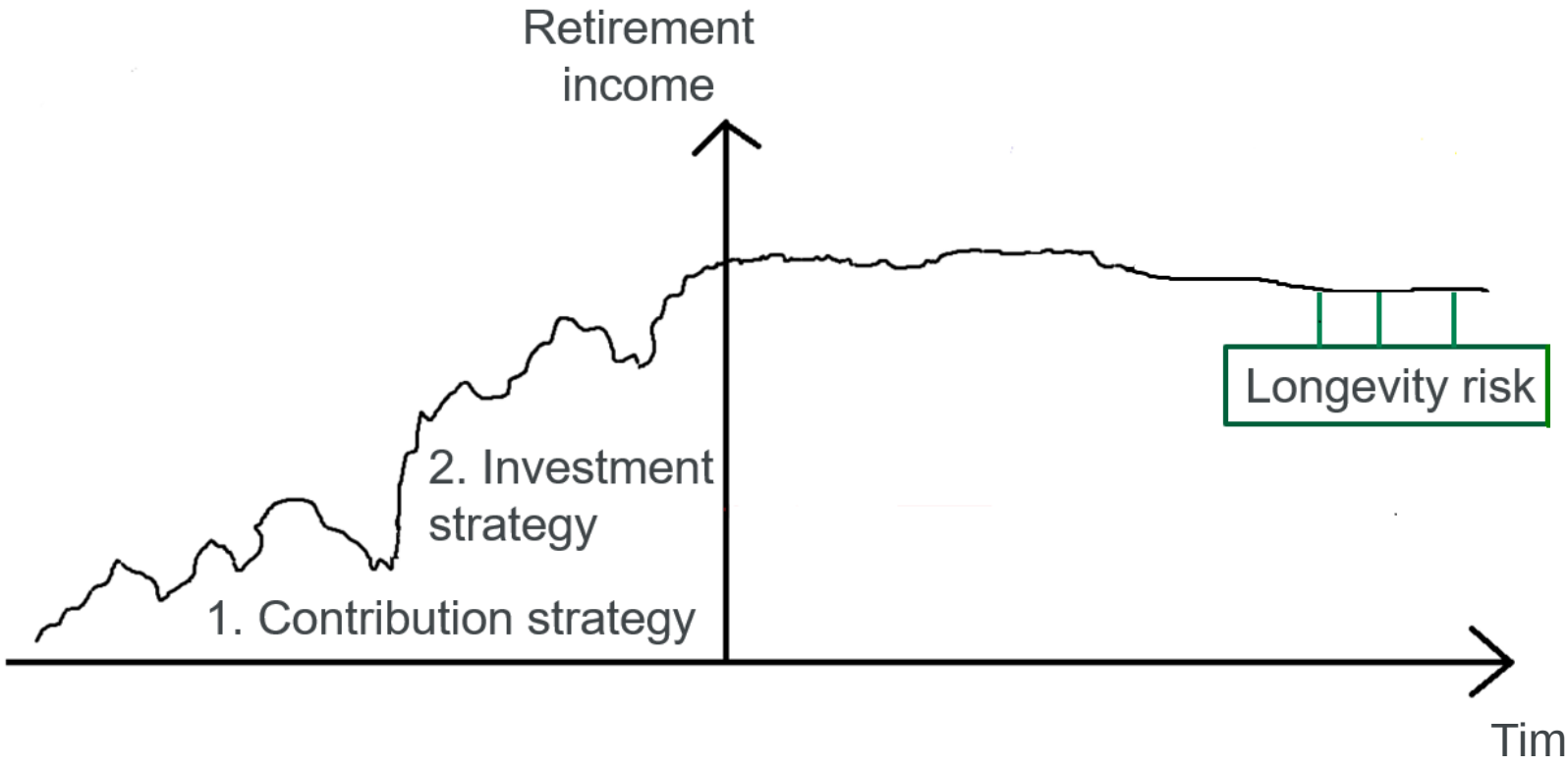

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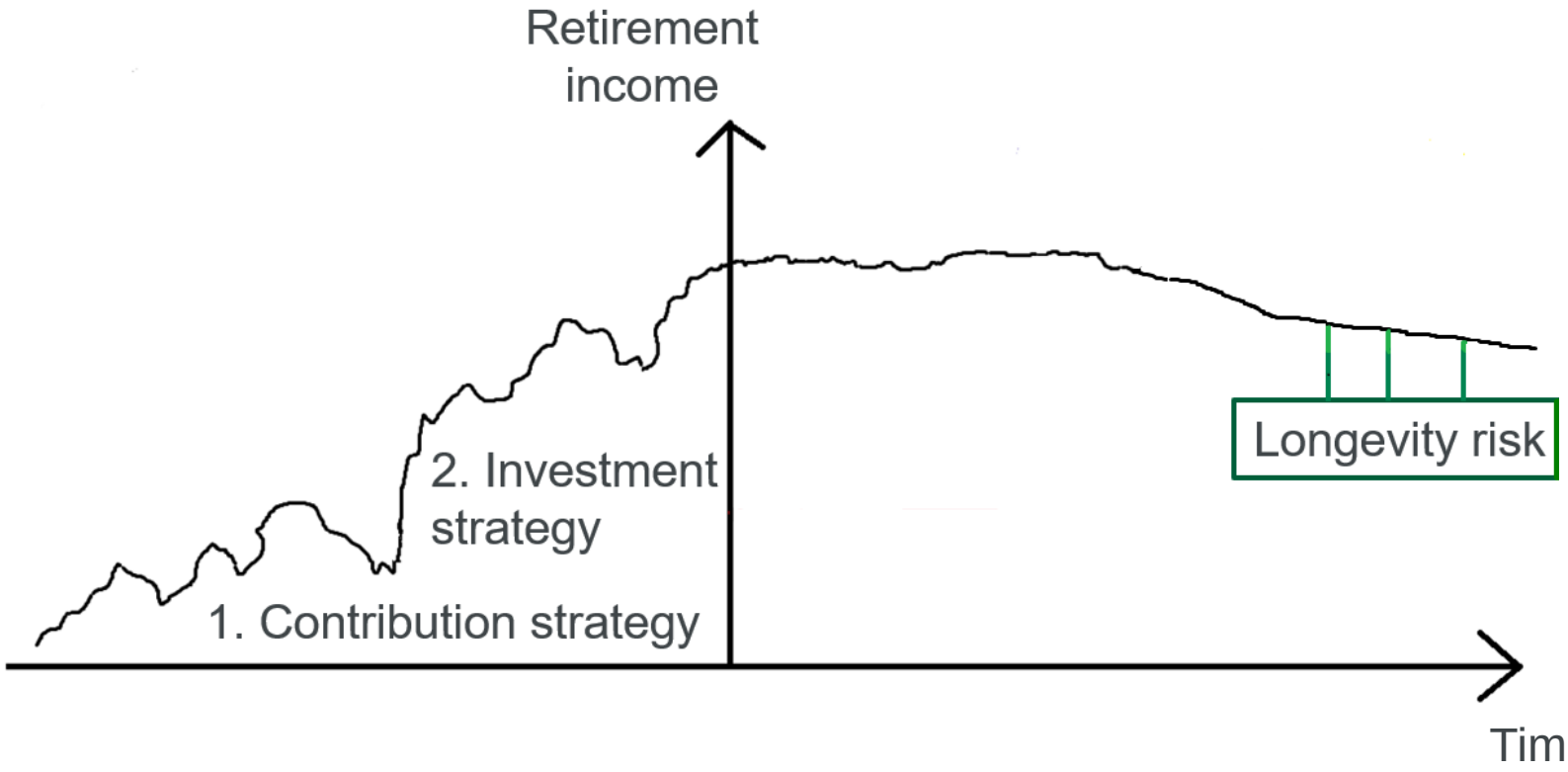

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Put customer objectives at the centre

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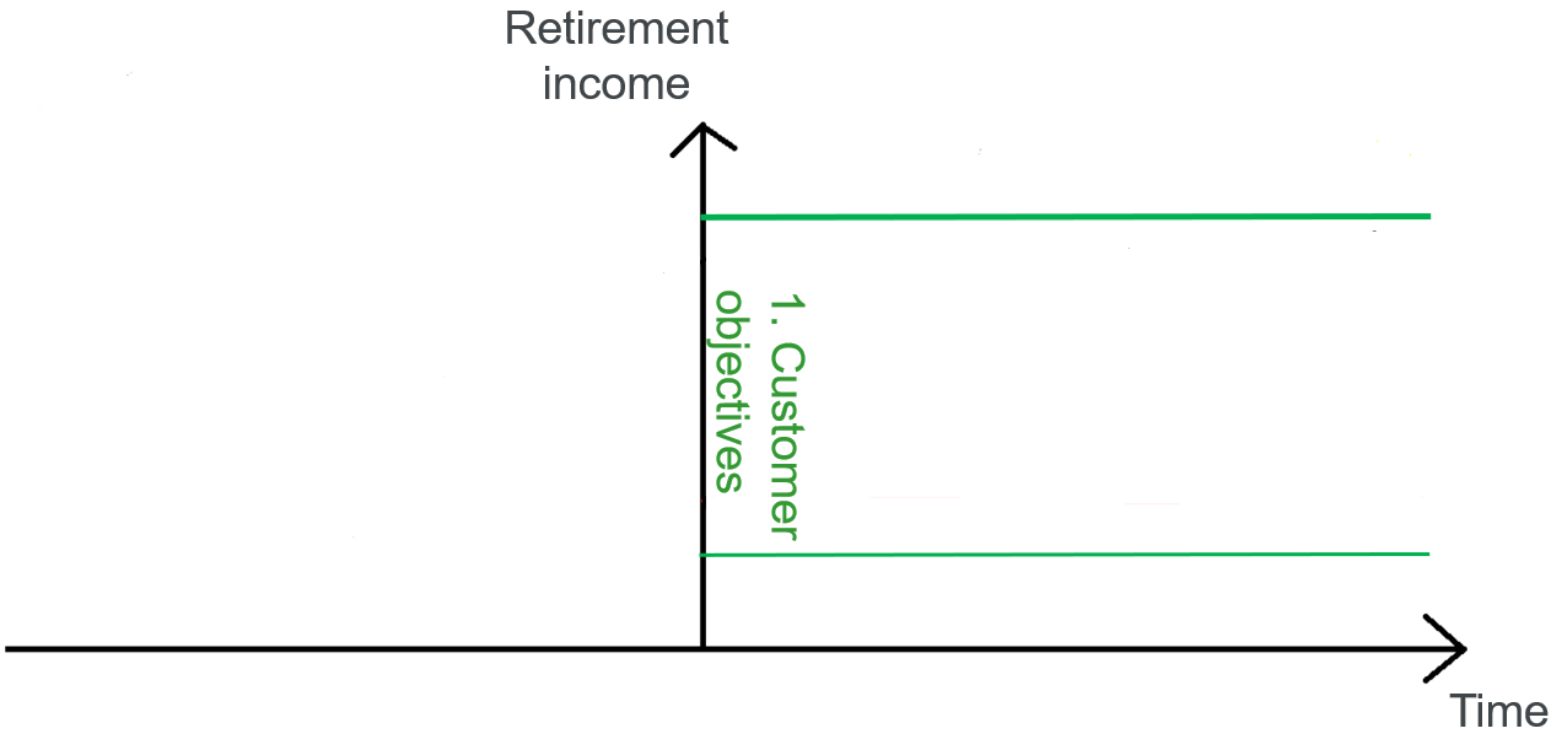

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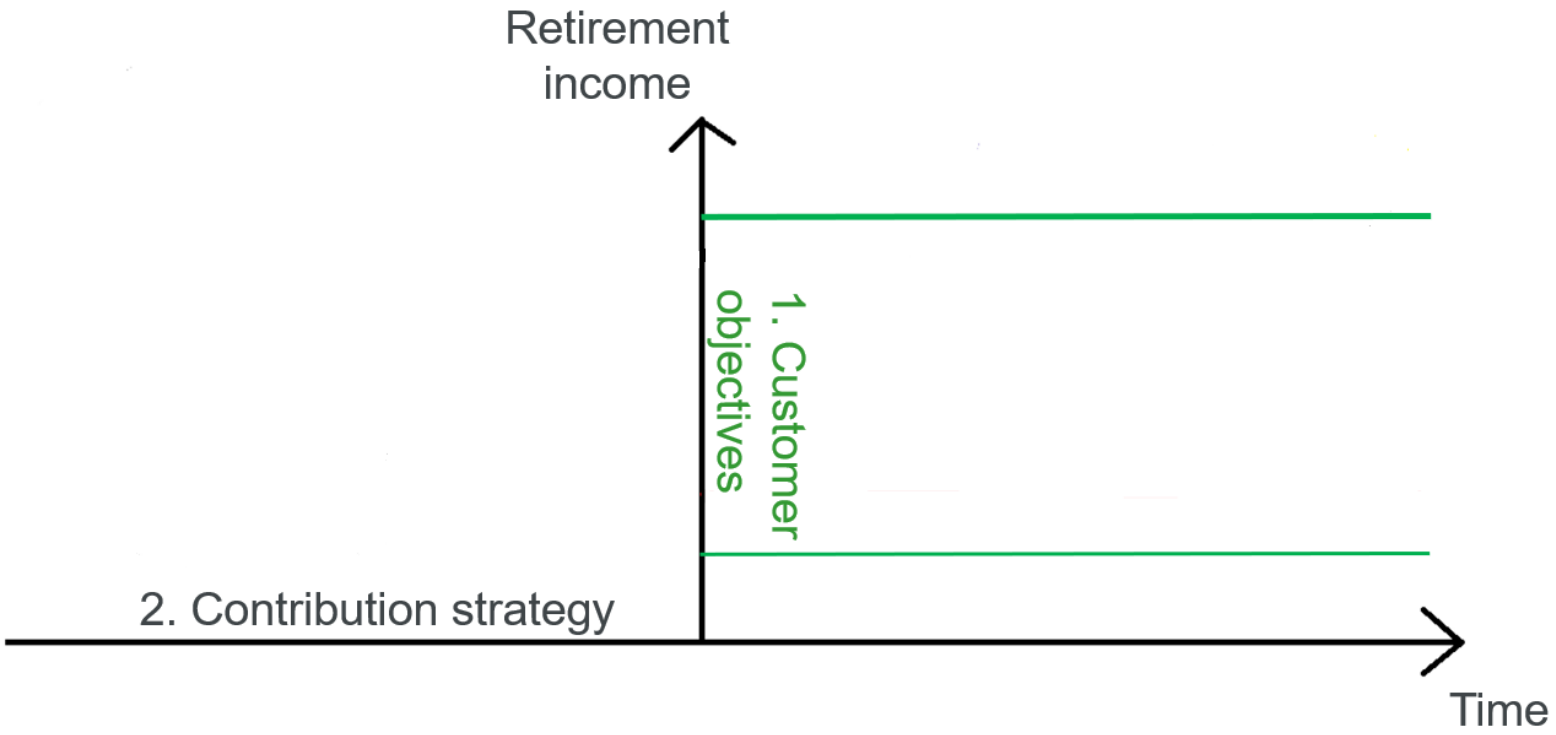

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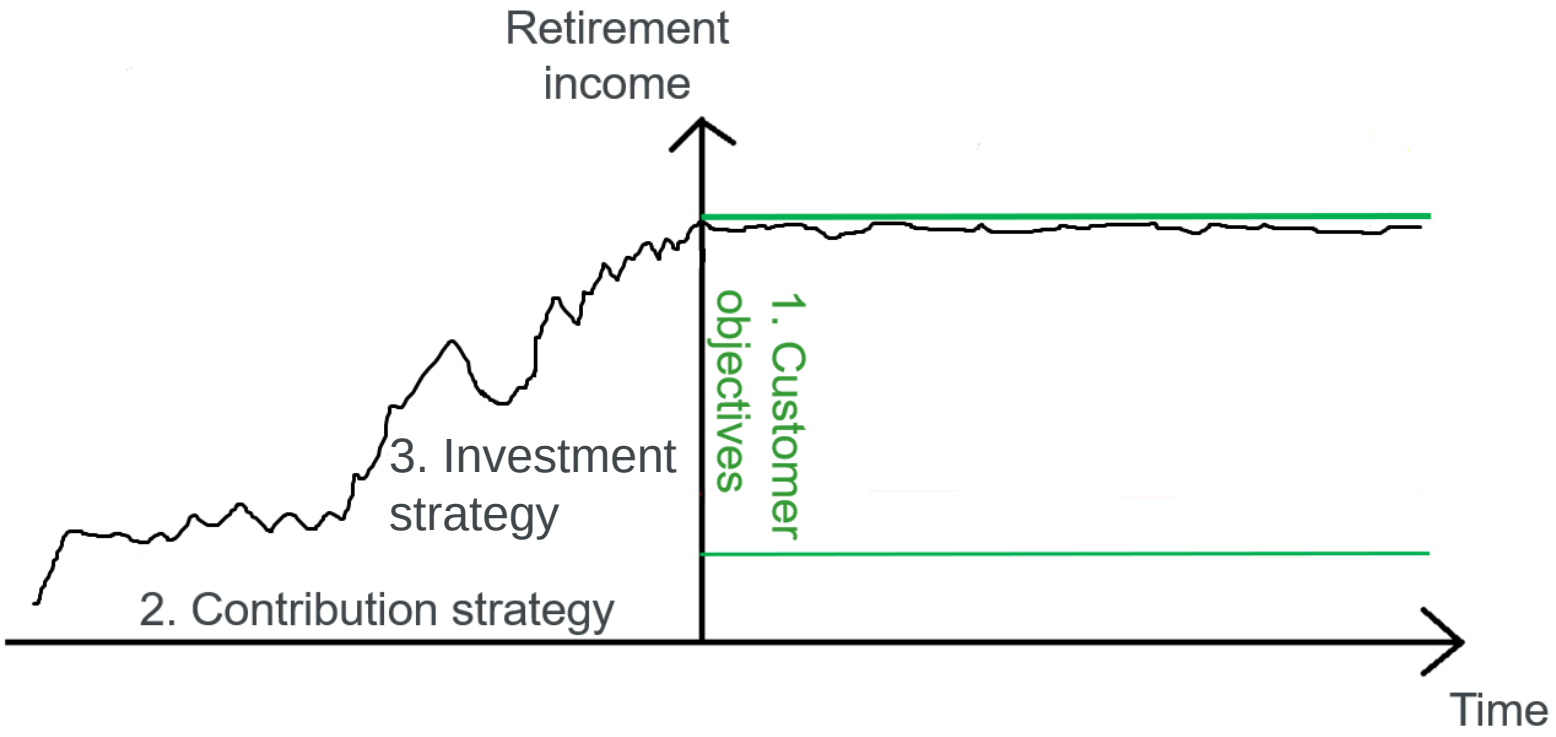

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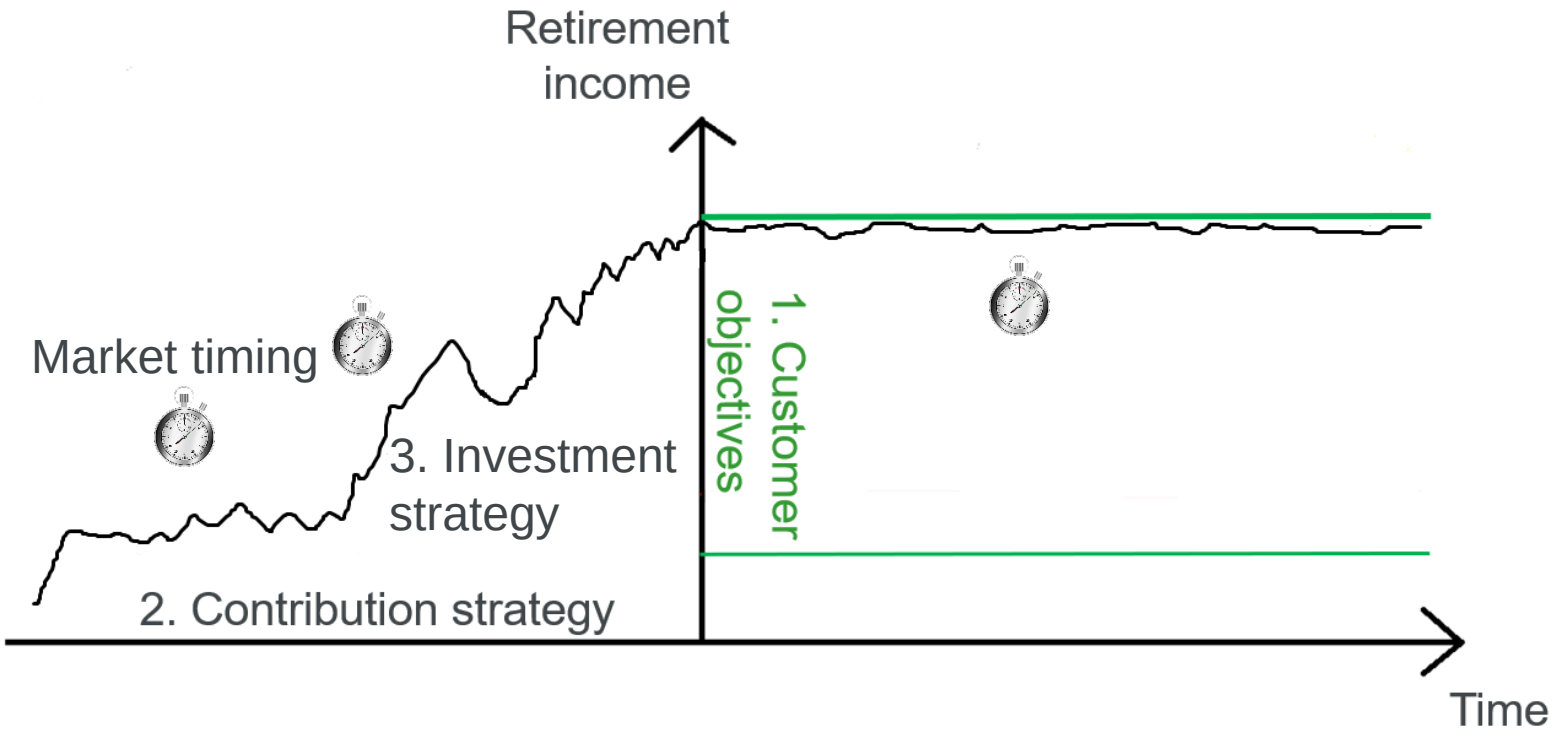

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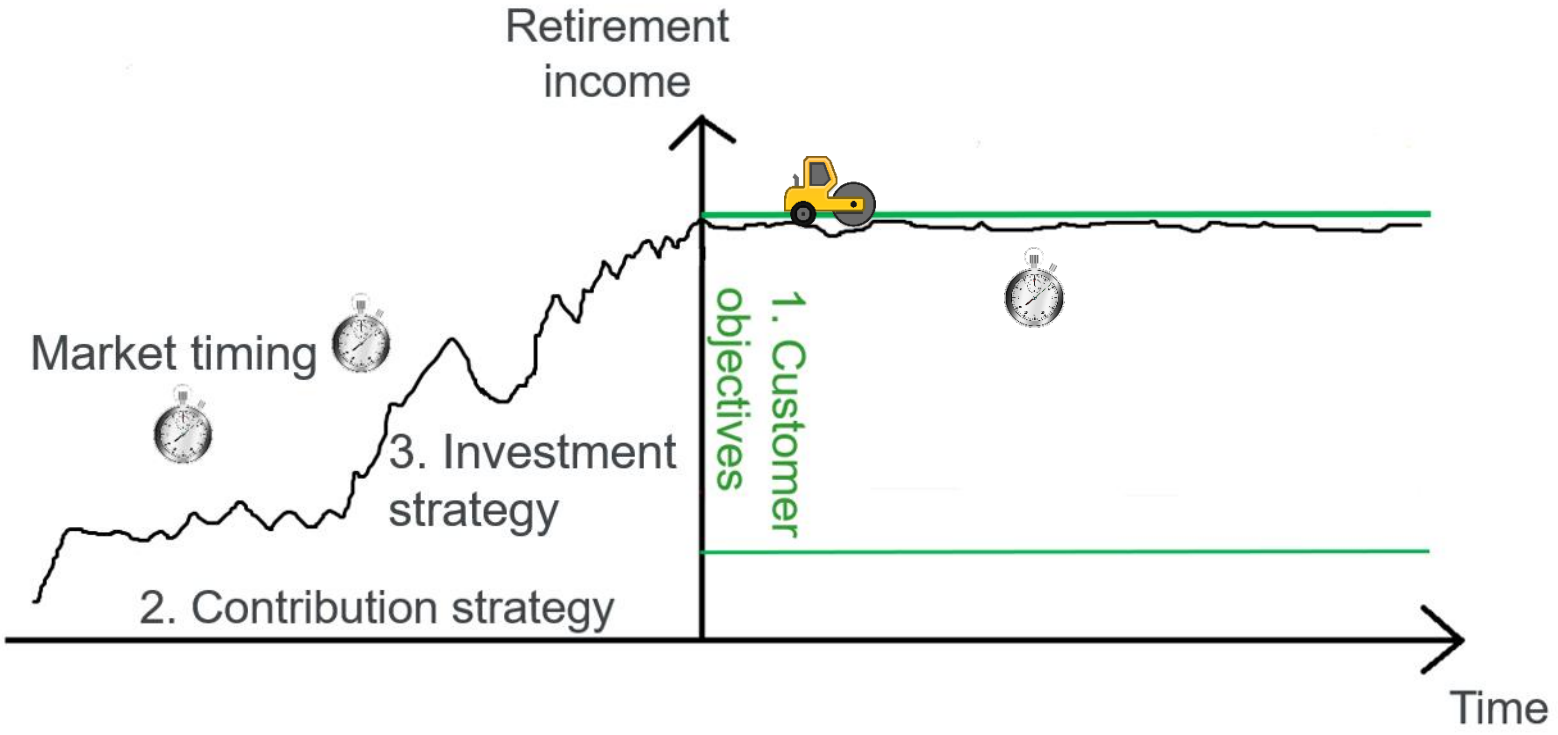

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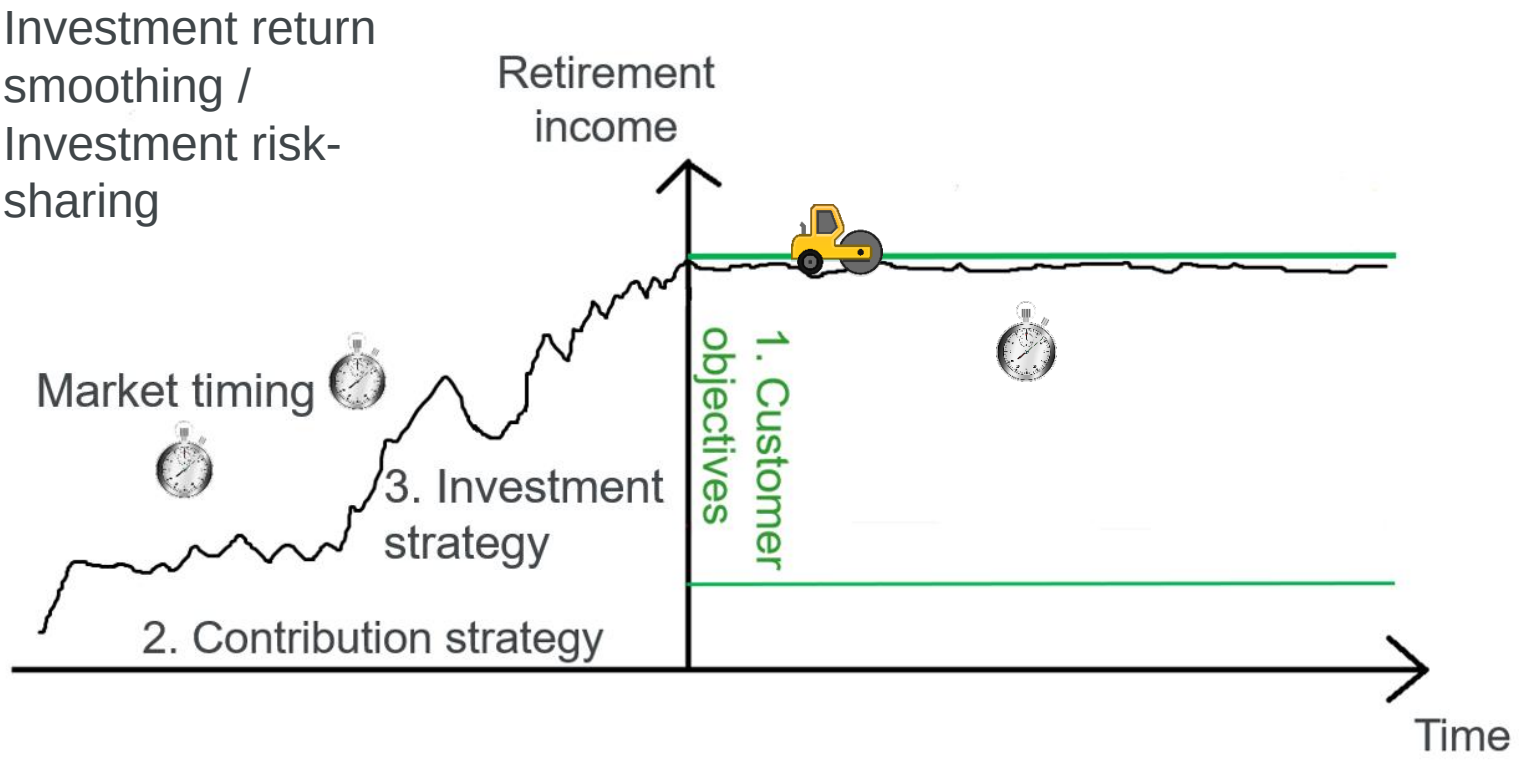

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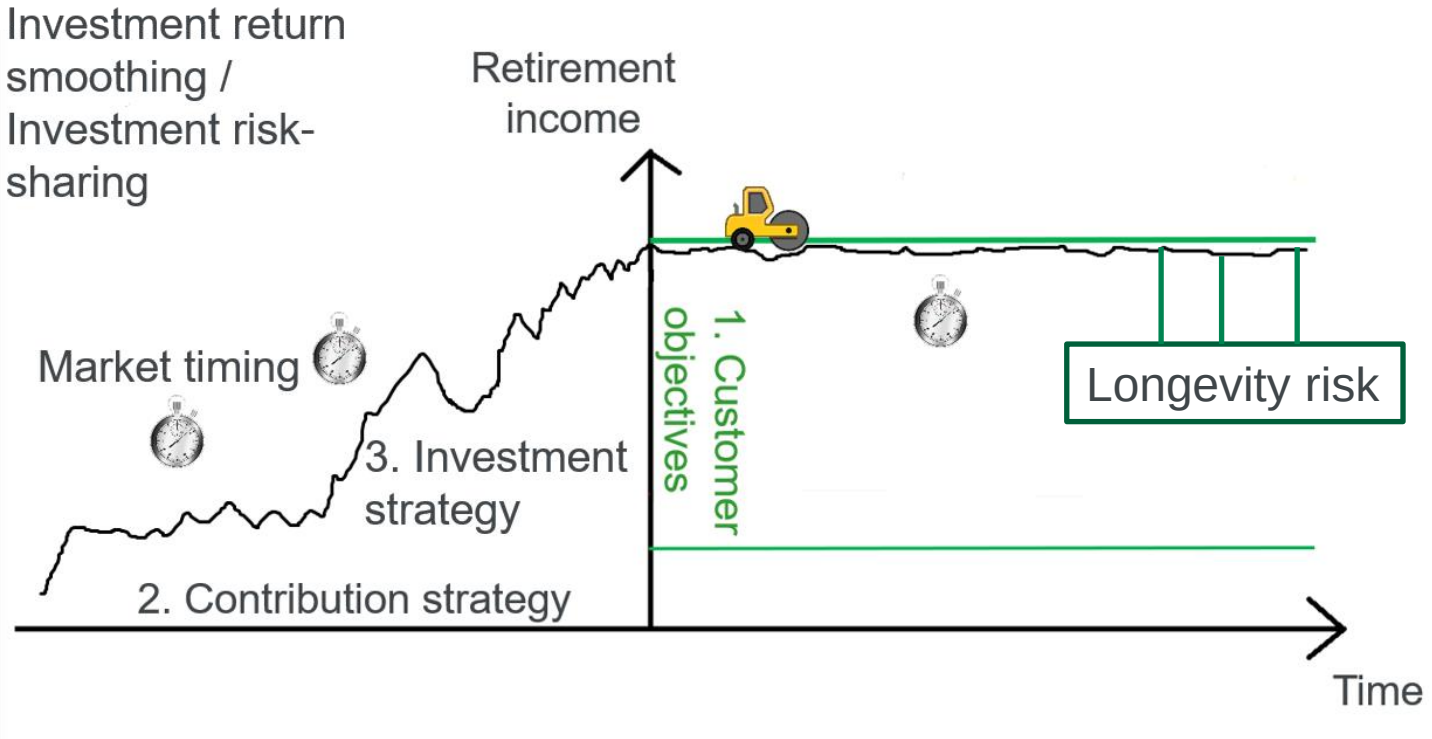

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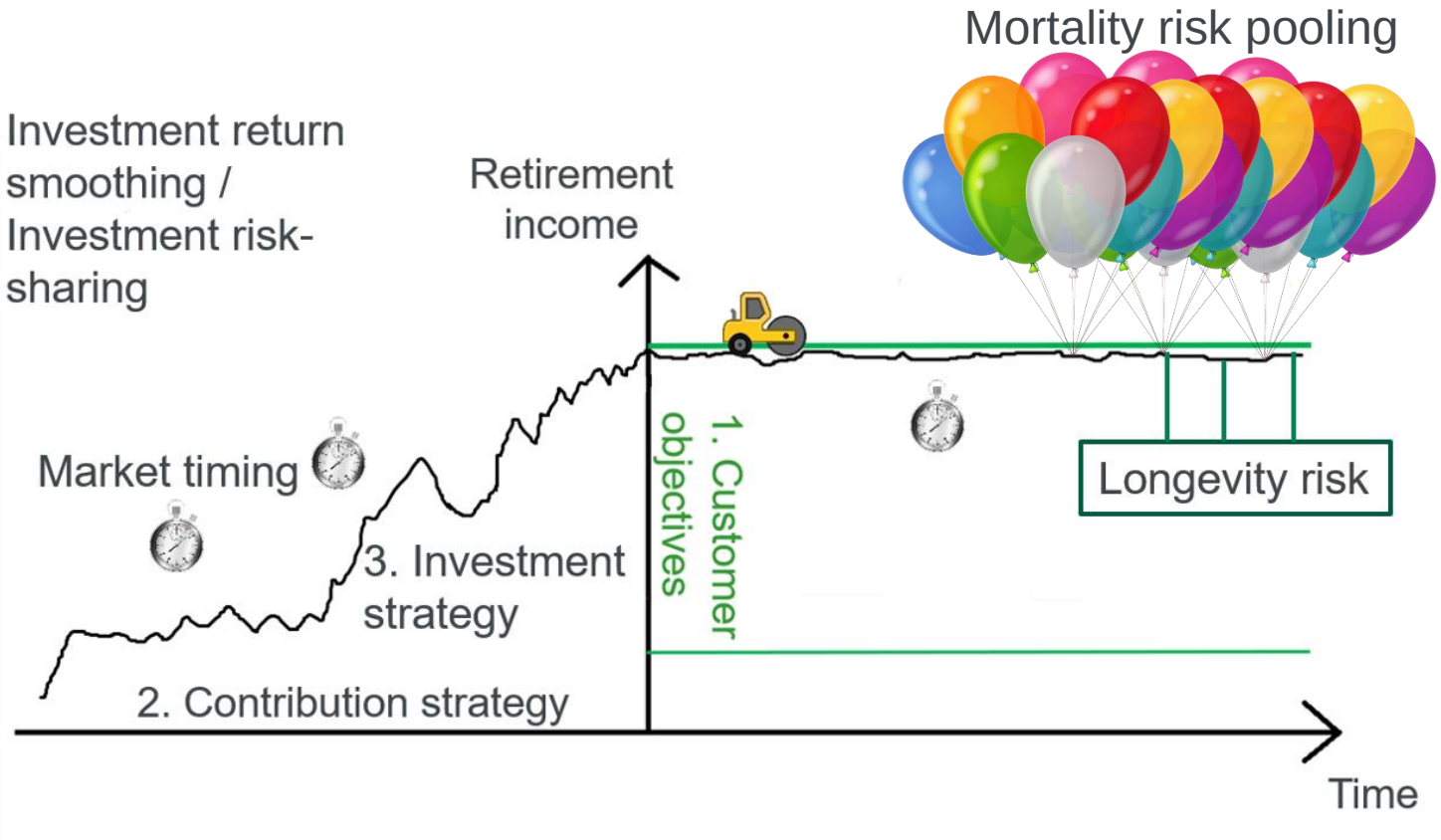

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Research topics

- Investment strategies throughout the customer's lifetime
- Investment return smoothing and/or risk sharing
- Mortality risk sharing
- Performance measurement: investment risk vs income stability
- Market timing
- Guarantees: only when needed
- Robustness to assumptions

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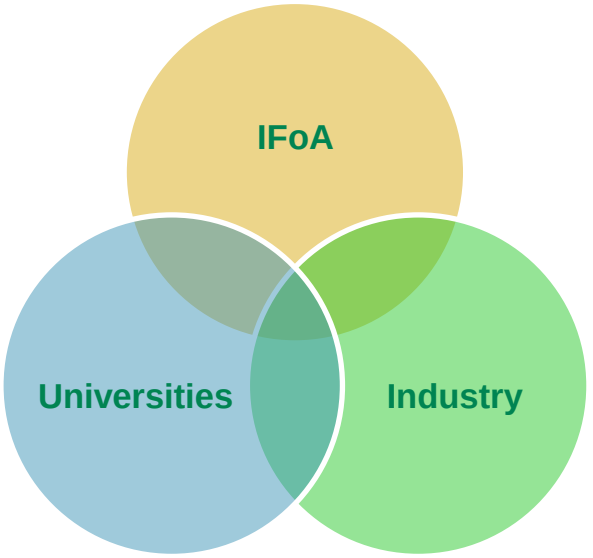
Research coalition

Dr Catherine Donnelly

Dr Thomas Bernhardt

Dr Rami Chehab

Prof Montserrat Guillen



Prof Jens Perch Nielsen

Dr Munir Hiabu

Mr. Peter Vodička

Dr Ana-Maria Perez Marin

Dr Michael Scholz

Prof Stefan Sperlich

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Project structure

WP	WP title
1	Management, reporting and public visibility
2	Implementing Merton's vision via defined contribution plans
3	Incorporating investment market timing in pension products via econometric modelling
4	Re-inventing the approach to the decumulation phase of pension plan
5	Minimizing longevity risk and investment risk via customers' risk sharing
6	Bringing it all together into concrete suggestions for future pension products

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Next year's deliverables: HWU

Date	Deliverable
Feb 18	STAR* on investment strategies for decumulation.
Apr 18	STAR* on investment risk-sharing.
Oct 18	Paper + demonstration code: Maximising the stability of real income while allowing for investment performance.
Oct 18	Paper + demonstration code: Sharing investment risk and return within an age-heterogeneous group.

*STAR = State of the Art Report

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Next year's deliverables: Cass

Date	Deliverable
Aug 18	Paper component on sharing investment risk and return within an age-heterogeneous group
Aug 18	Paper component on maintaining the investment risk profile when there is investment risk sharing
Aug 18	Paper component on maximising the stability of real income while allowing for investment performance.
Aug 18	Paper on Merton's vision with more flexible and robust risk preferences from the customers.

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What people want

An inflation-indexed retirement income that lasts for their lifetime.

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Robert C. Merton (2014) The Crisis in Retirement Planning. HBR.

- Goal= inflation-increasing income for life.

- Risk = failure to meet goal.

- Align investment strategy with goal.

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How are pension outcomes communicated today?

- Focus on investment values

- Risk is not generally communicated.
  - Example: DC pension pot converts to £872 p.a. income in retirement (inflation-increasing).

  - But, income goes down by 11% if net return goes down by 0.5% [not shown]
  - Income goes down by 22% if net return goes down by 1%,…

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Improving communication by product design

- Plan today…

- …for the future, but which one?

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Improving communication by product design

- How much income in retirement?
- Target: The income you'd like to live on.
- Minimum: The minimum income that you are happy to live on.

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Preliminary “proof-of-concept”

- How much **income in** retirement?
- Target: The **income** you’d like to **live on**.
- Minimum: The minimum **income** that you are happy **to live on**.

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Preliminary “proof-of-concept”

- How much **money at** retirement?
- Target: The **money** you’d like to **have at retirement**.
- Minimum: The minimum **money** that you are happy **to have at retirement**.

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Preliminary “proof-of-concept”

- How much **money** in retirement?
- Target: The **money** you’d like to **have at retirement**.
- Minimum: The minimum **money** that you are happy **to have at retirement**.

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Santa Claus' data

- 1,747 years old.
- Current value of pension savings = £50,000.
- Retiring at age 1,757.
- For simplicity, no future contributions.

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Santa Claus' choices

- Target value of savings at retirement: £61,000 (2% p.a.).

- Minimum value of savings: £50,000 (0% p.a.).

- Retiring in 10 years' time.

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Santa Claus' feedback

- 42% chance of getting £61,000.
- 14% chance of getting £50,000.
- To increase the chance:
  - Start contributing,
  - Retire later,
  - (Take more investment risk).

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Remove target – what happens?

- 42% chance of getting £61,000 **and no more**.
- 14% chance of getting £50,000.

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Remove target – what happens?

- 33% chance of getting £61,000 **or more**.
- 21% chance of getting £50,000.

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Securing a value at retirement

Chance of getting £61K or higher	Target £61K	No target
Minimum £50K	42%	33%
No minimum	51%	41%

Chance of getting £50K or lower	Target £61K	No target
Minimum £50K	14%	21%
No minimum	10%	15%

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Securing a value at retirement

- A target increases the chance to hit the target value.
- However, give up upside risk to do this.
- Offsets the cost of the minimum value.

Initial wealth £50K, no min, values in £000s, r = 0.01, μ = 0.04, σ = 0.20, γ = -2, T=10 years

p	Target=£58K (1.5% p.a.)	Target=£61K (2% p.a.)	Target=£67K (3% p.a.)	No Target
5%	49.4	47.2	45.8	45.6
25%	57.6	55.0	53.4	52.9
50%	58.0	61.0	59.5	58.8
75%	58.0	61.0	66.2	65.4
95%	58.0	61.0	67.0	76.3
Prob. hit Target	74%	51%	23%	N/A
Quantile uplift	109%	104%	101%	N/A

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Conclusion

- Target wealth restriction:
  - Increases certainty of level of retirement wealth,
  - Offsets the cost of a minimum wealth,
  - May aid in communication of risk.

- Plan: do this for an income in retirement:
  - Aim for an income close to a target income, and
  - Income should not fall below a minimum income.

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Group discussion

- What did you hear that you:
  - liked?
  - didn't like?
  - And why?
- What would you like to know more about?
- Anything else?

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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

- Donnelly, C, Guillén, M, Nielsen, J.P. and Pérez-Marín, A.M. Implementing individual savings decisions for retirement with bounds on wealth. *Accepted by ASTIN Bulletin, in press*.
- Donnelly, C, Guillén, M, Gerrard, R. and Nielsen, J.P. Less is more: Increasing retirement gains by using an upside terminal wealth constraint. *Insurance: Mathematics and Economics* (2015), 64, pp259-267.

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Questions

Comments

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

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Derivation of the investment strategy

- Black-Scholes market
  - Risky stock price dynamics $\frac{dS(t)}{S(t)} = \mu\, dt + \sigma\, dW(t)$,
  - Risk-free bond price dynamics $\frac{dB(t)}{B(t)} = r\, dt$,
  - Process *W* a standard Brownian motion.

Derivation of the investment strategy

- Initial wealth $x_0 > 0$.
- Find an optimal strategy π^* that maximises

$$E[\frac{1}{\gamma} X^{\pi}(T)^{\gamma}]$$

subject to $X^{\pi}(T) \in [Minimum, Target]$, a. s.

- An optimal strategy is the hedging strategy that gives wealth

$$X^{\pi^*}(T) = z_0 Z(T) - [z_0 Z(T) - Target]_+ + [Minimum - z_0 Z(T)]_+.$$

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Remove minimum

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$$X^{\pi^*}(T) = z_0 Z(T) - [z_0 Z(T) - Target]_+.$$

- For $t \leq T$, $X^{\pi^*}(t) = z_0 Z(t) - call\big(t, z_0 Z(t)\big)$.

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- An optimal strategy is the hedging strategy that gives wealth

$$X^{\pi^*}(T) = z_0 Z(T) - [z_0 Z(T) - Target]_+.$$

- At $t = 0,\ x_0 = z_0 - call(0, z_0) \ \Rightarrow\ z_0 \geq\ x_0$

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Interpretation of z_0

- Quantile uplift z_0/x_0.
- *p*-quantile

$$\mathcal{Q}_p = \inf\{y \in \mathbb{R}: \mathbb{P}[X^{\pi}(T) \leq y] \geq p\}.$$

- Without Target constraint: $\mathcal{Q}_p = x_0\beta_p$
- With Target constraint *K*: $\mathcal{Q}_p = \min\{K, z_0\beta_p\}$