Metrics for comparing retirement strategies: a road test

26th Colloquium on Pensions and Retirement Research

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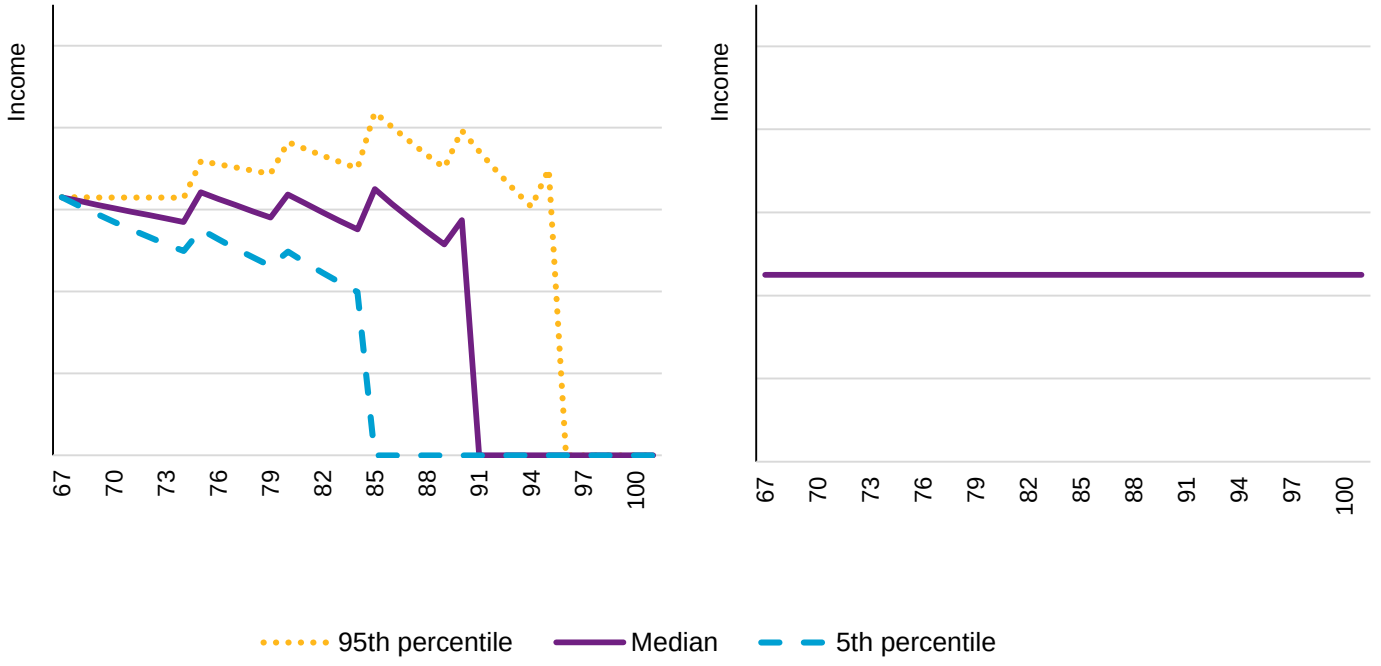
Motivation – why we need retirement metrics

"Annuities don't return enough to fund a full retirement"

"A shift away from account-based pensions is needed to combat longevity risk"

"Group self annuities deliver the best of both worlds – high returns and longevity protection"

Motivation – why we need retirement metrics



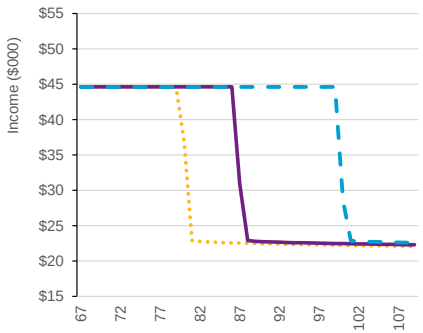
The road test: metrics considered

Metric Type		Metric	Form of output	Allows for target income?	Allows for residual?
Entry-Level		Probability and average age at ruin	probability	✗	✗
		Probability of income inadequacy	probability	✓	✗
		Depth and duration of income misses	$ & time horizon	✓	✗
Proportion measures		NPV(total retirement income) / Money's Worth	$ / %	✗	✓
		Desired income attainability	%	✓	✗
		Goodness of Fit index	% between 0 & 100	✓	✗
Utility-based		Risk-adjusted income	$	✗	✗
		MDUF Score	$	✗	✓

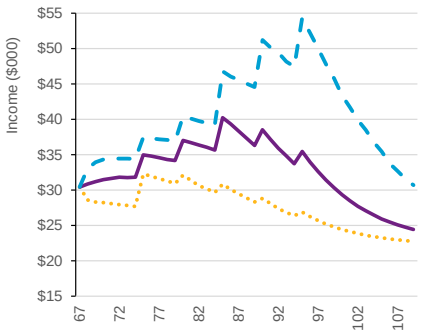
Retirement strategies modelled

"Strawman" retiree with $450,000 initial retirement assets

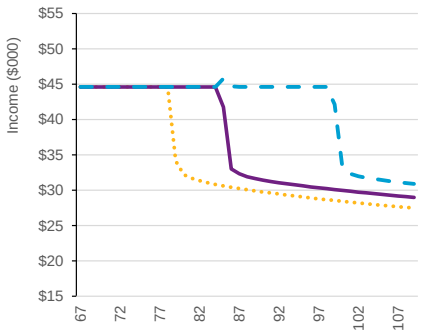
ABP (target)



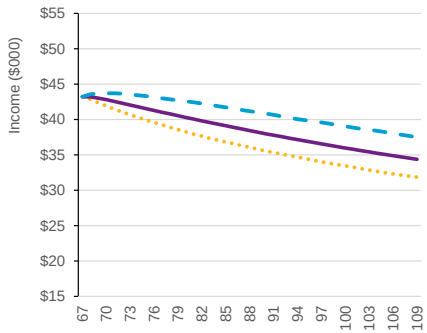
ABP (min DD)



50/50 ABP/LA



100% LA



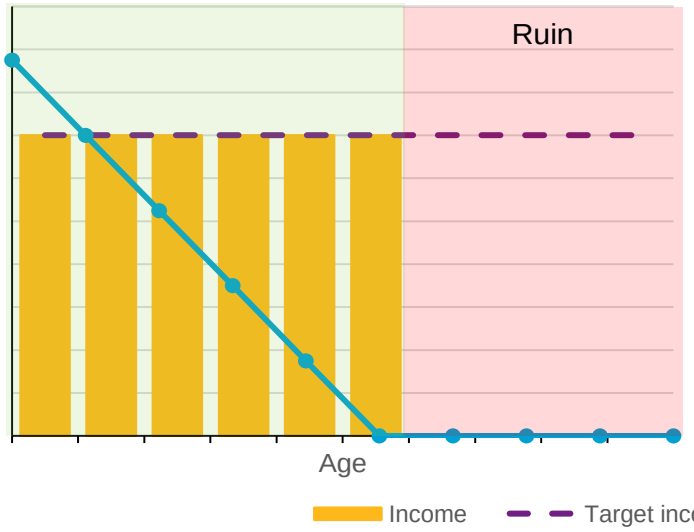
5th percentile Median 95th percentile

Entry-Level

Probability/age at ruin

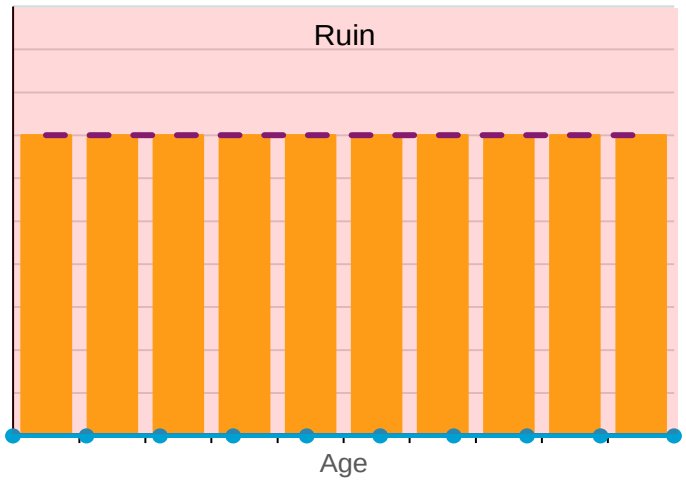
Entry-Level

Scenario 1: An account-based pension



Ruin = relying on age pension only

Scenario 2: A lifetime annuity

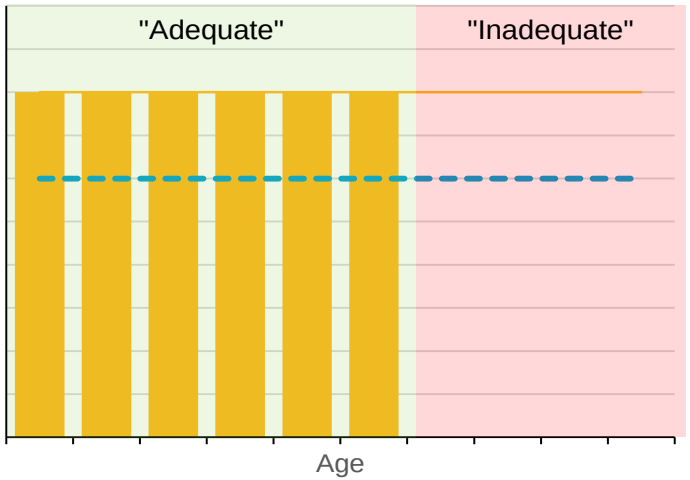


Ruin = still has income

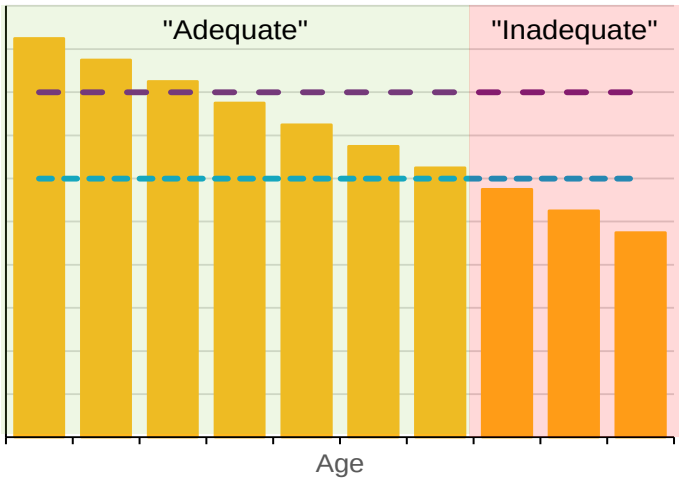
Probability of inadequacy

Entry-Level

Scenario 1



Scenario 2



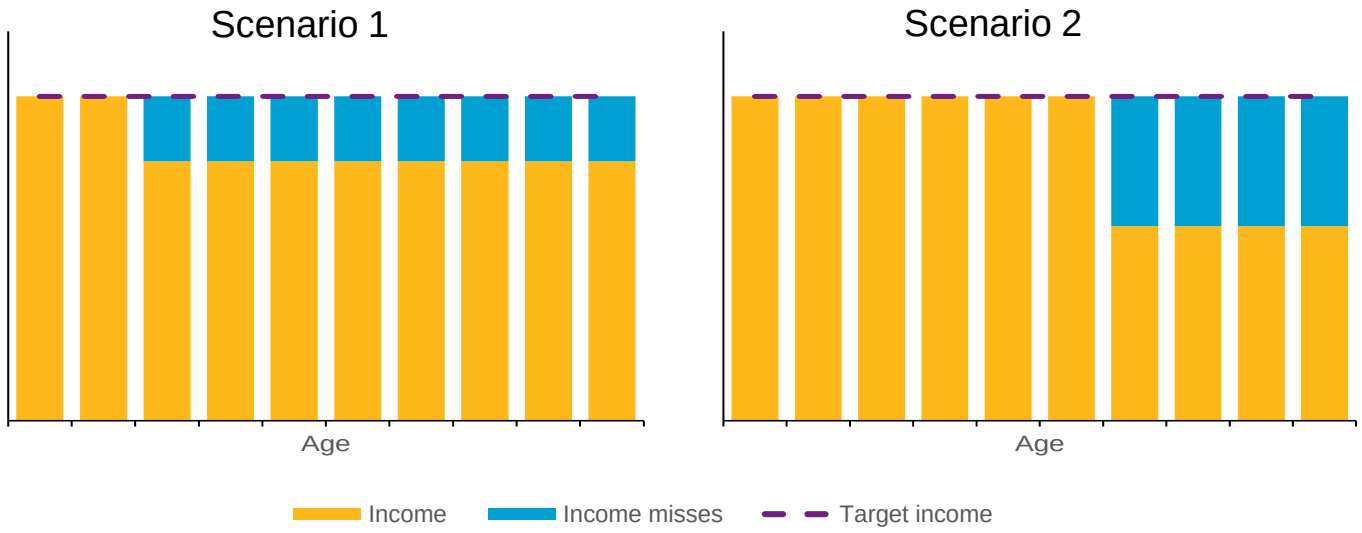
Income Target income Adequate Income

Inadequacy = ruin

Inadequacy = low income

Duration and depth of income misses

Entry-Level



Duration = 8, Depth = 0.5

Duration = 4, Depth = 1

Comparison

Entry-Level

Metric Name		ABP (target)	ABP (min DD)	50/50 ABP/LA	100% LA
Probability of ruin	To age 90	59%	0%	68%	100%
	Mortality weighted	48%	0%	54%	100%
Age at ruin	Median	89	109	88	67
	5th percentile	82	109	81	67
Probability of inadequacy	To age 90	59%	64%	9%	0%
	Mortality weighted	48%	64%	13%	0%
Depth of income misses (to age 90)	Median	$17,038	$9,940	$11,456	$3,935
	5th percentile	$21,603	$13,086	$13,583	$5,461
Duration of income misses (to age 90)	Median	8	24	8	24
	5th percentile	23	24	22	24

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Best in class

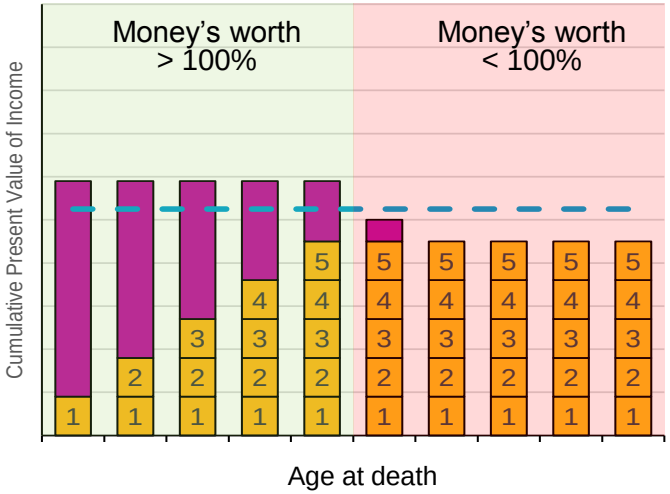
Best in class

Proportion measures

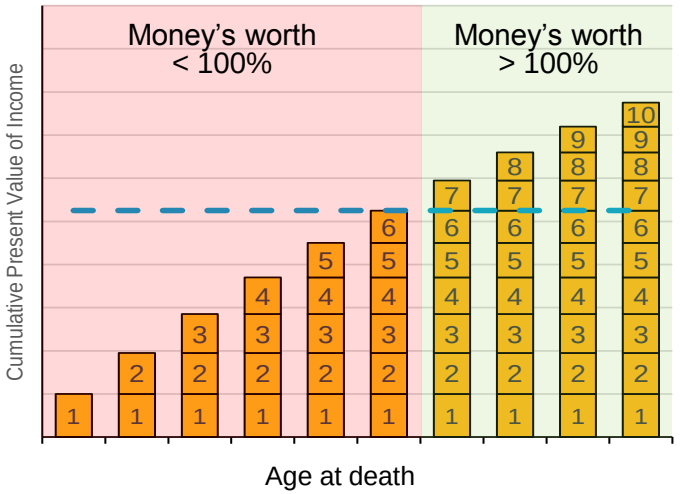
NPV lifetime income/money's worth

Proportion measures

Scenario 1: An account-based pension

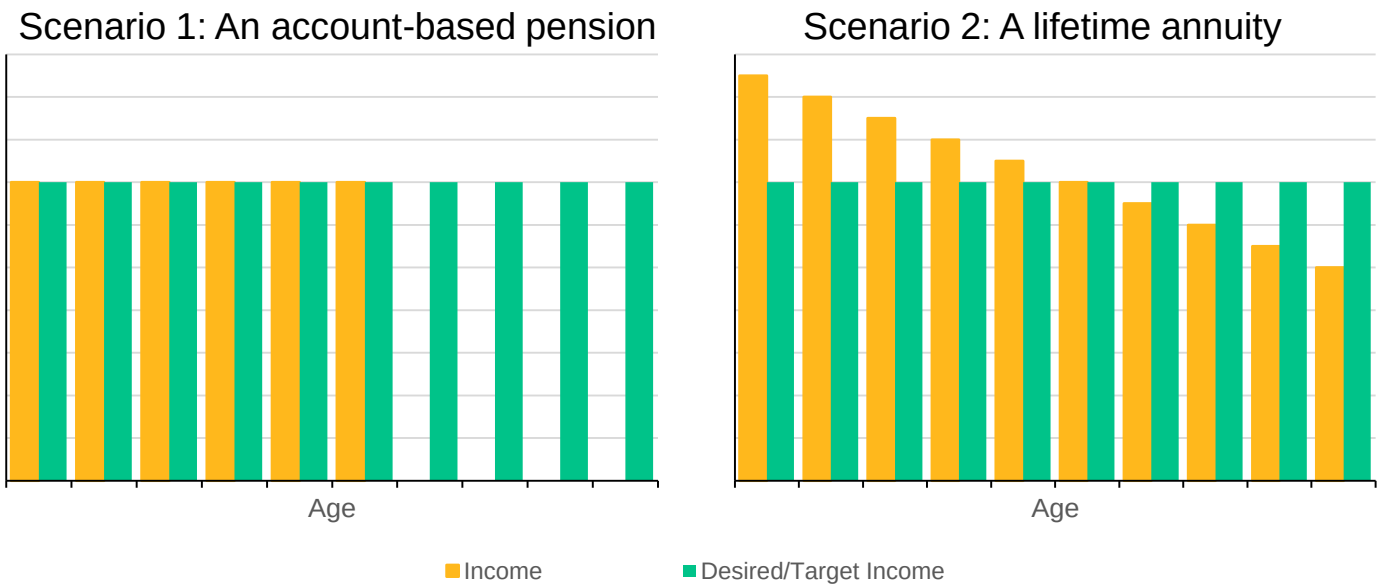


Scenario 2: A lifetime annuity



Desired income attainability

Proportion measures

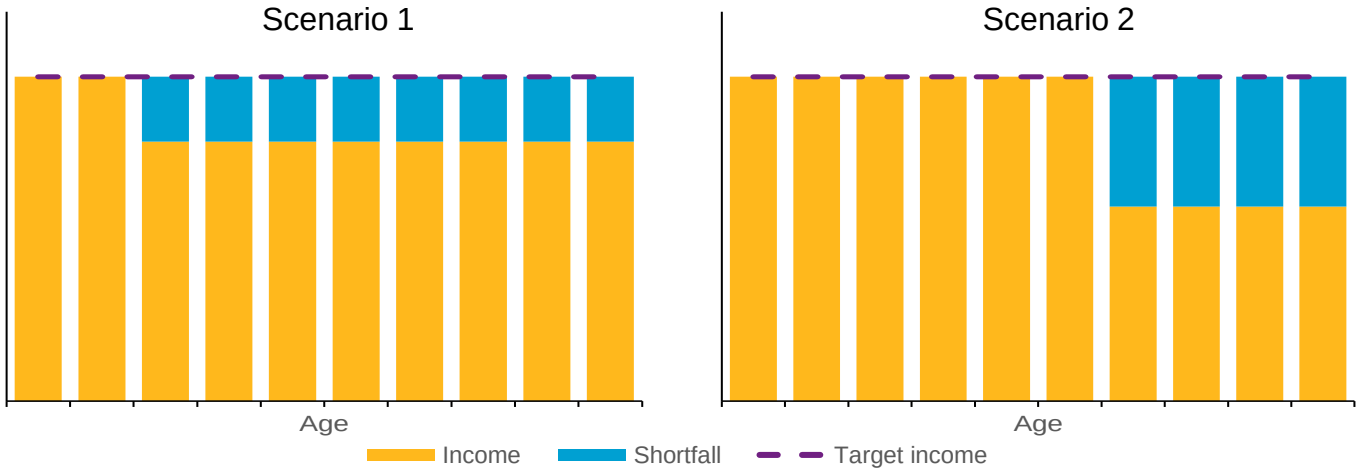


DIA < 100%

DIA > 100%

Goodness of Fit Index (“GOFI”)

Proportion measures



	Scenario 1	Scenario 2
Total Target Income	$500,000	$500,000
Total Shortfall	$80,000	$80,000
Delivery ratio (D)	81.0%	81.0%
Actual Squared Shortfall ratio (A)	95.0%	82.2%
Optimal Squared Shortfall ratio (B)	96.4%	96.4%
GOFI	79.8%	69.1%

Comparison

Proportion measures

Metric Name		ABP (target)	ABP (min DD)	50/50 ABP/LA	100% LA
NPV (Lifetime income)	Median	$1,007,192	$1,011,488	$999,428	$942,774
	5th percentile	$810,877	$791,756	$829,179	$793,208
Money's worth	Median	224%	225%	222%	210%
	5th percentile	180%	176%	184%	176%
Desired Income Attainability (to age 90)	Median	93%	78%	94%	91%
	5th percentile	79%	71%	85%	88%
GOFI	Median	92%	75%	94%	92%
	5th percentile	81%	70%	88%	89%

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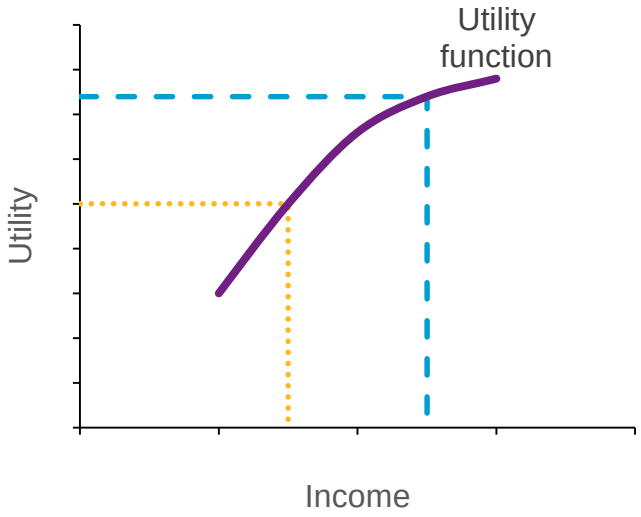
Best in class

Best in class

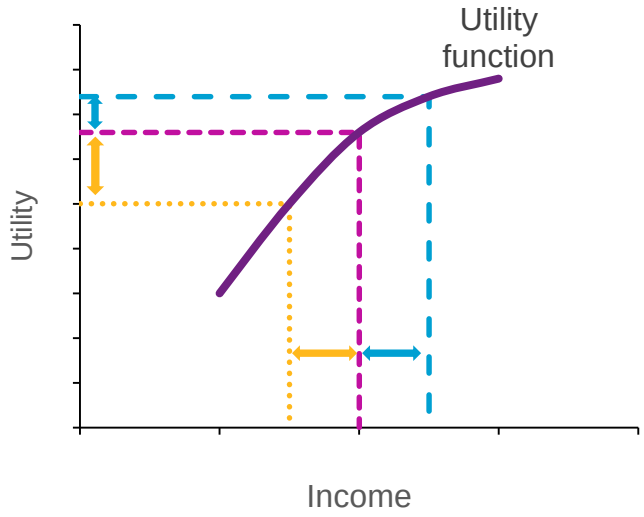
Utility-based

Key Utility theory concepts

Utility-Based



Higher income preferred

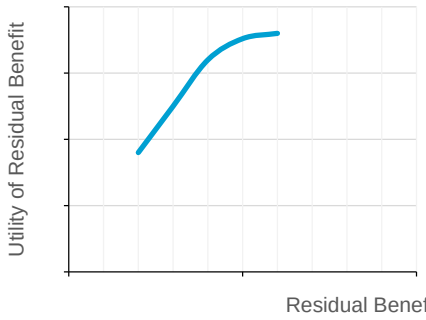


Risk aversion – losses penalizes more than gains

MDUF including a bequest motive

Utility-Based

U_C + U_B = U_O



MDUF Utility

Utility-Based

$$U_O = expected\ value\ of$$

$$\sum_{t=0}^{T} \beta^t \left\{ \quad {}_tp_x \frac{income_t^{1-\rho}}{1-\rho} + {}_{t-1|}q_x \frac{bequest_t^{1-\rho}}{1-\rho} \left(\frac{\phi}{1-\phi} \right)^{\rho} \right\}$$

$$\rho = risk\ aversion\ parameter$$

$$\phi = \ \ residual\ bequest\ motive\ \ parameter$$

MDUF Utility

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Income utility (U_c)

MDUF Utility

Utility-Based

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Income utility (U_c)

Residual Benefit Utility

MDUF Score

Utility-Based

MDUF Score

$$= \left[U_O \times \frac{1-\rho}{\left[\sum_{t=0}^{T} \beta^t \left\{ {}_tp_x + {}_{t-1|}q_x \frac{\phi}{1-\phi} \right\} \right]} \right]^{\frac{1}{1-\rho}}$$

= constant level of income which delivers the same level of overall utility (considering the income/bequest trade-off)

Risk Adjusted Income

Utility-Based

Risk adjusted income =

$$S_C = \left[U_C \times \frac{1-\rho}{\left[\sum_{t=0}^{T} \beta^t \ {}_tp_x\right]} \right]^{\frac{1}{1-\rho}}$$

= constant level of income which delivers the same level of income utility (i.e. with bequest motive parameter set to zero)

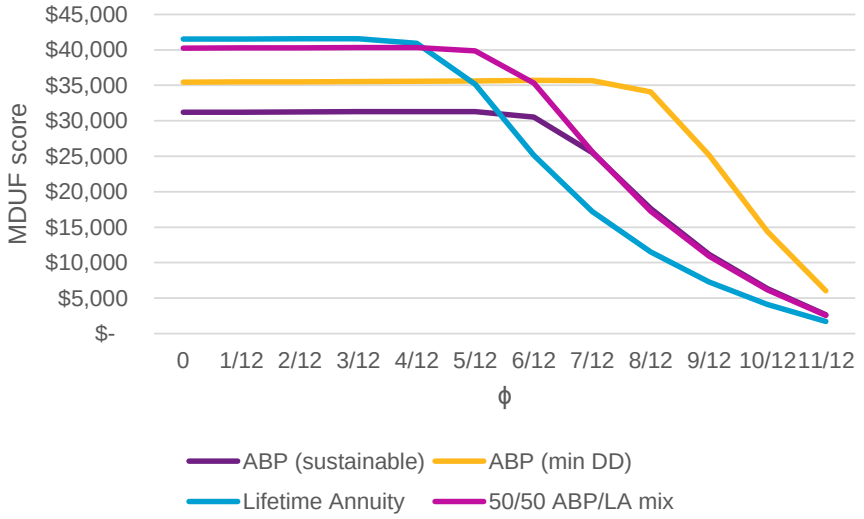
MDUF for different ϕ

ϕ = choice in trade-off between income and bequest (proportion)

- Higher ϕ = more bequest
- 0 < ϕ < 1

More ϕ = care more about expected bequest vs income

- = want less annuity
- = want more ABP
- = want less ABP drawdown



Comparison

Utility-Based

Metric Name		ABP (target)	ABP (min DD)	50/50 ABP/LA	100% LA
Risk-adjusted income	Mean	$30,881	$32,764	$38,201	$40,333
	5th percentile	$25,967	$30,573	$34,294	$38,557
MDUF Score	Mean	$5,080	$7,241	$4,658	$3,808
	5th percentile	$4,921	$5,144	$4,552	$3,665

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Best in class

Best in class

Metrics considered: a road test

Metric Type		'Best in class'		ABP (target)	ABP (min DD)	50/50 ABP/LA	100% LA
Entry-Level		Depth of income misses (to age 90)	Median	4	2	3	1
			5th percentile	4	2	3	1
		Duration of income misses (to age 90)	Median	1	4	1	4
			5th percentile	3	4	1	4
Proportion measures		GOFI	Median	2	4	1	2
			5th percentile	3	4	2	1
Utility-based		MDUF Score (with bequest motive; φ = 0.83)	Median	2	1	3	4
			5th percentile	2	1	3	4

Concluding comments

- No metric ‘dominates’
- Resonance with target audience will be a factor
  - Government may mandate comparable metric for retirement products
- Exploring tail – not just expected – value is important particularly for CIPRs whose retirees may have been ‘soft defaulted’

Contact us

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