



Evaluating post-retirement investment strategies

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Introduction



- Why did we write the paper?

Introduction



- **What should a member do at retirement?**
- **We consider an individual at point of retirement**
 - Accumulated assets
 - No guaranteed retirement income

Introduction



- **Investment strategies for members of DC schemes traditionally focus on the accumulation stage**
- **Houseview research typically advocates a lifestyle or lifestage strategy.**
- **Marketed these days as target dated funds**

Introduction



- A practitioner's perspective
- Our experience is that of the SA landscape

Risks



- **Retiree faces many risks in retirement**
 - Inflation risk
 - Longevity risk
 - Consumption risk
 - Annuitisation/interest rate risk
 - Investment risk

Risks



- **Investment strategy needs to address these risks**
- **Complicated by irreversibility of the decision**

Investment literature



- **So what should an individual do at point of retirement?**
- **Notable literature exists on the topic**
- **Yaari (1965) – in absence of bequest motive, shows it is optimal to fully annuitise**

Investment literature



- **Milevsky et al(1977) – use a ruin probability measure to determine optimal allocation to risky assets.**
 - Consumption assumed to be that of life annuity
 - Ruin defined as running out of funds

Investment literature



- **Albrecht and Maurer (2002) – use a ruin probability measure to compare life annuity with investment in mutual funds**
- **Mutual fund drawdown assumed to be equivalent to that of the life annuity**

Investment literature



- **Much of the literature provides recommendations that could be made in absence of knowing anything about the retiree**
- **Exception are those approaches based on utility functions**

Advice Framework



- **We believe cognisance of income requirements of individual in retirement is essential**
- **Ruin has no meaning for a life annuity when defined as running out of funds**
- ***Rather, ruin is experienced when individual is unable to sustain a certain standard of living***

Funding Level



- **Borrowed Funding Level for a DC retiree**
- **Funding Level typically a DB term**

$$\text{Funding Level (t)} = \frac{\text{Assets of member at time t}}{\text{Liability of member at time t}}$$

- ***How do you define liabilities?***

Funding Level



- **We define liability value of individual as cost of guaranteeing**
 - Monthly income requirement;
 - In real terms;
 - For rest of lifetime.
- **Liability therefore has a market value provided by the cost of an appropriate inflation-linked life annuity**

Funding Level



- **Example:**
 - Male retiree aged 65
 - Accumulated Funds R1,000,000
 - Monthly income requirement R8,000

Funding Level



- **Example (ctd):**
 - Cost of securing inflation-linked life annuity of R8,000 is R1,449,275
 - Individual thus 69% of funds required
 - Individual has 69% funding level (deficit)
 - R1,000,000 can be used to secure R5,556 from same insurer

Funding Level



- **Framework flexible**
- **Useful starting point**
 - Funding level function of consumption required
 - Annuitisation risk explained

Funding Level



- **Many of the retiree risks are incorporated within the measure**
 - Monthly income requirement [consumption]
 - In real terms [inflation]
 - For rest of lifetime [longevity]

Funding Level



- **Funding Level in excess of 100%**
 - Inflation-linked annuity minimum risk option
 - **Funding Level lower than 100%**
 - No risk-free solution exists
 - Reconsider monthly income requirement
- OR
- Some level of risk required to meet consumption needs (inflation, longevity and/or investment)

Funding Level



- **Individual income requirements**
 - Determine with assistance of financial planner
 - Various levels of income required
 - Living comfortably
 - Providing for necessities
 - Survival income level

Example ctd



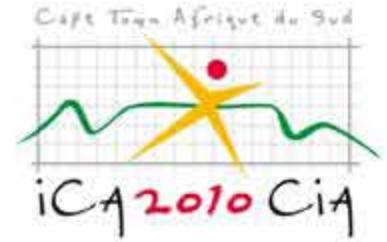
- **Individual income required**
 - For comfort: R8000 per month
 - For necessities: R5500 per month
- **Funding level**
 - 69% funded on comfort income basis
 - 101% funded on necessity income basis

Funding Level



- **Majority of South Africans in deficit on this basis**
- **No risk-free solution exists**
- **Alternative strategies need to be considered**

Evaluating investment strategies



- **We compare various investment strategies available to a retiree**
 - Nominal level life annuity
 - Nominal escalating life annuity
 - Inflation-linked life annuity
 - Income drawdown facility

 - Assessment criterion required

Evaluating investment strategies



- Milevsky defines a ruin probability as follows

$$\emptyset(w) = \Pr \left[\inf_{0 \leq t \leq T} W_t \leq 0 \mid W_0 = w \right]$$

- Ruin occurs when the lowest value of the wealth process breaches zero before death at T
- Function of initial wealth

Evaluating investment strategies



- We modify the ruin probability formula as follows

$$\emptyset(f, C) = \Pr \left[\inf_{0 \leq t \leq T} C_t \leq C \mid F_0 = f \right] \quad (1)$$

- Ruin calculates likelihood of individual consuming at a real level lower than that required during lifetime
- Function of income required and initial wealth

Evaluating investment strategies



- **Example continued:**
 - Pricing obtained for each of the life annuities assuming funds of R1,000,000

	Initial level of monthly income
Nominal level life annuity	R10,643
Nominal escalating life annuity	R8,664
Inflation-linked life annuity	R5,556

1st July 2009

Evaluating investment strategies



- **Example continued:**
 - R1,000,000 invested in a mutual fund consisting of two assets
 - Local equities and nominal government bonds
 - Allocation to equities: 0%, 25%, 50% & 75%

Example ctd



- The income drawdown facility permits the member to specify a monthly income draw

Which strategy is optimal for individual?

Evaluation of ruin probability



$$\phi(f, C) = \Pr \left[\inf_{0 \leq t \leq T} C_t \leq C \mid F_0 = f \right]$$

- Discrete time framework used
- Simulation techniques

Evaluation of ruin probability



- Numerically calculated as follows:

$$\emptyset(f, C) = \frac{1}{N} \sum_{i=1}^N \sum_{t=1}^K F_{i,t} S_{i,t}$$

- $F_{i,t}$ is the financial ruin indicator

0 if $C_{i,t} \geq C$

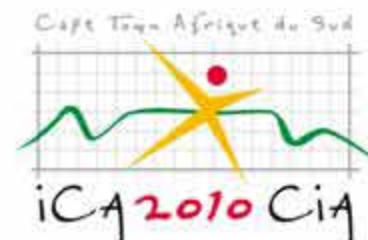
1 otherwise

- $S_{i,t}$ is the mortality indicator

1 if member has died in year t or prior to year t

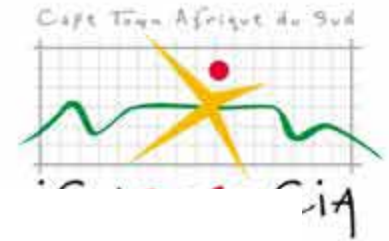
0 otherwise

Ruin Probability Results

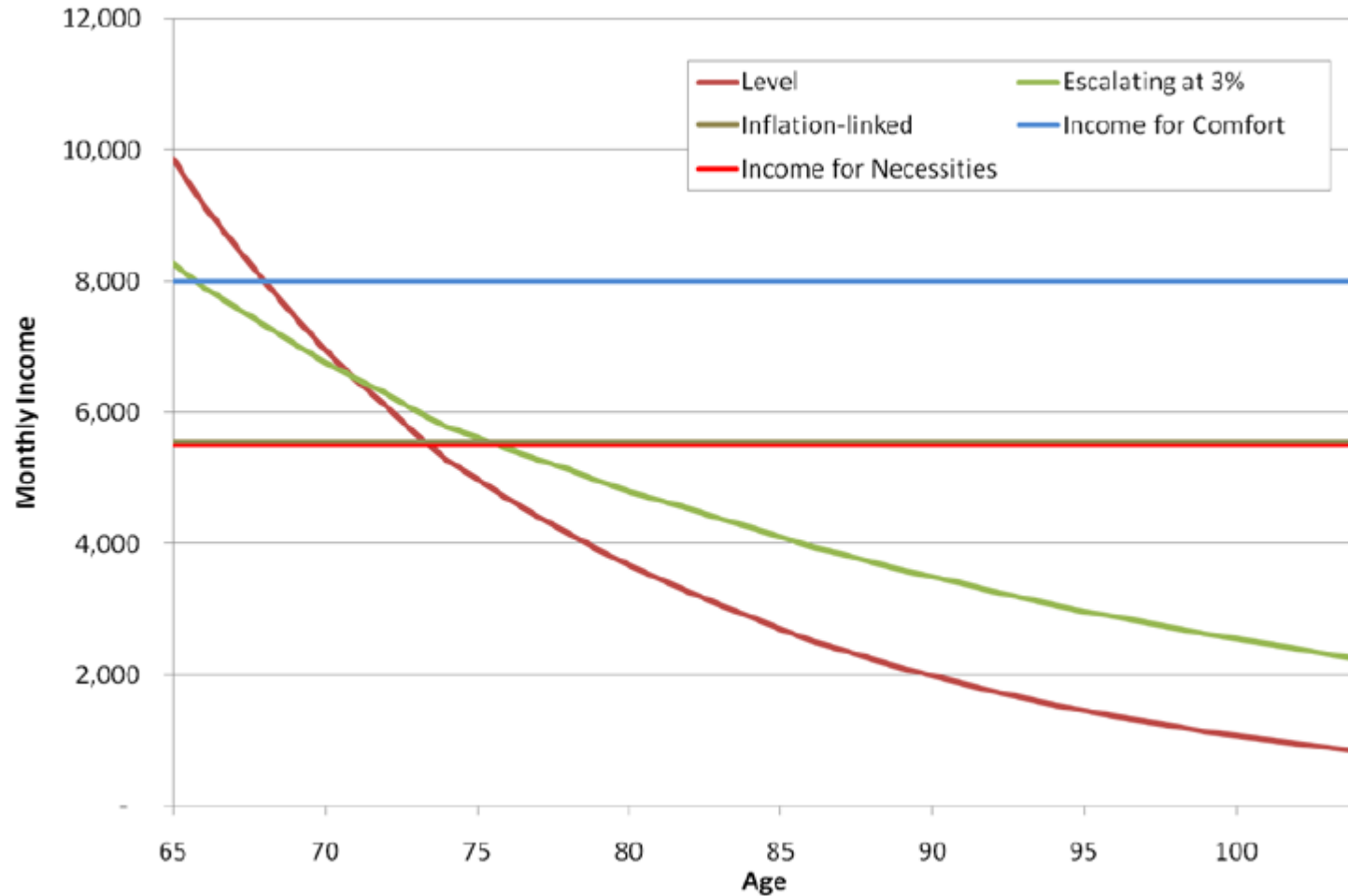


Income Required	Level Annuity	Escalating Annuity	Inflation-linked Annuity
500	0.00%	0.00%	0.00%
1,000	0.80%	0.00%	0.00%
1,500	6.90%	0.00%	0.00%
2,000	16.70%	0.00%	0.00%
2,500	25.50%	0.80%	0.00%
3,000	34.40%	4.80%	0.00%
3,500	43.80%	10.80%	0.00%
4,000	52.60%	21.20%	0.00%
4,500	59.80%	31.40%	0.00%
5,000	66.10%	42.60%	0.00%
5,500	71.70%	53.50%	0.00%
6,000	76.00%	64.20%	97.20%
6,500	79.70%	73.70%	97.20%
7,000	82.40%	81.10%	97.20%
7,500	85.90%	86.40%	97.20%
8,000	88.30%	91.40%	97.20%
8,500	90.40%	96.20%	97.20%
9,000	92.60%	97.20%	97.20%
9,500	93.70%	97.20%	97.20%
10,000	95.40%	97.20%	97.20%

Income through time



Income Received Trough Time

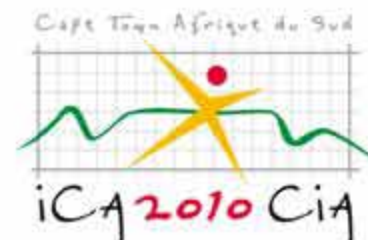


Results



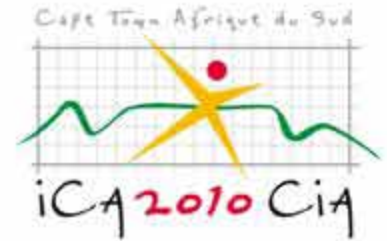
- **Under this ruin measure, life annuities can have a non-zero probability of ruin**
- **Ruin is 0% or 100% in the case of an inflation-linked annuity**
- **Level, escalating and inflation-linked annuities have different levels where ruin is minimised**
- **Consumption level of member is key**

Ruin Probability Results



Income Required	0% Equity	25% Equity	50% Equity	75% Equity
500	0.00%	0.00%	0.00%	0.00%
1,000	0.00%	0.00%	0.00%	0.40%
1,500	0.00%	0.00%	0.20%	0.50%
2,000	0.00%	0.00%	0.40%	1.50%
2,500	0.00%	0.30%	1.10%	3.30%
3,000	0.50%	1.20%	2.70%	6.20%
3,500	5.10%	2.80%	5.70%	12.90%
4,000	17.60%	10.00%	13.00%	19.90%
4,500	32.10%	21.00%	21.60%	26.50%
5,000	45.70%	33.90%	33.00%	33.70%
5,500	58.20%	46.00%	40.60%	41.30%
6,000	66.20%	57.70%	48.10%	47.40%
6,500	72.20%	65.80%	57.30%	54.10%
7,000	76.20%	72.50%	65.40%	61.10%
7,500	79.00%	75.40%	70.60%	65.70%
8,000	82.30%	79.00%	74.80%	70.30%
8,500	85.50%	81.80%	77.60%	73.80%
9,000	86.90%	84.10%	80.70%	77.70%
9,500	87.80%	86.60%	83.80%	80.40%
10,000	89.10%	88.90%	86.70%	82.40%

Example ctd



- **No one size fits all solution**
- **Income preference is key**

Investment Strategy	Income requirement of R5,500	Income requirement of R8,000
Level Annuity	71.70%	88.30%
3% p.a. Escalating Annuity	53.50%	91.40%
Inflation-linked annuity	0.00%	97.20%
Income drawdown (best case)	40.6%	70.3%

Results



- **Level annuity income 33% higher than the income for comfort level**
- **Pr(ruin) is 88%**
- **Minimised at 70% for an income drawdown strategy**
- **Other strategies exist which minimise further**

Implications for advice



- **Ruin probability can be used as part of a consulting framework**
- **Not just an academic measure**
- **Risk of misselling minimised**

Funding level and Ruin Probability Framework



- **Flexible**
- **Any strategy can be incorporated**
- **Illustrates that there is no unique solution for retirees and that customisation needed for post-retirement advice**

Conclusions



- **Ruin probability measure improvement over others as actual income requirements of members taken into account**
- **Takes cognisance of annuitisation, consumption, inflation and longevity risk**

Conclusions



- **Funding level measure can be used for ongoing advice**
- **Useful for definition of a minimum risk investment**
- **Framework allows individuals to appreciate the impact of changing their consumption behaviours**

Scope for future research



- **Strategies for those individuals in deficit and how it varies based on extent of deficit**
- **Integration of pre and post retirement investment strategies**
- **Concept of deferring annuitisation with the aim of obtaining 100% funding level**

Scope for future research



- **Extent of ruin measure can be developed**
- **Propensity to take risk and utility associated with different income levels not taken into account. Utility function elicitation can be explored further**

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