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Evaluating Post-Retirement
Investment Strategies

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Introduction

- Why did we write the paper?
- A practitioner's perspective
- Our experience is that of the SA landscape

Introduction

- We consider an individual at point of retirement
 - Accumulated assets
 - No guaranteed retirement income
- Paper considers advice provided to member at time of retirement

Risks

- Retirees face 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

- Milevsky and Young (2004) – seek optimal consumption and time of annuitisation.
- Power utility function used

Investment literature

- Much of the literature provides recommendations that could be made in absence of knowing anything about reitree
- Exception are those based on utility function approach

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

- Introduce Funding Level for a DC retiree
- Funding Level typically a DB term

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

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:
 - A male retiree aged 65
 - Accumulated Funds R1,000,000
 - Monthly income requirement R8,000

Funding Level

- Example:
 - Cost of securing inflation-linked life annuity of R8,000 is R1,449,275
 - Individual thus has 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

- Need to incorporate time and income needs
- Framework flexible
- Useful starting point
 - Funding level function of consumption required
 - Annuitisation risk explained

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

Funding Level

- Many of the retiree risks are incorporated within this 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 risk-free 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

Funding Level

- Individual income requirements
 - Majority of individuals wont be able to support initial income required for comfort
 - Financial planners have evolved into “life planners“ (Eisenberg, 2006)

Example ctd

- Individual income required
 - For comfort: R8,000 per month
 - For necessities: R5,500 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 income required for comfort 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

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

- 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

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

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
- SA legislation stipulates that drawdown p.a. should be between 2.5% and 17.5% of asset value

Which strategy is optimal for individual?

Evaluation of ruin probability

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

- Discrete time framework used
- Simulation techniques

Evaluation of ruin probability

- Numerically, calculated as follows:

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

- $F_{i,t}$ 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

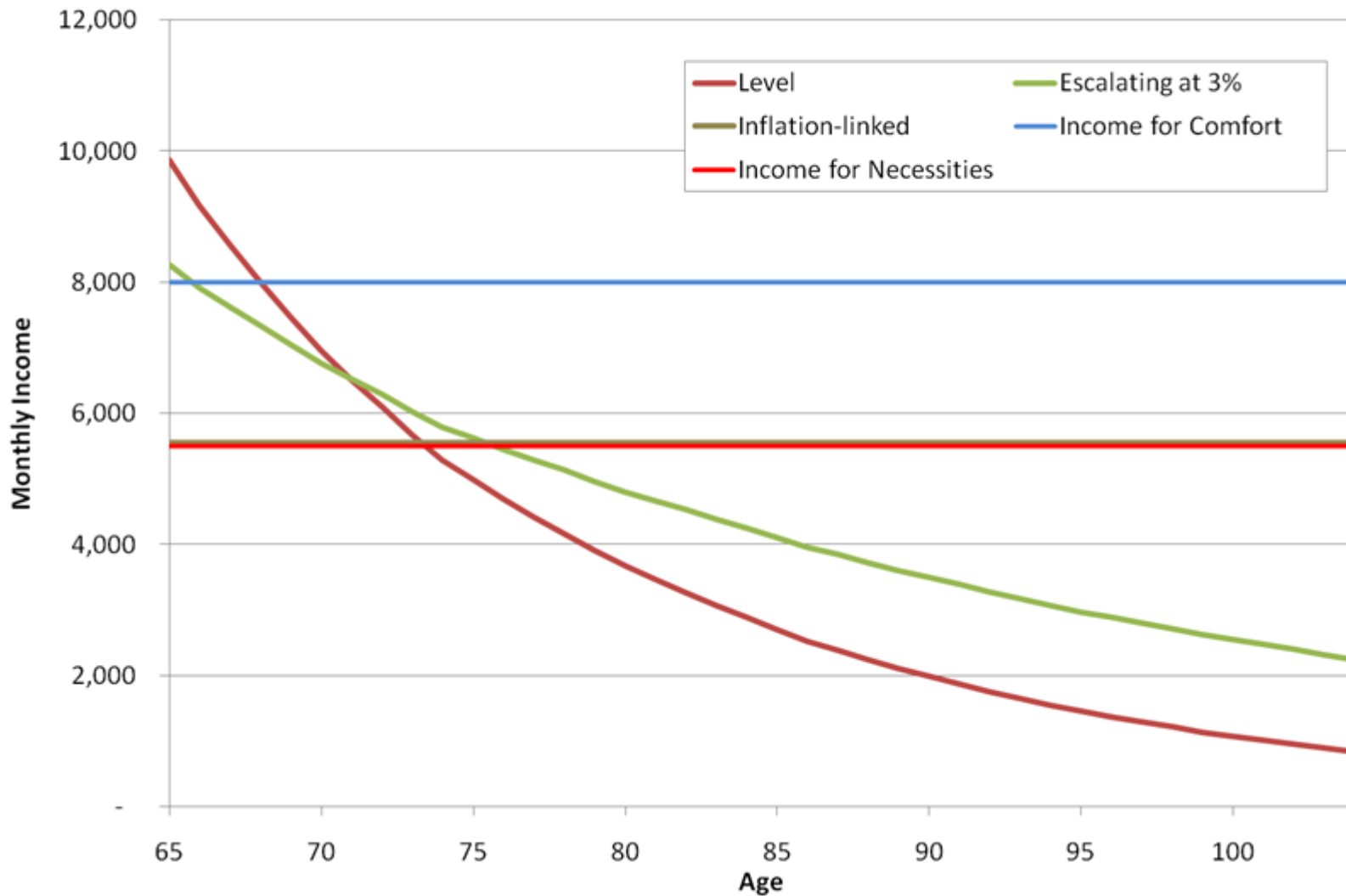
Assumptions

- Simulations done in MATLAB
- Income received at the end of each year
- Maitland Model used
- Mortality assumed to be PA(90)-3
(1.5% p.a. mortality improvement)

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 Received Trough Time



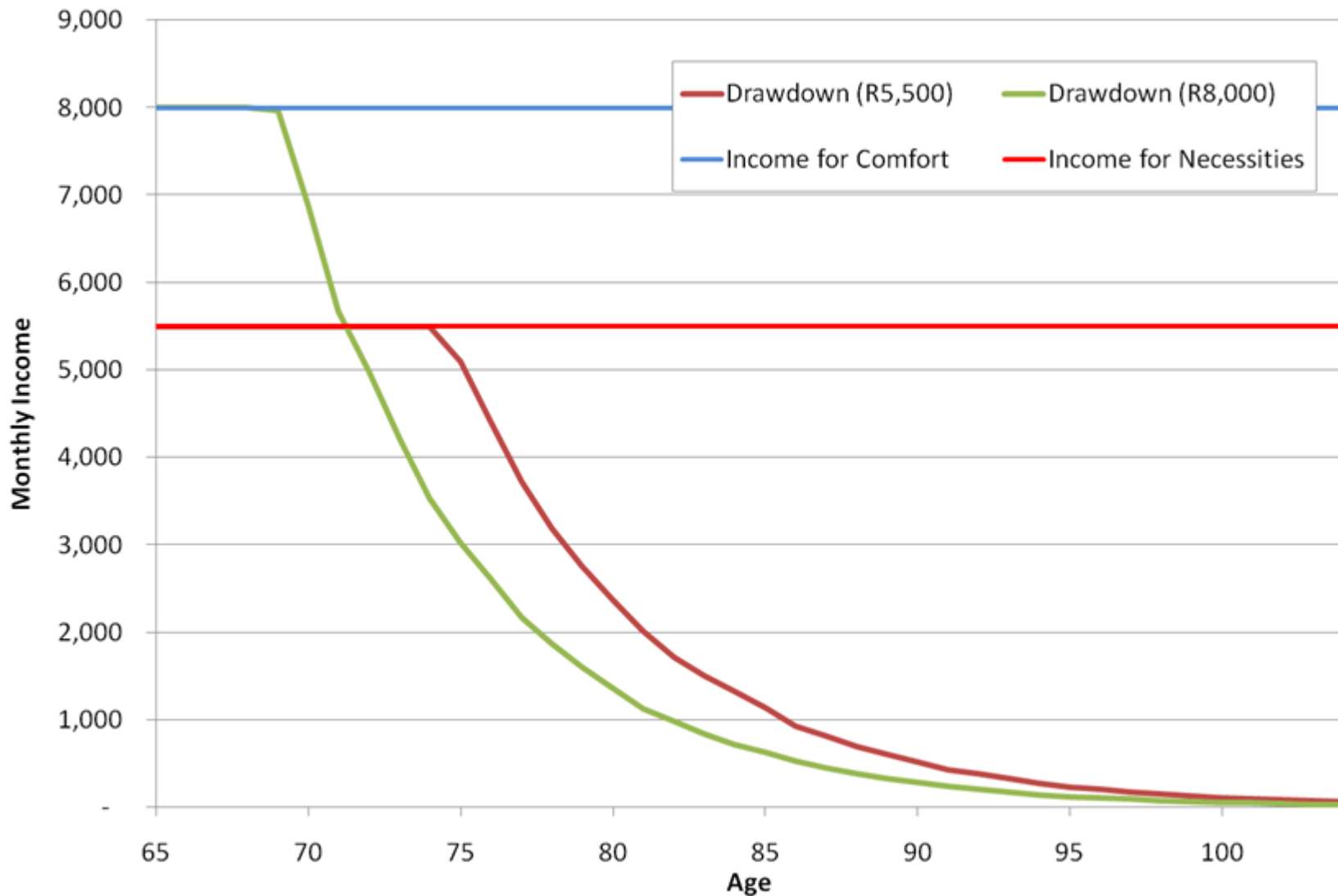
Results

- 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%

Income Received Trough Time



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.
- $\Pr(\text{ruin})$ 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 behaviour

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

Thank you