The Legacy Index – a framework to evaluate an appropriate retirement income

By Vernon Boulle

Presented at the Actuarial Society of South Africa’s 2014 Convention 22–23 October 2014, Cape Town International Convention Centre

ABSTRACT
Deciding on how to structure assets at retirement to provide the required income for the remainder of their lives will be one of the most important financial decisions taken by individuals or couples. A wide range of products exist to attract and service this market. The new business statistics for South African life insurers show that the most popular option is to utilise a living annuity where the investment and longevity risks are borne by the annuitant. The paper proposes a financial planning framework that enables the planner and retiree to understand the extent of the risks being accepted through the use of a simple measure known as the Legacy Index. The model underlying the framework is stochastic and allows the effect of various investment outcomes to be illustrated on both the retirement income received and the potential bequest.

KEYWORDS
Retirement income; legacy index; living annuity; guaranteed annuity; investment risk; longevity risk

CONTACT DETAILS
Vernon Boulle Tel: +27 (0)21 524 4697; Email: Vernon.Boulle@OMWealth.co.za
1. INTRODUCTION

People facing retirement have a bewildering array of options available to them – living annuities with hundreds of investment choices, guaranteed annuities with varying escalation rates, with profit annuities with a range of interest rates and longevity protection options amongst others.

The amount saved for retirement will have to provide a real income for an unknown period through variable future investment conditions and inflation rates. The safest option in terms of securing a constant real income is a guaranteed annuity which escalates with inflation. The risks are transferred to the life insurer providing the annuity and the annuitant can retire knowing the lifestyle they can afford to lead.

New business figures from three major insurers for 2013 retail annuity premium income show that just over 1% is used to buy inflation-linked annuities. Nearly 99% is used to buy a solution that introduces one or more of the longevity, investment return or inflation risks.

There may be reasons why a retiree would choose, or is persuaded, to avoid an inflation-linked annuity – it may appear expensive relative to the other options, there may be a concern that if they die early they won’t get full value, they may wish to leave something to their heirs, they may need more flexibility in their income stream, they may feel that the risks associated with the alternatives are acceptable or they may not be able to sustain the lifestyle they wish to lead with the capital at their disposal.

In contrast to the inflation-linked annuities, living annuities are very popular. True South (2014) shows that in 2003 living annuity premium income and guaranteed annuity premium income each comprised about 15% of single premium life company sales. By the second half of 2013, living annuity sales had increased to 39% of single premium life company sales whilst guaranteed annuities had fallen to just 5%. Living annuity sales were 88% of the total compulsory annuity market for this period.

An ASISA\(^1\) media release dated 23 June 2014 indicated that the average withdrawal rate from living annuities was 6.63% in 2013, still substantially above their recommended maximum drawdown rate of 5%, although the withdrawal rate had fallen from 6.99% in 2011.

Living annuities are at the other end of the risk spectrum, with retiree facing both longevity and investment risk. The concept of a living annuity is appealing as it allows flexibility of income, an ability to invest as you please, the possibility of leaving a bequest and the ability to convert to a guaranteed annuity at a later date. The question is whether people choosing this option properly understand the risks they are taking.

Living annuities are complex products. When life insurance companies contract with individuals to pay them a defined annuity for life they put significant effort behind the product, employing actuaries, accountants, auditors and investment professionals to ensure they are able to meet their obligations. The life insurance company has the

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1. Association for Savings and Investment South Africa
advantages of a strong balance sheet and the pooling of longevity risks and are required to report to shareholders and regulators to ensure everything remains on track.

The retiree choosing a living annuity is effectively issuing an annuity for life to themselves with the desired outcome of a stable standard of living, but without the infrastructure to support the desire. There are complex decisions to be made in terms of asset allocation and managing both the income and emotions through market volatility.

In moving from a world of certainty to one involving risk, the retiree is moving into a probabilistic environment and, in this case, one where the probabilities can only be estimated. No-one knows how things will turn out for the retiree and the best we can do is estimate the chance of various outcomes. The models used to estimate the chance will vary widely and each will have its own inherent assumptions which can be questioned.

The most basic model shows living annuities to be deceptively simple products. The portfolio can be projected using the expected return on a balanced fund with the desired income level removed each year to illustrate whether it is sustainable, with the projection often only lasting to the average life expectancy.

This approach masks many underlying assumptions about longevity, the investment return, volatility, the actual portfolio construction, the underlying expenses and how the income will be managed through various investment conditions, each of which can influence whether the chosen income level will be sustainable. Ideally, the retirees and their advisers need a simple measure that summarises the complexity to be able to assess whether a living annuity is appropriate.

For the retiree the consequences of the decision made at retirement will materially affect their quality of life, possibly at a time when they are older and more vulnerable. They need to make a more informed choice rather than rely on a simplified projection. They need to be in a better position to evaluate whether, for example, they should travel in their sixties if that may mean relying on state medical facilities in their eighties.

This paper will use more complex modelling in an attempt to unravel some of the underlying assumptions within the above simple projection. It will follow a case study to illustrate a financial planning process which considers both the income and the bequest.

The paper will introduce a simple measure, the Legacy Index, which aims to provide the retiree with a way of assessing whether they are willing and able to take the risks inherent in their chosen retirement income strategy.

It must be recognised that the financial planning process will not necessarily be an entirely rational financial optimisation process. Other non-financial aspects will influence the outcome such as being aware of the decisions taken by friends, personal preferences towards financial institutions and past experiences. The retiree will factor in their need to ‘sleep well’ in their decision-making process even if the models show a different picture. The role of the process is to bring them closer to a more optimal decision through a better understanding of their situation.
2. LITERATURE REVIEW

William P. Bengen (1994) wrote a paper in the *Journal of Financial Planning* entitled “Determining withdrawal rates using historical data”. He imagined a future scenario of high inflation undermining a living annuitant’s standard of living and the annuitant discovering that when the withdrawal rate was increased to accommodate inflation that the income became unsustainable with a consequence of the annuitant running out of money sooner than planned. He then looked at past returns for a portfolio comprising of 50% in US equities and 50% in US bonds to determine a safe drawdown rate and concluded that the drawdown rate should not exceed 4% per annum. The analysis did not include an allowance for expenses or taxes. Bengen went further in varying the proportions invested in US equities and US bonds and concluded that “it is appropriate to advise a client to accept a stock allocation as close to 75% as possible, and in no cases less than 50 percent.” He also concluded that allocations to equities below 50% or in excess of 75% were counterproductive.

Pfau (2010) showed that the 4% rule may be an anomaly of the US market as in most other developed countries the sustainable drawdown rate was less than 4%. Finke, Pfau and Blanchett (2013) showed that when a Monte Carlo model was calibrated to the capital market conditions at the time, rather than historical averages, the sustainable withdrawal rate fell to 2.5%.

Kitces (2008) raised the ‘starting point paradox’ which shows that if a constant sustainable withdrawal rate is applied then two retirees with exactly the same amount of remaining capital could have different ‘safe’ incomes if one retired later than the other and the market values moved between the retirement dates. If the markets fell between the retirement dates, then the person retiring earlier would draw a higher ‘safe’ income than the person who had just retired, even if their capital balances and ages were exactly the same. Kitces constructed a 10 year Price/Earnings ratio using the average real earnings over ten years as the denominator. He showed that the sustainable withdrawal rate was linked to this average PE ratio as when the ratio was low a higher withdrawal rate could be sustained.

Pfau (2011a and 2011b) constructed a formula that used dividend yields, price earnings ratios and nominal bond yields to calculate the sustainable withdrawal rate. The formula predicts the safe withdrawal rate at less than 2% per annum for those retiring in 2010, although it is subject to a number of caveats.

Guyton and Klinger (2006) proposed four drawdown rules that could assist with ensuring that the retirement income was sustainable. The four rules were:

— **Portfolio Management Rule**, which described which assets should be sold to generate the income and how to rebalance the portfolio
— **Withdrawal Rule**, which increases the income by inflation each year if the portfolio experiences a positive return
— **Capital Preservation Rule**, which reduces the real income by 10% if the withdrawal rate increases to more than 20% above the initial withdrawal rate
Prosperity Rule, which increases the real income by 10% if the withdrawal rate reduces to below 80% of the initial drawdown rate.

Blanchett (2013) put forward a basis that determined a new withdrawal rate each year based on the asset allocation, the remaining retirement time horizon, the targeted probability of success and an alpha term that reflected the anticipated out- or underperformance of the portfolios. He concluded that the optimal retirement time horizon was the life expectancy plus two years and the optimal probability of success was 80%.

Pfau (2013) evaluated both these approaches using stochastic modelling and showed that the Guyton approach produced smoother income. The Blanchett approach provided a more flexible income and the income could be reset should an unusual expense be incurred.

Lodhia and Swanepoel (2012) compare living annuities with guaranteed annuities as sources of sustainable retirement income. They highlight the differences including the often overlooked benefits of mortality pooling and the implicit cost of life insurance within a living annuity.

3. FRAMEWORK

The literature review covers a number of papers considering sustainable retirement income within a living annuity context. The general aim is to find an answer that is suitable for all retirees, whether it is an initial withdrawal rate or rules for managing the withdrawal rate whilst in retirement.

These rules provide an answer for the general case, but individuals at retirement are not a homogenous group all having the same requirements, expectations and support networks. Their circumstances will vary considerably, particularly in their need and ability to accept and accommodate risk.

This paper will propose a framework that allows the retiring person or couple to come to terms with the risks they are taking and to frame their retirement income accordingly. An imaginary couple, Dr and Mrs Green, both aged 65 and about to retire, will be used as a case study throughout the paper. The terms ‘withdrawal rate’ and ‘drawdown rate’ are used interchangeably.

The financial planning process used to develop a suitable retirement income strategy for the Greens works in the following sequence:

— Establish the lifestyle they wish to lead (i.e. the drawdown rate they desire)
— Establish the asset allocation best suited for the required drawdown rate
— Explain the risks associated with the asset allocation to the lifestyle
— Adjust the lifestyle through the drawdown rate and drawdown rules if not comfortable with the risks
— Restart the process and continue until an acceptable outcome is established
— Add guaranteed annuities and reassess their views on risks and bequests
— Repeat the process annually
We don’t know what the future holds for investment returns. The best we can do is to build models that attach probabilities to future outcomes to allow decisions to be made in a more informed manner. These models will consider past returns, build in economic theory and include assumptions to create a picture. The future will unfold in its own particular way.

The proposed framework is described for a person or couple at retirement and would require a financial adviser to take them through the process. Although the framework illustrates the way in which the income should be managed in future, it is assumed that the retirees will have an annual review of the financial plan where that can make any required changes to their income and asset allocation for any changes in their circumstances.

The various components of the framework are provided below.

3.1 Assets

3.1.1 Initial Retirement Capital

The Initial Retirement Capital is the accumulated capital to be used to generate the income whilst in retirement. It will include savings through pension or retirement funds, discretionary savings and other income-producing assets. It will exclude assets such as the primary residence and those that don’t produce an income such as cars, household possessions and holiday homes.

For the purposes of this paper, it is assumed that the Retirement Capital may be invested in the following asset classes:

— Local assets:
  — equities
  — listed property
  — nominal bonds
  — index linked bonds
  — cash

— Offshore assets
  — equities
  — nominal bonds
  — cash

3.1.2 Investment Portfolio

It is assumed that the assets are held in pooled vehicles, such as collective investment schemes or life funds, known as Investment Portfolios. Various Investment Portfolios are constructed to deliver a range of risk and return profiles through different allocations to the above asset classes. The Investment Portfolios utilised are shown in the table below.
Table 1 Investment portfolios

<table>
<thead>
<tr>
<th>Description</th>
<th>Equity</th>
<th>Property</th>
<th>Bonds</th>
<th>CPI bonds</th>
<th>Cash</th>
<th>Equity</th>
<th>Bonds</th>
<th>Expected real return*</th>
<th>Annual man charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>No equity</td>
<td>75.0%</td>
<td>25.0%</td>
<td>25.0%</td>
<td>5.0%</td>
<td>5.0%</td>
<td>10.0%</td>
<td>5.0%</td>
<td>2.2%</td>
<td>0.75%</td>
</tr>
<tr>
<td>Low equity</td>
<td>25.0%</td>
<td>5.0%</td>
<td>40.0%</td>
<td>10.0%</td>
<td>5.0%</td>
<td>10.0%</td>
<td>5.0%</td>
<td>4.2%</td>
<td>1.00%</td>
</tr>
<tr>
<td>Medium equity</td>
<td>35.0%</td>
<td>7.5%</td>
<td>30.0%</td>
<td>5.0%</td>
<td>2.5%</td>
<td>12.5%</td>
<td>7.5%</td>
<td>5.0%</td>
<td>1.00%</td>
</tr>
<tr>
<td>High equity</td>
<td>50.0%</td>
<td>7.5%</td>
<td>20.0%</td>
<td></td>
<td>17.5%</td>
<td>5.0%</td>
<td></td>
<td>5.7%</td>
<td>1.00%</td>
</tr>
<tr>
<td>Pure equity</td>
<td>75.0%</td>
<td></td>
<td></td>
<td></td>
<td>25.0%</td>
<td></td>
<td></td>
<td>6.3%</td>
<td>1.25%</td>
</tr>
</tbody>
</table>

* before annual management charge is levied

It is assumed that each portfolio is rebalanced quarterly to the desired asset allocation. The implicit assumption is that the portfolios track the index, although active management fees are attached to each investment portfolio. The stochastic model does not allow for any out-performance or underperformance through stock selection or asset allocation.

The assumptions used for the expected returns from each asset class will have a material effect on the results. Pfau (2011a) shows the effect of using historical assumptions as opposed to the current capital market conditions, and argues that it is more important to use the current market rates.

Varying the assumptions as the market conditions fluctuate will mean that the results will change over time. This reinforces the message that the retiree’s portfolio and income should be reviewed at least annually to ensure they remain on track.

The rationale behind the return assumptions made in the stochastic model and whether different assumptions should be considered are beyond the scope of this paper. The model has been calibrated to market conditions at the end of 2013.

3.2 Retirement Income

The income that the retiree requires has been defined in two ways, both of which are required to understand their financial position.

3.2.1 Chosen Income

The Chosen Income is the income level at which the retiree starts their annuity. This will allow a lifestyle that they wish to lead given financial constraints, their risk tolerance and the support network that exists.

The paper concentrates on a stable annual income using a pre-determined approach to inflation and market conditions. It does not illustrate irregular cash flows such as a child’s wedding, replacing a car or a reduction in expenses when the laatlammetjie finishes university, although these could be built into the projections.
3.2.2 **Breadline Income**

The Breadline Income is the minimum income that the retiree needs to allow them to maintain their financial independence. If their income falls below this level, the retiree will be required to receive financial assistance from their support network (children, siblings) or sell assets that did not make up the amount that they set aside for retirement, such as their house, household possessions or car.

The Breadline Income should be equal to or lower than the Chosen Income and will depend on the annuitants’ personal circumstances and outlook. Retirees will have different requirements before they ask for financial assistance or start selling their assets. As an example, some may be willing to forego their medical aid whilst others may see this as a necessity.

If the Breadline Income is above their current means then they will be obliged to consider alternatives such as delaying their retirement date, selling other assets or moving in with their children from the outset of their retirement.

3.3 **Stochastic Model**

The underlying model used is the Stochastic Research Multi-State Stochastic Investment Model developed by James Maitland. The software used to run the model is the Asset Liability Investment System (ALIS) developed by Stochastic Solutions.

The model includes a stochastic inflation variable and all numbers, including investment returns, are expressed in real terms throughout the paper.

The stochastic model produces 1000 simulations of possible investment returns for each of the asset classes over a 30-year period. Each simulation is used to calculate, amongst other information, the retirement income and remaining retirement capital for the asset returns and inflation rates associated with that simulation. The outcomes for each period can then be ranked in numerical order and percentiles attached to the outcomes given their relative position. The $x^{th}$ percentile will have $x$ percent of simulated outcomes at or below it, and $(1-x)$ percent of outcomes above it. The answer for the $x^{th}$ percentile will move freely between different simulations at each sequential period end. Similarly a single simulation will be at a different percentile at each period end.

The graphs will show the required outcome at a set percentile, which usually provides a more ‘smoothed’ picture than the underlying variability of individual simulations. The purpose of using set percentiles is provide an indication of the probability of being less than or equal to that outcome at any point in time.

The graphs and tables will show the 40th percentile and, where appropriate, the 66th and 16th percentiles. The 40th percentile was chosen for the following reasons:

— It is below the median and therefore more conservative than the 50th percentile
— It moves away from the idea that the 50th percentile is the ‘best’ answer
— It starts to indicate that the ‘best’ answer must take the retirees’ ability to absorb the associated risk into account
— It is roughly mid-way between the other percentiles considered, namely the 16th and the 66th.
The 16th and 66th percentiles were chosen as being illustrative of a poor and a good investment outcome respectively.

3.4 Regulatory and Tax Environment

The paper incorporates the South African living annuity rules in terms of maximum or minimum drawdown rates. There are no investment restrictions on living annuities that fall outside of the Pensions Fund Act of 1956, although ASISA recommends that retirees buying a living annuity follow the investment restrictions of Regulation 28. Living annuities that are owned by a pension or retirement fund on behalf of their members are obliged to adhere to Regulation 28, which in broad terms are:

- Maximum exposure to all equities of 75% (excluding property shares)
- Maximum exposure to property (including property shares) of 25%
- Maximum exposure to offshore assets (excluding African assets) of 25%
- Maximum exposure to offshore assets (including African assets) of 30%

An ASISA media release dated 23 June 2014 indicated that nearly a quarter of living annuities did not adhere to these investment guidelines.

As no tax is assumed within either the portfolio or the income, the principles can be applied to both compulsory assets (those accumulated within a pension or retirement fund) as well as discretionary assets.

The tax that would be applied is:

- **On compulsory assets** Tax free build up within the Investment Portfolio and the drawdown taxed as income
- **On discretionary assets** The income and realised capital gains taxed within the Investment Portfolio and the drawdown is not taxed

3.5 Legacy Index

The Legacy Index is a concept introduced in this paper which is designed to assist with the financial planning process. Before going into an explanation of how the Legacy Index is calculated two examples are provided.

Mr and Mrs Koekemoer retired at the age of 65 using a living annuity with an initial drawdown rate of 6.5%. After ten years they realised that they needed to cut back on their standard of living as their investments hadn't performed as well as had been hoped. They didn't regret their biennial trip to visit their grandchildren overseas as they had fond memories, but they wouldn't be able to afford them in future. Five years later they had reduced their standard of living further, to the point that they had none of the luxuries that they previously took for granted. They drew enough to remain in their own home and pay their utility bills, for their groceries and medical aid but little else. A couple of years later they hit the
limit on their living annuity drawdown and had to pluck up the courage to ask
their children for financial assistance. They were fortunate in that their children
were able to provide the requested support. Mr Koekemoer recalled joking on his
retirement that his kids would have to underwrite his future income as he couldn’t
afford to allow an insurance company to do so. He just didn’t ever expect to have
to call on his underwriters …

Mr and Mrs Swart also retired at the age of 65 but ten years after the Koekemoers.
Although investment returns in the recent past had been poor, they had managed
to save a bit more and retired drawing 5% of their capital via a living annuity.
They were fortunate as the years following their retirement were a period of strong
investment returns. By the time they were in their mid-eighties they were living on
3% of their capital and their children could look forward to a healthy inheritance.
Looking back they could have spent more in their early years of retirement but
they were cautious by nature and didn’t wish to risk being in dire financial straits
when they were older and more vulnerable to possible high medical costs.

The Legacy Index is a measure that illustrates the bequest assuming that the annuitant
dies at different times and under different investment conditions. The bequest is the
amount that remains for the annuitant’s heirs, and can be either positive (as in the case
of the Swarts) or negative (as in the case of the Koekemoers where the heirs had to
supplement their parents’ income). The Legacy Index should provide the retiree with
an indication at outset as to whether they can take on the risk associated with their
desired drawdown rate and the investment portfolio they have selected.

A couple who have no bequest motives will target a Legacy Index of close to zero
so they will have consumed their Retirement Capital without having gone into debt.

A positive bequest is simply the value of the Retirement Capital, whilst a negative
bequest is the accumulated amount borrowed to sustain the Breadline Income plus
interest less any remaining Retirement Capital. There will be remaining Retirement
Capital as the maximum drawdown rules limit the income to 17.5% of Retirement
Capital.

The Legacy Index expresses the bequest (in real terms) as a percentage of the
Initial Retirement Capital, which enables the retiree to understand its magnitude.

If the Legacy Index is negative the retirees can assess this against the ‘reserves’
that they hold, which can either be physical reserves in terms of their home, holiday
house, possessions or potential inheritances or social reserves which would include
their children’s, siblings’ or community’s ability to step in and support them.

If the projected positive Legacy Index is too high they have the option to increase
their lifestyle or perhaps support their favourite charity more lavishly.

Algebraically, the Legacy Index is defined as:

\[ LI(x,y) = \frac{RC_t - B_t}{IRC} \] and is expressed as a percentage
Where

- \( \text{LI} \): Legacy Index
- \( x \): probability that one of the annuitants is still alive at the date the LI is calculated
- \( y \): percentile of the Legacy Index
- \( \text{RC}_t \): Retirement Capital in real terms at time \( t \)
- \( t \): Time from retirement date to the date the Legacy Index is calculated, which is derived from the probability \( (x) \) that one of the annuitants is still alive
- \( B_t \): Accumulated borrowings to maintain the Breadline Income (where necessary) at time \( t \). The borrowings are accumulated using the cash return and are expressed in real terms.
- \( \text{IRC} \): Initial Retirement Capital

The borrowings have been accumulated using the interest rate associated with a cash deposit. This is probably too low as the support will need to come from the children whose cost of capital will probably be equal to the rate they pay on their mortgage.

The Legacy Index can be used to show results at different ages (probability that one of the annuitants is alive) and for different investment outcomes for a given asset allocation (percentile of the Legacy Index).

The Legacy Index could be shown at different ages for people with different life expectancies. A Financial Service Provider that provides advice should decide on the parameters for the Legacy Index that it believes best suits its client base and advice process. It should decide on a probability that at least one annuitant is alive and the relevant percentiles for the investment outcome.

In this paper three Legacy Indices are shown to summarise the outcome of each option. The same probability that the annuitant (or annuitants) will still be claiming their income has been used for each of the three scenarios. It is assumed that the annuitants live longer than expected but not too long (33% chance that at least one is still alive).

\( \text{LI}(33\%, 66\%) = :-) \) The happy position where the annuitants have benefited from good market conditions during their retirement

\( \text{LI}(33\%, 40\%) = :-| \) The OK (slightly disappointing) position where the annuitants have earned a little less than the anticipated investment returns during retirement

\( \text{LI}(33\%, 16\%) = :-( \) The sad (unhappy) position where the annuitants have experienced poor market conditions during their retirement.

The Legacy Index will be dependent on many factors including the asset allocation, the expenses incurred, the Chosen Income, the Breadline Income and the way in which the annuitant chooses to adjust their income for the market conditions they encounter during their retirement.
The Legacy Index will provide a measure of the risk being taken with a particular annuity strategy, and the retiree will be in a position to assess whether they are willing and able to accept that risk. A person or couple with no support network may be less willing to take a chance than a couple who have children with the ability to support them should the markets turn against them or they live for a long time.

The Legacy Index will also allow the retiree to assess the extent of the risk being taken and quantify that against physical assets owned such as their primary residence where a reverse mortgage may be considered. They could decide to delay their retirement or sell assets to add to their Retirement Capital.

The Legacy Index does not provide a view of the shape of the income generated and whether that will meet the retiree’s needs. Both the income and the Legacy Index will need to be considered at the same time to reach a decision on the appropriate financial structure.

3.6 Expenses

It has been assumed that the living annuities are purchased with the assistance of a financial adviser and are held on an investment platform. Financial adviser fees are usually negotiable and can be up to 1% per annum. It has been assumed that the financial adviser takes no upfront fee and charges 0.5% per annum.

Platform fees can vary in the way in which they are levied with some platforms receiving rebates from the CIS managers and others offering ‘clean’ collective investment scheme prices where the annual management charge has been reduced by the rebate. The platforms that receive rebates may either retain the rebate or pay it back to the investor. The net annual cost to the retiree is the important figure.

The annual management charge (“amc”) imposed by the CIS manager can also differ significantly, with the various base fees, performance fees and charges for underlying or offshore funds. The extent of the difference between the cheapest (a passive or tracker fund) and the most expensive can be more than 2% per annum.

The base annual expense assumptions for these components, charged quarterly in arrears and excluding VAT, are:

- Platform fees: 0.50% p.a.
- Adviser fees: 0.50% p.a.
- Multi-asset class fund amc: 1.00% p.a.

The amc for the no equity (bond and cash) fund was reduced to 0.75% and the cost of the pure equity fund was increased to 1.25%.

As the main analysis will consist of investing in multi-asset funds, the total annual cost is effectively 2.0% per annum.

3.7 Mortality Assumptions

It has been assumed that the retirees would be part of a group that followed the PA90 mortality table, reduced by four years.
For the purposes of the examples provided in this paper, it is assumed that a couple retire at age 65. The Legacy Index is calculated after 28 years as there is a roughly 33% chance that either one or both of them will still be alive at that point. It is assumed that the income requirements do not change on the first death.

3.8 Case Study

As mentioned previously a case study is used throughout the paper to illustrate the process.

Meet the Greens

Dr and Mrs Green have had an interesting life, living in various communities throughout South Africa where Dr Green practised medicine as a GP and Mrs Green taught. Dr Green also had an entrepreneurial streak, which had seen him set up various ventures, most of which he'd let go of too early and someone else made the money. He still had a few ideas and registered patents although he'd found his desire to actively pursue them had diminished as he got older. The Greens are physically fit and healthy although he could probably lose a bit of weight. They enjoy hiking and are looking forward to doing more of it whilst in retirement. The Greens have two children with whom they have a great relationship. The older daughter followed in her Mum's footsteps and became a teacher, and the younger son changed course numerous times and hadn't settled into any particular career. He was currently in India taking another (albeit self-funded) gap year.

4. INITIAL LIFESTYLE CHOICE

The financial planning process will start with the adviser collating information about the clients who are about to retire, ideally from the records that they have from past interactions. This information should include a complete picture of their assets and liabilities rather than just the part they are currently seeking advice on.

The adviser will need to know the Chosen Income that the retirees wish to receive as well as the ‘breadline income’ and any anticipated but infrequent expenditure not included in the Chosen Income.

Initially it is assumed that the retirees will wish to maintain their desired standard of living for as long as possible and only reduce it if and when the income reaches the maximum drawdown of 17.5% allowed under a living annuity. The initial drawdown amount will therefore be increased by inflation until the maximum drawdown rate is reached.

The initial planning process will consider a living annuity only with guaranteed annuities being brought in as an alternative once a clear picture has emerged of the desired structure of the living annuity.

At the first meeting with their financial adviser, the Greens had been asked to create a budget for their chosen income and their breadline income. They had determined they needed 6.5% of their Initial Retirement Capital to maintain their
5. APPROPRIATE ASSET ALLOCATION

The Investment Portfolio chosen will influence both the expected return and the volatility of the returns. Volatility plays a role as the retiree will experience ‘rand cost averaging’ but in the opposite way to whilst they were accumulating assets. Each time the market dips they will be selling more units than expected to produce their income. The shape of the investment returns will play a role in determining whether their income is sustainable. Even if the market produces the expected return over their retirement period, the outcome will be different if they experienced a bear market at the start of their retirement with a bull market in the final years or the other way around. In other words, the money weighted return will determine the outcome rather than the time weighted return.

The five Investment Portfolios outlined in Section 3.1.2 have been considered to establish which asset allocation may best suit the Greens.

Graph 1 below shows the real income at the 40th percentile for each Investment Portfolio. It also shows the Breadline Income as a reminder of the income required for the retirees to retain their financial independence. The Investment Portfolio producing the best outcome at this percentile is the High Equity portfolio, although it is only marginally better than the Medium Equity and Pure Equity portfolios. The income is only maintained at the desired level for 13 years for these portfolios before falling away sharply. The Investment Portfolio containing only bonds and cash provides the desired level of income for 10 years.

The vertical axis of the graph is labelled as the percentage of initial retirement capital. It is assumed that the retirement income increases with inflation each year and does not change as the retirement capital fluctuates until it is forced to do so when it reaches the maximum allowable drawdown rate of 17.5%.

Graph 1 provides an initial warning bell that the desired income is not sustainable but doesn’t yet provide a clear indication as to which Investment Portfolio may be best suited for the living annuity.

Under poor market conditions, shown in Graph 2, the various Investment Portfolios provide a similar duration for provision of the desired income, although the pure equity portfolio falls away first, after nine years followed closely by the other portfolios.

Under good market conditions, the differentiation between the portfolios becomes clearer with the Pure Equity portfolio providing the desired income for 21 years. The dispersion of the results increases as the percentile increases due to the enhanced upside from utilising equities. The dispersion of results is at its lowest at about the 20th percentile where the Pure Equity results and the No Equity results are similar. At lower percentiles the Pure Equity results underperform the No Equity results (Graph 3).
The Legacy Index provides another way of looking at the outcome, by considering the real capital or real debt remaining after a given period. In this case the period chosen is 28 years which is linked to the probability that at least one of the retirees is alive and needs at least the Breadline Income to maintain their financial independence. In Table 2 the percentage shown is of the Initial Retirement Capital.

The warning bells about the sustainability of the desired income are amplified as the Legacy Index shows that it is very likely that significant ‘debt’ will need to be incurred to maintain even the Breadline Income. With this information an assessment can be made as to whether the retirees have sufficient reserves to incur such ‘debt’. If the High Equity portfolio is utilised and the markets produce poor returns then their

**Graph 1** Real income – 40th percentile

**Graph 2** Real income – 16th percentile
support network (children or siblings) will have had to contribute an equivalent of 53% of the Initial Retirement Capital to support them or they will have to have other assets to this value that could be sold.

Table 2 Legacy Index for a 6.5% drawdown rate

<table>
<thead>
<tr>
<th>Investment Portfolio</th>
<th>Happy (66%)</th>
<th>OK (40%)</th>
<th>Sad (16%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No equity</td>
<td>−39%</td>
<td>−54%</td>
<td>−82%</td>
</tr>
<tr>
<td>Low equity</td>
<td>−21%</td>
<td>−34%</td>
<td>−58%</td>
</tr>
<tr>
<td>Medium equity</td>
<td>−10%</td>
<td>−26%</td>
<td>−54%</td>
</tr>
<tr>
<td>High equity</td>
<td>3%</td>
<td>−20%</td>
<td>−53%</td>
</tr>
<tr>
<td>Pure equity</td>
<td>13%</td>
<td>−20%</td>
<td>−60%</td>
</tr>
</tbody>
</table>

The Legacy Index table can be converted into Graph 4 below to illustrate the effect of the various Investment Portfolios.

The shape and direction of the lines (upward sloping) provide an indication of the value of increasing the equity exposure particularly for the Happy and OK investment conditions. Where investment returns disappoint (Sad) there is still some benefit to increasing the equity content until the high equity composition, where after the line slopes downward indicating that increasing the equity content decreases the Legacy Index and increases the debt. From Graph 4 it can be deduced that there is upside only to using a High Equity portfolio and no downside relative to the other Investment Portfolios.
After assessing the various graphs the Greens agreed that they would have to reconsider their desired lifestyle. The Legacy Index provided a clear indication that they would have to hope for very good investment conditions and have at least a High Equity portfolio to have a chance of not relying on their children, and if things didn't go well then their children would have to contribute an unacceptable amount towards their parents' retirement.

They didn't wish to continue working and didn't have any other assets that they could sell and add to the retirement capital.

They hoped that if they managed their income throughout their retirement by taking the economic circumstances into account they may be able to afford the same starting income. The adviser agreed to investigate this possibility.

Together with the financial adviser, and with the assistance of the graphical information, they decided to use the High Equity investment portfolio to consider these options. They weren't entirely comfortable with this due to nervousness about equities but agreed the decision could be reassessed once the income had been decided.

6. DRAWDOWN RULES DURING RETIREMENT

Living annuities offer flexibility in the income that can be drawn each year, ranging from a minimum of 2.5% of the retirement capital to a maximum of 17.5%. This flexibility can be utilised to try and increase the period over which income can be drawn.

In the first step above it was assumed that the retiree would increase their income at the inflation rate, regardless of market conditions, until the maximum drawdown rate was reached.
The initial change that can be made is to consider the effect of limiting the drawdown each year to a lower maximum percentage of the retirement capital, so that should the markets fall the increase in the nominal income will be limited or may even reduce. This is a variation of the Capital Preservation Rule put forward by Guyton & Klinger (op. cit.).

Three options are examined – limiting the drawdown to 8%, 10% and 12.5% of the retirement capital. Where possible the inflationary increases remain at 100% of the inflation rate. Once the income has reduced to the Breadline Income, these constraints are removed as the retirees cannot afford to reduce their real income any further. The income increases with inflation each year thereafter until the maximum drawdown rate of 17.5% is reached.

Guyton and Klinger’s Prosperity Rule, which increased the real income by 10% if the withdrawal rate reduced to below 80% of the initial withdrawal rate has been simplified. Should the withdrawal rate fall below 4%, then the income is increased to 4% of the Retirement Capital. This change is to accommodate strong markets where the retirees can afford to increase their income rather than leave an excessive bequest.

Graph 5 shows the 40th percentile for the three scenarios of limiting the drawdown to a percentage of the retirement capital.

In the first scenario (increasing retirement income by inflation each year with no limits and shown in Graph 1) the retirees would reach the Breadline Income after about 15 years and then fall straight through it. Controlling the drawdown rate delays some of the consumption and the retiree is able to remain financially independent for a longer period of time. Limiting the drawdown to 10% of the Retirement Capital extends the financial independence by six years at the 40th percentile and by ten years if the drawdown is limited to 8% of the Retirement Capital.
Under the 8% limit the retirees spend the first 12 years above the Breadline Income and a further 12 years at the Breadline Income before the income falls away.

The second approach is to retain the above limits to the drawdown rate, but to further limit the increase to 75% of the inflation rate which will result in a slow decline in the standard of living. The remaining constraints remain unchanged from the scenarios above. Graph 6 is again shown at the 40th percentile:

The various options illustrated above are an attempt to spread the income more evenly over the lifetime of the retirees and, once the income reduced, to maintain the Breadline Income for as long as possible. The trade-off between higher incomes earlier and sustaining the Breadline Income later becomes apparent. Adding the 75% of inflation limit increases the financial independence by at most one year, and changes the shape of the income before the Breadline Income is attained for the 10% and 12.5% scenarios. Under the 8% limit scenario, adding the 75% of inflation rule does not materially change the shape of the real income at the 40th percentile.

The Legacy Index is indicated in Table 3 for each option above. The Legacy Index for the original scenario (increasing by inflation and only limiting the income once the 17.5% maximum drawdown rate is reached for a high equity portfolio) is also shown for comparative purposes.

Table 3 can be converted into a graph to illustrate the effect of the different scenarios under different investment conditions (Graph 7).

The inclusion of various drawdown rules is assisting in increasing the Legacy Index, although it remains below –20% under adverse market conditions. The chances of requiring financial support during retirement can be reduced by adding drawdown rules.
After considering the various graphs, the Greens realised that although the Legacy Index was heading in the right direction, they were uncomfortable with the amount of time their income would be at the Breadline level. They recognised that their 6.5% starting point would have to be reduced. The shape of their income had to be considered – would they be comfortable with a slow decline in their standard of living or wish to maintain it for as long as possible and then drop to the Breadline level?

After a few days to think it through, the Greens decided that they would like to look into reducing their initial income but then try to maintain it as they preferred some stability in their standard of living.

### Table 3 Legacy Index for different drawdown rules

<table>
<thead>
<tr>
<th>Max drawdown</th>
<th>Inflation increase</th>
<th>Legacy index result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Happy</td>
<td>OK</td>
</tr>
<tr>
<td>8% 75%</td>
<td>44%</td>
<td>11%</td>
</tr>
<tr>
<td>8% 100%</td>
<td>39%</td>
<td>8%</td>
</tr>
<tr>
<td>10% 75%</td>
<td>32%</td>
<td>1%</td>
</tr>
<tr>
<td>10% 100%</td>
<td>23%</td>
<td>−3%</td>
</tr>
<tr>
<td>12.50% 75%</td>
<td>25%</td>
<td>−8%</td>
</tr>
<tr>
<td>12.50% 100%</td>
<td>12%</td>
<td>−12%</td>
</tr>
<tr>
<td>17.50% 100%</td>
<td>3%</td>
<td>−20%</td>
</tr>
</tbody>
</table>

### Graph 7 Legacy indices by drawdown strategies
7. INITIAL DRAWDOWN RATE

Various options are again considered to find the appropriate initial drawdown rate, by varying the initial drawdown and linking them to two of the options outlined in the previous section. The drawdown rule options maintained are:

— Maximum drawdown of 10% with 100% inflationary increase
— Maximum drawdown of 12.5% with a 75% inflationary increase

The initial drawdown rates are reduced to 4.5%, 5% and 5.5%, with the Breadline Income remaining at 4% of the Initial Retirement Capital. The following graphs 8 and 9 show the real income levels at the 40th percentile for the two drawdown rules.

**Graph 8** Real income varying initial drawdown rate: 10% max drawdown/100% inflation

**Graph 9** Real income varying initial drawdown rate: 12.5% max drawdown/75% inflation
The graphs provide a picture of the shape of real income that could be achieved. The next step is to use the Legacy Index to understand whether the risk associated with the income is acceptable.

**Table 4 Legacy Index for various drawdown rates and rules**

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Drawdown rate</th>
<th>Max drawdown</th>
<th>Inflation increase</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Happy</td>
</tr>
<tr>
<td>One</td>
<td>4.50%</td>
<td>12.50%</td>
<td>75%</td>
<td>69.1%</td>
</tr>
<tr>
<td>Two</td>
<td>4.50%</td>
<td>10%</td>
<td>100%</td>
<td>54.3%</td>
</tr>
<tr>
<td>Three</td>
<td>5.00%</td>
<td>12.50%</td>
<td>75%</td>
<td>61.9%</td>
</tr>
<tr>
<td>Four</td>
<td>5.00%</td>
<td>10%</td>
<td>100%</td>
<td>44.4%</td>
</tr>
<tr>
<td>Five</td>
<td>5.50%</td>
<td>12.50%</td>
<td>75%</td>
<td>52.2%</td>
</tr>
<tr>
<td>Six</td>
<td>5.50%</td>
<td>10%</td>
<td>100%</td>
<td>35.9%</td>
</tr>
</tbody>
</table>

This can be represented graphically to illustrate the effect on the remaining capital after 28 years.

The Legacy Index is now positive at the 40th percentile (OK investment returns represented by the light grey dashed line in Graph 10) whereas for these drawdown rules it was negative for the 6.5% drawdown rate. Lowering the initial drawdown rate improves the chances of a positive bequest. The medium grey dashed line, which represents the adverse market returns, is still negative for all the various drawdown rates and drawdown strategies.

The Greens have had long discussions about their current and future lifestyle. They really don’t want to reduce their starting income to below 5.0% and have a number of medium term travel plans they wish to fulfil, which will push their requirements
a little higher. They consider the options and decide to go with option 5, which is a 5.5% initial drawdown but to increase their income at only 75% of inflation each year. The Legacy Index is probably too low for their liking at –25% if things go wrong, and they aren’t comfortable with the implications for their children, but it’s the best option under the circumstances. Their adviser suggested it was time to review the asset allocation again now that they had an income basis.

8. CONFIRMATION OF ASSET ALLOCATION

The process started by considering various asset allocations and then determined the initial drawdown rate and real income profile using a single asset allocation, the High Equity investment portfolio. A check should be performed to ensure that the assumption as to the acceptable asset allocation will still work with the revised drawdown rate and rules, which are a 5.5% initial drawdown, 12.5% maximum drawdown against the retirement capital and increases of 75% of inflation.

The real income profile for the 16th, 40th and 66th percentiles are shown in the graphs below, starting with the 40th percentile in Graph 11.

The same outcome as the original graph, Graph 1, is shown in Graph 11, although there is better dispersion making the results clearer. The High Equity portfolio sustains the income for the longest period, followed by the Pure Equity, Medium Equity and Low Equity with the No Equity portfolio producing significantly less income in retirement.

Graph 12, showing the 16th percentile, is also similar to Graph 2 with the Pure Equity portfolio reducing below the expected retirement income first. The Low, Medium and High Equity portfolios all produce a similar shape of real income in retirement. It is only below the 5th percentile that the real incomes reflect the downside risk being taken and the low equity portfolio outperforms the medium equity portfolio

![Graph 11 Real income by investment portfolio (40th percentile)](image-url)
which outperforms the High Equity portfolio which outperforms the Pure Equity portfolio. At the 5th percentile the No Equity portfolio produces similar income to the Low Equity portfolio. As the time periods are reasonably long (10 to 15 years) some of the equity volatility will have been muted over this period.

Graph 13 shows that if the markets perform well the strength of the pure equity portfolio comes through, with the income being increased above the 75% of inflation level due to the minimum drawdown rate of 4% taking effect. Under these circumstances the high and medium investment portfolios both manage to track the expected income (75% of inflation until the breadline is reached and 100% of inflation thereafter) for the full period.
The Legacy Index graph (Graph 14) reinforces the above picture and shows that the high equity portfolio should provide upside with limited or no downside when compared to the other portfolios over the long term.

The Greens feel they have found a solution from the available options, although three areas worry them
— despite all the fancy models and endless graphs they are concerned about having so much of their portfolio invested in equities as they have had an uncomfortable experience of market volatility previously and are not sure they would see it through,
— they are still troubled by the variability of the income level and would prefer more certainty around their lifestyle, and
— the Legacy Index under the adverse conditions is still below –20% and they don’t wish to leave their children burdened as they must consider the impact on their children’s retirement too.

Perhaps they should consider the Medium Equity Investment Portfolio? It may reduce the stress even if their children pay for it …

9. SMOOTH BONUS
The concern about market volatility affecting the value of the retirement capital and potentially leading to the retirees abandoning their retirement income plan, quite likely at the worst time to do so, could be addressed through the use of a smooth bonus portfolio.

Chennels (2012) argued that smoothing can be used in the accumulation (pre-retirement) phase to satisfy the conflicting risk and return objectives faced by trustees of defined contribution retirement funds. The paper provided a smoothing basis for converting monthly investment returns into a monthly bonus rate.
The model produced by Chennels has been replicated and used for the post retirement phase. The model smooth bonus fund has not been adjusted for income payments as it is assumed that it is open to new business and the outflows are matched by inflows. The bonus rates are therefore determined assuming that there are no flows either into or out of the smooth bonus funds.

The asset allocation has been adjusted from the model provided by Chennels to be consistent with the High Equity portfolio. The comparison is shown in Table 5.

<table>
<thead>
<tr>
<th></th>
<th>Equity</th>
<th>Property</th>
<th>Bonds</th>
<th>CPI bonds</th>
<th>Cash</th>
<th>Offshore</th>
<th>Equity</th>
<th>Bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Equity</td>
<td>50.0%</td>
<td>7.5%</td>
<td>20.0%</td>
<td></td>
<td></td>
<td>17.5%</td>
<td></td>
<td>5.0%</td>
</tr>
<tr>
<td>Chennels</td>
<td>60.0%</td>
<td></td>
<td>20.0%</td>
<td>7.5%</td>
<td></td>
<td>12.5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The portfolios are broadly consistent with 75% of the High Equity portfolio being in growth assets (equity and property) and 72.5% of the Chennels portfolio being in growth assets.

The expense assumptions are that the asset management charge will be 0.8% and there will be a smoothing charge of 0.2% giving the same total cost as the multi-asset-class Investment Portfolios. A reduced asset management fee is justified on the basis that these funds are institutional in nature.

The Smooth Bonus expected return before fees is 5.3% which is midway between the expected return for the High Equity (5.7%) and Medium Equity (5.0%) Investment Portfolios. The portfolio underlying the smooth bonus fund is the High Equity Investment Portfolio and the total costs are the same. The life company is only taking the asset management and smoothing charges and is not benefiting in any other way. A question is then raised as to why the expected return is lower than the underlying fund.

The answer lies in the assumptions made in the calculation of the smooth bonus rate and the reserves held within the smooth bonus fund. The smooth bonus portfolio will run with an average reserve of nearly 5% of its assets, and this can vary between –10% and the 10th percentile and 20% at the 90th percentile. It was assumed that when the bonus series was started there was no initial reserve and this was created over time, leading to a slightly reduced expected return.

A further consequence of the assumption that the annuity outflows are met by inflows is that the annuitant is implicitly removing their income from the smooth bonus fund as well as the reserve (positive or negative) attaching to that income from their personal share of the smooth bonus fund. The reserve they withdraw is transferred to the new entrant who joins the fund to keep the fund in a cash flow neutral position.

The Chennels model utilised monthly investment returns and generated monthly bonus rates. The Maitland stochastic model produces quarterly investment returns and it was found that the smoothing process did not work appropriately with
quarterly returns. Monthly returns were generated by assuming the same return would be earned in each month during the quarter. These monthly investment returns were in turn used to generate the monthly bonus rate. The monthly bonus rates were then compounded to create the quarterly returns required by the projections.

The first analysis is to compare the volatility of returns experienced by the investor when investing in the low, medium and high equity Investment Portfolios with that of the Smooth Bonus portfolio. The histogram in Graph 15 shows the range of standard deviations of quarterly investment returns from the individual simulations for each of the Investment Portfolios. The bands shown are for the 10th, 20th, 50th, 80th and 90th percentiles.

Graph 15 Range of standard deviations for different portfolios

Graph 16 Smooth bonus quarterly returns – single simulation
It is clear that the volatility of returns is substantially reduced for the Smooth Bonus portfolio. The range of standard deviations of the Smooth Bonus returns is less than a quarter of that of the High Equity portfolio which it is tracking. The smoothing is illustrated using a single simulation to compare the quarterly returns of the High Equity portfolio with the smooth bonus return in Graph 17.

The same process and rules are followed to generate the real income that the retiree could enjoy if invested in a smooth bonus fund using the drawdown rules and rates agreed by the Greens.

The income graph at the 40th percentile shows the income from the smooth bonus portfolio between the high and medium equity portfolios as may be anticipated from the expected returns. At the 16th percentile the income from the three portfolios is indistinguishable and at the 66th percentile all three portfolios meet the expected drawdown for the full period.

If we consider the Legacy Index, then a similar picture to that above emerges, with the smooth bonus falling between the High and Medium Equity portfolios (Graph 18).

It can be shown that the variability of the income is very similar for the three portfolios when abiding by the drawdown rules. The variability of the remaining retirement capital is however significantly reduced by using a smooth bonus fund which may lead to a more stress free retirement. Graph 19 shows the retirement capital for a single simulation and compares the quarterly capital values for the Smooth, High Equity and Medium Equity portfolios.

The Greens consider the new information and feel that they would be comfortable with a smooth bonus portfolio so that they don't have to read quarterly statements.
that have values jumping around too much. They realise that the underlying portfolio is doing the jumping but it will make them sleep better at night. They still have their concern about the variability of their income and the negative Legacy Index if things don't go well …

10. GUARANTEED ANNUITIES

The process so far has considered the asset allocation, the drawdown rules, the initial drawdown rate and the volatility of the invested assets. The retiree is still taking the investment and longevity risk. The process should consider whether there are ways of managing these risks to a more acceptable level.
This paper will only consider guaranteed annuities although other options are available such as longevity protection and investment guarantees. The guaranteed annuities to be evaluated will be a level annuity, an annuity with a 5% per annum escalation and an inflation-linked annuity. They will be joint life annuities with no guarantees on early death and no reduction in income on the first death. Guarantees on early death can be built into the framework but more work would need to be done to consider how to incorporate a reduction on the first death.

Two approaches are considered, both of which combine living and guaranteed annuities:

— Spending more than half of the Initial Retirement Capital to buy annuities of:
  — The initial Chosen Income (5.5% of initial retirement capital) with level nominal payments
  — The initial Breadline Income with 5% escalations
  — The initial Breadline Income with escalations equal to inflation

— Spending a third of the Initial Retirement Capital on
  — A level annuity
  — A 5% escalating annuity
  — An inflation-linked annuity

### Table 6 Guaranteed annuity starting income and cost

<table>
<thead>
<tr>
<th>Guaranteed annuities</th>
<th>Percentage of Initial Retirement Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
</tr>
<tr>
<td>Initial annual income</td>
<td>5.50%</td>
</tr>
<tr>
<td>Annuity premium</td>
<td>57.3%</td>
</tr>
</tbody>
</table>

The rates in Table 6 were obtained on 30 June 2014. The costs associated with the guaranteed annuity are limited as the rate quoted is net of the insurance company’s expenses and the financial adviser’s commission of 1.5% plus VAT of the premium. The expenses are included in the rate quoted and cannot be changed in future.

In each case the remaining assets are invested in the High Equity Investment Portfolio.

The minimum drawdown rules for the remaining assets had to be changed to accommodate the level annuity. Where the starting annuity was at the desired income, the minimum drawdown rate had to be reduced to zero initially otherwise the total income (living annuity plus the guaranteed annuity) would exceed the Chosen Income. The minimum drawdown rate was gradually increased as inflation reduced the value of the level annuity. The same principle applied for the reduced level annuity. This variation is possible in practice if compulsory assets are used to buy the level annuity and discretionary assets are used for the drawdown. If all the assets are compulsory then the level annuity can be reduced so as to allow for the minimum allowable drawdown rate from the living annuity to make up the Chosen Income.
The results from the first option, with different amounts paid for the guaranteed annuity, are shown in Graph 20. The greater amount invested in a living annuity is shown in the real income level profile incorporating the level annuity. The cost of the inflation-linked annuity relative to the 5% escalating annuity (light grey dotted line compared to the solid line) can be seen as the 5% escalating annuity consistently provides more income than the inflation-linked annuity.

The real income for the alternative approach, investing one third of the retirement capital in a guaranteed annuity is shown in Graph 21. Here the real incomes are very similar for the three options, although the options using the level and inflation-linked annuities (medium grey and light grey dotted lines respectively) fall away after 25 years.

The Legacy Indices are shown below after 28 years, although it should be recognised that the Legacy Index will start at a lower level as part of the retirement capital is paid away as a premium to buy the guaranteed annuity. The Legacy Index is still shown as a percentage of the Initial Retirement Capital before the guaranteed annuity payment.

**Table 7 Legacy index including guaranteed annuities**

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Annuity type</th>
<th>Starting level</th>
<th>Legacy index results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Happy</td>
</tr>
<tr>
<td>1</td>
<td>Level</td>
<td>5.50%</td>
<td>38%</td>
</tr>
<tr>
<td>2</td>
<td>5% esc</td>
<td>4.00%</td>
<td>29%</td>
</tr>
<tr>
<td>3</td>
<td>CPI esc</td>
<td>4.00%</td>
<td>7%</td>
</tr>
<tr>
<td>4</td>
<td>Level</td>
<td>3.20%</td>
<td>38%</td>
</tr>
<tr>
<td>5</td>
<td>5% esc</td>
<td>2.06%</td>
<td>43%</td>
</tr>
<tr>
<td>6</td>
<td>CPI esc</td>
<td>1.56%</td>
<td>35%</td>
</tr>
</tbody>
</table>

**Graph 20** Varying amounts spent on guaranteed annuity (40th percentile/real income)
The effect of spending most of the Initial Retirement Capital on an inflation-linked annuity which guarantees the Breadline Income can be seen in Strategy 3. The Legacy Index will always be positive but with little upside. The variability of the Legacy Index increases between investment outcomes as more of the Initial Retirement Capital is made available for the living annuity component.

Where one-third of the Initial Retirement Capital is spent on the guaranteed annuity (strategies 4, 5 & 6 in Graph 22), the 5% escalating annuity produces higher Legacy Indices than the level or inflation-linked annuities for all three investment outcomes.

The Greens liked the look of the graphs. They seemed to be getting similar income and the risk of having to rely on their children appeared to have been removed. If

**Graph 21** One third spent on guaranteed annuity (40th percentile/real income)

**Graph 22** Legacy Index – Guaranteed annuities
one of Dr Green’s patents did find an enthusiastic buyer the children could benefit from it. That seemed a preferable option rather than the children carrying the risk that only the sale of a patent would prevent them from having to care for their parents.

After some consideration, which included keeping some flexibility to manage their finances including their income, they felt that from the options shown above, they’d choose to invest one third of their capital in a 5% escalating annuity. The downside risk (−5%) appeared manageable.

Their adviser asked that they take the time to compare this solution with the living annuity invested in the smooth bonus fund that they had previously elected.

11. THE FINAL COMPARISON

The final choice was between the pure living annuity and the combination of a living annuity and a guaranteed annuity. The guaranteed annuity component of the combination would be a 5% escalating annuity using one third of the initial retirement capital as a premium. The graphical results comparing the real income for the two solutions are shown for each of the 40th, 16th and 66th percentiles in Graphs 23, 24 and 25 respectively.

The income graphs clearly show that the combination annuity should outperform the living annuity under all the circumstances for the drawdown rules used. The trade-off would come in the amount left over as a bequest where the living annuity will outperform the combination annuity under most circumstances. The Legacy Index has been shown for every year from retirement rather than at one particular point to illustrate the cost of the guaranteed annuity in terms of the bequest. Conversely the lower income from the living annuity shows that the bequest comes at a cost.

The effect of including a guaranteed period in the guaranteed annuity has
not been shown. It should reduce the difference in the Legacy Index between the combination annuity and the living annuity during the guaranteed period with a subsequent reduction in the Legacy Index for the combination annuity due to the increased cost of the guaranteed period.

Graph 26 shows that under a poor market outcome the living annuity will produce a higher bequest until about the 18th year, where after the combination annuity provides the larger bequest or smaller ‘debt’.

Under “OK” market returns the crossover point is 21 years after retirement with the combination annuity not requiring the retirees to go into ‘debt’.

The strong market conditions show that the living annuity produces a higher
bequest until the 30th year after retirement, although the combination annuity is within ten percentage points from year 20.

The comparison of the Legacy Indices on the same basis as previously shown (i.e. after 28 years only) revealed that the combination annuity was similar to the pure living annuity if the investments performed well and significantly better if the investments did not do that well.
Lodhia and Swanepoel (op. cit.) showed that the mortality release from a guaranteed annuity at age 65 added about 2% per annum to the return. If it is assumed that the expense differential between the guaranteed annuity and the living annuity is 1.5% per annum, with the living annuity being more expensive, then the living annuity will need to outperform the guaranteed annuity by 3.5% per annum to provide the same income if the annuitants live for the average life expectancy. The guaranteed annuity return is fixed whereas the living annuity return will have volatility, which should require an additional premium. The flexibility that a living annuity provides comes at a cost.

The Greens considered the various graphs and their state of health. They liked the more stable income from the combination annuity and when looking at the Legacy Index graphs there was more than enough to leave to their children. Under their circumstances the combination seemed like the right trade off – it was more important to have some security of income than having to worry about investment returns. In fact, on further consideration, perhaps they should go for the combination option where the escalating guaranteed annuity covered their Breadline Income? And the balance in the Smooth Bonus fund. They asked their adviser for yet more graphs …
12. CONCLUSION

The financial decisions taken at retirement could materially influence the quality of life thereafter. The financial planning process at retirement cannot increase the value of the retirement capital but it can ensure that appropriate decisions are taken with due cognisance of the risks.

The proposed framework provides an engagement process that allows the financial adviser to understand the client’s requirements and personal circumstances. It offers a methodology to illustrate and quantify the risks associated with the various retirement options and enables the adviser and retiree to craft a solution that is tailored to their needs.

The process can incorporate different retirement products and, as it is cash flow based, allow for irregular but expected income or expenses. It provides a basis from which an annual review can be undertaken and the retiree’s position tracked relative to the plan.

The framework considers both the shape and amount of real income, the assets or liabilities remaining at a point in time, different asset allocations for the retirement capital and the expenses incurred. The Legacy Index provides a simple and intuitive measure of the risk being taken for the product(s) selected and the income required.

Further work can be done on testing the sensitivity to different stochastic parameters generating the investment returns, on the effect of expenses and different drawdown rules.

ACKNOWLEDGEMENTS

I would like to thank James Maitland for the use of ALIS, the stochastic software system, as well as providing the parameter set that enabled the framework to be constructed and illustrated. James was very patient in explaining the software package as well as contributing to, and being a sounding board for, the concepts behind the framework. I would also like to thank Mayur Lodhia for his advice and comments in his role as reviewer of the paper, as well as Jonathan Brummer and Poobalan Govender who provided insights and comments. Sincere thanks to Hannchen Louw for all the support and encouragement.
REFERENCES


