LIVING ANNUITIES: THE ADVISORY PROCESS

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ABSTRACT
This paper reports on financial advisers' views on the advisory process used when selling living annuities and subsequently managing them. This includes aspects such as the methods used in assessing the risk appetite and needs of the investor as well as the advice given on appropriate investment and drawdown strategies for the investor. The advisers' views on the mis-selling of living annuities are also presented. Finally, the paper presents a mathematical model to determine an appropriate investment strategy and income drawdown rate for an investor so as to minimise the probability of financial ruin. Eight different investment portfolios are tested to determine the portfolio that will most likely provide an investor with an annuity for life. Results are presented for a specific South African investor assumed in the model. Advisers may use the model suggested to determine the most appropriate portfolio and drawdown rates for their clients.

KEYWORDS
Living annuity; sustainable drawdown rates; asset allocation; financial adviser

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1. INTRODUCTION

1.1 The Linked Investment Service Providers Association (LISPA) code on linked annuities[1] defines a linked or living annuity as, "a special type of compulsory purchase annuity offered by insurers and retirement funds, under which the income (or annuity amount) is not guaranteed but is instead dependent on the performance of the underlying investments. It allows the annuitant to select an income level that ranges between a pre-defined minimum and maximum level." In South Africa, the minimum drawdown rate allowed on the fund value is 2,5% a year and the maximum is 17,5% a year.

1.2 The Actuarial Society of South Africa[2] highlights the advantages and disadvantages of a living annuity. A living annuity provides the following attractive features:
- flexible drawings as the investor may choose what income to draw down annually;
- investment flexibility as the investor has a choice of a wide range of asset classes and unit trusts in which to invest; and
- the ability to bequeath the capital to dependants on death.

1.3 The investor is however exposed to the following risks:
- longevity risk as the investor's capital may be insufficient to provide an income for the rest of his or her life, especially if he or she lives longer than expected;
- investment risk as the responsibility for the investments lies with the investor who may make poor investment decisions; and
- drawdown risk as the investor may erode the value of the capital by drawing down at too high a rate.

[1] The LISPA code on linked annuities: Annexure B to the LISPA code of conduct, March 2007
[2] Source: Are living annuities so great? http://www.assa.org.za/scripts/file_build.asp?id=100000224

1.4 The Deputy Ombudsman for Long-Term Insurance mentions in the Life Offices Association code of conduct[3] that a living annuity is 'appropriate mainly for individuals with a fair degree of financial knowledge who must be relatively wealthy'.

1.5 This paper reports on financial advisers' views on the advisory process used when selling living annuities and subsequently managing them. This includes aspects such as the methods used in assessing the risk appetite and needs of the investor as well as the advice given on appropriate investment and drawdown strategies for the investor.

1.6 The term "financial adviser", or simply "adviser", will be used throughout the paper to represent a person who provides advice on living annuities. This includes independent brokers, agents and direct sales staff of the providers of living annuities.

1.7 This report also addresses the issue of the quality of advice provided by advisers. In particular, it looks at advisers' perceptions on the mis-selling of living annuities and the reasons for their being mis-sold. This is in light of complaints on the mis-selling of living annuities issued to the Ombudsman for Long-Term Insurance, as mentioned in the Life Offices Association code of conduct[4].

1.8 Finally, the paper presents a mathematical model to determine an appropriate investment strategy and income drawdown rate for a purchaser of a living annuity so as to minimise the probability of financial ruin. Eight different investment portfolios are tested to determine the portfolio that will most likely provide an investor with an annuity for life. Results are presented for a specific South African investor assumed in the model. Advisers may use the model suggested to determine the most appropriate portfolios and drawdown rates for their clients.

1.9 The content of this paper is arranged as follows. Section 2 presents a literature review of the advisory process and models used to determine optimal drawdown and investment strategies specifically for living annuities as well as in related cases. Section 3 explains the process followed when conducting the research and discusses the choice of sampling frame. Section 4 presents the results of the survey conducted. Section 5 presents the form, assumptions and parameters of the model. Results of the model are presented in Section 6. Section 7 concludes the paper. Areas for further research are identified.

2. LITERATURE REVIEW

2.1 Previous research on the quality and nature of advice that is provided to clients who own living annuities was not found. However related research exists.

2.2 Collard & Kempson (unpublished) conducted research for the Department for Work and Pensions in the United Kingdom to investigate the role played by financial intermediaries in the provision of advice about saving for retirement. The core of the research involved in-depth interviews with financial intermediaries who provide advice to the public at a local level. They concluded that changes to the way that advice is regulated have raised the quality of advice offered, although the availability of advice for people on lower incomes has declined. They found that advice was invariably provided face-to-face and this usually took place over two or three meetings. The advice given and the recommendations made

[3] Chapter 21:Code of conduct on living annuities, 2002
[4] ibid

were tailored to individual circumstances and what people could afford. They determined that many—but by no means all—financial intermediaries already make full use of mathematical tools such as the State Pension forecast service and find it a useful tool in their work.

2.3 There is literature available that details ways to determine optimal strategies for a pensioner in retirement. Different assumptions and approaches are used in different papers. Some focus on determining the optimal investment portfolio under certain conditions; some provide techniques to calculate a sustainable drawdown rate in retirement and others determine an optimal time to annuitise.

2.4 Merton (1969) presents a continuous-time model of optimal consumption and portfolio choice. In the model, individuals maximise their expected utility from consumption of goods and leisure over their lifetimes. Both he and Samuelson (1969) have shown that for utility functions that exhibit constant relative risk aversion, i.e. one's attitude to financial risk is independent of one's wealth level, the proportion of total wealth optimally held in risky assets is the same regardless of age. Their models show that very risk-averse people should choose to invest in such a way as to minimise the volatility of their lifetime consumption flow.

2.5 Bengen (1994) suggests an approach that a financial adviser may use when determining an appropriate investment strategy and drawdown rate for a client, based on historical data in the United States of America. He assumes that the amount withdrawn in each year is based on the previous year's amount withdrawn plus an inflation factor. The historical records support a portfolio with a holding of between 50% and 75% in equity as being an appropriate starting allocation.

2.6 Pye (2000) uses Monte-Carlo simulation to simulate possible future investment returns and inflation. He concludes that for an expected real return of 8% a year and a standard deviation of 18% a year, an initial withdrawal of 4% a year is sustainable for thirty-five years with a probability in excess of 80%.

2.7 Ameriks (2001) considers four possible portfolios, ranging from a conservative portfolio, comprising 20% equity, 50% bonds and 30% cash, to an aggressive portfolio comprising 85% equity and 15% bonds. He concurs with Bengen (1994) and Pye (2000) that for a thirty-year retirement horizon, a 4,5% annual withdrawal rate succeeds more than 90% of the time only if the asset mix is very heavily weighted towards equity. For a more conservative portfolio, the probability of lifetime ruin will be significantly higher over time periods of 20 years or longer.

2.8 A utility framework has been considered in Blake, Cairns & Dowd (2003), who compare the purchase at retirement age of a conventional life annuity (i.e. a bond-based investment) with distribution programmes involving differing exposures to equities during retirement. The paper concludes that if the member is highly risk averse, the appropriate programme is a conventional life annuity and if the member has a higher appetite for risk, the investment portfolio will hold more equities. The bequest motive and the optimal time to annuitise are also considered in this paper. Similarly, Milevsky & Young (2002) use a utility approach. This paper however assumes a dynamic asset mix as opposed to Blake et al (2003), who assume a constant asset mix. Blake et al (2003) present a table of the previous literature written on this topic and the features of the proposed models.

2.9 Gerrard, Haberman & Vigna (2006) use dynamic programming techniques in determining the optimal consumption and investment strategies for a pensioner in the decumulation stage of a defined-contribution fund. The pensioner is given the choice of deferring annuitisation in the hope of being able to purchase in the future an annuity higher than the pension income provided by immediate annuitisation at retirement. The target level of income before annuitisation and the target level of annuitisation subsequent to annuitisation are considered in a target function. The effect of the bequest motive is also included in this function. The paper concludes that the individual acts optimally as though his or her bequest motive is null. The risk appetite of the member is considered by changing a parameter in the disutility function chosen.

2.10 Levitan & Thomson (forthcoming) consider the practicality of eliciting utility functions of members of a defined-contribution retirement fund. The purpose of this elicitation is to provide assistance in recommending appropriate investments for the specific member. These authors, unlike the other authors who use utility theory in their models, actually elicit utility functions from the members rather than assuming one. The authors comment though that, "It is not trivial to specify the utility function of a member. An incorrect specification of a member's utility function can result in the recommendation of an incorrect investment strategy."

2.11 Milevsky & Robinson (2005) present an analytical formula for the probability that a portfolio earning a lognormal investment return will be sustainable over a random lifetime horizon. It is assumed in the paper that a constant real amount of the value of the portfolio is withdrawn each year. This method avoids Monte-Carlo simulations and as a result is practical and easy to implement.

2.12 The above literature was not written specifically in the context of living annuities. In contrast, Baldeaux (unpublished) attempts to quantify the risk associated with living annuities and considers the underlying investment strategies that are appropriate for a particular type of pensioner—a male aged 65 with R1 000 000 in retirement savings. He compares the attractiveness of a living annuity with a conventional index-linked annuity, and concludes that for a pensioner who values both the drawing down of income and the capital value or bequest obtained on death, the living annuity is more attractive.

2.13 He also considers six investment strategies of varying degrees of risk and expected return. Returns are generated for local equity, international equity, local property and local fixed-interest investments. He concludes that diversified strategies outperform those that are not diversified, but that once diversified, it does not seem that the probability of ruin achieved by a strategy allocating 25% to each of the four investment vehicles can be substantially improved on.

3. RESEARCH METHODS

3.1 In order to determine advisers' views on the advisory process used when selling living annuities and to understand the industry practices involved in suggesting drawdown strategies and portfolio allocation, it was necessary to draw a sample of advisors.

3.2 The sampling frame used was a list of financial advisers found on the Financial Planning Institute's website. According to the website[5], "The Institute is the leading

[5] Source: The Financial Planning Institute, http://www.fpi.co.za

professional association for financial advisers and planners in South Africa." Financial advisers are listed by geographical area and qualification, which in decreasing order of level of qualification are a Certified Financial Planner (CFP), an Associate Financial Planner (AFP) and a Registered Financial Planner (RFP).

3.3 A sample was taken from each level of qualification in the Johannesburg area. This was done by searching for advisers by the dialling code '011' and then removing any advisers who were situated on the outskirts of Johannesburg. This was done for convenience. There is no apparent reason why the results of the survey should be materially affected by the geographical region in which the advisers practice. In total, there was a list of 132 RFPs, 214 CFPs and 94 AFPs. A random sample from each qualification was taken. Those chosen were then contacted to see if they sold living annuities and were willing to be interviewed. A problem with this sampling frame is that many either did not sell living annuities or could not be contacted. A larger sample than was needed was drawn in anticipation of the above-mentioned problem. From an overall sample size of thirty, nine advisers were interviewed, two of whom were RFPs, two of whom were AFPs and five of whom were CFPs. Thirteen could not be contacted. Two were willing to participate in the survey but were unable to do so owing to an overseas trip in the one case, and a family bereavement in the other. Six did not sell living annuities. The questionnaire is attached in Appendix A.

3.4 To claim that the research determines 'industry' practices would be misleading as a sample of nine cannot provide a credible representation of the entire industry. Nevertheless, despite the small sample size, it is felt that the results from the survey were generally consistent amongst the advisers. In particular, it should be noted that although the sample size may seem small relative to the sampling frame, many advisers within the sample frame do not actually sell living annuities. In the sample drawn, 35% of those contacted did not sell living annuities.

3.5 A possible problem with the sampling frame is that advisers are not required to become members of the Financial Planning Institute. As a result, the sampling frame excludes those advisers who are not members and who are possibly less reputable. In addition, the financial advisers might give answers that are filtered so as to portray themselves in a more positive light.

4. RESULTS OF THE SURVEY

4.1 The results of the survey can be split into three main categories. The first category of results relates to questions about the assessment of the financial needs and risk appetite of the investor as well as how the risks inherent in living annuities are expressed to the investor. These risks include longevity risk, investment risk and drawdown risk, as mentioned in ¶1.3. The second category considers the mathematical models used in suggesting portfolio allocation and drawdown rates. The third category relates to the quality of advice and the mis-selling of living annuities.

4.2 A question was asked about the proportion of total annuity sales that living annuities comprise. One adviser said less than 10% of her total annuity sales were living annuities, two said between 70% and 80% and six said between 90% and 100%. A survey conducted by Alexander Forbes Financial Services[6] showed that living annuities comprised 75% of total annuity sales.

[6] Source: Alexander Forbes Financial Services Member Watch Series, Issue 3

4.3 RISKS

4.3.1 All the advisers explain the difference between a living annuity and a conventional annuity.

4.3.2 Past investment performance is generally shown by the advisers, although a mention is made of the fact that past performance is not necessarily a good indicator of future performance. Sometimes, it is actually the client who requests to see past performance.

4.3.3 When suggesting a drawdown rate to their clients, the advisers felt that the most important factors to consider were:

- the fund value, with an emphasis on its growth;
- the income requirement of the client, which is determined by drawing up a budget;
- the role that the living annuity plays in the client's whole portfolio; and
- tax.

4.3.4 With regard to the drawdown rates chosen by clients, the following may be observed:

- Some clients draw down at the minimum of 2,5% a year, if for example they are still working or do not require the income. This is especially true when the client has other assets that may provide an income and desires to bequeath the living annuity on death.
- Some clients may draw down at the maximum of 17,5% a year. This typically occurs when the client is emigrating or the living annuity is a negligible component of the client's whole portfolio, and the client wishes to draw it down as quickly as possible.
- As a rule of thumb, advisers recommended not drawing down more than 5% to 8% a year if the living annuity provides the client's sole source of income. Two advisers try to keep the drawdown rate to 5% or less.
- Before each policy anniversary, there is an option to change the drawdown rate for the following year. When adjusting this, some advisers change the rate, for example from 5% to 6%, whereas others change the actual amount of the income to be received regardless of the percentage of the fund that this now implies.

4.3.5 A living annuity is supposed to produce a level of income that is sustainable for life[7]. According to the Retirement fund practice notes[8], "The requirement that the income level must at all times produce a life annuity means that the administrator of the annuity must ensure that the rate at which the annuity is currently paid can continue for at least the expected lifetime of the retiree. This places a duty on the administrator to reduce the rate at which the annuity is paid whenever the underlying capital becomes insufficient to guarantee a life annuity." The advisers were asked if they felt it was their responsibility to limit the drawdown rates to a sustainable level. All of them acknowledged their role in advising the client to choose a responsible drawdown rate that should provide an annuity for life. The language in the legislation suggests that a living annuity can be 'guaranteed'. This however raises questions as the age at death of an investor is not known with certainty. The word 'guarantee' implies a minimum income level in absolute terms, but if this required minimum income is higher than can be obtained using only risk-free investments, the income cannot be guaranteed for life, without proper annuitisation.

4.3.6 Two of the advisers felt that the rates at which clients draw down income do provide an annuity for life. Two said that they do not, simply because clients have not saved sufficiently for retirement. In this case, clients are forced to make sacrifices and cut down expenditure.

[7] The LISPA code on linked annuities: Annexure B to the LISPA code of conduct, March 2007

[8] South African Revenue Service retirement fund practice notes: Addendum A to RF 1/96

4.4 MATHEMATICAL MODELS

4.4.1 An area where there appeared to be differences in the advisers' responses, was that of a mathematical framework used in suggesting drawdown rates and deciding on the asset allocation in the portfolio.

4.4.2 Five of the advisers have models that allow a sustainable drawdown rate to be determined. These models are typically spreadsheets that can be shown to the client. The exact form of the model differs from adviser to adviser. In general, the models make an assumption about parameters such as investment returns and expenses, and allow inputs for age, and an assumed drawdown rate. The client can then see at what age he or she is expected to run out of money, where by running out of money, it is meant that the fund value goes to zero. The problem with this definition of ruin however, is that it overestimates the time of ruin. According to this definition, an investor may not be considered ruined if say his fund value is R20 000 even if he cannot live off less than R24 000 a year. A better approach may be to define ruin directly in connection with the income required by the investor. Thus financial ruin is said to have occurred if the living annuity fails to provide a sufficient income on which to live. This definition is used in the model presented in Section 5. Some of the advisers' models also allow for mortality. Three advisers do not use a model.

4.4.3 All the advisers felt that a tool that calculates the probability of the client's running out of money before he or she dies can be useful and can often reinforce their recommendations to the client. One commented that clients 'hear what they want to hear' so it is very important to demonstrate to the client in plain terms what the implications are of his or her drawdown strategy. One adviser felt though, that most clients are not that interested in seeing a model of this sort, as they are not concerned with the minutiae of running their portfolios.

4.4.4 One adviser pointed out, "The adviser's role is to match the solution to the client's needs rather than create the solution." He continued to explain that, for example, a range of unit trusts are available, but it is the adviser who needs to determine the appropriate unit trusts in which to invest for the client's funds.

4.4.5 Each of the advisers uses a different process to determine the portfolio allocation. In particular, three of the advisers use mathematical models to decide on a portfolio allocation. In these cases, the asset allocation tends to be driven by the client's income requirements. In other words, the income needs and hence the drawdown rate are determined. Then a portfolio is set so as to provide an expected return that should provide the income needed and allow the capital to grow. In contrast, the other advisers place more emphasis on the risk assessment, and therefore try to slot the client into a portfolio commensurate with his or her risk-tolerance level. One adviser who does not use a model shows a graph from one to ten of the rate of aggressiveness of a fund. This adviser does not like to place a client in a portfolio that is more aggressive than a balanced portfolio comprising a range of asset classes.

4.4.6 Advisers without asset allocation models rely on their experience to determine a portfolio allocation. The appropriateness of this approach needs to be questioned. Although the adviser may claim to be experienced and that this experience can add value, this implies a less objective approach than using a model, and hence the investment and drawdown strategies may be influenced by the adviser's biases.

4.4.7 Balanced funds provide a popular choice for the advisers as they provide a spread of asset classes and may be chosen in accordance with the risk appetite of the investor. Two advisers in particular liked absolute-return funds. These aim to preserve the capital base and provide positive returns.

4.4.8 A comment was also made that risk-profiled funds are liked. In risk-profiled funds, the asset manager rebalances the portfolio regularly to ensure that the amounts

invested in each asset class are in accordance with its mandate. This removes the responsibility from the adviser to rebalance the portfolio.

4.4.9 Three advisers place the income needed for the next one to three years in cash or money market instruments. The client draws down the income from the cash part of the portfolio. This may be done to avoid being forced to withdraw from a more volatile component of the portfolio, especially when the market is underperforming. An adviser who does not do this said that in principle he disagrees with the concept as it can reduce the returns on the portfolio, but that in practice there may be a place for it.

4.4.10 One of the advantages of a living annuity is that on death, it allows the fund to be bequeathed to the dependents of the client. It was discovered that this motive to bequeath played a role in encouraging clients to buy a living annuity instead of a conventional annuity. However, in general, it did not affect the portfolio allocation and drawdown strategies in that a client would draw down less than required so as to leave a larger capital value on death.

4.4.11 A living annuity may be converted into a conventional annuity if desired by the client. A conventional annuity cannot be converted into a living annuity. Only one adviser has a model that can determine an optimal time for the client to convert a living annuity into a conventional annuity. The other advisers felt that a living annuity is not generally bought with the intention to later annuitise it. Conversion to a conventional annuity may be influenced by the risk profile of the person and his or her income requirement, but with interest rates at currently low levels (with a repo rate of 10% a year on 30 August 2007 in South Africa), conversion to a highly priced conventional annuity is unpopular. However, conversion may become a more viable option if interest rates increase.

4.4.12 The advisers emphasised the need to consider the client's whole portfolio and not just the living annuity component of it when providing advice. A question arises as to whether the portfolio should contain both a living annuity and a conventional annuity. In other words, should the fund at retirement be partially invested in a living annuity and partially invested in a conventional annuity and if so, what proportion should be invested in each one? The same adviser who has the model to determine an optimal time for the client to convert a living annuity into a conventional annuity, commented that for some clients with retirement savings in the region of about R10 million to R15 million, the portfolio comprises both a conventional annuity and a living annuity. For most other advisers, this is done infrequently.

4.5 THE QUALITY OF ADVICE

4.5.1 There did not appear to be any significant differences in the responses given by the advisers with different qualifications. The quality of advice and techniques used in deciding upon an asset allocation and drawdown rates did not appear to be strongly related to the level of qualification.

4.5.2 Three advisers felt that advisers are not adequately prepared to sell living annuities and one said that when living annuities were originally launched, there was insufficient training about the risks inherent in the product. Seven commented however that today there is much better and more frequent training. One felt that training should be even stricter.

4.5.3 Six advisers said they would be willing to sell a living annuity or allow a certain drawdown rate or portfolio allocation if the client insisted upon it, even if they had advised the client against its appropriateness. In this case, all six commented that they would have the client sign the necessary disclaimers saying that the adviser's advice had been ignored. One adviser commented, "If I do not sell the living annuity to the client, he simply goes to the next broker."

4.5.4 The advisers felt that it was generally easier to explain the concepts of a living annuity to a financially sophisticated person. Five felt that clients understand the concepts

and two felt that the clients do not understand them especially when there are fluctuations and market prices fall. The advisers stressed the importance of explaining to the client that 'investments do not go in only one direction' but that returns are linked to the market and may go down. An enlightening comment from one adviser was that the product itself is not complicated but clients have unrealistic expectations of risk of returns and of longevity.

4.5.5 On average, seven advisers meet their clients one to two times a year, one adviser meets his clients three to four times a year and one adviser meets his clients more than four times a year. Clients with larger assets to manage are provided with advice more frequently. At these meetings, the portfolio performance to date is analysed and it is considered if the asset allocation and drawdown rates are still appropriate.

4.5.6 The advisers were asked what they felt were the reasons living annuities were being mis-sold. The following points were raised by them:

- In some cases, the adviser does not understand the mechanics of the product or the general economic environment and hence incorrect advice is provided.
- The adviser may not have adequate qualification.
- The product and the advice might be appropriate, but the asset allocation is inappropriate. Even if the asset allocation is initially appropriate, the adviser does not review it often enough to determine if it is still appropriate.
- The advisers have pressure to deliver the income required by the client. As a result, drawdown rates may be higher than they should be and hence the income is not sustainable for life.
- Clients are not suitably informed that their capital will fall if they draw down at a rate higher than the rate at which their capital is growing.
- One of the main problems is that clients do not save enough for retirement. Insufficient accumulation of capital means that there is little the adviser can do to provide an annuity for life.
- Unscrupulous behaviour by advisers to earn higher commissions can lead to mis-selling. However, the advisers felt that these advisers are few and far between. One commented that a more appropriate alignment between the needs of the client and the adviser, for example in commission structure, might reduce mis-selling.

4.5.7 All the advisers felt there is room for improvement in the advisory process. The areas that need to be addressed are:

- more frequent communication with the client;
- more regular statements from the administrator, for example quarterly; and
- improved software.

4.5.8 Mixed answers were obtained when advisers were asked if they feel that investment strategies are becoming too conservative as a result of the stricter requirements on the advisory process. Four said that strategies were becoming too conservative, which can also present a problem as capital growth may be low. One admitted to being too conservative but said that it is better to be too conservative than too aggressive. Two felt that strategies have not become too conservative and two felt that there is a danger that strategies will become too conservative.

5. THE MODEL

5.1 The above findings suggest that there is room for development of a mathematical model to calculate the probability of financial ruin. Improved software can better enable advisers to advise their clients. In particular, a model that allows the adviser to choose an appropriate allocation of assets so as to minimise the probability of financial ruin can be

helpful and perhaps reduce the problems of mis-selling. As mentioned in ¶4.4.2, financial ruin is said to have occurred if the living annuity fails to provide a sufficient income on which to live. A mathematical definition of ruin is given in Section 5.6.

5.2 As a result, it was decided to build a model to calculate the probability of financial ruin. The criteria for the model are that it should be practical and easy for advisers to run and tailored to suit the client's circumstances. It is clear from the advisers' comments that the advice is client-specific and hence any model should be able to handle the individual's unique circumstances.

5.3 A cash-flow model is used to calculate the probability of financial ruin. The added advantage of using a cash-flow model that shows the income drawn down each year, is that an adviser can demonstrate to his or her client in an easily understood manner, the impact of the chosen drawdown rate on the client's income, the probability of ruin and the expected time of ruin.

5.4 None of the advisers used a utility approach in assessing the risk appetite of the client. No utility functions were elicited but rather multiple-choice questionnaires, generally designed by administrators who provide the product, were used. As a result, it was decided not to use a utility approach to try to fit a model since it is difficult to elicit the utility function of a client, as mentioned in ¶2.10. Utility approaches require a utility function or at least a risk-aversion coefficient that is difficult to assign and impractical to use if the adviser cannot determine an appropriate coefficient.

5.5 NOTATION

The following notation is defined. Let:

- t be the time interval in years, $t = 0,1,2,...$;
- V_t be the fund value at time t;
- M_t be the minimum annual income that the investor needs to live on at time t;
- B_t be the actual amount of annual income drawn down at time t;
- b_t be the proportion of the fund drawn down such that $B_t = V_t b_t$;
- P be the maximum proportion of the fund the investor is allowed to draw down;
- R_t be the investment return earned in year $t+1$ i.e. from time t to time $t+1$; and
- x be the age of the investor at time 0.

5.6 MATHEMATICAL DEFINITION OF FINANCIAL RUIN

5.6.1 Some models regard financial ruin as having occurred at time t if $V_t = 0$. The problem of this approach was explained in ¶4.4.2. In this model, financial ruin is said to have occurred if the living annuity fails to provide a sufficient income on which to live. In mathematical terms, ruin is said to have occurred at time $t = ruin$ if a life aged x at time 0 is still alive at time $t = ruin$ and if $V_t P \le M_t$. In other words, the maximum income that can be drawn down at time t is less than the absolute minimum income required to live on.

5.6.2 It is assumed that b_t will be equal to b_{t-1} provided $B_t \ge M_t$. If $B_t < M_t$, it is assumed that b_t will be increased so that $B_t = M_t$. It is reasonable to assume that at policy anniversary, the drawdown rate will be adjusted to ensure that at least the minimum income can be drawn down.

5.6.3 The model is run 10 000 times. The number of ruins and the times at which they occur are recorded. The notation used is similar to that used for mortality functions and the number of simulations may be thought of as the number of individuals in a mortality investigation. In the notation defined, a superscript of r denotes a function calculated with respect to ruin, a superscript of m denotes a function calculated with respect to mortality and a superscript of rm denotes a function calculated with respect to both ruin and mortality. Thus let:

– d_t^r be the number of individuals who are ruined in year $t+1$ i.e. from time t to time $t+1$; and

– l_t^r be the number of individuals who have not been ruined by time t.

Then ${}_t|q_0^r = \frac{d_t^r}{l_0^r}$ is the probability that an individual who is not ruined by time 0 is ruined in year $t+1$.

5.6.4 Mortality needs to be accounted for in the model as the investor is considered ruined if the income is insufficient to live on and he or she is still alive. Longevity risk is one of the key risks inherent in a living annuity. For purposes of illustration, the mortality table PA(90) for female pensioners[9] is used. This table does not make an allowance for improvements in mortality. In practice, it would be prudent to make an allowance for mortality improvements. The survival function ${}_t p_x^m$ is determined from the mortality table. This function decreases from a value of one when $t=0$, to a value of zero when the mortality table ends at age 105.

5.6.5 The probability of ruin is now calculated allowing for mortality. It is assumed that investment returns and hence the time at which ruin occurs are independent of mortality. In other words, it is assumed that the investment returns obtained do not provide an indication as to the expected time of death, and vice versa. Therefore, the probability that a life aged x survives to time $t+1$ may be multiplied by the probability that the individual is ruined in year $t+1$.

The probability that an individual aged x at time 0 is ruined in year $t+1$ and is alive at that time is equal to:

$$ {}_t|q_x^{rm} = {}_{t+1}p_x^m \, {}_t|q_0^r .$$

Therefore, the probability of ultimate ruin is calculated by summing over all values of t. It is given by:

$$P(ruin) = \sum_{t=0}^{104-x} {}_t|q_x^{rm} .$$

The summation goes to $104-x$ as the mortality table ends at age 105. Thus any term beyond this will be zero.

The conditional probability that an individual is ruined in year $t+1$ given that he or she is ruined is given by:

$$P(ruined\,in\,year\,t+1 \,|\, ruined) = \frac{{}_t|q_x^{rm}}{P(ruin)}$$

[9] Continuous Mortality Investigation (1979). PA(90) Tables for pensioners.

5.6.6 It is now possible to calculate an average time of ruin and average age of ruin given that the individual is ruined. If an individual is ruined in year $t+1$, it is assumed that the time of ruin is $t+1$, i.e. at the end of the year and not at the beginning. Thus:

$$Average\,time\,of\ ruin = \frac{\sum_{t=0}^{104-x}(t+1)_t|\,q_x^{rm}}{P(ruin)}\text{; and}$$

$$Average\,age\,of\ ruin = x + \frac{\sum_{t=0}^{104-x}(t+1)_t|\,q_x^{rm}}{P(ruin)}.$$

5.6.7 It is also possible to calculate the probability that an individual is not ruined by time t, by noting that ${}_{t+1}p_x^{rm} = {}_tp_x^{rm} - {}_t|\,q_x^{rm}$. This is a similar result to the case when considering only mortality as:

$$\begin{aligned} {}_tp_x^{m} - {}_t|\,q_x^{m} &= \frac{l_{x+t}^m}{l_x^m} - \frac{d_{x+t}^m}{l_x^m} \\ &= \frac{l_{x+t+1}^m}{l_x^m} \\ &= {}_{t+1}p_x^{m}. \end{aligned}$$

To obtain a starting point for this recursive formula, it is noted that ${}_0p_x^{rm} = 1$.

5.7 MINIMUM INCOME

The model is built in terms of a minimum income requirement as an adviser determines a budget with each of his or her clients and therefore this minimum income requirement is likely to be known. Care needs to be taken how M_t is expected to change over time. It may be argued that it should grow in line with inflation, as presumably, the investor will wish to preserve the real value of his or her money. The decision whether this should be at price inflation or perhaps take account of a higher medical inflation rate depends on what the client's future expenditure and medical needs are likely to be. Although it is unlikely that all the client's expenses will be medical expenses, as the client ages, an increasing proportion of his or her expenses may be medical expenses. For the purposes of this paper, it will be assumed that M_t is constant as the model will be run using real investment returns.

5.8 INVESTMENT RETURNS

5.8.1 Investment returns are modelled using the model suggested by Thomson & Gott (unpublished). In the paper, a long-term arbitrage-free equilibrium model of a local market is developed. The authors explain, "The variables modelled are the returns on risk-free zero-coupon bonds—both index-linked and conventional—and on equities, as well as the inflation rate. The risk-free asset is taken to be the one-year index-linked bond. The model is developed in discrete (nominally annual) time, but allowance is made for processes in continuous time subject to continuous rebalancing. It is based on a model of the market portfolio comprising all the above-mentioned asset categories. It is assumed that, conditional upon information at the beginning of a year, market participants have homogeneous

expectations with regard to the forthcoming year and make their decisions in mean–variance space." The authors apply their model in the South African context. The data used were historical returns from 1986 to 2005. The model is then used to predict returns into the future.

5.8.2 In this model, investment returns are simulated for five different asset classes, namely:

- equity;
- long-term index-linked bonds;
- long-term conventional bonds;
- short-term conventional bonds; and
- one-year index-linked bonds.

The one-year index-linked bond is assumed to be the risk-free asset. In the living annuity model it is used to represent investment in money market instruments. The term 'equities' represents a broader asset class that includes all risky capital assets except bonds. Derivative instruments are excluded.

5.8.3 Annual investment returns are simulated. For each run of the model, fifty years of returns are generated for each asset class. The youngest age considered for an investor in the model is 55. The mortality table used ends at age 105, thus fifty years is an appropriate horizon to consider. A longer time horizon may be considered if necessary.

5.8.4 Different portfolios are tested to determine the investment strategy that minimises the probability of ruin. For each portfolio, investment returns are simulated. At time $t+1$, the fund value is:

$$V_{t+1} = (V_t - B_t)(1 + R_t).$$

5.8.5 Portfolio one comprises 100% in long-term index-linked bonds. This is a strategy that may arguably best match the need for a real annual income.

5.8.6 Portfolio two comprises 100% in equity. This strategy should provide the highest expected return with the highest volatility. This strategy is considered to demonstrate the impact of high volatility on the probability of financial ruin. An investment strategy might provide an expected return well in excess of the drawdown rate chosen but if in the short term the returns are poor, the portfolio may not be able to recover even when returns improve.

5.8.7 Portfolio three comprises 100% in long-term conventional bonds.

5.8.8 Portfolio four consists entirely of bonds. It comprises 50% in long-term index-linked bonds, 25% in long-term conventional bonds and 25% in short-term conventional bonds.

5.8.9 Portfolio five comprises 20% in each asset class. This portfolio is tested to determine the potential benefits of diversification.

5.8.10 Portfolios six to eight are based on asset allocations used in prudential low-equity funds, medium-equity funds and high-equity funds respectively. These would represent balanced funds that may be attractive to the conservative, moderate and aggressive investor respectively.

5.8.11 Portfolio six comprises 20% in equity, 50% in one-year index-linked bonds and 30% in long-term conventional bonds.

5.8.12 Portfolio seven comprises 50% in equity, 20% in one-year index-linked bonds, 15% in long-term index-linked bonds and 15% in long-term conventional bonds.

5.8.13 Portfolio eight comprises 75% in equity, 5% in one-year index-linked bonds and 20% in long-term index-linked bonds.

5.9 ASSUMPTIONS

5.9.1 It is assumed that portfolios are rebalanced at the beginning of each year. This rebalancing maintains the proportions allocated to each asset class and the terms of the bonds. Typically, the fund manager rebalances the unit fund to maintain asset allocations in line with the fund's mandate.

5.9.2 For long-term conventional bonds and index-linked bonds, the one-year holding period return on a bond of term 20 years is used. All the returns in the model are real returns.

5.9.3 The risk appetite of the investor is not allowed for explicitly in the model as would be the case if say using a utility approach.

5.9.4 Tax and expenses such as commission and annual management charges are excluded from the model. They may easily be included if desired.

6 RESULTS OF THE MODEL

6.1 The model assumes a female investor aged 65 with R1 000 000 in retirement savings with which she purchases a living annuity. According to regulation, $P = 17{,}5\%$.

6.2 Initially, it is assumed that $B_0 = M_0$. This implies that the investor is drawing down her minimum income from the outset. The alternative is to assume that $B_0 > M_0$. This means that the investor augments her income in the early years by drawing down more than the minimum income she requires. For this investor, $B_0 = M_0 = 4\%$.

6.3 Investment returns for portfolios one to eight are simulated so that the model may be run 10 000 times. The expected returns and standard deviations for each asset class are shown in Table 1. These statistics are based on 500 000 simulations of annual returns.

Asset class	Equity	long-term index-linked bonds (ILB)	one-year index-linked bonds (ILB)	long-term conventional bonds (CB)	short-term conventional bonds (CB)
Average Return	3,67%	2,31%	2,15%	2,97%	2,41%
Standard deviation of return	20,16%	6,16%	1,61%	16,38%	4,51%

Table 1. Average return and standard deviation of return for each asset class

6.4 The table shows that equity produces the highest expected return and the highest standard deviation of return. This appears intuitive as equity represents the risky assets in the market. Both long-term and short-term conventional bonds produce higher expected returns than for the corresponding index-linked bonds.

6.5 The probability of ruin is calculated for each portfolio for a drawdown rate of 4% a year. If the investor was ruined, the average time and age at which she was ruined was calculated. The results are shown in Table 2. The average portfolio return and standard deviation of the portfolio return are also shown.

	Portfolio	One	Two	Three	Four	Five	Six	Seven	Eight
Portfolio Composition	Equity		100%			20%	20%	50%	75%
	Long ILB	100%			50%	20%		15%	20%
	Short ILB					20%	50%	20%	5%
	Long CB			100%	25%	20%	30%	15%	
	Short CB				25%	20%			
Average portfolio return		2,31%	3,67%	2,97%	2,50%	2,70%	2,70%	3,06%	3,32%
Standard deviation of returns		6,16%	20,16%	16,38%	4,93%	5,90%	6,75%	10,47%	14,90%
Probability of Ruin		8,44%	31,71%	24,87%	6,13%	8,47%	10,54%	15,31%	22,92%
Average time of ruin		25,81	15,51	15,64	25,97	24,56	22,99	20,73	17,99
Average age of ruin		90,81	80,51	80,64	90,97	89,56	87,99	85,73	82,99

Table 2. Probabilities of ruin for a drawdown rate of 4%

6.6 Portfolio four comprising a range of bonds performs best as it provides the lowest probability of ruin i.e. 6,13% and the highest average age of ruin i.e. 90,97. It is the portfolio with the lowest standard deviation of returns.

6.7 It appears that as the holding in equity increases, the probability of ruin also increases. There is a 31,71% chance of running out of money when drawing down at 4% a year and investing purely in equity. Analysis of Table 2 reveals that as more equity is held in the portfolio, the standard deviation of returns increases. Thus, if there are years when investment performance is very poor, it may be impossible for the portfolio to recover, even if the expected returns are higher. Portfolio three comprising 100% long-term conventional bonds has the second highest probability of ruin.

6.8 The most conservative balanced portfolio—portfolio six—performs best of the balanced portfolios tested. Portfolio five, which is a simple diversified portfolio, produces the third-lowest probability of ruin. Nevertheless, for some of the portfolios the probability of ruin might still be considered too high for most investors to willingly accept.

6.9 The average age of ruin is approximately 90 years for the two best-performing portfolios. In the worst-case scenario, the investor is expected to be ruined within 15,51 years.

6.10 The distribution of the time of ruin given the investor was ruined was also calculated. Figure 1 shows this distribution for the best-performing portfolio—portfolio four, and the worst-performing portfolio—portfolio two. Both distributions, especially that of portfolio four is approximately symmetrical. This shape reflects the fact that for low values of t, the

probability of ruin is small as the fund value at retirement should be sufficient to last a few years. It is also small for large values of t as the probability of surviving to these ages is low. The distributions are thus peaked around their means. Intuitively, the probability of ruin will be highest when time has elapsed for the fund to become insufficient but it is likely that the investor is still alive. Portfolio four lies to the right of portfolio two, demonstrating that the investor is expected to be ruined at a later time.

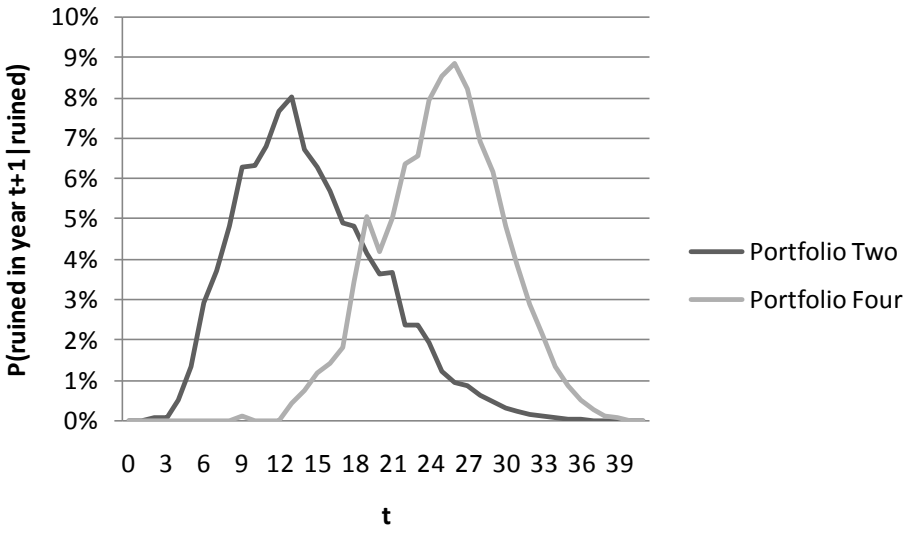

Figure 1. Distribution of the time of ruin given the 65-year-old investor is ruined.

6.11 The probability that the investor is not ruined by time $t+1$, ${}_{t+1}p_x^{rm}$ is shown in Figure 2 for portfolios two and four. The figure demonstrates that portfolio four better ensures that the investor's funds last for a longer time. For portfolios that perform poorly, the graph drops down rapidly from one at small values of t.

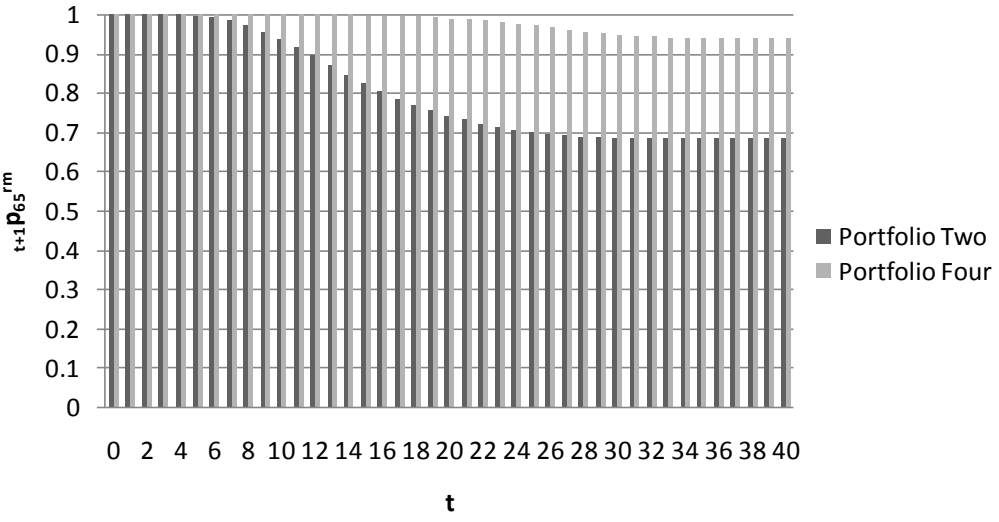

Figure 2. The probability the investor is not ruined by time $t+1$, ${}_{t+1}p_x^{rm}$

6.12 The effects of a change in the chosen drawdown rate may be seen in Table 3. The model was rerun for initial drawdown rates of 3%, 5%, 6% and 10%. The results, together with the results for the initial case of 4% are displayed in the table. For each drawdown rate,

the lowest probability of ruin and the highest average time of ruin are shown in bold. The probabilities of ruin are more easily compared in Figure 3.

		Portfolio	One	Two	Three	Four	Five	Six	Seven	Eight
Portfolio Composition		Equity		100%			20%	20%	50%	75%
		Long ILB	100%			50%	20%		15%	20%
		Short ILB					20%	50%	20%	5%
		Long CB			100%	25%	20%	30%	15%	
		Short CB				25%	20%			
Drawdown rate	3%	Probability of Ruin	0,57%	19,13%	14,17%	**0,55%**	0,96%	1,94%	4,50%	10,44%
	4%		8,44%	31,71%	24,87%	**6,13%**	8,47%	10,54%	15,31%	22,92%
	5%		35,42%	44,27%	37,95%	28,69%	**27,53%**	28,80%	31,68%	37,60%
	6%		58,40%	55,64%	51,80%	54,63%	50,23%	49,75%	**49,13%**	51,97%
	10%		88,60%	**84,20%**	85,86%	88,41%	87,95%	87,70%	86,54%	85,39%
	3%	Average time of ruin	24,8	17,4	16,7	26,9	**27,8**	25,3	23,7	20,3
	4%		25,81	15,51	15,64	**25,97**	24,56	22,99	20,73	17,99
	5%		21,0	13,8	14,5	**22,0**	20,7	19,8	18,0	15,8
	6%		16,2	12,2	13,1	**17,1**	16,9	16,4	15,4	13,8
	10%		7,0	7,2	7,4	7,1	7,3	7,3	**7,5**	7,4

Table 3. Comparison of probability of ruin and average time of ruin for different portfolios and drawdown rates

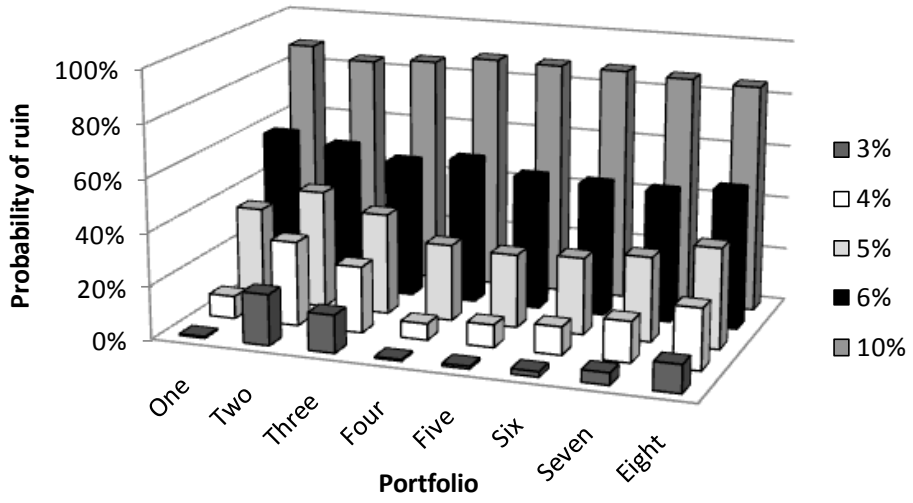

Figure 3. Probabilities of ruin for different drawdown rates and portfolios

6.13 The first point of interest is that only with drawdown rates of 3% and 4%, are there some probabilities of ruin that are less than 10%. The probability of ruin increases as the drawdown rate increases—a result that would be expected. The ruin probabilities are still much too high to consider a drawdown of 6% and 10% as being able to provide an annuity for life. Even a drawdown of 5% will only succeed in 55% to 72% of cases.

6.14 The results suggest that as the drawdown rate increases, a larger portion of the fund should be invested in equities. For example, from the table, for a drawdown rate of 5%, the equally-weighted portfolio comprising 20% in equities performs best; for a drawdown rate of 6%, portfolio seven with 50% invested in equity produces the lowest probability of ruin and for a drawdown rate of 10%, portfolio two with 100% invested in equity produces the lowest probability of ruin. The percentage of the fund that should be invested in each asset class for the portfolio that produces the lowest probability of ruin is shown in Figure 4. For example, for a drawdown rate of 3%, 50% should be invested in long-term index-linked bonds, 25% in long-term conventional bonds and 25% in short-term conventional bonds. The figure demonstrates that at low drawdown rates, investment should be in a range of different bonds. Only for drawdown rates greater than 4% does equity begin to feature in the portfolio. The equity holdings increase all the way up to 100% for a drawdown rate of 10%. This suggests that if an investor is drawing down at a high rate for portfolios without any equity holdings, the expected return is too low to sustain the higher drawdown rate. The extra return expected from equity over the other asset classes reduces this probability of ruin.

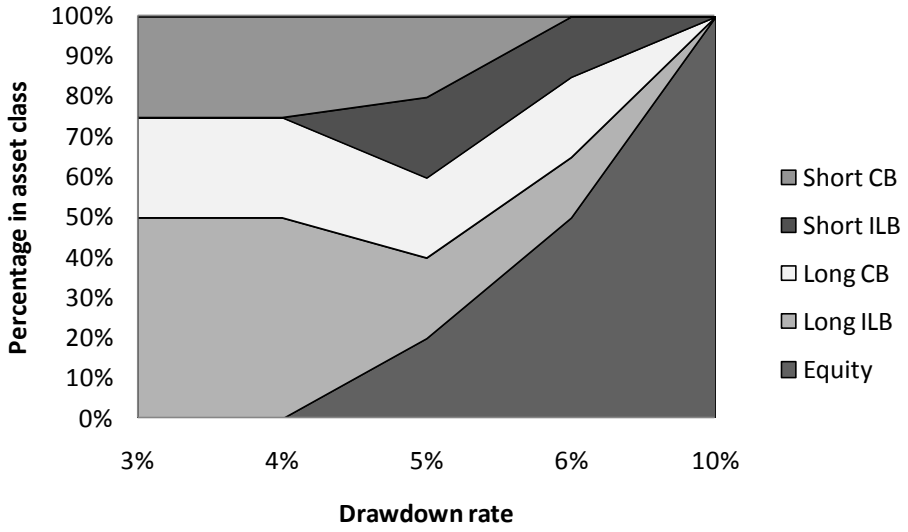

Figure 4. Percentage invested in asset classes for the portfolio that produces the lowest probability of ruin

6.15 The average age of ruin also decreases as the drawdown rate increases, reflecting the fact that the investor is expected to be ruined sooner. In the best-case scenario, the investor is ruined at an average time of 27,8 years or equivalently at an average age of 92,8 years.

6.16 To test the sensitivity of the results to the age of the investor, the model is run assuming the investor is aged 55, 65 and 75. Results are plotted in Figure 5 for a drawdown rate of 4% a year.

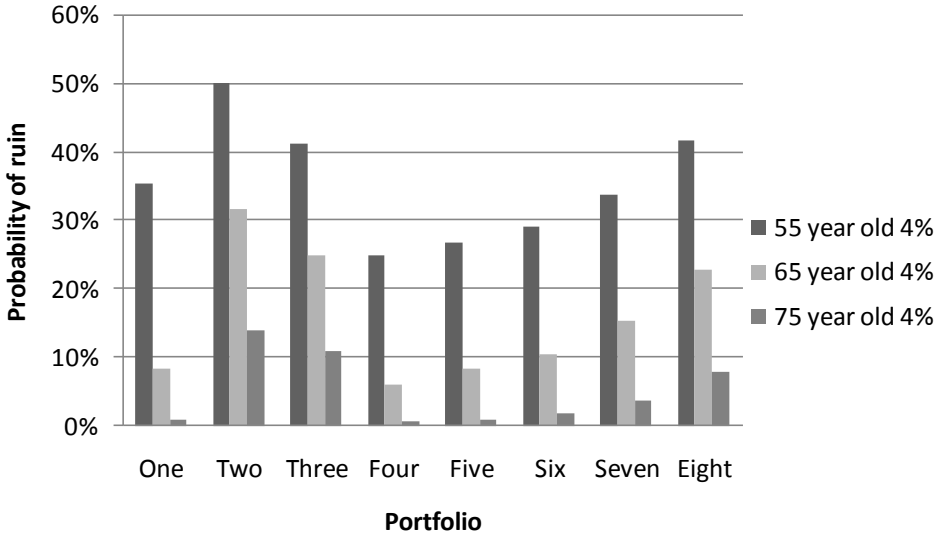

Figure 5. Comparison of probability of ruin for different ages across different portfolios

6.17 The figure illustrates that as the age at which the living annuity is purchased, increases, the probability of ruin decreases. The plot for the 75-year-old investor is the lowest, then the 65-year-old investor and finally the 55-year-old investor. This intuitively makes sense as the older the person is, the less time the income from the living annuity needs to last.

6.18 It appears from the figure that a drawdown rate of 4% for a female investor aged 75 is sustainable for life provided a probability of ruin in the vicinity of 10% and less is considered satisfactory. For an investor aged 65, there are three portfolios with a probability of ruin less than 10%. For a 55-year-old investor, none of the portfolios appear to be sustainable for life.

6.19 This figure also illustrates the effect of portfolio choice on the probability of ruin. For the three ages, the rankings of the portfolios from lowest probability of ruin to highest probability of ruin are similar. In all cases, the best performing portfolio is portfolio four. Portfolio two, with 100% invested in equity produces the highest probability of ruin in all cases. These results suggest that the age of the investor has little impact on the choice of a suitable portfolio. However, whereas portfolio one comprising 100% in long-term index-linked bonds provides the second-lowest probability of ruin for an investor aged 65 or 75, for a 55-year-old investor, this portfolio has the fourth-highest probability of ruin.

6.20 The distribution of the time of ruin given the investor was ruined is shown in Figure 6 for portfolio one. Graphs for a 55-year-old investor, a 65-year-old investor and a 75-year-old investor are shown. The older the investor, the more the distribution lies to the left suggesting an earlier time of ruin. The same graphs are plotted against the age at ruin in Figure 7. In this case, the older the investor, the more the distribution lies to the right. The two figures may be understood by realising that for an older investor, the starting age at retirement is higher and thus he or she is expected to be ruined at a later age even though in years the investor is expected to be ruined sooner.

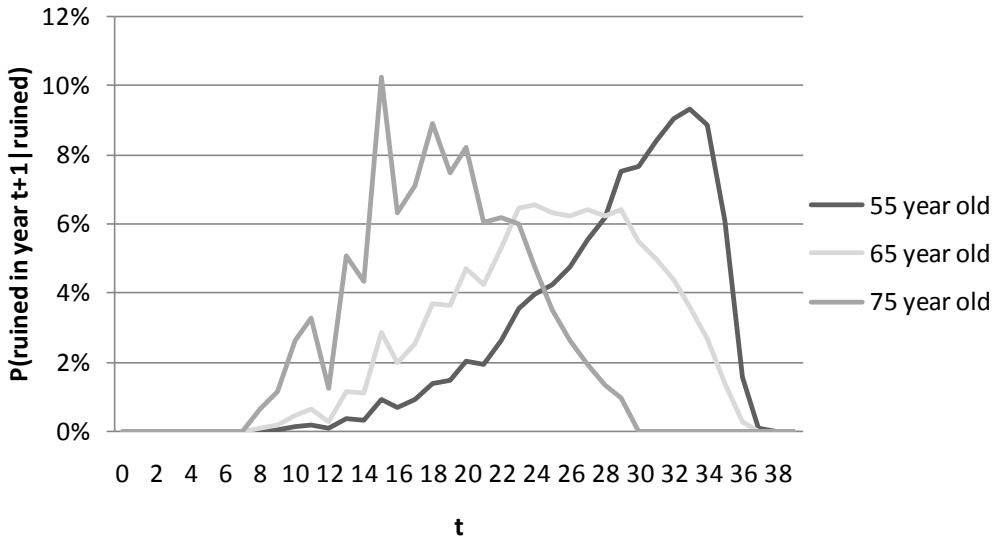

Figure 6. Distribution of the time of ruin given the investor is ruined for portfolio one and a drawdown rate of 4%

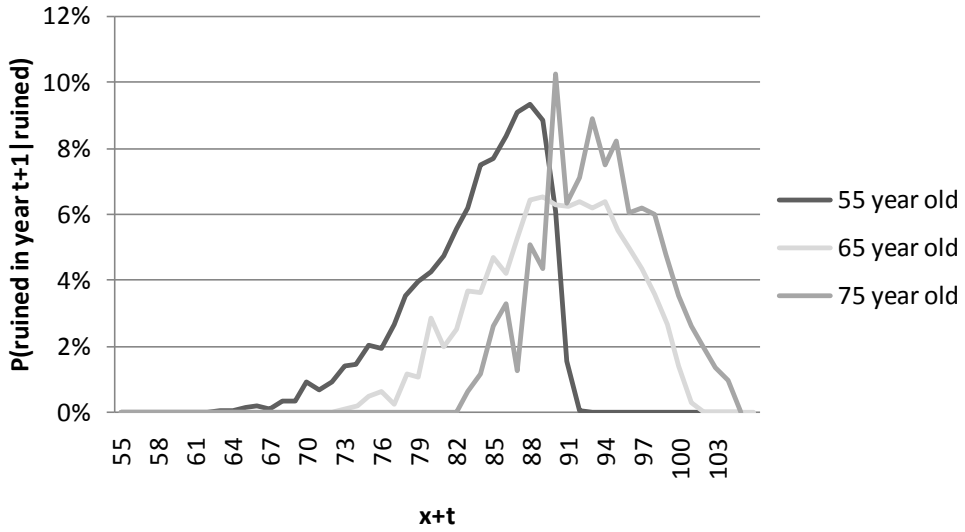

Figure 7. Distribution of the age at ruin given the investor is ruined, for portfolio one and a drawdown rate of 4%

6.21 The model is rerun for portfolios two and five for a 75-year-old investor drawing down at 5% a year. These two portfolios were the worst-performing portfolio and best-performing portfolio respectively for a 65-year-old investor drawing down at 5% a year. Table 4 shows the results obtained. The probabilities of ruin are lower than for a 65-year-old investor. If a probability of ruin of 6,31% is considered to be satisfactory, then a 5% drawdown rate may be sustainable for a 75-year-old provided an appropriate portfolio is chosen.

	Portfolio Two	Portfolio Five
Probability of ruin	22,71%	6,31%
Average time of ruin	11,5	18,5
Average age of ruin	86,5	93,5

Table 4. Results for portfolios two and four for a 75-year-old investor drawing down at 5% a year

6.22 The model is rerun assuming that $B_0 > M_0$. In other words, the investor is drawing down at an initial rate higher than the minimum income required. The aim of this run of the model is to test how sensitive the results are to the assumption that the investor draws down her minimum income from the outset. It is unlikely in practice that an investor would draw down at the bare minimum on which she can live, but rather would seek to augment the income by drawing down at a higher rate. In this case, it is assumed that $M_0 = 4\%$ and $B_0 = 5\%$. Table 5 displays the effects this has on the probability of ruin and the average time of ruin.

Portfolio:	One	Two	Three	Four	Five	Six	Seven	Eight
Probability of ruin B_0=4%	8,44%	31,71%	24,87%	6,13%	8,47%	10,54%	15,31%	22,92%
Probability of ruin B_0=5%	12,31%	33,44%	26,43%	8,84%	10,99%	12,96%	17,50%	24,91%
Increase in probability of ruin	45,90%	5,45%	6,29%	44,21%	29,78%	22,98%	14,27%	8,65%
Reduction in years of average time of ruin	0,1	0,1	0,1	0,1	0,3	0,2	0,2	0,1

Table 5. Effects of drawing down initially at a higher rate than the minimum income

6.23 As may be seen, by drawing down initially at a higher rate than the minimum income, the probability of ruin has increased. In this particular case, the probability has increased the least for portfolio two and the most for portfolio one. The ranking of the portfolios does however stay the same, except for portfolios one and five that switch places. The implication however is that regardless of whether the investor draws down initially at 4% a year or 5% a year, portfolio four is still the most appropriate portfolio. The average time of ruin has also fallen by 0,1 years to 0,3 years depending on the portfolio chosen, suggesting that on average, the investor will run out of money sooner.

6.24 The sensitivity of the results to the assumption that the minimum income remains constant in real terms needs to be tested. This is done by running the model assuming M_t grows at 1% and comparing the probabilities of ruin to the case where the growth in M_t is constant. The age of the investor is assumed to be 65 and the drawdown rate is 4%. The reasoning behind the possible growth in M_t was discussed in ¶5.7 above. Table 6 shows that the probabilities of ruin increase, and for portfolios one, four and five, the increase is over 100% i.e. more than double the case with zero growth. The average time of ruin and hence the average age of ruin has also reduced.

	Portfolio:	One	Two	Three	Four	Five	Six	Seven	Eight
Probability of ruin	Growth=0%	8,44%	31,71%	24,87%	6,13%	8,47%	10,54%	15,31%	22,92%
Average time of ruin		25,81	15,51	15,64	25,97	24,56	22,99	20,73	17,99
Probability of ruin	Growth=1%	21,90%	37,13%	30,47%	16,46%	17,49%	19,13%	22,93%	29,55%
Average time of ruin		23,9	15,1	15,6	24,5	22,9	21,9	19,8	17,4
Increase in probability of ruin		159,5%	17,1%	22,5%	168,4%	106,5%	81,6%	49,8%	28,9%
Reduction in years of average time of ruin		1,9	0,4	0,0	1,4	1,6	1,1	0,9	0,6

Table 6. Effects of growth in minimum income on the probability of ruin and the average age of ruin for an investor aged 65 who is drawing down at 4% a year.

6.25 Since the model is formulated using the percentage growth of the fund and the rate at which income is drawn down, it makes no difference what initial starting capital the investor holds. Whether an investor has R1 000 000 or R10 000 000, the performance of the different portfolios will be exactly the same provided she draws down at the same rate. Therefore, the investor with the higher fund value of say R10 000 000 will have a lower probability of ruin if she draws down the same amount of income in monetary terms, which will be a lower percentage of the fund.

7 CONCLUSION

7.1 The paper has reported on financial advisers' views on the advisory process used when selling living annuities and subsequently managing them. This included aspects such as the methods used in assessing the risk appetite and needs of the investor as well as the advice given on appropriate investment and drawdown strategies for the investor. In general, advisers recommended not drawing down more than 5% to 8% a year if the living annuity provides the client's sole source of income.

7.2 Advisers expressed their opinions on the reasons why living annuities are mis-sold and offered suggestions on how to reduce mis-selling. Advisers also highlighted the difficulties in determining appropriate asset allocations and rebalancing the portfolios regularly. The quality of advice given to investors did not seem to depend significantly on the level of qualification of the adviser.

7.3 Some advisers use models to determine appropriate investment strategies and drawdown rates for their clients, whereas others do not and hence rely more on their experience. A balance needs to be struck between choosing an appropriate asset allocation to meet a particular income target while still considering the risk appetite of the investor.

7.4 An advantage of a living annuity is that on death, it allows the fund to be bequeathed to the dependents of the client. It was discovered that this motive to bequeath played a role in encouraging clients to buy a living annuity instead of a conventional annuity. However, in

general, it did not affect the portfolio allocation and drawdown strategies in that a client would draw down less than required so as to leave a larger capital value on death.

7.5 A model that determines the probability of ruin was presented. In the model, ruin was defined in terms of the minimum income an investor requires. The model allowed for mortality and utilised investment returns on equity, long-term index-linked bonds, long-term conventional bonds, short-term conventional bonds and short-term index-linked bonds. Eight different investment portfolios were tested. The results of the model suggest that for an investor aged 75, a drawdown rate of 4% a year is sustainable. In some cases a drawdown rate of 5% a year is also sustainable. For a 65-year-old, a drawdown rate of 3% is sustainable for most of the tested portfolios. A drawdown rate of 4% a year is also sustainable for portfolios one, four and five assuming the investor is satisfied with a probability of ruin less than 10%. These rates are lower than the drawdown rates suggested by the advisers as being sustainable. The reason for this may be that advisers recognise that most investors have lower risk-aversion than that implied by the minimisation of the risk of default.

7.6 The results from the model showed that as the drawdown rate increased, the probability of ruin increased. As the age of the investor increased, the probability of ruin decreased. As the drawdown rate increased, the average age of ruin tended to decrease. The results also suggested that as the drawdown rate increases, the investor should invest in a portfolio with a larger holding in equity. Regardless of the age of the investor at retirement, if the investor is drawing down at 4% a year, portfolio four, comprising a range of bonds, produces the lowest probability of ruin. There is scope for further research on the investment returns to use in the model. In particular, absolute-return funds need to be modelled in order to test whether their inclusion in the portfolio can reduce the probability of ruin.

7.7 The output of the model suggests that the results are sensitive to the assumption that the minimum income remains constant in real terms. The decision of whether the minimum income should be constant in real terms relative to price inflation or perhaps to a higher medical inflation rate depends on what the client's future expenditure and medical needs are likely to be. Although it is unlikely that all the client's expenses will be medical expenses, as the client ages, an increasing proportion of his or her expenses may be medical expenses. The probability of ruin increased and the average age of ruin decreased when growth was assumed to be 1%.

7.8 The balanced portfolios, which the advisers suggest, often performed poorly relative to a pure bond or equity portfolio. The diversified portfolio, with equal weightings in each asset class, was the portfolio with the lowest probability of ruin only in the case of a 65-year-old investor drawing down at 5% a year, suggesting that an improvement can generally be made on simply allocating equal amounts to the different asset classes.

7.9 The model has identified which portfolio of those tested performs best. The question needs to be raised, however, whether a portfolio can be found that minimises the probability of ruin i.e. an optimal investment strategy. To find an optimal strategy may involve trial and error in testing a number of different portfolios in a systematic way. This is an area for further research.

7.10 The comments made by brokers have highlighted further areas where research may be of benefit. In particular, it may be investigated if there is an optimal time to convert a living annuity into a conventional annuity. In addition, the question of whether an investor should buy both a conventional annuity and a living annuity at retirement needs to be

answered. If both should be bought to produce the most appropriate strategy for the client, then the proportion of the client's funds that should be invested in each type of annuity needs to be determined. Models that attempt to answer these questions may be useful to advisers.

7.11 Advisers may use the model developed in this paper to determine an appropriate investment strategy and drawdown rate for their clients. By identifying the target rate of income required, the fund may be invested to reduce the probability of ruin. This is a practical model that may help advisers in providing advice on living annuities.

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APPENDIX A
QUESTIONNAIRE ON LIVING ANNUITIES

Number:___

Questionnaire administered by Lauren Beinash, an honours student in the School of Statistics and Actuarial Science at the University of the Witwatersrand. Tel: 011-786-8360. Cell: 082-745-3018. E-mail: beinashla@gmail.com

1. What proportion of your total annuity sales do living annuities comprise?

<10%	10%-20%	20%-30%	30%-40%	40%-50%	50%-60%	60%-70%	70%-80%	80%-90%	>90%

2. What proportion of your clients who seek advice on a living annuity actually buy it? What would make them decide not to buy it after seeking advice?

3. How are the needs of the investor assessed?

4. How is the risk appetite of the investor assessed?

5. What investment choices are offered to investors, for example portfolio funds, and are results from past performance shown to investors when suggesting a certain investment strategy?

6. How are the risks of the different investment strategies expressed to the client?

7. How is the risk of longevity expressed to the investor?

8. Do you explain the differences between a living annuity and a conventional annuity?

9. Are limitations advised as to a maximum possible drawdown—not just legally but depending on the investor's income, targets etc.? Is advice given on this matter?

10. What do you feel are the most important factors that should be taken into consideration when suggesting a drawdown rate?

11. What is the distribution of drawdown rates for the living annuities you have sold?

12. Do you find that these rates provide an adequate balance to allow the client to draw sufficient income now as well as having an annuity for life?

13. Do you feel it is your responsibility to limit the withdrawals to sustainable levels? If so, why? If not, with whom do you think the responsibility lies?

14. Is a mathematical framework used to suggest the optimal investment strategy and drawdown rates?

15. If a mathematical framework is used, can you please describe how it works, what shortcomings it has and if it is being improved. If a mathematical framework is not used, why not? Do you feel one should be used?

16. Do you think that an analytical tool used to calculate the probability of the investor reaching financial ruin under different drawdown strategies may be useful when advising the investor?

17. Is the bequest motive formally accounted for in the investment strategy and allowable drawdown rates?

18. Are living annuities generally bought with the desire to later annuitise when more favourable terms are available? Is this explicitly allowed for when advising the investor?

19. Do you feel the qualifications and training that financial advisers receive, adequately prepare them for selling living annuities?

20. Do clients easily understand how a living annuity works?

21. What do you do if your client is financially unsophisticated and may not realise the implications of the information disclosed? For example, if fees are disclosed, is it emphasized to investors what the impact of these fees on their real return and monthly income is?

22. To what extent does advice continue to be given once the policy has been taken? For example, are the strategies analysed periodically to see if the investment and drawdown rates need to be adjusted for the investor to meet his/her needs? Do you think the client would benefit from ongoing advice on the investment and drawdown strategies?

23. Do you feel there is a need for the advisory process to be improved and if so what steps can be taken to do this?

24. Will you sell a living annuity if you have advised against its appropriateness for the investor but the investor insists on it?

25. Directive 135 discusses the transfer of the funds to a different administrator. When transfers occur, for what proportion of the time is this by the request of the client or by your own recommendation?

26. What do you feel are the issues that are causing living annuities to be mis-sold?

27. Do you feel that the advantages of living annuities are being lost as a consequence of the stricter requirements on the advisory process, for example, are suggested investment strategies becoming too conservative?

28. Are there any additional comments that you would like to make?

29. Would you like to receive a copy of the research report when completed?

30. If I have any more questions or need clarification, may I please contact you again?