somewhat
different

When calculating an annuity value medical and lifestyle factors must be taken into account

# Underwritten annuities: How to price a fair annuity

Why annuities?

It has become common knowledge that life expectancy is rising and social security systems alone cannot guarantee security in old age. However, if asked, most people underestimate both their life expectancy and the amount of funds needed to provide an income for life. Therefore, to maintain a standard of living and to safe guard against old-age poverty, at least a portion of available funds at retirement should be invested in a retirement product. The insurance industry has the solution to meet these needs: annuities.

Standard annuities provide a guaranteed series of life-long payments in exchange for an upfront amount. There are many variations on this concept, with the overall intent to provide a comfortable level of income for life.

However, when insurers offer standard annuities, consumer rates are mostly only differentiated by age, and in some cases by gender, as permitted by local market regulations. As such, insurers generally expect only healthier lives to purchase an annuity – unhealthy lives are not likely to purchase an annuity if they know they don't have long to live – reducing the income insurers are prepared to guarantee.

Fig. 1 The concept of annuities

Annuity: life-long payment

Single premium: lump sum payment
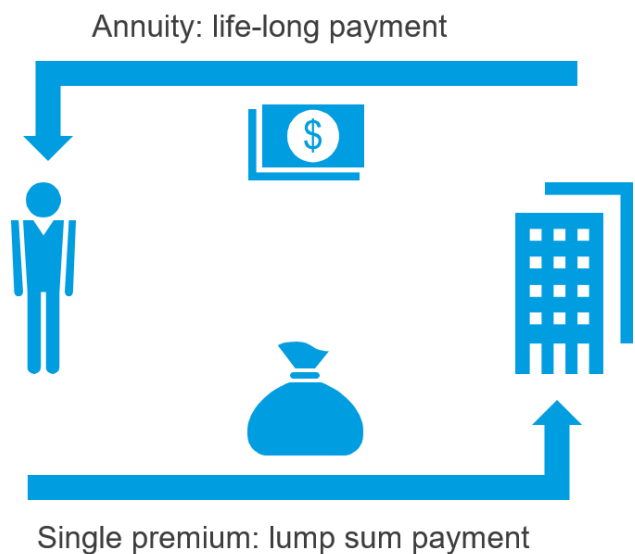
What appears to make sense on the one hand, can on the other hand also be perceived as being unfair. How do these products work for people with health issues? When purchasing an annuity, someone with health issues should not be offered the same annuity amount as someone who is super healthy. Nor should someone with a health issue pay the same insurance premium for a life insurance policy,

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as a super-healthy life. Furthermore, as higher socio-economic classes have a higher life expectancy, it could also be argued that annuities are possibly subsidised by the lower socio-economic classes, assuming both groups are offered the same price.

The solution

Flip underwriting as we know it to create underwritten annuities (or known in the UK as enhanced annuities). This variation on a standard annuity takes into account the health issues of a customer and provides an annuity reflecting their individual life expectancy. An underwritten annuity offers higher regular income to applicants who are not in good health, and who in all likelihood have a lower average life expectancy. It's underwriting, in reverse. Everything you know and do as an underwriter, when it comes to underwritten annuities, you effectively do the opposite. A history of cancer that will still qualify for life insurance? Offer them a higher annuity payment. The same applies to many other conditions.

In order to be fair, each and every medical or lifestyle component, which influences life expectancy, is taken into account. On the one hand, it is appreciated that an annuitant who suffers from cancer receives a higher life-long annuity while on the other hand an annuitant who smokes may also be "rewarded", as this also reduces life expectancy.

In the UK, enhanced annuities have proven to be a huge success. In recent years, annuity regulations were changed and the tax incentives for buying an annuity were withdrawn. That said, there is still a sizable market for enhanced annuities as people are keen on ensuring that they do not outlive their retirement savings.

Today, automated underwriting systems providing guaranteed quotes at point of sale are the market standard in the UK. The systems gather information via a questionnaire commonly agreed upon by the providers of enhanced annuities. This questionnaire asks general health questions and is set out in terms that can easily be understood and answered by the customer. This is then evaluated by the system and an annuity offer is made on the spot.

Assessment of risk

As with life insurance, when it comes to underwritten annuities, the assessment of life expectancy is key. There are many factors influencing life expectancy, the most obvious being diseases. What also comes into play are educational and behavioural issues. With a higher education, income is generally higher, access to medical treatment is better, there is a improved understanding of disease management (e.g. diet in diabetes) and thus life expectancy is above average.

What makes the calculation of underwritten annuities special is the combination of medical and actuarial expertise. Not only actuarial statistics of life expectancy but also medical expertise in assessing specific illnesses and their development over time are crucial.

While in the early days of underwritten annuities in the UK fixed multipliers were applied to a standard annuity table, today the approach is much more sophisticated. Survival curves are important and one example for modelling is the use of probability functions. Based on medical research, survival probabilities at a certain point in time are derived and survival curves are developed through actuarial methods.

Once the policy is issued, the insurer would have the right to check the disclosure as to discourage over-disclosure. Typically, only a sample of policies are reviewed, in most cases no findings are found, and the policy can be re-confirmed.

If there are issues with the disclosure, the insurer might vary the rate (up or down) or potentially cancel the policy.

Illustration

For example, look at the two diseases colon cancer and diabetes. Cancer is a disease most deadly in the early years of diagnosis, whereas diabetes is a progressive disease with death occurring at a later stage. When calculating an annuity value (the discounted value of life-long annuity payments) one has to take into account the special shape of the survival curves of these diseases.

Fig. 2 Survival curves for different conditions
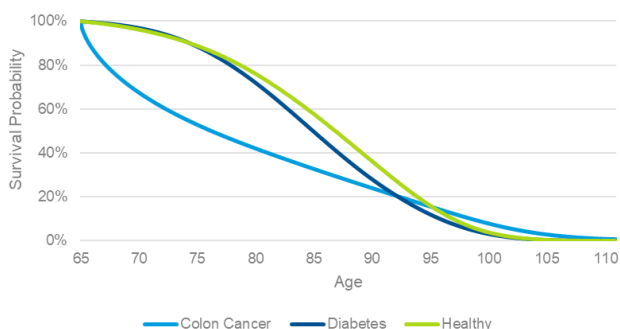
Based on medical research and evaluating medical literature and statistics, an excess mortality (hazard ratio) is assessed and translated into reduction in life expectancy compared to standard mortality. To reflect the different progression of diseases, the survival curves have to be modified in a way that can easily be expressed and at the same time reflect the true shape of the diseases. In order to do so, a probability function, e.g. a Weibull distribution is used and two points in time are determined to define the shape of the curve: the Estimated Life Expectancy (ELE) and Maximum Probable Life Expectancy (MPLE). The ELE is the probability that 50% of the cohort survive this time, while the MPLE is the probability that 10% of the cohort survive this time.

For the colon cancer case in our example in Fig. 2 the ELE is 10.7 and the MPLE is 29.9 compared to the ELE of 24.8 and MPLE of 35.1 of a healthy person reflecting the higher mortality of colon cancer in the early years. Looking at diabetes the ELE is 18.8 and the MPLE is 27.8 reflecting the progressive nature of diabetes. Based on these survival functions the annuity values are calculated and result in our examples in Fig. 3 (@1.5% interest rate) in 12.1 for the colon cancer case and 16.9 for the diabetes case, respectively. For comparison: the annuity value of the healthy case is 19.7.

Out of a wide range of diseases covered, illustrated in Fig. 3 are two typical examples demonstrating the potential impact on the annuity value. All examples are simplified cases based on a standard annual annuity of EUR 1,000.

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[1] Diagnosis one year ago, tumour invaded adjacent lymph nodes

Fig. 3 Typical examples demonstrating the impact on the annuity value

	Healthy	Standard	Diabetes Type 2 Tablets	Colon Cancer[1]
Annuity in EUR	970	1,000	1,140	1,590
Increase/decrease relative to standard	-3%	0%	14%	59%

In a market where no underwritten annuities are sold, the so-called standard annuities are a blend of ill and healthy lives. When calculating annuity values for underwritten annuities it has to be taken into account that there are no longer standard cases in this portfolio. As each and every case will be underwritten there is a rating for every case. This means that cases with no impairment are considered "healthy" and will receive a lower annuity than a standard case.

Furthermore, the usual aspects of pricing also hold true for underwritten annuities: socio-economic effects and selection factors. Socio-economic effects reflect that higher income groups tend to have a longer life expectancy whereas selection factors reflect that those people who are considering buying an annuity are usually healthier and live longer than those who do not.

In combination, underwriting, socio-economic effects and selection factors reflect the fair price for a life-long retirement income.

Final thoughts

An underwritten annuity is tailored to individual life expectancy and offers fair value for money. When retiring, no one knows how long they will live and the risk of outliving the retirement savings can be mitigated for a fair price by an underwritten annuity.

We do not sell life insurance without underwriting, as that would increase the cost to healthy policyholders. Equally, sick annuitants should not bear the high costs of the super-healthy, therefore we must underwrite annuities.

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