Pricing a Single Premium Immediate Annuity

Many editorials have been devoted to the need for a protected income stream in retirement and the public’s reluctance to annuitize savings. There are many reasons for this aversion: loss of liquidity, preference for mutual funds, a lack of focus on outliving assets, etc. As a result, annuities generally are sold as asset accumulation vehicles that rarely enter the distribution phase.

In recent years insurers have begun addressing product design to increase the attractiveness of annuitizing at least a portion of a retirement lump sum. Consequently, consumers may begin to appreciate lifetime income as a way to address their individual longevity risk. If an insurer has not already developed an annuity product to meet this growing need, now may be the time.

The question then becomes how to price a SPIA or income from a deferred annuity properly. There are three main components to pricing:

1. Net interest rate for a fixed annuity or the mortality and expense/rider charges for a variable annuity
2. Base mortality table
3. Mortality improvement assumption

Net Interest Rate

The interest rate used for discounting future annuity income benefits is made up of two components: the gross yield assumption and the expected spread. The gross yield assumption can be developed using a portfolio rate, new money rate or investment generation method. Regardless of the approach used, one should work very closely with the investment department to determine an accurate projection of the yield associated with the current asset allocation.

Once a company determines its gross yield, it subtracts its expected spread to calculate the net interest rate. The spread covers expenses (administration, acquisition, investment, etc.), expected defaults, cost of capital (whether based on RBC or company specific internal model), as well as profit margin. While RBC currently does not have a longevity component in C2, it is only a matter of time before one is added. Thus it makes sense to build longevity into annuity pricing now.

Base Mortality Table

A base mortality table is a company’s view of current mortality. Because unhealthy people are unlikely to buy an annuity, expected
mortality should be significantly better than the general population. The best approach to developing a table is by using actual company experience. While we prefer to build an attained-age table from raw mortality rates, it is perfectly acceptable to perform an A/E study against an industry table and then apply adjustment factors to the table to reflect a company’s own experience (via scalars or setbacks). With enough credible data a pricing actuary can also layer on adjustment factors based on the relative size of annual annuity income and/or other information such as the existence of any guarantees.

Unfortunately, most insurers do not have credible internal experience to build their own robust payout annuity table. Annuity actuaries can use one of the annuity tables published by the Society of Actuaries as an alternative. Annuities are not underwritten so an industry table is likely to be a better fit for an annuity product than for life insurance, where a company’s underwriting guidelines can greatly affect experience. However, companies must still factor how their preferred distribution channel and target clientele choices may affect their table construction.

Historically, most companies have used the Annuity 2000 Table as the standard (with many applying a company-specific overlay). It is important to note that this table is based on dated information, a product of the 1983 A Table improved to 2000 using Projection Scale G (50% for females). Even if annuity experience is relatively similar, the table would be considered current only as of 2000, and needs to be generationally improved to an annuity’s issue date.

Recently the SOA published a new table for payout annuities called the 2012 Individual Annuity Mortality (IAM) Table. This table was developed from a prior SOA study on payout annuities covering 2000-2004, and then improved to 2012 (see Figure 1 for a comparison). Based on the company’s annuity design (e.g., refund feature, liquidity provision), one can use adjustment factors from the SOA 2000-2004 Individual Payout Annuity Experience Report to make modifications to the 2012 IAM Basic Table.

**Mortality Improvement**

Mortality tables must reflect mortality improvement or they will be out-of-date before they are even used. First we must generationally improve the mortality table to the annuity issue date. We also need to layer in periodic mortality improvement for each future calendar year to project future mortality rates. For example, to project the attained-age mortality rate at age 70 for an annuitant who purchased an annuity at age 65 in 2013, we would modify the 2012 IAM Table as follows:

\[ q_{70} \times (1 - MI^{2013-2012}_{\text{generational}}) \times (1 - MI^{70-65}_{\text{periodic}}) \]

There are many schools of thought regarding mortality improvement. Historically, many insurers used the SOA's Projection Scale G. The SOA has since published two new scales for US business. Projection Scale G2 was published in tandem with the 2012 IAM Table. This version was developed by modifying rates developed by Social Security Administration (SSA) actuaries, who derived the rates based on SSA experience.

In addition, the Pension Section of the SOA recently published Projection Scale BB. This scale uses past US population experience, projected forward using the Continuous Mortality Investigation tool developed in the UK for projecting improvement on a calendar year basis. The scale was developed by present-valuing the calendar year projection into a single vector of improvement rates.

However, traditional methods have consistently underestimated improvements in longevity. Both scales show significantly lower improvement than what was experienced during 2000-2010 (Figure 2).

**Approaches popular outside the US include:**

1. **Extrapolative Methods**
   a. Targeting methods, which interpolate between current mortality rates and a set of target rates assumed to hold at a certain future date (based

![Figure 2 - Mortality Improvement Scales](image-url)

Mortality improvement assumptions can vary noticeably depending on the improvement scale the pricing actuary uses as the company basis.
b. Trend methods, which involve projection of historical trends in age-specific mortality. This includes parametric models which involve fitting a parameterized curve (or surface) to past mortality data (aggregate or cause specific) and then projecting these parameters forward.

2. Explanatory methods, cause-of-death and disease-based models relying on medical expert opinion, government health policy, socio-economic development, etc.

Annuity pricing does not require many assumptions, but developing a credible set is still complicated with multiple options and likely little credible experience. Given the long-tail nature of annuities, a carrier will only know whether pricing assumptions were valid after years of accumulating data (and business). Many stakeholders view this uncertainty negatively.

Life companies may wish to share some of the risk, which would allow them to grow assets in a risk-controlled environment. A reinsurer can partner with insurers in pricing annuities and participating on the risk. For example, longevity swaps are an easy tool to reduce exposure to mortality table basis error and the risk of underestimating future mortality improvement, with no up-front premium. Our sales and pricing staff look forward to discussing how we may help you manage the risk of your payout annuity block.