

## **7. Modeling Considerations**

Actuarial appraisals are performed using discounted cash-flow models. Using local market insurance accounting standards, an appraisal model typically assumes annual after-tax distributable earnings that are repatriated to the investor. The various lines of business are modeled and validated individually and presented in separate sections of the appraisal report before being aggregated into a total company model. General considerations in constructing appraisal models and specific considerations by line of business are presented below.

### **7.1 Valuation Date**

The valuation date is chosen by the external actuaries and investment bankers and is usually the most recent quarterly reporting period. However, as interim reporting is often less rigorous than annual reporting and usually unaudited, year-end valuation dates are usually preferable to other periods.

Sell-side appraisals may take anywhere from two to six months or more to complete. This extended timeframe may put the most recent reporting period well beyond the valuation date. In this case, there are two alternatives—change the valuation date and update the model, or review the model to ensure goodness of fit at the most recent reporting period. There are valid reasons for either approach, but the decision typically comes down to time and budget. For a complicated model, it is generally easier to keep the validation date the same and ensure that the cash flows coming out of the model reasonably track reported numbers. This approach has the added benefit of dynamic model validation on both a historic and prospective basis.

### **7.2 Years of New Business Production**

The purpose of modeling new business is to estimate the value of the distribution channel. Various forces can affect the amount of money a willing buyer is willing to pay a willing seller for a distribution channel. Considerations include the age of the company, the stability of the market and the relative bullishness of local market sentiment.

In an appraisal model, the value of the distribution channel is captured in the premium production levels (discussed in section 6.2) and the years of new

business production modeled. New business projection periods of 10 years are commonly used for the base case. Typically, sensitivities are presented with different production periods to provide investors with a sense of both a range of potential value for the distribution channel and the degree to which the profitability of new business is weighted towards the beginning or end of the projection period.

Another approach is to project one year of new business production and allow potential investors to make their own determination of value attributable to new business. While this allows bidders to craft their own projections, it provides less information about the seller's expectations. This approach may not be appropriate in situations where the macro-economic assumptions, product mix or product margins are expected to change materially over time.

### **7.3 Individual Life**

Individual life is typically modeled in actuarial software using representative cells based on the in force as of the valuation date. The seller's valuation area passes a policy level or grouped extract to the external actuary to build the model. Cells are constructed to speed model run time and increase flexibility without materially changing the profit signature. Individual policies are mapped to representative products, issue ages, durations and policyholder characteristics (sex, face amount, rate class, etc.) in such a manner that the size and run time of the model are reduced without compromising accuracy or robustness.

Representative cells should be validated at the policy level to ensure policy mechanics are properly replicated. For UL policies, illustration systems are commonly used as the benchmark. For traditional policies, if reserves and non-forfeiture values are provided by the company (the preferred approach), validation is an administrative chore. However, if reserves and non-forfeiture values are instead being calculated by the actuarial software, the task is decidedly more challenging and involves more back and forth between the external actuaries and the company's actuaries to work out the details of the calculations.

In order to measure the value generated by a block of individual life business and associated new business production, a projection period of 10-20 years beyond the last-date new business is assumed to be issued and is generally

appropriate. The decision ultimately depends on the materiality of the profits in the product tails and the level of the discount rates used.

#### **7.4 Individual Life Riders**

Riders and built-in benefits can make up a significant proportion of premium in developing markets and an even greater percentage of profits, as rider pricing typically assumes that expenses are covered by the base policy. Riders are often sold on a package basis along with the base policy. As such, reported claims can be quite low, as the policyholder may not understand their benefits or even know that they have coverage. Thus, it is important that the external actuary pay close attention to the riders to accurately capture the full profitability of the line.

Rider benefits run the gamut from lump-sum benefits based on complicated eligibility criteria to disability income/hospital indemnity-type benefits to waiver of premium benefits. Lump-sum benefits can be modeled using standard techniques of incidence rates times benefit amount. Income benefits may be modeled similarly if the external actuary can accurately estimate the single premium reserve needed to fund the future benefits. The single premium thus calculated can then be substituted for the benefit amount as described above.

Unfortunately, although the profit contributed by riders is very high, the amount of management attention paid to them locally is often minimal (perhaps for that very reason). Often, they are priced using outdated tables from the United States or other markets as a proxy. Experience data can be very hard to obtain due to minimal statutory and management reporting requirements. The external actuary must be both creative and disciplined to model rider profitability with the same degree of accuracy as the base policy.

If rider claims and premiums can be isolated, then it is generally appropriate to model riders using loss-ratio techniques either on a bulk basis in spreadsheets or in actuarial software substituting age-dependent incidence rates for an equivalent loss ratio. The latter approach is generally preferable, as the degree of accuracy generating future rider premiums and income for the base case and sensitivities can be compromised if the riders are run separately from the base model cells.

## 7.5 Annuities

Modeling annuity business in markets with privatized Social Security systems can be extraordinarily complex. Mexican annuities, for example, can have unlimited beneficiaries that must be modeled prospectively on a multiple-life basis. The permutations of beneficiaries, ages and benefit levels is far greater for multiple-life annuities than on a typical individual life portfolio, while the number of policies in even a large block of annuity business is far smaller than for a life portfolio with comparable reserves. Because of this, constructing a cellular annuity model that appropriately captures the profit signature of an annuity block of business going forward is *reductio ad absurdum*. For this reason, seriatim projections are generally used.

Likewise, it is not possible to capture the profit signature of a complex multiple-life annuity using models constructed with only single- or joint-lives. While it is possible to solve for a joint-life distribution that validates at time zero, future cash flows and reserves generated by such models can be materially inaccurate.

Validating the complex interactions of an annuity projection is a far more difficult task than validating an individual life model. There are no illustration systems comparable to an individual life fund accumulation product. This is an important start in replicating initial reserves but, as mentioned earlier, it is no guarantee of reasonableness going forward. While an initial model discrepancy of 0.5 percent versus published financials is excellent for individual life, due to the sheer size of annuity reserves and the potential impact on future profits, greater accuracy is required.

As of the date of this paper, there is no production software specifically geared towards projecting these types of annuity reserves and cash flows. Company projection models, if they exist at all, are custom built in spreadsheets or C++ programs. There are many more decisions in calculating prospective annuity reserves than calculating static time-zero reserves. Hence, there are more possible discrepancies between the company's methodology and the external actuary's. The key is to develop a methodology that all parties feel comfortable with and can defend. More detailed disclosure of the methodology and assumptions used by the external actuary is needed for this line of business.

The reserves remaining at the end of a 20- or even a 30-year projection may still be material because there are no lapses on these types of products.

Thus, in order to measure the value generated by a block of annuity business and associated new business production, a projection period of 30-40 years beyond the last date that new business is assumed to be issued may be required. Because of the long duration of the liability and the sensitivity of the value to projected earned rates, it is critical to accurately reflect current asset positions in the model and project a coherent investment strategy going forward with realistic investment yields.

## **7.6 Other Lines**

Companies in developing markets are often multi-line operations. In addition to life and annuity, the external actuary may be required to model various types of group, property and casualty (P&C), health or asset accumulation products. Sometimes a product or line of business may be unique to a market and there may be little or no experience in modeling that line outside of that market. In these instances, the external actuary must again be both creative and disciplined to understand the business well enough to create suitable modeling techniques as well as determine appropriate assumptions for the key drivers of value in order to project the profit signature.

Spreadsheets may be appropriate for loss-ratio lines and asset accumulation products, although modeling using actuarial software provides the advantages of consistency and flexibility when consolidating results and performing sensitivities. On the other hand, spreadsheet models can be perfectly adequate, and the dictates of time, budget and availability of data may force the decision of one platform over the other. As it is difficult to separately identify new and existing business on annually renewable policies, the convention is to present them together.

The determination of loss ratios, commissions and expense levels for P&C business is more of an art than a science. Market cycles can drive profitability levels of P&C lines to a far greater extent than on life business. The degree to which reported experience can be relied upon depends entirely on the accuracy of company data systems, which are often not up to the task. Particularly in Latin America, inflation can quickly render historic premium and claims data meaningless, if this data is even maintained at all. Ultimately, the goal is to model profit margins that are reasonable in the long term, taking into account the current and expected degree of competition in the market.

## **7.7 Reserve Review**

The appropriateness of starting balance sheet items such as unearned premium reserves, claim reserves and IBNR is often a source of controversy in the sales process. Developing markets can have statutory requirements or company practices that differ widely from international standards.

It is in the best interest of the seller to have an external actuary review the sufficiency of these reserves. The analysis is almost always performed in a report separate from the actuarial appraisal. The determination of adjusted book value in the actuarial appraisal then relies on this analysis to adjust initial surplus up or down, depending on whether the external actuary's assessment of appropriate reserve levels is lower or higher than the reserves held on the company's balance sheet.

From the standpoint of preparing the data alone, this is an important exercise. Any potential investor will want an assessment of these types of reserves. It is advisable that the seller not be caught unable to produce the data required for this type of analysis, as this would have negative implications to the buyer about the management of the business and its potential value.

After these adjustments, the reserve run-out in the model is assumed to be without profit or loss other than interest earnings. The calculation of the IBNR reserve typically provides the claim payout pattern for use in the projections, which drives IBNR levels going forward.

## **7.8 Sensitivities**

The results obtained using the assumptions described in the actuarial report are referred to as the base case. While the base case scenario is developed in conformity with what the seller's team believes to be the best estimate, actual experience will certainly vary from these assumptions.

A range of sensitivities is typically provided for each line of business to demonstrate the effect on value of variations in key assumptions. The sensitivities and their ranges are chosen to assist potential investors in evaluating the effect on results of deviations in future experience from that assumed in the base case. A well-constructed set of sensitivities should provide a potential investor with enough information to develop a sound estimate of value based on their own perception of the market, company and macro-economic conditions.

However, as investors become more familiar with the transaction, they are likely to have a view of future conditions that they would like to see presented in individually tailored sensitivity runs. While these types of requests are commonly fulfilled, it is important for the external actuary to assess the reasonableness and consistency between the assumption changes requested, both actuarial and macro-economic. For example, a significant reduction in projected levels of inflation should not be analyzed in isolation from the implications on the discount rate or the margins of the products being sold.

In some markets, sensitivities may be performed on existing business only, under the theory that any deviation in assumptions will be reflected in future pricing such that margins remain the same. This argument may be sound in any particular developing market, but it is up to the bidder to determine their own view. Thus, sensitivities are typically provided by incorporating adjustments to both existing and new business.

## **7.9 New Business Margins**

Although implicit margin changes may be contained in prospective adjustments to macro-economic assumptions or expense levels, new business pricing margins are usually not explicitly assumed to change in the time horizon of the projection. The rationale behind this approach is that the market continues to operate in such a way that the company obtains profit margins on new business production comparable to the margins obtained in the current portfolio.

This approach may not be appropriate where markets are undeveloped or uncompetitive; however, it is very difficult to anticipate the extent and timing of market adjustments, and even more difficult to incorporate these changes in a model prospectively. The sensitivities provided in the appraisal report may assist a potential investor in assessing the possible impact on value of changes in future profit margins, or a particular bidder's view can be explored in individually tailored sensitivities.