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Substandard Lives: Cost of Insurance Charges
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substandard one-year survival rate is expressed as the standard rate, raised to an exponent, $(1+m)$; that is:

$$p_x' = p_x^{(1+m)} \qquad \text{(D)}$$

where:

p_x is the one-year survival rate for unimpaired lives

p_x' is the one-year survival rate for impaired lives.

We observe that m is a useful measure of the relativity of one-year survival rates and that, if $m = 0$, the one-year survival rate for the impaired class is equal to the one-year survival rate of the standard class. If m is greater than zero, it has the effect of reducing the one-year survival rate.

Equation D immediately leads to Equation E below, which can be written in the form of Equation F:

$$(1-q_x') = (1-q_x)^{(1+m)} \qquad \text{(E)}$$

$$q_x' = 1-(1-q_x)^{(1+m)} \qquad \text{(F)}$$

Equation F enables ready calculation of substandard mortality rates for any age and any m.

It is instructive to consider Equation F after binomial expansion as in Equation G:

$$q_x' = (1+m)q_x - \frac{(1+m)m}{2!}q_x^2 + \frac{(1+m)m(m-1)}{3!}q_x^3 - \ldots \qquad \text{(G)}$$

If we ignore powers of q_x greater than unity and substitute k for m in Equation G, it reduces to Equation B (the "popular" approach). For large m and q_x, however, the second term on the right hand side of Equation G is significant and, when ignored, leads to the problems and anomalies inherent in the "popular" approach.

Once one appreciates that Equation B leads to a logical "dead end" and that assignment of a 100k percent numerical extra rating really means replacing m with k in Equations D, E, F, or G, the numerical rating is clarified with respect to its meaning and application, and one can immediately see that the "popular" approach is a first-order approximation to the "correct" approach.

The "correct" approach can be implemented as set out below:

$$\frac{COI_x^1}{1000} = 1-\left(1-\frac{COI_x}{1000}\right)^{(1+k)} - a(x,k)$$

where $a(x,k)$ is an adjustment "extracting" excess expense loadings (if any) in the cost of insurance rates.

While the "correct" approach is scientifically and logically defensible, the "popular" approach is not. In traditional products, the premiums calculated on the "correct" approach do not differ very much from those on the "popular" approach. In unbundled products, the deficiencies of the "popular" approach are completely and embarrassingly visible. The "popular" approach can lead to policyholder dissatisfaction when the cost of insurance deductions approach the magnitude of the sums at risk. The correct approach avoids potential market conduct difficulties.

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Pitfalls in Equity-Indexed Products

by Jay Glacy

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Equity-indexed products burst upon the scene in 1996 and interest in them remains high, rivaling the waves of second-to-die product development in the late 1980s and universal life product development in the early 1980s. The future of indexed products probably holds more marketplace entrants, innovative second- and third-generation designs, some unexpected regulatory wrinkles and, in general, more controversy. The complexities associated with equity-indexed life and annuity products already create a number of general misconceptions about them. This article identifies some key pitfalls in developing equity-indexed products and suggests some steps insurers can take to avoid unpleasant financial surprises.

Macro Product Management

A common way to think about pricing single-premium deferred-indexed annuities contemplates the purchase of a zero-coupon bond to fund nonforfeiture law minimums in conjunction with the appropriate S&P 500 Index hedging instrument. In this simplified framework, the present value of profit is what is left over. But some important things are overlooked in this formulation. First, the question of how the insurer intends to fund the hedge purchase for those policyholders persisting beyond the first

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index term is ignored. There will be no renewal premium conveniently arriving at the beginning of the second term, and the first-term hedge payoffs all belong to the annuitant. Thus, the concept of a "hedge budget" and how such hedge outlays are planned and made becomes central to the economic viability of an indexed product.

Second, anticipating second-term persisters can have a dramatic effect on the investment choices an insurer otherwise would make. Hedges or bonds timed to mature at the end of the initial index term turn into cash, while, with luck, not all policies will. The ability to move out on the yield curve to garner the higher investment yields that typically exist there is a key competitive advantage. So is the hedging flexibility that accompanies the recognition that hedges don't necessarily have to pay off at the end of the index term. In addition, the insurer will need to adjust its declared participation rates in renewal terms to accommodate changing hedging costs.

Finally, some hedging strategies may work better than others. Insurers facing the cross-currents of ongoing new issues, renewal premiums, free looks, and policy surrender activity very quickly realize the futility of attempting to match up hedge purchases with specific policies or blocks of policies (a process called "emulation"). A "macro" hedging approach that manages asset and liability positions in aggregate can considerably ease the hedging effort required while increasing the trade latitude available to the hedge manager. "Delta" hedging, which equates the overall sensitivity of assets and associated liabilities to changes in the S&P 500 Index, is one common example of a macro hedging approach.

Hedge Mania

Some indexed-product writers become obsessive about hedge perfection. While the pursuit of watertight hedges is laudable, hedgers need to adopt a reasonable and consistent perspective on total company risk exposures. It makes little sense to button up S&P 500 Index exposure on an indexed product while neglecting to measure the company's exposure in, say, its sister SPDA product line. This is especially so because the forces affecting the equity markets will also be at play in the debt markets, moving interest rates that control traditional product economics. Writers will want to understand and measure the interrelationships among its various product lines and ensure that its overall hedge position properly constitutes a measured and thoughtful response to *all* risks the company faces.

The Volatility Frown

About 20% of indexed policies being sold include some sort of cap limiting the amount of index-based interest credits. In hedging, caps are usually handled through the simultaneous sale of an out-of-the-money call option. The combination of this sold option and a near-the-money purchased call option (termed a "bull call spread") creates the desired hedging effect. The price of the sold call relies on the underlying assumption of marketplace "implied" volatility, which can materially differ (in either direction) from volatility near the money. The curve, which depicts implied volatilities as a function of strike levels, is called the volatility "smile" or "skew." Failure to properly recognize this source of risk can result in seriously overstated profit expectations, because product pricing will implicitly rely on the sold call as a supplier of revenue.

Policyholder Misbehavior

The presence of equity-market elements in indexed products can create new and unfamiliar patterns of policyholder behavior. Policyholder expectations incorporate oft-told adages about equities' ability to outperform over various holding periods. As such, new approaches to understanding surrender activity become necessary. In making these analyses, it is convenient to categorize policyholder behavior into two primary modes:

- Naïve mode: Buy as prices increase; sell as prices decrease.
- Savvy mode: Sell as prices increase; buy as prices decrease.

For example, naïve policyholders prematurely surrender their contracts because of index-based underper-formance and resulting poor policy returns. Such underperformance is typically accompanied by elevated levels of market interest rates, constituting an additional incentive to depart. Most insurers are familiar with the psychology underlying this decision-making mode.

In contrast, consider savvy policyholders. They know that markets go down as well as up, and they believe they are able to time such movements. When advancing equity markets cause policy returns to outperform expectations, they may be induced to "lock in" gains in order to redeploy them elsewhere. While not all indexed product designs can be parsed this way, the savvy *insurer* will process the inducements of its particular product design against both the motivations of its distribution force and the governing dynamics of the capital markets.

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