# AN ACTUARIAL VIEW

Stochastic projections improve understanding of universal life policies.

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With the drop in interest rates and the subsequent class action lawsuits during the 1990s, insurers and advisors now recognize the need to show alternative scenarios when presenting universal life (UL) illustrations. The investment return that is credited determines the premium amounts and number of years they need to be paid. It's now common practice for illustrations to automatically include alternative results based on different investment returns.

But is this additional information sufficient for clients and advisors to make decisions? Are expectations being properly set? What additional information can be provided to improve the understanding of how UL works and create reasonable expectations? What is the likelihood of the scenarios provided actually playing out?

It's crucial to answer these questions, since investments in UL policies may be in various funds—including different equity and fixed income options—and the monthly returns on these funds fluctuate significantly. What is the appropriate investment return to use when preparing the UL illustration? Is it appropriate to use an average of historical returns?

Unfortunately, there are no easy answers. When a client invests in funds, there is no guaranteed minimum rate of return (only a guaranteed spread with funds; one must invest in fixed interest terms to have a minimum guarantee but this has limited upside). If there was a guaranteed minimum rate, the conservative option would be to illustrate based on that guaranteed rate, and any excess would then be a bonus.

Some insurers do illustrations by using variable investment returns and perhaps even actual historical returns on indexes. Others suggest using a level rate based on the historical average returns of the index. But there are problems with those approaches. First of all, it still only presents one scenario of returns that will never be exactly repeated. There is a difference between dollar-weighted average rate of return and time-weighted average rate of return.

These approaches also don't show the possible range of results or the likelihood the illustrated scenario (or better) will occur. Finally, the fact that the level cost of insurance (LCOI) is deducted every year from the account value means there is dollar cost averaging in reverse with UL policies, further complicating the calculation of the

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Stochastic scenarios involve running illustrations using several thousand scenarios of future investment returns, and ranking the results.

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average rate of return.

An alternative is to produce several illustrations using different levels or variable investment returns. Even so, a few scenarios may improve the understanding of the impact of different investment returns, but it does not help to gauge the likelihood of the various results.

Stochastic scenarios or Monte Carlo simulations may be used to improve the information UL illustrations give clients and advisors. This involves running the illustration using several thousand scenarios of future investment returns, and ranking the results to show the percentile likelihood of outcomes. For example, one may wish to know the amount of premium required to be paid over 20 years so the policy will last until age 90 in 75% of the scenarios (called 75% confidence).

Insurers have experience using stochastic scenarios to determine costs of guarantees on segregated funds and are starting to use it to price UL plans. Why shouldn't advisors use these scenarios to illustrate UL plans?

Developing the scenarios is the first step. This means getting, say, 5,000 different sets of annual investment returns for each of 50 or more years.

The investment returns should reflect actual history and expectations for the future. The annual returns within each scenario should recognize the other returns within the scenario (for example, return for year three should recognize the returns for years one and two) and be consistent with returns for other investment options for the same scenario (for a given scenario, the returns for Canadian equities should be properly related to the returns for U.S. equities and Canadian bonds).

The good news is the scenarios only need to be developed once and then can be used over and over again. Scenarios are also readily available from different sources, including the insurers themselves.

Once the scenarios are created, the next step is to run them through the illustration. At first, this seems time consuming. It can take a few minutes to run one UL illustration, so running 5,000 seems to take forever.

In reality, much of the time spent running an illustration is for the print set-up and only a small part goes into the actual calculation of the numbers. We created a spreadsheet that runs 5,000 scenarios in five seconds using a computer with a 2.8Ghz CPU. We typically do multiple iterations to fine-tune the results and that still takes less than one minute.

The most important step is interpreting the results. Consider a male non-smoker, age 40, who wants a UL policy with LCOI and a death benefit of $1 million, plus fund value. He will invest fully in equities and wants to pay only the minimum required premium to fund the policy over 20 years.

The (time-weighted) compound average credited rate of return of our 5,000 scenarios is about 5.5%, net of typical MERs. The returns are slightly skewed on the low end, with 54% of the scenarios having a higher compound average rate of return and 46% having a lower average. This is a typical distribution for equity returns, but certainly results may differ slightly with other scenarios.

The premium required to fully fund a policy over 20 years, assuming 5.5% level credited return, is $7,530 (based on a common UL plan; the analysis does not depend on the specific plan). This is how advisors regularly illustrate the UL and determine the premium to be paid by the client. However, it ignores the risks of earning lower average returns as well as monthly volatility. Either would mean higher premiums may be required to keep the policy from terminating before the client dies.

Figure 1 shows the probability from the 5,000 scenarios of this policy terminating at future ages based on paying only this premium. It shows after age 70 there is significant risk of more premiums being required to prevent the policy from terminating. For example, the policy only lasts to age 90 in 63% of the scenarios.

Another way of considering the same issue is to determine the premium

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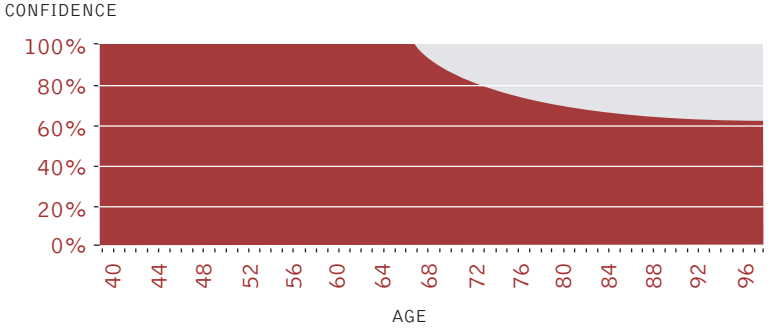
# FIGURE 1

*Policy confidence*
*(likelihood that plan will not lapse)*



# FIGURE 2

*Required annual premium over 20 years to maintain the UL policy to age 90, based on indicated confidence*

| Confidence of Policy Not Terminating | $ | % of Premium Using "Average" Investment Rate |
|---|---|---|
| 50% | $6,700 | 89% |
| 63% (average returns) | 7,530 | 100% |
| 75% | 8,760 | 116% |
| 90% | 11,000 | 146% |
| 95% | 12,135 | 161% |

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required given a confidence the policy will not terminate before a given age. This shows the potential range of premiums needed.

Figure 2 shows the required premiums, based on our 5,000 scenarios, that allow the policy to last at least to age 90 for the indicated confidence intervals. For example, if the client wants a 90% confidence that the policy will not terminate before age 90, then the required premium is $11,000. This premium is 46% higher than the amount determined using the average rate of return and shows the downside of only considering average returns. Do clients realize the probability of having to pay more to maintain their UL policy? Do they know the potential range of how much more?

Scenarios may also be used to see the impact of different returns for leveraged loan cases. Here we consider multiple credited investment returns and corresponding loan interest rates (the loan rates for each scenario are related to the credited returns in an appropriate manner). Consider the same 40-year-old male non-smoker who now wishes to pay $30,000 for 20 years to a UL policy with LCOI and death benefit of $1 million, plus fund value. Starting at age 65, he will take the maximum income over 25 years using leveraging and capitalize the loan interest. This is a common sale.

Using the average credited investment return of 5.5% and average loan rate from the scenarios of 7%, an income of $45,000 may be taken. With these assumptions, the policy lasts until at least age 100, meaning the accumulated loan balance never exceeds 90% of the UL's cash value. The loan interest rate is based on short-term floating rates and includes the appropriate bank costs. For simplicity, we ignore any requirement to invest in GICs once the loan balance exceeds 50% or 75% of the UL cash value.

What is the likelihood of the policy lasting and not terminating? How volatile is this retirement income to different assumptions? Using the multiple scenarios, we can assess the confidence for each age, or portion of scenarios where the policy remained in force. Doing this gives a wide range of results.

Investing in UL plans has risk, whether it is done as a means of prepaying future insurance costs or to provide a retirement income. The results, such as the amount of premiums to pay or retirement income available, change significantly depending on the assumptions. Illustrations show results based on one main set of assumptions and at least one additional set. But this doesn't show advisors and clients the potential range of results, nor does it indicate the degree of confidence for the specified results. One large insurer, for example, acknowledges the guidance it provides on assumptions used for its illustrations only has a 50% confidence. Are advisors and clients thus willing to accept a UL policy may fail half the time?

A better alternative is to use multiple stochastic scenarios for illustrations. These confirm the possibility the policy may lapse or that more premiums may be required. They also show the range of results that may occur, and give an indication of the confidence interval for a given result. AE

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