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A Practical Approach to an Enhanced Premium Persistency Assumption

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Premium persistency for flexible premium life products has been an interesting and challenging area in actuarial modeling. On one hand, most products have a target premium of some sort for each policy that could be and often is used as a future premium assumption. On the other hand, the flexible nature of the products makes it difficult to argue that customers will repeat the same premium paying pattern year after year.

Many practitioners take a simple approach to the premium persistency assumption. According to the 2012 SOA survey on the very topic, most survey participants assumed 100 percent premium persistency for pricing and reserving.[1] Premium persistency factors, when used at all, tended to be developed and applied at the product or product group level; policyholder behavior was not explicitly modeled. There is a risk that this simplified approach to modeling premium persistency could understate (or overstate) the value of certain policy features, such as secondary guarantees.

This article describes a refined approach to premium persistency that takes actual policyholder behavior to the center of the assumption development and modeling, and how this approach was implemented at one company. Unlike conventional dynamic assumptions that tie policyholder behavior to external economic factors such as interest rates, this approach focuses only on premium history at an individual policy level. The examples in this article will focus on a current assumption universal life (CAUL) block. We will also discuss the assumption variation of universal life with secondary guarantees (ULSG).

SETTING UP THE ASSUMPTION

The premium persistency assumption at Resolution Life was developed during the pricing of an acquired block of UL policies. We reviewed models from leading consulting firms and decided on an approach that incorporates past premium payment behavior on an individual policy level.

The assumption uses premium paid to-date as the primary indicator for the future premium behavior. Actual to-date paid premium was compared to to-date target premium to determine a premium funding level, aka funding bucket, a particular policy falls into. Three primary funding buckets were defined to categorize the level of expected future premiums for each policy. Policies without any premium payment in the past 12 months were viewed as implicit zero-pay policies. These policies would be assumed to no longer pay any premium in the future. Single-pay policies were also separated to assume no more future premiums. Premium multipliers were developed for each of the five categories, as shown in Table 1.

Table 1
Original Funding Bucket Assumptions

Funding Bucket	Single Pay	Implicit 0 Pay	Low	Medium	High
Issue-to-date paid premium/ target	n/a	n/a	0–89%	90–110%	111%+
Target premium multiplier	0%	0%	55%	100%	125%

The funding bucket is refreshed for each policy quarterly and is built into the policy inventory file. This enables automatic recalibration of the funding bucket as the model inventory file is refreshed.

ANALYSIS OF ACTUAL EXPERIENCE

A study of actual premium experience was conducted to evaluate the aggregate premium trend as well as premium experience by funding bucket. We studied distribution of policies among the different funding buckets and how a policy moved from one bucket to another during the study period. We also studied the premium amount within each funding bucket.

The review of the actual experience indicated that policies in each funding bucket displayed very different premium paying behavior. In addition, even though policies moved from bucket to bucket (Table 2), the relative population residing in each funding bucket was quite stable, as shown in Figure 1.

Table 2
Distribution of Policy Movement

Movement	Distribution
Up 3 buckets	0.05%
Up 2 buckets	0.40%
Up 1 bucket	3.75%
Same bucket	92.06%
Down 1 bucket	3.36%
Down 2 buckets	0.35%
Down 3 buckets	0.03%

ALTERNATIVES TO KEY PARAMETERS

Upon review of the actual experience, we observed an aggregate actual-to-expected ratio of 116 percent for premiums paid when compared to model prediction. Instead of applying a straight-up scalar to all policies, we considered some alternatives to the key assumption parameters.

- Instead of using issue-to-date paid premium vs. target, a limited period of recent premium history could be used. For policies in later durations, limited period premium history would exclude the initial premium dump-in that might skew the resulting funding bucket. We ended up using the last 24 months in our analysis.
- We divided the low funding bucket into medium-low and low. Actual experience suggested that the policies in the bottom funding quartile displayed different premium paying behavior from those in the higher quartiles.
- Expanding the time period for determining the implicit zero-pay bucket allowed us to consider practical issues such as off-cycle premiums or late payments. For our analysis, we chose the last 24-month premium history as an alternative to the 12-month history. You can see a smaller number of zero-payers under 24-month premium lookback vs. 12-month premium lookback in Figure 2.
- We then calibrated the funding bucket for each policy after these changes to the parameters and refreshed target premium multipliers for each bucket. Premium multipliers developed under the alternative parameters are shown in Table 3.

As a result of these changes, our model fit improved as shown by the ratio of actual/expected in Table 4. The overall financial impact of these updates was minimal.

ULSG VERSUS CAUL

We performed the same analysis for ULSG policies as well. In addition to all the dimensions of CAUL analysis, we developed separate factors for products with specified premium secondary guarantee design vs. shadow account secondary guarantee design. Furthermore, we assumed ULSG policies would always at the minimum pay premiums carrying to maturity with secondary guarantee regardless of funding level (subject to an extra lapse rate). We observed that, in general, ULSG exhibited similar pattern in funding as CAUL but with less movement across different funding buckets throughout time. There was clear evidence that some sophisticated customers really understood the product features and took advantage of the no-lapse guarantees.

NOTES ON IMPLEMENTATION: A MODELER'S PERSPECTIVE

Documentation is extremely important in all actuarial modeling. The cornerstone of good model documentation is clean assumption inputs. It might be easier to code a simple "if" state-

Figure 1
Funding Bucket Movement

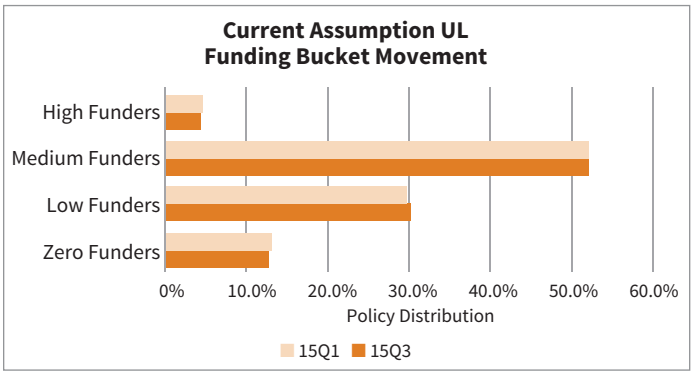

Figure 2
12-Month vs. 24-Month Lookback Period

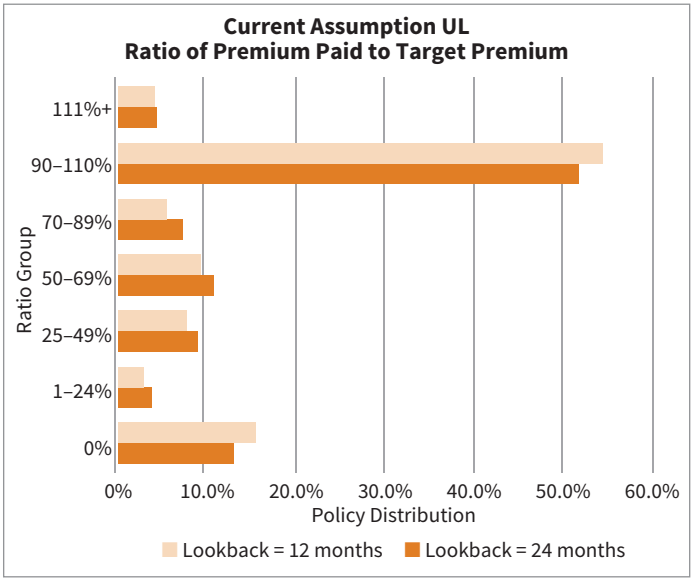

Table 3
Updated Funding Bucket Assumption

Funding Bucket	Single Pay	Implicit 0 Pay	Low	Medium-Low	Medium	High
24-month paid-premium/target	n/a	n/a	0–49%	50–89%	90–110%	111%+
Target premium multiplier	0%	0%	25%	65%	100%	190%

Table 4
Actual to Expected Comparison

A/E (prior method)	116.1%
A/E (updated method)	102.9%

This automatic recalibration allows the model to reflect the new best estimate premium pattern immediately.

ment in the formula tables to force policies that have not paid a premium in the last 24 months to not pay a premium going forward. However, it would be difficult for someone not familiar with the model to find this code. Therefore, once we completed our study, we took the time and made sure to put all of the premium persistency inputs in assumptions tables that would be easily understood by our internal stakeholders and auditors.

Actuarial modelers oftentimes face pressure to complete tasks as quickly as possible and take shortcuts that do not adhere to modeling best practices. This is just the nature of our work and all of us run into time pressures at some point. But during modeling off-cycles, don't forget to spend some time on model development and tidy up the shortcuts that were taken earlier.

FINAL TAKEAWAYS

Premium persistency is a true policyholder behavior assumption, yet often the analysis of premium payment is done at product or product group level. Our premium persistency approach not only improved model accuracy; it also provided deeper insight into policyholder behavior.

Building this approach into the modeling inventory file allows for dynamic adjustments to the premiums multiplier as soon as the funding bucket is refreshed. This automatic recalibration allows the model to reflect the new best estimate premium pattern immediately.

Other things that we learned along the way:

- Most people are paying what they are billed.
- There are other internal and external factors that might affect policyholder behavior, such as policy duration or competitor rate, yet to be explored.
- Premium persistency assumption can have a significant impact on lapses and the in-the-moneyness of the secondary guarantee.
- Be mindful of REAL policyholder behavior such as initial dump-in, late premium and catch-up premiums. Conversation with operations can be very valuable in determining assumption parameters.
- Be careful of how the premium persistency assumption is implemented, coded and documented. Adhere to modeling best practices.
- Last but not least, data is king. We wouldn't be able to do any of the analysis if we did not have policy-level transaction data. ■

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ENDNOTE

[1] Society of Actuaries, "Report on Premium Persistency Assumptions Study of Flexible Premium Universal Life Products," (May 2012).