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Dynamic Assumption-Setting for Variable and Non-Variable Annuities

Part 1: Full Surrender Rates for Variable Annuities with Guaranteed Lifetime Withdrawal Benefits

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Assumption-setting is the foundation of a professional actuary's work. In traditional applications, actuaries know how to set assumptions when there is relevant, credible historical data available to use, but constantly changing environmental conditions and new product features bring advanced challenges.

What can actuaries do to incorporate the impact of dynamic factors such as the current interest and equity environment, current economic indicators, and current policy values in modeling processes? And how can actuaries set reasonable assumptions when there is a new benefit and experience is just emerging?

This article is the first of a three-part discussion that proposes an approach to develop dynamic assumptions using a combination of available experience data and simple predictive modeling techniques. In this article (Part 1), we will introduce the approach and apply it to develop full surrender assumptions for variable annuities (VAs) with guaranteed lifetime withdrawal benefits (GLWBs). In Part 2, we will use the approach to determine GLWB utilization assumptions for VAs. In Part 3, we will apply

the approach to non-variable annuities (NVAs) with guaranteed lifetime income benefits (GLIBs) and contingent deferred annuities (CDAs), and will propose a methodology for applications with limited historical data.

PROPOSED METHODOLOGY

We propose a three-step methodology using simple predictive models to provide a means for actuaries to incorporate dynamic assumption structures to improve internal models.

Step 1: Develop a set of base experience assumptions by exploring the impact of various factors on currently available data.

Step 2: Incorporate the key factors identified in Step 1 to construct a predictive model to allow us to quantify the impact of dynamic factors on base experience assumptions.

Step 3: Use the predictive model constructed in Step 2 to develop a dynamic adjustment to base experience assumptions.

STEP 1: Develop a Set of Base Experience Assumptions

The first step in a predictive modeling process is to explore the available experience data. In this article, we are looking to develop a base set of full surrender rates as well as understand what factors are the most likely candidates for inclusion in the development of a predictive model.

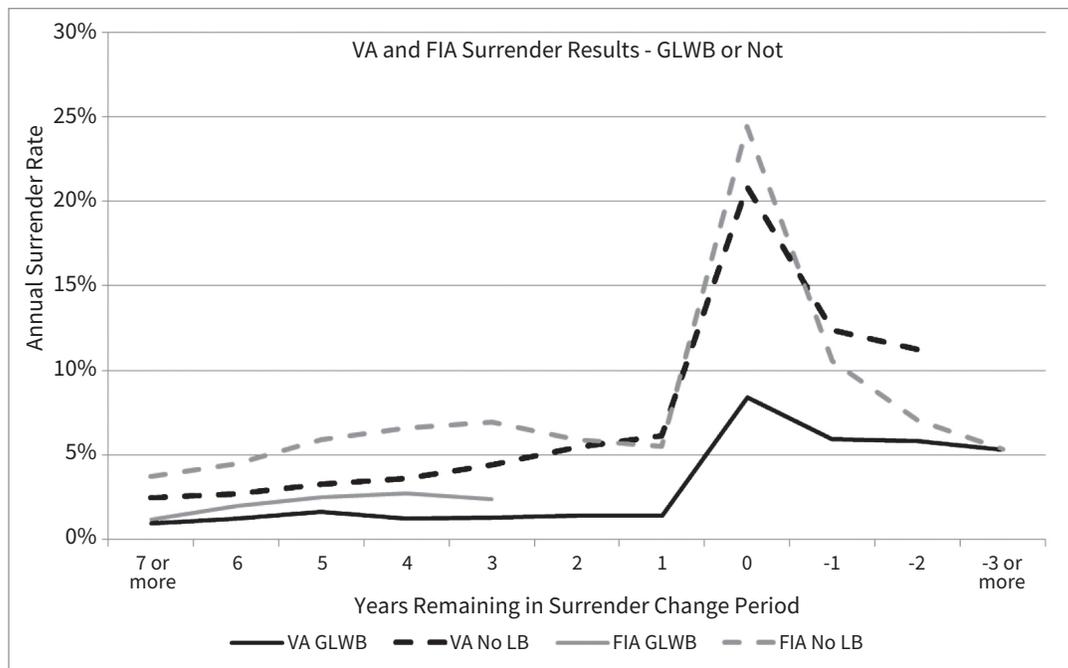
The data exploration in Step 1, will provide insight into setting the base full surrender assumptions and will also help identify key factors impacting full surrender rates that can be used in developing a dynamic surrender function using predictive modeling techniques.

Full Surrender Experience for Contracts with and without Guaranteed Lifetime Withdrawal Benefit

Let's start with industry data on the impact of the presence of a GLWB or GLIB benefit on the full surrender rates of VAs and Fixed Indexed Annuities (FIAs). Exhibit 1 below shows rates of full surrender for 2013 on VA and FIA contracts as compiled by Ruark Consulting (used with permission).

This data is presented with the horizontal axis representing years remaining in the surrender charge period rather than

Exhibit 1—Rates of Full Surrender – VA and FIA contracts
Presence of GLWB/GLIB Benefit



duration from issue, permitting the alignment of experience from products with different surrender charge periods.

As expected, for VA and FIA contracts without GLWBs or GLIBs, there is a large spike in full surrender rates at the end of the surrender charge period, between 20 percent and 25 percent, followed by large decreases in full surrender rates to about 6 percent for FIAs.

And based on this data, it appears that VA contracts with and without GLWB have a different level and pattern of full surrenders and therefore should be studied separately. For Part 1 of the discussion, this article will focus on the development of assumptions for VA contracts with GLWBs as dynamic factors are anticipated to have a significant impact in the presence of the GLWB.

Care must be taken in interpreting these data for VAs and

FIAs with GLWBs or GLIBs. Focusing on the solid lines in the above graph, data for both VA and FIA contracts with GLWBs include full surrender experience for contracts both before and after the utilization of the withdrawal benefit. However, Ruark notes that for FIAs to date, very few contractholders have begun to utilize the withdrawal benefit. Therefore, the FIA with GLWB line essentially represents pre-GLWB utilization rates of full surrender, while the VA with GLWB line includes a significant amount of surrender experience for VAs with GLWBs both before and after the exercise of the withdrawal benefit.

FULL SURRENDER EXPERIENCE BY BENEFIT UTILIZATION STATUS

Next we look at variations in the VA with GLWB full surrender experience from the most recent LIMRA/SOA study by benefit utilization status. For

this purpose, we define the following contract benefit utilization categories in Table 1.

Exhibit 2 shows rates of full surrender by current benefit utilization status.

Note that here the horizontal axis represents duration from issue as most companies currently define base surrender

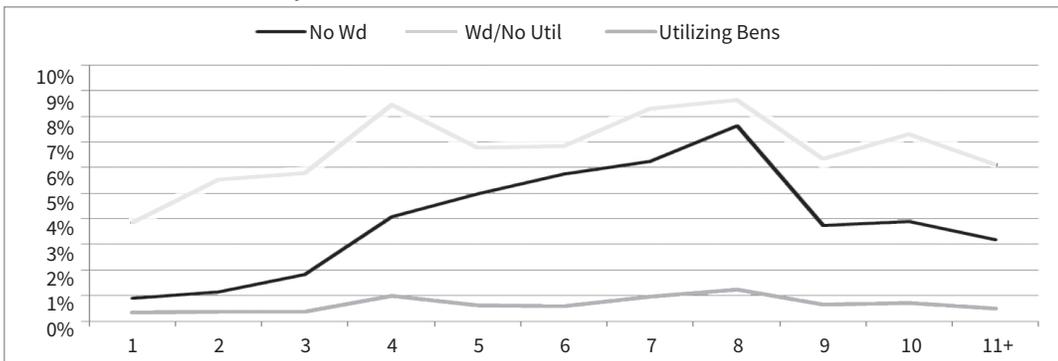
rate assumptions in terms of duration from issue, and we have taken that approach for this example. There are clear differences in the level and pattern of surrender experience by current benefit utilization status. Based on this data, base surrender experience rates will be developed separately for each benefit utilization status.

Table 1

Benefit utilization Status	Description	2013 Study Exposure	Comments
Status A	The contract holder has taken no withdrawals to date.	72%	
Status B	The contract holder has taken withdrawals, but the GLWB has not yet been utilized.	11%	This status includes withdrawals taken outside of 90% to 110% of the contractual maximum GLWB with no apparent pattern associated with GLWB utilization.
Status C	The contract holder is utilizing the GLWB benefit.	17%	Both Ruark and LIMRA consider that a contract is utilizing its GLWB benefit if the contract holder is taking regular withdrawals in the range of 90% to 110% of the contractual maximum GLWB.

Exhibit 2—VA Contracts with GLWB

Rates of Full Surrender by Benefit Utilization Status



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FULL SURRENDER EXPERIENCE BY ATTAINED AGE

Exhibits 3-9 (pgs. 6-9) examine the impact of other potential predictive factors on full surrender rates for pre-GLWB utilization contracts (Benefit Utilization Status A). This is the largest category of current industry in-force business representing just more than 70 percent of the total.

Exhibit 3 looks at full surrender rates by attained age group and policy duration from issue.

So surrender rates vary by attained age group but more significantly at durations 4 and later for contract holders between 70 and 80. The drop in full surrender rates after duration 8 may represent those contracts that have a longer roll-up period or second roll-up period for which the contract holder anticipates larger benefits.

FULL SURRENDER EXPERIENCE BY SURRENDER CHARGE LEVEL

Exhibit 4 shows rates of full surrender by policy duration and surrender charge level.

As exemplified in the Total row of Exhibit 4, the impact of surrender charge level on surrenders is very significant and follows a similar pattern to Exhibit 3. The SC=0 column also follows this pattern of increases, followed by decreased surrender rates.

FULL SURRENDER EXPERIENCE BY DISTRIBUTION CHANNEL

Exhibit 5 (pg. 7, top) shows rates of full surrender by policy duration and distribution channel. While banks appear to have higher overall rates of full surrender at several durations, other factors including product design must be considered

in comparing results by distribution channel. Perhaps most noteworthy is the similarity of the pattern of surrenders across all of these distribution channels: full surrender rates gradually increasing to a jump in duration 4, then increasing to a peak in duration 8, followed by decreased surrender rates.

FULL SURRENDER EXPERIENCE BY IN-THE-MONEYNESS

Exhibit 6 (pg. 7, bottom) shows rates of full surrender by policy duration and in-the-moneyness (ITM). For this purpose, ITM is defined as the benefit base divided by the contract account value. Note the significant impact of ITM across the spectrum of values.

Exhibit 3—Benefit Utilization Status A
Full Surrender Rates by Attained Age and Duration

Duration from Issue	Attained Age						Grand Total
	Under 60	60-64	65-69	70-74	75-79	80+	
1	0.9%	0.8%	0.8%	1.0%	1.1%	1.5%	0.9%
2	1.2%	1.1%	1.1%	1.1%	1.3%	1.3%	1.1%
3	1.8%	1.8%	1.7%	1.8%	2.1%	1.7%	1.8%
4	3.8%	4.0%	4.1%	4.8%	4.9%	4.0%	4.1%
5	4.6%	4.9%	5.0%	5.7%	5.9%	5.0%	5.0%
6	5.3%	5.6%	5.9%	6.7%	5.9%	6.0%	5.7%
7	5.9%	5.8%	5.8%	8.5%	6.8%	7.8%	6.3%
8	7.2%	6.6%	8.0%	9.7%	7.7%	8.6%	7.6%
9	3.4%	4.1%	3.2%	4.2%	2.6%	*	3.7%
10	4.8%	4.3%	3.0%	4.6%	1.1%	*	3.9%
11+	3.7%	3.7%	2.1%	4.6%	*	*	3.1%

*Insufficient data

Exhibit 4—Benefit Utilization Status A
Full Surrender Rates by Level of Surrender Charges and Duration

Duration	Overall	.09	.08/.085	.07/.065	.06	.05	.04	.03	.02	.01	0
1	0.9%	0.8%	1.0%	0.8%	0.1%	1.2%					2.2%
2	1.1%	1.1%	1.3%	0.9%	1.0%	1.6%	2.2%				2.5%
3	1.8%	0.9%	1.5%	2.2%	1.2%	2.0%	3.7%	2.3%			3.0%
4	4.1%	1.1%	2.2%	2.2%	5.4%	3.5%	2.8%	5.1%	3.6%		6.6%
5	5.0%		1.7%	2.6%	6.0%	2.9%	2.7%	3.4%	22.5%		8.1%
6	5.7%		1.4%		2.7%	3.3%	5.2%	3.7%	11.3%	10.1%	8.1%
7	6.3%						2.4%	3.2%	6.7%	9.9%	6.8%
8	7.6%						*	2.5%	4.8%	5.6%	8.1%
9	3.7%								2.3%	10.0%	3.9%
10	3.9%										3.9%
11+	3.1%										3.1%
Total	2.5%	1.0%	1.3%	1.3%	2.4%	3.2%	3.2%	4.2%	7.0%	9.8%	6.2%

*Insufficient data

Exhibit 5—Benefit Utilization Status A

Full Surrender Rates by Distribution Channel

Duration	Overall	Banks	Career Agents	Independent Agents/Brokers	Stockbroker/Wirehouse
1	0.9%	0.8%	0.7%	0.9%	0.6%
2	1.1%	1.1%	0.9%	1.1%	0.9%
3	1.8%	1.4%	1.9%	1.6%	1.1%
4	4.1%	4.7%	3.8%	4.0%	4.2%
5	5.0%	5.7%	4.1%	4.9%	4.6%
6	5.7%	7.1%	4.0%	5.6%	4.9%
7	6.3%	8.9%	5.6%	5.9%	7.3%
8	7.6%	9.8%	7.0%	7.0%	8.0%
9	3.7%	4.3%	3.9%	3.6%	4.3%
10	3.9%	2.8%	2.9%	4.1%	2.8%
11+	3.1%	2.7%	2.8%	3.0%	2.4%

Exhibit 6—Benefit Utilization Status A

Full Surrender Rates by In-the-Money (ITM)

Duration	Overall	ITM<100%	100% < ITM < 125%	125% < ITM < 150%	ITM >=150%
1	0.9%	0.8%	0.9%	3.4%	*
2	1.1%	1.6%	1.1%	1.9%	*
3	1.8%	3.0%	1.7%	1.5%	*
4	4.1%	5.2%	4.2%	3.6%	3.6%
5	5.0%	8.1%	7.3%	3.5%	3.1%
6	5.7%	6.8%	7.4%	4.5%	3.8%
7	6.3%	12.5%	7.2%	4.6%	4.2%
8	7.6%	14.0%	7.3%	3.6%	2.3%
9	3.7%	2.4%	3.5%	4.1%	2.8%
10	3.9%	1.5%	4.3%	4.0%	4.3%
11+	3.1%	3.1%	3.6%	2.4%	*

*Insufficient data

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For ITM > 125 percent, the full surrender rates become very flat, with no noticeable shock lapse. In this context, ITM incorporates the impact of economic scenarios on the contract account values, as well as product design including richness of benefit.

FULL SURRENDER EXPERIENCE BY LEVEL OF INVESTMENT RESTRICTION ON THE GUARANTEED FUNDS

The difference between these two categories of contracts is striking (see Exhibit 7). To the extent the investment restrictions are due to the GLWB, this provision may increase the prominence of the withdrawal benefit guarantee to the contractholder. The pattern of full surrenders for contracts with investment restrictions shown above had a similar impact to higher ITM—a significantly smaller spike in the surrender rate followed by decreasing surrender rates for the durations analyzed.

FULL SURRENDER EXPERIENCE BY SIZE OF CONTRACT

Exhibit 8 indicates that the larger the contract account, the lower the full surrenders for contracts in Status A. As with Exhibits 6 & 7, this pattern may reflect the greater prominence of the guaranteed withdrawal benefit as the prospective benefit size and its associated rider fees increases.

Exhibit 7—Benefit Utilization Status A
Full Surrender Rates by Duration and Investment Restrictions versus No Restrictions

Duration	Overall	No Investment Restrictions	Investment Restrictions
1	0.9%	1.1%	0.8%
2	1.1%	1.5%	1.0%
3	1.8%	1.8%	1.8%
4	4.1%	5.6%	3.5%
5	5.0%	8.1%	3.9%
6	5.7%	9.2%	4.8%
7	6.3%	12.3%	4.5%
8	7.6%	12.0%	3.4%
9	3.7%	5.6%	3.3%
10	3.9%	6.3%	3.2%
11+	3.1%	3.4%	2.9%

Exhibit 8—Benefit Utilization Status A
Full Surrender Rates by Duration and Size of Account Value at Beginning of Year (AV BOY) in \$1,000s

Duration	Overall	AV BOY 10	AV BOY 25	AV BOY 50	AV BOY 100	AV BOY 250	AV BOY 500
1	0.9%	2.5%	1.4%	1.0%	0.7%	0.6%	0.6%
2	1.1%	3.1%	2.0%	1.3%	0.9%	0.8%	0.8%
3	1.8%	4.3%	2.5%	2.0%	1.6%	1.4%	1.4%
4	4.1%	6.5%	4.7%	4.2%	4.0%	3.5%	3.9%
5	5.0%	7.0%	5.8%	5.1%	4.9%	4.1%	4.5%
6	5.7%	8.5%	6.6%	5.8%	5.5%	5.0%	4.8%
7	6.3%	9.4%	8.0%	6.3%	6.0%	5.2%	5.2%
8	7.6%	12.3%	7.5%	8.1%	6.9%	7.4%	5.3%
9	3.7%	8.8%	5.4%	3.6%	3.8%	2.8%	2.6%
10	3.9%	3.2%	4.4%	3.8%	3.1%	4.3%	4.5%
11+	3.1%	1.2%	7.7%	3.4%	3.0%	2.7%	1.2%

Exhibit 9—Benefit Utilization Status A

Full Surrender Rates by Duration and Back-Loaded AV with GLWB, Investment Restrictions, ITM > 100 percent, AV > \$50,000

Duration	Overall	Back-Loaded, IR, ITM>100%, AV>\$50K
1	0.9%	0.6%
2	1.1%	0.9%
3	1.8%	1.2%
4	4.1%	1.7%
5	5.0%	2.2%
6	5.7%	3.4%
7	6.3%	4.1%
8	7.6%	3.8%
9	3.7%	3.3%
10	3.9%	4.2%
11+	3.1%	1.8%

Exhibit 10—Benefit Utilization Status B

VA with GLWB-Level of Withdrawal and Duration

Duration From Issue	Under 75%	75%-90%	110%-125%	Over 125%	Grand Total
4	3.8%	1.2%	0.7%	6.1%	3.9%
5	6.3%	1.0%	0.8%	7.7%	5.5%
6	6.8%	1.2%	1.1%	7.4%	5.8%
7	10.2%	2.5%	2.2%	9.8%	8.4%
8	8.5%	2.5%	2.0%	7.0%	6.8%
9	8.9%	2.6%	2.0%	6.0%	6.8%
10	11.1%	4.1%	1.8%	6.7%	8.3%
11+	8.9%	3.3%	1.0%	7.7%	7.5%

FULL SURRENDER EXPERIENCE BY RICHNESS OF BENEFIT

Benefit prominence as exemplified by richness of benefit and higher rider fees, fewer investment restrictions, and larger account values, produces a strikingly different pattern of full surrenders as compared to the overall experience for these contracts. For example, consider Exhibit 9 that compares the overall surrender experiences with the experience of contracts with greater benefit prominence (contracts that are back-end loaded), with fewer investment restrictions, ITM >= 100 percent, and account value >= \$50,000.

To the extent that a richer benefit may be more sensitive to variations in full surrender rates than more modest benefits, these differences in full surrender experience can have important ramifications for pricing and reserving.

FULL SURRENDER EXPERIENCE BY WITHDRAWAL LEVEL (BENEFIT UTILIZATION STATUS B)

Contracts in benefit utilization status B are exemplified by the contract holder taking withdrawals at levels significantly higher or significantly lower than the maximum guaranteed withdrawal amount according to the terms of the GLWB.

Therefore, perhaps to address an urgent need for funds, the contractholder has withdrawn money from the contract, but not in the sense of taking regular income.

Exhibit 10 illustrates the impact of the level of withdrawal as a percentage of the GLWB maximum withdrawal amount, as well as the impact of duration for contracts in this status.

Note that the 90 percent to 110 percent band is excluded. As stated previously, withdrawals in this band are considered by both Ruark and LIMRA to represent utilizations of the GLWB.

While the Grand Total full surrender rates in Exhibit 10 are somewhat comparable to the corresponding full surrender rates by duration from issue in the Grand Total column of Exhibit 3 (Benefit Utilization Status A), the variation by withdrawal level is significant. Note also that the surrender rates in the later durations in Exhibit 10 are much higher than the corresponding rates in Exhibit 3.

Care must be taken in modeling contracts in this benefit utilization status, perhaps more than either of the other two contract statuses. These contract holders may be more varied in their motivations for taking specific actions. Some may be withdrawing money to deal with a

current, urgent economic issue while others may simply be using their annuity as an occasional source of additional income.

FULL SURRENDER EXPERIENCE BY ATTAINED AGE (BENEFIT UTILIZATION STATUS C)

While the “duration” in Exhibit 11 is measured from issue for consistency with the general structure of base surrender rates, it may also be useful to examine experience for contracts in Status C by increasing ITM and duration from the start of GLWB utilization. Just before and after utilization, the degree of ITM-ness is similar, but as withdrawals are taken over several years, the account value decreases until it may reach zero. At that point, there would be no cash alternative for the contract holder and surrenders should be zero.

STEP 2: Construct a simple predictive model to estimate the impact of changes in these factors on base experience

Based on the full data exploration, from which we provided some examples above, the following factors were identified as potential predictors in the modeling process.

- Benefit utilization status
- Policy Duration
- Attained Age of Policyholder
- Market (qualified, non-qualified)
- Surrender Charge Level
- In-the-Money (ITM) of the guarantee

Exhibit 11—Benefit Utilization Status C
Full Surrender by Attained Age and Duration after the start of GLWB utilization

Duration From Issue	Ages						Grand Total
	Under 60	60-64	65-69	70-74	75-79	80+	
1	1.3%	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%
2	1.3%	0.6%	0.4%	0.3%	0.2%	0.1%	0.4%
3	1.1%	0.5%	0.4%	0.3%	0.4%	0.4%	0.4%
4	2.5%	1.4%	1.0%	0.8%	0.9%	0.9%	1.0%
5	1.2%	0.8%	0.6%	0.6%	0.6%	0.7%	0.6%
6	2.2%	0.9%	0.5%	0.5%	0.6%	0.7%	0.6%
7	1.8%	1.5%	0.7%	0.9%	0.8%	1.1%	0.9%
8	5.3%	0.8%	1.4%	1.8%	0.5%	0.3%	1.2%
9	5.9%	1.3%	0.3%	0.3%	1.0%	0.7%	0.6%
10			0.5%	0.9%	1.8%		0.7%
Greater than 10 yrs						3.1%	0.5%
Total	1.7%	0.8%	0.6%	0.6%	0.5%	0.6%	0.6%

- Account Value Size
- Distribution Channel
- Investment Restriction Indicator
- Current withdrawal as percent of maximum withdrawal level (for Status B only)
- Share Class (a proxy for product design: back-loaded, front-loaded, no load)
- Issue Age of the Policyholder
- Policy Charge Level (M&E)
- Size of VA with GLWB block/Company Indicator

A separate model selection process was implemented for each of the three benefit utilization statuses described above. Using SAS/Stat, R, and KNIME modeling tools, the selection process considered generalized

linear models (GLMs), logistic regression, and decision tree family model forms. As part of the process, variable reduction was employed to limit the number of independent variables in each model to the extent possible without giving up significant model accuracy.

The GLM model considers a continuous response variable form, so in building a GLM model for the three benefit utilization statuses the response variable was set equal to the “rate of full surrenders.”

For the logistic regression and decision tree family models, the response variable takes the form of a binary result. So the response variable (surrender) is equal to zero if the model predicts a particular policyholder will not take a full surrender and is equal to one if the model predicts a particular policy-

holder will take a full surrender during the experience period.

For each model form considered, each of the three datasets (representing each of the three benefit utilization categories) was randomly split into model training and model validation subsets using 70 percent of the data for training and 30 percent for validation purposes. Model fit, significance of predictors, accuracy of prediction, and validation results were all considered in the final model selection process.

For the logistic regression and decision tree models, Table 2 indicates the primary statistic considered in selecting a particular member of the model family. The “Concordance Statistic” (c statistic) represents the percentage of the time that a model correctly predicts an “event”/“non-event” and is re-

Table 2

Logistic Regression and Decision Tree Model Statistics

	Benefit Utilization Status A		Benefit Utilization Status B		Benefit Utilization Status C	
	Logistic Regression	Decision Tree	Logistic Regression	Decision Tree	Logistic Regression	Decision Tree
c statistic	.77	.70	.75	.68	.80	.73

lated to the “Receiver Operating Characteristic” curve.

For the GLM model family, a Poisson distribution was assumed and Table 3 shows the R-squared values for the models in the GLM family selected for consideration. R squared represents the percentage of the total variance in the response variable explained by a particular model.

Consideration of the model fit and validation results as well as the ease of application to an implementation plan, led to the selection of the following models for each of the benefit utilization status populations (Table 4).

Logistic regression is appealing in that it allows for a more straightforward implementation of the model results to a typical actuarial model.

Finally, each of the selected models was run to predict results of the response variable for the validation datasets and accuracy of predictions were reviewed across the models. Model sensitivity and specificity were in the range of 77–82 percent and 67–70 percent respectively. And, based on a 70 percent cut off level, full surrenders are predicted accurately by the above models for between 77–82 percent of the policies.

Table 3

GLM Model Statistics

	Benefit Utilization Status A	Benefit Utilization Status B	Benefit Utilization Status C
R squared	.72	.69	.81

Table 4

Selected Models for Variable Annuity with GLWB Rates of Full Surrender

Benefit Utilization Status A	Benefit Utilization Status B	Benefit Utilization Status C
Logistic Regression Predictors: policy year surrender charge level ITM account value size attained age distribution channel	Logistic Regression Predictors: policy year surrender charge level withdrawal as % of max account value size attained age distribution channel	Logistic Regression Predictors: market attained age

STEP 3: Use the predictive model to develop a dynamic adjustment to base experience assumptions

The results of the data exploration and model selection process led us to select the following factors to include in the base tables of full surrender rates:

- Benefit Utilization Status A: policy year and surrender charge level;
- Benefit Utilization Status B: attained age group, surrender charge level and distribution channel; and
- Benefit Utilization Status C: attained age group and market.

Note that the above selections may be different at the individual company level.

Also, it is important to consider that in applying this process, the user should avoid the temptation to “over model.” For example, for contracts in post-GLWB utilization status (Status C above), a base full surrender assumption is likely sufficient. For these contracts, the industry data does not indicate any significant impact on this group from dynamic factors, and the experience data is credible at the industry level. However, this statement is made with the caveat that considering the post-GLWB utilization contracts with respect to duration

from the GLWB utilization data may produce additional insights about the dynamic nature of those surrenders.

Based on the modeling results, the following formulas are used to predict the probability of a full surrender (that accounts for key dynamic factors) for contracts in Benefit Utilization Statuses A and B. For contracts in Benefit Utilization Status C, only base full surrender tables appear to be necessary at this point in time.

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Probability of Full Surrender = $[e^{(\text{sum of } B_i \cdot X_i)}] / [1 + (e^{(\text{sum of } B_i \cdot X_i)})]$

where the B_i are the maximum likelihood estimates for the logistic regression models and are shown in the tables below and the X_i are the parameter values.

Table 5

Benefit Utilization Status A
Maximum Likelihood Estimates

Parameter	Parameter Value	Maximum Likelihood Estimate	Probability > Chi Sq
Intercept		-2.5052	<.0001
Policy Yr		-0.0348	<.0001
distrib_ch	other/unknown	-0.0557	0.777
distrib_ch	Stockbroker/Wirehouse	0.2063	<.0001
distrib_ch	Independent Agents/Brokers	0.2038	<.0001
distrib_ch	Career Agents	-0.5480	<.0001
surr_chg level	9%	-0.3738	<.0001
surr_chg level	8/8.5%	-0.4953	<.0001
surr_chg level	7/6.5%	-0.5772	<.0001
surr_chg level	6%	-0.2305	<.0001
surr_chg level	5%	0.0479	0.064
surr_chg level	4%	0.0473	0.122
surr_chg level	3%	0.2828	<.0001
surr_chg level	2%	-0.1091	0.128
surr_chg level	1%	1.0366	<.0001
acct value	500K and over	-0.4981	<.0001
acct value	250K-499K	-0.4928	<.0001
acct value	100K to 249K	-0.3602	<.0001
acct value	50K to 99K	-0.1153	<.0001
acct value	25K to 49K	0.3508	<.0001
age_grp	Under 60	0.5409	<.0001
age_grp	85 and over	-0.2355	<.0001
age_grp	70-85	-0.4512	<.0001
ITMrange	Under 100%	-0.0717	0.001
ITMrange	150% and over	-0.00626	0.790
ITMrange	125% to 150%	-0.0328	<.0001
M_E_1 Level	Medium	-0.0267	0.0721
M_E_1 Level	Low	-0.1457	<.0001

Table 6

Benefit Utilization Status B
Maximum Likelihood Estimates

Parameter	Parameter Value	Maximum Likelihood Estimate	P Value
Intercept		-2.9164	<.0001
Policy Yr		-0.0388	<.0001
withpct_range	Under 75%	0.7167	<.0001
withpct_range	Over 125%	0.5901	<.0001
withpct_range	75 to 90%	-0.4682	<.0001
distrib_ch	other/unknown	-0.0353	0.858
distrib_ch	Stockbroker/Wirehouse	0.2307	<.0001
distrib_ch	Independent Agents/Brokers	0.2253	<.0001
distrib_ch	Career Agents	-0.6278	<.0001
surr_chg level	9%	-0.3325	<.0001
surr_chg level	8/8.5%	-0.4305	<.0001
surr_chg level	7/6.5%	-0.5802	<.0001
surr_chg level	6%	-0.1767	<.0001
surr_chg level	5%	-0.00752	0.767
surr_chg level	4%	0.0249	0.420
surr_chg level	3%	0.2786	<.0001
surr_chg level	2%	-0.0830	<.0001
surr_chg level	1%	0.9097	<.0001
acct value	500K and over	-0.4270	<.0001
acct value	250K-499K	-0.4523	<.0001
acct value	100K-249K	-0.3431	<.0001
acct value	50K-99K	-0.1210	<.0001
acct value	25K-49K	0.3185	<.0001
age_grp	Under 60	0.4332	<.0001
age_grp	85 and over	-0.1353	<.0001
age_grp	70-85	-0.4076	<.0001

We have included the Wald Chi Squared test significance values in the last column of Tables 5 and 6. Based on this information, there are some areas for model simplification and this can be considered in allowing for a simpler implementation process.

These formulas produce a total full surrender rate. For implementation purposes, the dynamic surrender adjustments could then be estimated as the percent differences, positive or negative, between the modeled total full surrender rate and the modeled total full surrender rate by dynamic factor level (i.e., ITM, account value size, and/or withdrawal percent of the maximum level) for each of the base table rates.

APPLY THE PROCESS AT THE COMPANY LEVEL

Experience aggregators (or Statistical Agents as the PBR Valuation Manual refers to them) such as LIMRA and Rurark collect certain data fields that are common across most companies offering a particular product or benefit. However, in our analysis, company indicator was one of the most predictive factors for experience at the industry level. This indicates the importance of applying any such process at the individual company level to the extent possible.

If a company has a significant amount of VA with GLWB experience, there are opportunities at the company level to apply the analytical roadmap outlined in this article using actual company data to walk through the process, including

Key factors that drive experience should be identified ... and used to adapt the experience to a particular situation.

data exploration and predictive modeling, to develop a company level dynamic surrender function for VAs with GLWBs. Companies can examine additional data fields that may have significant predictive value and are available at the company level but not necessarily at the industry level. There will also be a need to evaluate the credibility of company experience. If Actuarial Guideline 43 (AG 43) is applicable to the particular situation, the credibility of company experience will impact the confidence interval in setting prudent best estimate assumptions per Section 3.B.8 and, if there is not relevant, credible historical data, the credibility of company experience should be considered in developing the plausible range as specified in Appendix 9.1 of AG 43.

If the company does not have a significant amount of VA with GLWB company experience, then industry experience can be used as the basis for the process with adjustments for differences in relevant company factors related to distribution channel, product design including investment restrictions, and so forth.

CONCLUSIONS

1. VAs and FIAs with GLWBs and GLIBs, respectively, have much lower full surren-

der rates than VAs and FIAs without those benefits.

2. VAs with GLWBs have very different surrender experience based on benefit utilization status with respect to the GLWB: the highest full surrender rates are seen on contracts for which withdrawals have been taken, but the GLWB not yet utilized. From Exhibit 2, surrenders for contracts that have utilized the GLWB are usually less than 1 percent by duration from issue. For VAs with GLWBs without any withdrawals under the contract to date, the surrender rates are in between the other two categories, but the pattern of surrenders can vary significantly by a number of factors, some affecting the prominence of the GLWB.

3. Industry data should be used with care, not relying on simple averages of overall experience across contracts in different benefit utilization statuses. Key factors that drive experience should be identified (if possible at the company level) and used to adapt the experience to a particular situation.

4. Even a very simple predictive model can be a useful starting point to bring dynamic structures into experience assumptions that are

strongly impacted by dynamic factors.

5. While industry data may provide a credible amount of experience data and a useful benchmark for comparison, where possible the unique profile of each company needs to be more fully recognized and additional information available at the company level should be incorporated into the process of developing the base full surrender rates and dynamic adjustments. ■



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