Policyholder Behavior in the Tail Risk Management Working Group
Variable Annuity Guaranteed Benefits Survey Results

Introduction

The Society of Actuaries' Risk Management Task Force is trying to develop better estimates of policyholder behavior in the tail (PBITT). Our mission is to examine and ultimately give guidance to actuaries on how to set policyholder assumptions in extreme scenarios. We are most interested in the assumptions used by companies or consultants for the scenarios in the 90 CTE calculations if stochastically modeled, or the assumptions for events that occur above two standards deviations of expected experience.

This document contains a summary of the results of a SOA questionnaire that confidentially gathered the range of assumptions actuaries use in pricing, reserving, and risk management of minimum guarantees on Variable Annuity products, such as death benefits, income benefits, withdrawal benefits and maturity benefits.

The definitions of these benefits used in this Survey are as follows:

Guaranteed Minimum Death Benefit (GMDB) guarantees minimum account value at death.

Guaranteed Minimum Income Benefit (GMIB) guarantees minimum monthly income at annuitization.

Guaranteed Minimum Withdrawal Benefit (GMWB) guarantees a minimum stream of income, provided it is withdrawn within specified limits over time.

Guaranteed Minimum Accumulation Benefit (GMAB) guarantees minimum account value at a specified future date.

If the underlying assumptions were based on data, then respondents were asked to specify them as such. If the assumptions were not based on data, the rationale for the assumptions was requested. Any questions that were not relevant to a respondent's business were ignored.

It is our hope that the results of this survey will enhance the Actuary's ability to set assumptions for these products in extreme scenarios. They may also provide a basis for further discussion of what may become current practices.

We greatly appreciate the time and efforts of those who responded.

We plan to do this survey again next year. Hopefully, the next report will include company responses to the new AAA LCAS C3 Phase II Modeling Approach that is within the NAIC RBC Requirements for December 31, 2005.

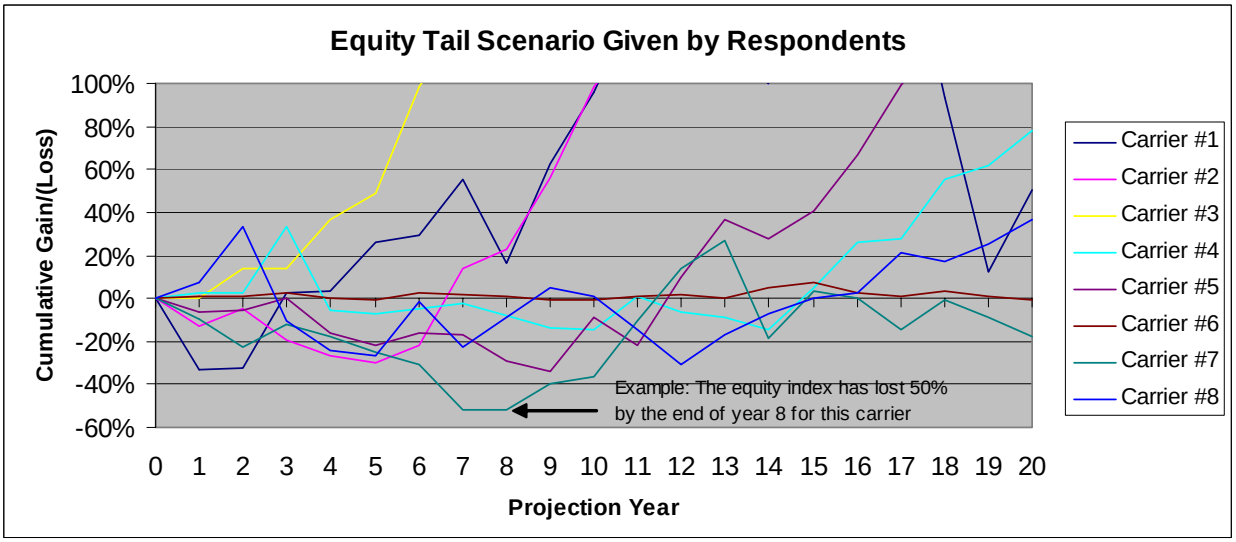
We encourage and welcome comments, questions, and suggestions from all of you. Please send them to either James Reiskytl at jimreiskytl@wi.rr.com or Steven Siegel @ ssiegel@soa.org.

Summary of Policyholder Behavior in the Tail Working Group Variable Annuity Survey Results

Profile of Participating Companies
(in millions)

	Net Premiums	Account Value	Guaranteed Value
GMDB			
Average	$11,754	$15,991	$19,217
25th Percentile	230	1,450	1,718
75th Percentile	18,793	22,212	29,357
GMIB			
Average	1,373	2,439	3,447
25th Percentile	306	300	521
75th Percentile	1,339	3,252	5,406
GMWB			
Average	1,631	4,009	3,495
25th Percentile	3	12	15
75th Percentile	1,312	2,028	2,030

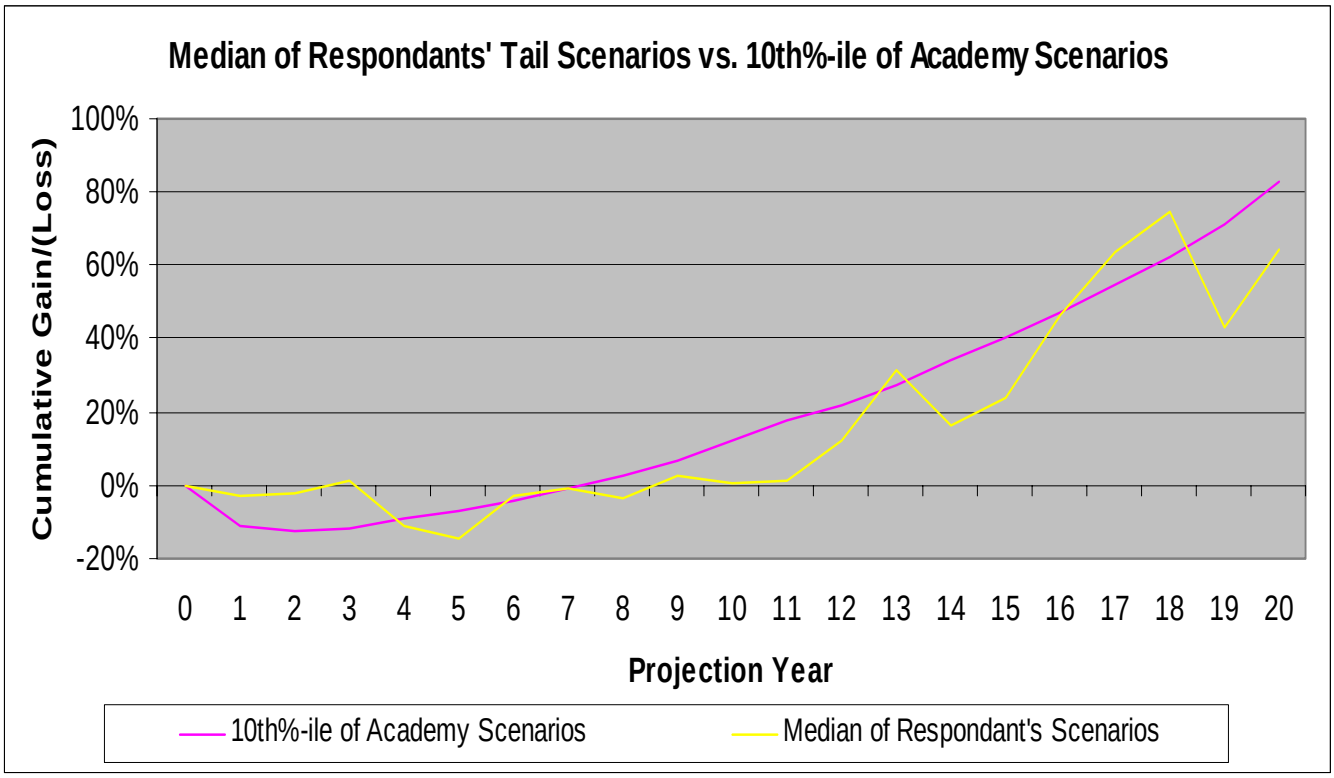
What equity tail scenarios are assumed?
(8 responses)



Due to the proliferation of guaranteed minimum death benefits and guaranteed living benefit, a tail scenario is most likely one with poor equity markets. However, depending on the type of guarantees sold, a tail scenario for company A may not necessarily be a tail scenario for company B. For example, a company with substantial ratchet guarantees may be most hurt by a

rapidly rising scenario followed by a crash, but a company with mostly return of premium guarantees will not be badly hurt by such a scenario. The wide variation in style of in-force business may explain the wide array in responses to this question.

To simplify the picture somewhat, the median of the respondents' scenarios at each projection year is shown alongside the 10th percentile of the 10,000 pre-packaged scenarios produced for the American Academy of Actuaries' LCAS RBC C3 Phase II effort. The scenarios were from the version published in March 2005 and the Diversified Large Cap US Equity Fund. The scenarios can be obtained from the following web page: www.actuary.org/life/phase2.asp#5. Note that the yellow and pink lines below represent the median and 10th %-ile, respectively, of the cumulative gains, rather than representing a particular scenario.



Description of Lapses and Utilization Functions

GMDB Lapses

18% (4 out of 22) assume dynamic lapse behavior for GMDBs

- Of those that do use dynamic lapses all four use a 1-sided function where lapses will only slow down when benefits become in-the-money (Lapses do not speed up when benefits are out-of-the-money).
- One of the four respondents slows lapses as attained age rises (in addition to in-the-moneyness).

Living Benefit Lapses

83% (15 out of 18) assume dynamic lapse behavior for living benefits

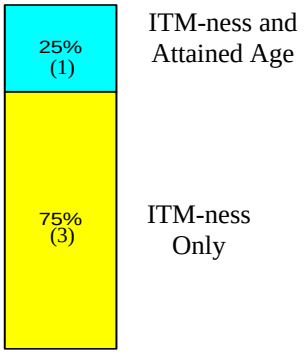
- Of the 14 that described their function, 93% (13 out of 14) use a factor based approach where the lapse rate used is a factor times the base lapse rate and the factor is based on in-the-moneyness.
- One carrier described a trigger function where lapses are X% if in-the-money and Y% if out-of-the-money.
- Only one carrier described a two sided factor-based function where lapses also increased as the benefit becomes out-of-the-money.

GMIB Utilization

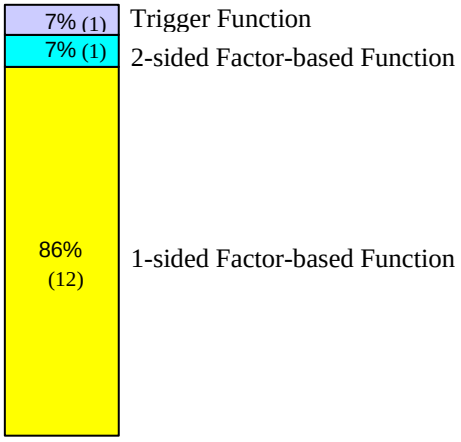
69% (11 out of 16) use dynamic utilization for GMIBs

- Of the 10 that described their function, 40% (4 out of 10) explicitly stated that dynamic utilization is a function of in-the-moneyness and attained age.
- The remainder only refer to in-the-moneyness as a factor for determining dynamic utilization.
- One carrier considers the option value of exercising the GMIB vs. the option value of holding onto the variable annuity in addition to considering in-the-moneyness and attained age.

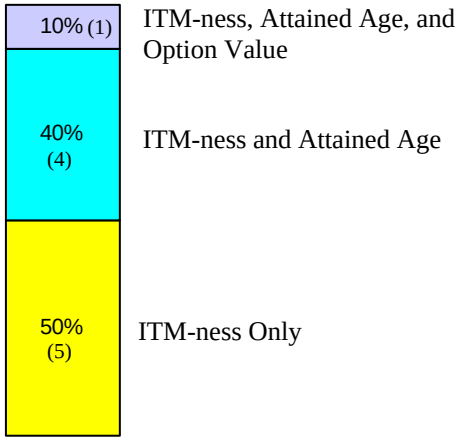
Factors used in Lapse Function



Features of Living Benefit Lapse Function



Factors used in GMIB Utilization Function

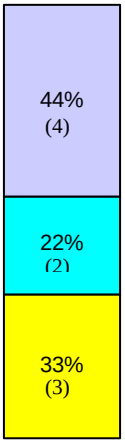


GMWB Utilization

64% (9 out of 16) use dynamic withdrawal assumptions for GMWBs

- Of the 9 that described their function 33% (3 out of 9) increase the withdrawal rate as in-the-moneyness increases.
- 22% (2 out of 9) explicitly state that they model different cohorts where full utilization begins when ITM-ness triggers are hit.
- The responses from the remaining 44% (4 out of 9) were not clear enough to determine whether ITM-ness increases the withdrawal rate or triggers full utilization of a cohort of policies.

Factors used in GMWB Utilization Function



Unclear how utilization increases when ITM-ness increases

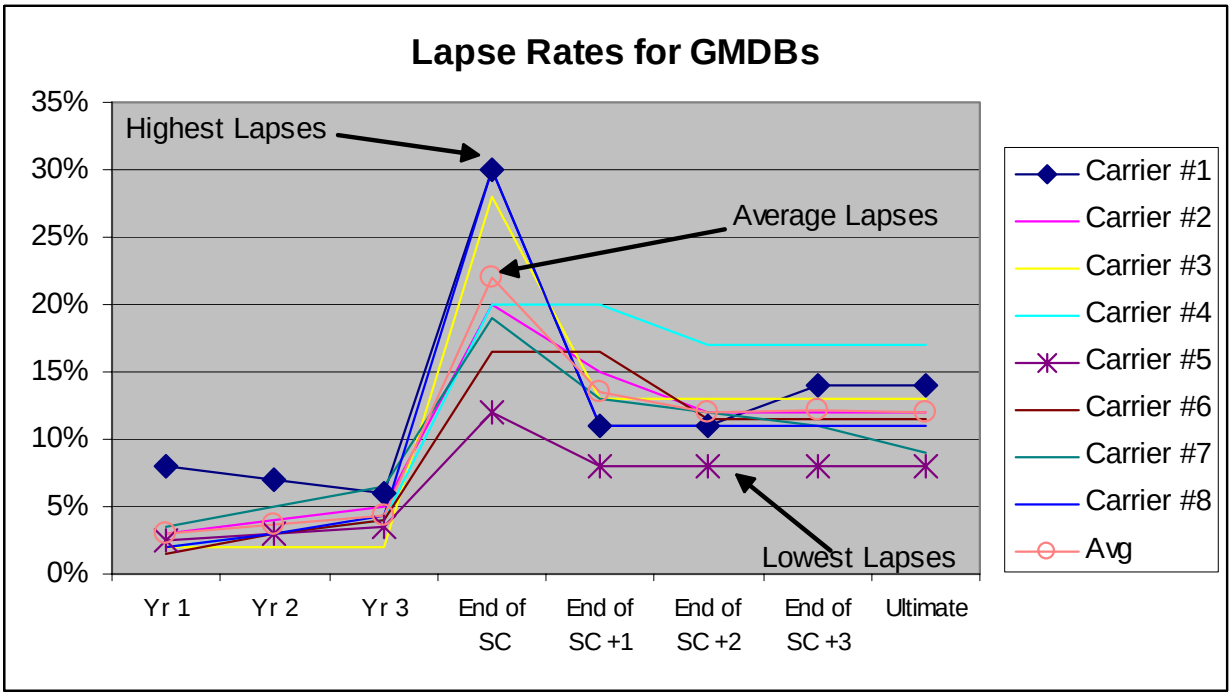
Full Utilization occurs when Policies are sufficiently ITM

Withdrawals Increase w/ ITM-ness

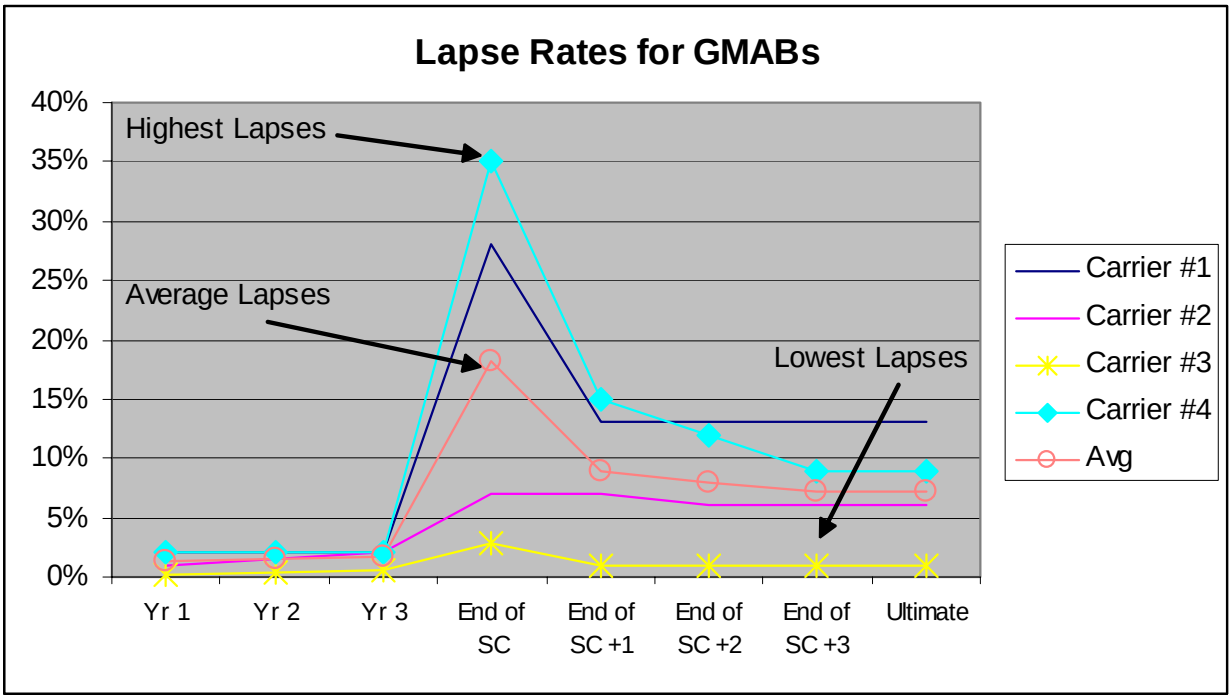
Lapse Rates in the Tail

Carriers were then asked to list their lapse rates in the tail scenario they described at the beginning of the survey under four different benefits (GMDB, GMAB, GMIB, GMWB). The carriers with the highest and lowest overall lapse rates along with the average across the carriers are highlighted.

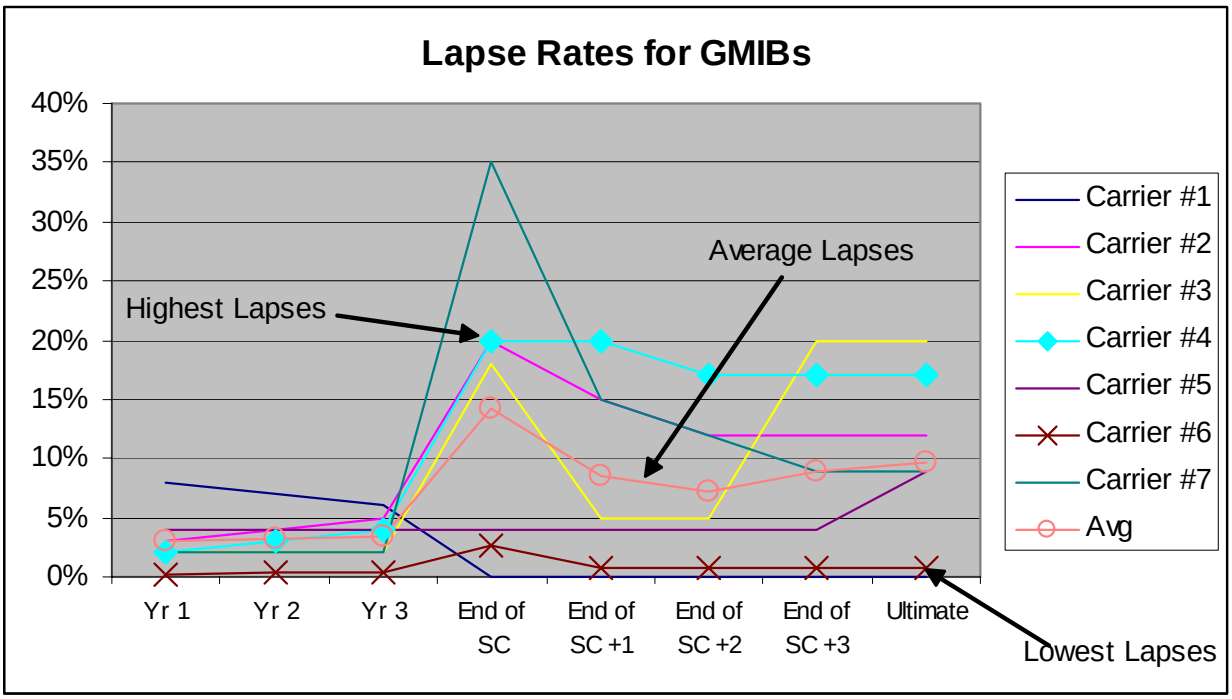
GMDBs



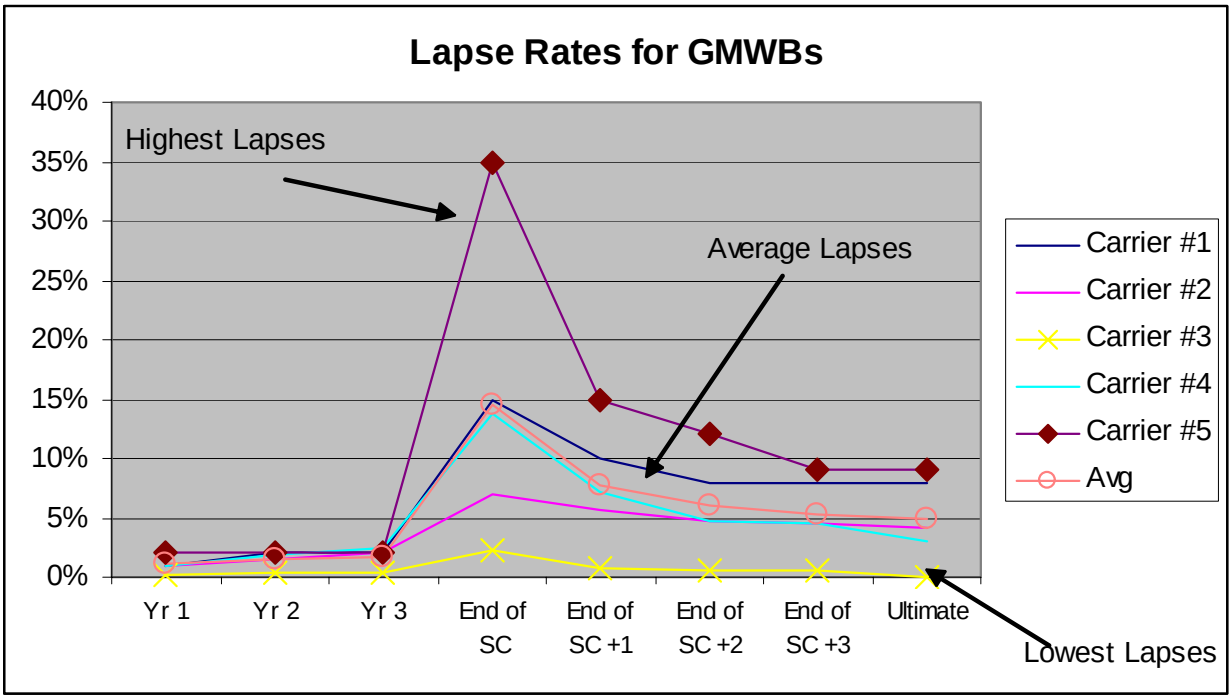
GMABs


Lapse Rates for GMABs
40%
35%
30%
25%
20%
15%
10%
5%
0%
Highest Lapses
Average Lapses
Lowest Lapses
Yr 1
Yr 2
Yr 3
End of SC
End of SC +1
End of SC +2
End of SC +3
Ultimate
Carrier #1
Carrier #2
Carrier #3
Carrier #4
Avg

GMIBs


Lapse Rates for GMIBs
40%
35%
30%
25%
20%
15%
10%
5%
0%
Highest Lapses
Average Lapses
Lowest Lapses
Yr 1
Yr 2
Yr 3
End of SC
End of SC +1
End of SC +2
End of SC +3
Ultimate
Carrier #1
Carrier #2
Carrier #3
Carrier #4
Carrier #5
Carrier #6
Carrier #7
Avg

GMWBs



GMIB Utilization in the Tail

Carriers were then asked to list factors that impact GMIB utilization rates as well as their GMIB utilization rates in the tail scenario they described at the beginning of the survey.

Factors that influence GMIB utilization:
Age: 50% (4 out of 8)
Duration: 25% (2 out of 8)
ITM-ness: 25% (2 out of 8)

5 Carriers listed their annuitization rates in the tail scenario
Carrier 1: 50%
Carrier 2: 0% if Age < 60, 50% if 60 <= Age < 65, 100% if Age >= 65
Carrier 3: 20-30%
Carrier 4: 35-45% if Age < 62, 45-50% if Age >= 62
Carrier 5: 0% at if at the money, 25% if 25% ITM, 50% if 50% ITM

GMWB Utilization in the Tail

Carriers were then asked to list factors that impact GMWB utilization rates as well as their GMWB utilization rates in the tail scenario they described at the beginning of the survey.

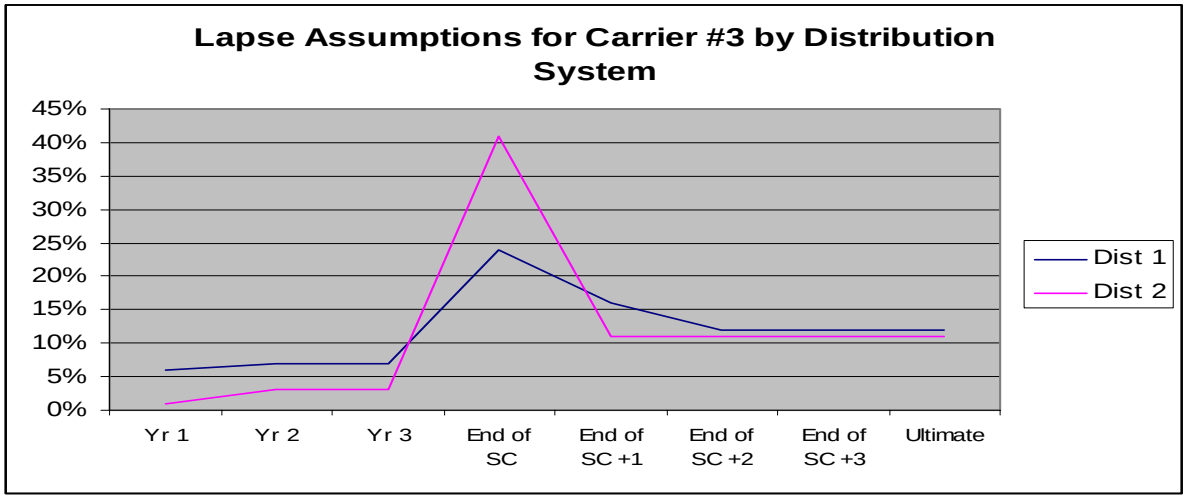
Factors that influence GMWB utilization:
Age: 29% (2 out of 7)
Duration: 29% (2 out of 7)
ITM-ness: 29% (2 out of 7)
Product: 13% (1 out of 7)

3 carriers listed their withdrawal utilization in the tail scenario
Carrier 1: 85% fully utilize benefit if ITM
Carrier 2: 75% fully utilize benefit for Product A, 100% for Product B
Carrier 3: Withdrawal rate = 2% if 10% ITM, 4.9% if 30% ITM, 7% if 50% ITM

Lapse Rates by Distribution Channel

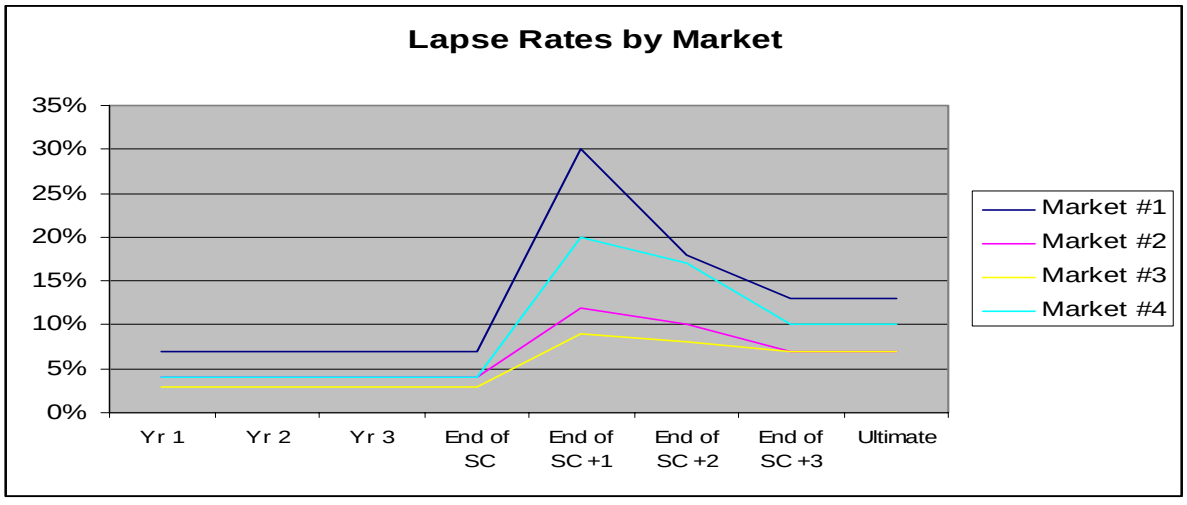
Companies were asked to list their lapse rates by distribution system (if they varied by this category). However the label each company used to represent Dist Channels #1, #2, #3, and #4 was not available. Consequently, only a comparison within a company is possible. Only 3 companies responded with differing assumptions by distribution channel, and of those, only 1 varied lapses substantially by channel.

Carrier 1: Only difference was at the end of the SC (30% vs. 60%)
Carrier 2: Only difference was at the end of the SC (30% vs. 25%) and SC+1 (20% vs. 15%)
Carrier 3:



Lapse Rates by Market

Only 1 company listed lapse rates that differed by Market, but as was the case with distribution system, it is not known what they intended to represent the various markets.



Appendix – Actual Survey Responses

Question 2d (Equity Scenarios): If you are performing stochastic modeling for required capital/RBC calculation purposes, please list the scenario that triggered the loss at the first non-zero result of your modified 90 CTE calculation (i.e. the first negative present value in these calculations). If you are not currently using stochastic modeling, please list the tail scenario.

Year	Carrier #1	Carrier #2	Carrier #3	Carrier #4	Carrier #5	Carrier #6	Carrier #7	Carrier #8
0	0%	0%	0%	0%	0%	0%	0%	0%
1	-33%	-13%	0%	2%	-6%	1%	-10%	7%
2	-32%	-5%	14%	2%	-6%	1%	-23%	33%
3	2%	-19%	14%	33%	0%	2%	-12%	-10%
4	3%	-27%	37%	-6%	-16%	0%	-18%	-24%
5	26%	-30%	49%	-7%	-22%	-1%	-25%	-26%
6	30%	-22%	98%	-5%	-16%	2%	-31%	-2%
7	56%	14%	130%	-3%	-17%	1%	-52%	-22%
8	17%	22%	132%	-8%	-29%	1%	-52%	-9%
9	62%	56%	182%	-14%	-34%	0%	-39%	5%
10	96%	98%	177%	-15%	-9%	0%	-37%	1%
11	139%	125%	218%	1%	-22%	1%	-10%	-14%
12	159%	183%	246%	-6%	10%	2%	14%	-31%
13	115%	291%	374%	-9%	36%	0%	27%	-17%
14	100%	344%	401%	-14%	28%	5%	-19%	-7%
15	225%	295%	471%	5%	40%	7%	4%	0%
16	173%	285%	508%	26%	67%	3%	0%	2%
17	184%	364%	575%	28%	99%	1%	-14%	21%
18	93%	227%	530%	55%	125%	3%	-1%	17%
19	12%	270%	607%	62%	173%	1%	-9%	25%
20	50%	249%	672%	78%	177%	-1%	-18%	36%

Displayed as Cumulative Returns

3a. Does your lapse assumption vary dynamically for death benefits?

Yes	4	18.18%
No	18	81.82%
Total	22	100%

3b. If so, please describe the dynamic lapse functions you are using for death benefits
Dynamic factor is a multiplier to lapses, varying by in-the-moneyness of the benefit.
The lapse rate gets larger as the GMDB gets more into the money, and larger as the surrender charge gets lower. The maximum additional lapse rate is 15%.
1-sided test - reduce lapse rates in proportion to AV/GMDB subject to a minimum threshold and maximum
N/A
Lapse rates grade down to a percent of the base lapse rates, with the degree of reduction being a function of attained age and the degree of in-the-moneyness.

3c. Does your lapse assumption vary dynamically for living benefits?

Yes	15	83.33%
No	3	16.67%
Total	18	100%

3d. Please describe the dynamic lapse functions you are using for living benefits:
One version has in the money and out of the money rates that switch as soon as the benefit is in the money. Another version assumes less rational behavior and dampens the behavior if not in the money by much.
As the benefit guarantees tend more toward being in the money, the election to access the benefits increases
Lapses decrease from base assumptions as the benefit increases in-the-moneyness: For 10% ITM--90% of base at issue grading to 35% of base at maturity of guarantee. For >50% ITM--50% of base at issue grading to 25% of base at maturity of guarantee. Linear in between 10% and 50% ITM.
Dynamic factor is a multiplier to lapses, varying by in-the-moneyness of the benefit.
the dynamic lapse factor depending on in-the-moneyness of GMIB is used.
GMIB 2 scenarios Time Scenario 1 Scenario 2 Year Eligible 10% of Base 25% of Base Year Before 25% of Base 50% of Base 2 Years Early 50% of Base 75% of Base GMAB ITM Years 1-5 6-8 9 10 0% 100% 100% 100% 100% 0%-20% 50% 25% 10% 0% 20%-40% 25% 10% 0% 0% >40% 10% 5% 0% 0%
Drivers include in-the-moneyness, trail commission, and surrender charge. In general, persistency improves as the living benefit's in-the-moneyness improves. The higher the trail commission/surrender charge, the better the persistency.
If the benefit is in the money, the lapse rate modeled will be 25-50% of the base lapse assumption. If the benefit is not in the money, base lapse assumptions will apply.
Percentages of base lapse are determined by measuring the ratio of discount present value of guarantee obligations to current account value. This relationship is generally inversely proportional, but not uniform over the in-the-money measure nor by time.
Base lapses adjusted by factor to decrease when ITM and increase when OTM
1-sided test - reduce lapse rates in proportion to AV/GMWB subject to a minimum threshold and maximum adjustment
Lapse rates grade down to a percent of the base lapse rates, with the degree of reduction being a function of attained age and of the degree of in-the-moneyness. In extreme moneyness a low ultimate lapse rate is used.
Lapse(t) = baseline(t) * min(1.0 , max(0.10 , (av/glb)**(.167*t)
various functions, linear or exponential, depending on type of benefit, all based on ITM

3e. For Income Benefits, does your utilization assumption vary dynamically?

Yes	11	68.75%
No	5	31.25%
Total	16	100%

3f. If so, please describe the dynamic utilization function that you are using:
((1+ITM)^2)/2
More toward being in the money increases election to access benefit
the dynamic utilization is dependent upon in-the-moneyness of GMIB
ITM Annuitization 5% 0% 25% 18% 50% 50%
Drivers include in-the-moneyness and policyholder attained age. In general, utilization increases as in-the-moneyness increases. Utilization increases as policyholder nears retirement age (spike at age 65). Utilization then decreases until age 75, after which it increases once again.
Percentages of base lapse are determined by measuring the ratio of discount present value of guarantee obligations to current account value. This relationship is generally inversely proportional, but not uniform

over the in-the-money measure nor by time.
Yes, utilization increases when ITM and also with age
Annuitization rates grade up to a capped rate, with the rates being a function of attained age and of the degree of in-the-moneyness.
gmib_util(t) = const + (1/8)*L where const = .005 per year for attained age < 62 and .0425 for age 62 and later. L is either 1 or 0-- if the option value of annuitizing the gmib equals or exceeds the option value of holding the Variable annuity, then L = 1. Otherwise L= 0;
an increasing function of the ratio of the guaranteed benefit base to account value, subject to a min and max

3g. For Withdrawal Benefits, does your withdrawal assumption vary dynamically?

Yes	9	64.29%
No	5	35.71%
Total	16	100%

3h. If so, please describe the withdrawal dynamic function you are using:

45% of buyers start withdrawals when PV WB > 80% of account value. Other buyers never excercise WB.
A cohort of policyholders will elect a systematic withdrawal program. For this cohort, the withdrawal amount is known and a dynamic assumption is not required. For the remaining policies, in-the-moneyness is the key driver.
If the benefit is in the money, the utilization ranges from 75-100%. If the benefit is not in the money, the utilization ranges from 25-100%.
Percentages of base lapse are determined by measuring the ratio of discount present value of guarantee obligations to current account value. This relationship is generally inversely proportional, but not uniform over the in-the-money measure nor by time.
increases wds in proportion to GMDB/AV for those policies at risk for GMDB stripping
Withdrawal rates grade up to the maximum allowed, with the rate being a function of attained age and of the degree of in-the-moneyness.
As a percentage of the available withdrawal amount: 78% - 70%*exp(-min(5.33 , 5*itm - 4.67)) Where itm = remaining total guaranteed amount / remaining acct value.
an increasing function of the ratio of the account value to the guaranteed remaining balance, subject to a min and max

Question 4: **LAPSE RATES IN THE TAIL for Variable Annuity Guaranteed Benefits**

Please enter the lapse rates assumed in the tail scenario listed in Question 2:

	Death Benefits	Maturity Benefits	Income Benefits	W/D Benefits	Combo of Benefits*
Year 1					
	8		8		
	3		3		
	2	2	2	1	
	2%	1%	2%	1%	N/A
	0.025				0.025
	1.50%				
	3.5		4		
	2%	0.20%	0.20%	0.20%	N/A
		2%	2%	2%	
Year 2					
	7		7		
	4		4		
	2	2	2	2	
	3	1.5	3	1.5	
	0.03				0.03
	3.00%				
	5		4		
	3%	0.30%	0.30%	0.30%	
				1.90%	
		2%	2%	2%	
Year 3	6		6		
	5		5		
	2	2	2	2	
	4	2	4	2	
	0.035				0.035
	4.00%				
	6.5		4		
	4.30%	0.60%	0.40%	0.40%	
				2.40%	
		2%	2%	2%	
End of Surrender Period					
	30		0		
	20		20		
	28	28	18	15	
	20	7	20	7	
	0.12				0.15
	16.50%				
	19		4		
	30%	2.90%	2.70%	2.30%	
				13.80%	
		35%	35%	35%	

SP+1

	11		0		
	15		15		
	13	13	5	10	
	20	7	20	5.6	
	0.08				0.1
	16.50%				
	13		4		
	11%	0.90%	0.70%	0.70%	
		15%	15%	15%	

SP+2

	11		0		
	12		12		
	13	13	5	8	
	17	6	17	4.8	
	0.08				0.1
	11.50%				
	12		4		
	11%	0.90%	0.80%	0.60%	
				4.70%	
		12%	12%	12%	

SP+3

	14		0		
	12		12		
	13	13	20	8	
	17	6	17	4.5	
	0.08				0.1
	11.50%				
	11		4		
	11%	0.90%	0.80%	0.60%	
				4.50%	
		9%	9%	9%	

SP+t (ultimate)

	14		0		
	12		12		
	13	13	20	8	
	17	6	17	4.2	
	0.08				0.08
	11.50%				
	9		9		
	11%	1%	0.70%	0.00%	
				3.10%	
		9%	9%	9%	

*Please describe the combined benefits:
GMDB/GMIB benefits combined for all GMIB policies
see Question 10: Comments

5. For Income Benefits, please enter the utilization rate or range of rates assumed in the tail scenario in Question 2. If rates vary by age, duration, or any other factor, please specify:

Age	4	40.00%
Duration	2	20.00%
Other	4	40.00%

Other Responses:
Make change to cash value in model if benefit is in the money
IB was priced using reinsurance rates; no utilization assumption was needed
None;Table_1.xls gives Utilization rates
Benefit Base/Account Value

Factor 1		**Factor 2**		**Factor 3**		**Factor 4**		**Factor 5**	
Factor	**Utilization**	**Factor**	**Utilization**	**Factor**	**Utilization**	**Factor**	**Utilization**	**Factor**	**Utilization**
	0.5								
Cash Value	100%								
Age<60	0	Age<65	0.5	Age>=65	1	Dur<7	0		
Age	20-30%								
<62	35-45%	62+	45-50%						
100%	0	125%	25%	150%	50%				

6. For Withdrawal benefits, please enter the % using full withdrawal rates assumed in the tail scenario in Question 2. If rates vary by age, duration, or any other factor, please specify

Age	2	25.00%
Duration	2	25.00%
Other	4	50.00%

Other Responses:

In-the-moneyness

Product

Table_2.xls gives % full withdrwal rates

Account Value/Remaining Benefit Balance

Factor 1		Factor 2		Factor 3		Factor 4		Factor 5	
Factor	**Utilization**	**Factor**	**Utilization**	**Factor**	**Utilization**	**Factor**	**Utilization**	**Factor**	**Utilization**
ITM	85%								
Product A	75%	Product B	100%						
90%	2%	70%	4.90%	50%	7%				

7. If lapse rates vary by distribution system, please list them in the following four boxes. In addition, if they vary, please complete the table below with the appropriate lapse rates:

		Year 1	Year 2	Year 3	End of SP	SP+1	SP+2	SP+3	SP=t (ultimate)
Company1	Dist 1	8	7	6	30	11	11	14	14
	Dist 2	8	7	6	60	11	11	14	14
Company2	Dist 1	0.06	0.07	0.07	0.24	0.16	0.12	0.12	0.12
	Dist 2	0.01	0.03	0.03	0.41	0.11	0.11	0.11	0.11
Company3	Dist 1	1	2	3	8	30	20	15	15
	Dist 2	1	2	3	8	25	15	15	15

8. If lapse rates vary by market, please list them in the following four boxes. In addition, if they vary, please complete the table below with the appropriate lapse rates:

		Market #1	Market #2	Market #3	Market #4
Company1	Year 1	7%	4%	3%	4%
	Year 2	7%	4%	3%	4%
	Year 3	7%	4%	3%	4%
	End of SP	7%	4%	3%	4%
	SP+1	30%	12%	9%	20%
	SP+2	18%	10%	8%	17%
	SP+3	13%	7%	7%	10%
	SP+t (ultimate)	13%	7%	7%	10%