



AMERICAN ACADEMY *of* ACTUARIES

**Report of the American Academy of Actuaries VAGLB Work Group
Presented to the NAIC's Life and Health Actuarial Task Force
New Orleans, Louisiana - June, 2001**

The American Academy of Actuaries is the public policy organization for actuaries practicing in all specialties within the United States. A major purpose of the Academy is to act as the public information organization for the profession. The Academy is non-partisan and assists the public policy process through the presentation of clear and objective actuarial analysis. The Academy regularly prepares testimony for Congress, provides information to federal elected officials, comments on proposed federal regulations, and works closely with state officials on issues related to insurance. The Academy also develops and upholds actuarial standards of conduct, qualification and practice and the Code of Professional Conduct for all actuaries practicing in the United States.

This report was prepared by the Academy's Variable Annuities with Guaranteed Living Benefits (VAGLB) Work Group of the Committee on State Life Insurance Issues.

Stephen J. Preston, F.S.A., M.A.A.A., Co-Chair

Thomas A. Campbell, F.S.A., M.A.A.A., Co-Chair

James E. Backus, F.S.A., M.A.A.A.

Jan C. Brown, F.S.A., M.A.A.A.

Robert A. Brown, F.S.A., M.A.A.A.

Donna R. Claire, F.S.A., M.A.A.A.

Franklin C. Clapper, Jr., F.S.A., M.A.A.A.

Robert A. Conover, F.S.A., M.A.A.A.

Larry M. Gorski, F.S.A., M.A.A.A.

James P. Greaton, F.S.A., M.A.A.A.

Timothy Hill, F.S.A., M.A.A.A.

James Lamson, F.S.A., M.A.A.A.

John O'Sullivan, F.S.A., M.A.A.A.

Timothy C. Pfeifer, F.S.A., M.A.A.A.

Timothy J. Ruark, F.S.A., M.A.A.A.

Vinaya K. Sharma, F.S.A., M.A.A.A.

Stephen A. Steinberg, F.S.A., M.A.A.A.

Jonathan L. Wooley, F.S.A., M.A.A.A.

The work group would also like to thank Geoffrey H. Hancock, from the Canadian Institute of Actuaries, who was a tremendous help with the construction of this report.

I. VA Historical Fund Data Update

1. Reasons for Updating VA Historical Fund Data
 - a) Changed data structure from “overlapping” to “non-overlapping”.
 - b) Data needed to be updated from 38 to 40 years to reflect 1999 and 2000 experience.

2. Overlapping versus Non-Overlapping data
 - a) Overlapping data utilizes 468 annual returns generated from monthly overlapping returns (1/61-12/61, 2/61-1/62...1/00-12/00).
 - b) Non-overlapping data utilizes 480 monthly returns from 1/61 to 12/00.
 - c) Overlapping data originally used to provide additional data points, but non-overlapping data better captures mean and volatility needed for statistical distributions.
 - d) A comparison of 38 year overlapping and non-overlapping parameters for draft Actuarial Guideline MMMM fund classes is shown in Appendix 1, Page 1.
 - e) The results using 38-year non-overlapping data generally produced slightly lower means and standard deviations compared to the overlapping data.

3. 38 versus 40 year database
 - a) VA database was revised to reflect fund returns, asset class weights for representative indices, and fund expenses for 1999-2000. A comparison of 38 and 40 year results is also shown in Appendix 1, Page 1.
 - b) The 40-year database generally produces slightly lower fund returns and slightly higher standard deviations compared to the 38-year non-overlapping database. These differences were caused mostly by lower fund returns and higher volatility during 1999-2000. Also, growth and income equity class weights decreased, while other equity classes decreased.
 - c) Appendix 1 – Page 2 converts the monthly empirical lognormal mean net annual returns and standard deviations for each fund class to normal parameters to facilitate the calculations shown in draft AG MMMM.
 - d) Appendix 1 – Page 3 adjusts the net annual returns for expense charges to determine the Gross Annual Returns required in draft AG MMMM. Note that expense charges for the 40 year database were slightly lower than those used in the 38 year database.

II. Fund Return Scenarios Used to Project VAGLBs

1. Draft AG MMMM provides a framework for 3 methodologies used to determine fund return scenarios used to project VAGLBs:
 - a) Stochastic Scenarios – a large number of stochastically determined sets of future gross assumed returns.
 - b) Representative Scenarios – optional sets of future gross assumed returns, determined by the valuation actuary to represent Stochastic Scenarios in VAGLB reserve calculations.
 - c) Keel Method Scenario – an optional, standardized simple set of future gross returns. Under certain “safe harbor” criteria, the Keel Method scenario may be used as a simplified alternative to Representative Scenarios.
2. Section III analyzes 3 alternative distribution models to be used in the determination of the Stochastic Scenario method discussed above.
3. Representative Scenarios and Keel Method Scenario alternatives are discussed under Recommendations in Section V.

III. AG MMMM Stochastic Scenarios – Analysis of Distribution Models

1. Desired Characteristics
 - a) The distribution should produce a good fit to historical data (empirical data), particularly at both tails of the distribution.
 - (1) A good fit will ensure that tails are fat enough to reflect the range of potential results over an extended period.
 - b) The distribution should produce reserves that are consistent with those produced by empirical data over a broad range of guaranteed benefit types.
 - c) The distribution should be relatively simple to implement and audit, given a seriatim CARVM reserve framework.
 - d) Where possible, the distribution should facilitate a reserve methodology which is consistent with the method ultimately utilized in the C-3 Phase II equity project for Life RBC.
2. Description of distribution models analyzed (see Appendix 2 for more detail)
 - a) Independent Lognormal (ILN) – “text book” two parameter model. The independent lognormal distribution, currently utilized in draft AG MMMM, is relatively crude but simple to implement.
 - b) Regime Switching Lognormal (RSLN) – lognormal distribution where the returns and volatility vary based on movement between two “regimes” (e.g., in either a “typical” or a “volatile” return period). This 6 parameter distribution, which is more complex than the independent lognormal, is generally believed to have the capability to produce a better fit than the independent lognormal. A description of the Regime Switching model is presented by Mary Hardy in the 4/01 North American Actuarial Journal.
 - c) Stochastic Log Volatility & Drift Lognormal (SLV&D) – the continuous analogue of the RSLD model (i.e., infinitely many regimes), with separate but correlated stochastic mean reverting processes for both drift and log volatility. This distribution, which has the capability to produce an excellent fit to the empirical data, has 9 parameters which are extremely difficult to determine, ideally requiring daily return data for a monthly model.
3. Criteria used to evaluate fit of distribution to empirical data
 - a) Accumulation factors from the distribution model should fall in the corresponding empirical range of historical data.
 - b) Moments of distribution
 - (1) The first 4 moments of each distribution (i.e., mean, standard deviation, skew, and kurtosis) are compared with first 4 months of the empirical data.

- (2) The first 4 moments of each distribution are also compared with the first 4 moments of the “statistically sampled data with replacement”, which is:
 - (a) not a model, but random samples with replacement returns from the 1961-2000 universe of monthly returns. This assumes that the universe of returns are the only returns which can occur, and that they occur at the same relative frequency, but in a different order.
 - (b) normally used only as a secondary criterion at longer return periods, where the number of empirical data points is inadequate.

4. Summary of Findings – Analysis of Fit

a) Historical empirical data range

- (1) Appendix 3 compares accumulation factors (i.e., 1+ the cumulative fund return over the time period chosen) based upon historical empirical data to accumulation factors based upon each distribution under review for each of the 5 draft AG MMMM asset classes over 1-240 month time periods.
- (2) Generally, the distribution would be considered a “good fit” to the empirical data if, at all percentiles under consideration:
 - (a) The 1 month returns generated by the distribution model are reasonably close to the 1 month empirical returns (labeled “AVG” in Appendix 3); and
 - (b) Returns generated by the distribution model over longer time periods (e.g., 6-240 months) are within the range of historical empirical data; and
 - (c) Where limited empirical data is available (e.g., 60-240 months), the returns generated by the distribution model are reasonably close to the stochastically sampled data with replacement.
- (3) Since the underlying empirical returns have a monthly frequency, the most important measure of fit should focus on the 1 month returns. Lack of data for longer periods makes it difficult to form definitive statements on data fit.
- (4) 1 month return period – conclusions
 - (a) No model provides a perfect fit to the underlying data
 - (b) However, all 3 distributions produce a reasonable fit for all 5 asset classes at all but the 2 “tails” of the distribution (e.g., 5-95th percentile)
 - (c) At both tails, the ILN model begins to show significant shortfalls in fitting to historical data
 - (d) The RSLN and SLV&D fit the historical data well, at all but the very extreme tails (e.g., 1-99%)
- (5) 6-240 month return periods – conclusions
 - (a) Appendix 3 shows (in bold) distribution model accumulation factors which are outside the historical empirical data range

- (b) Generally, all distributions provide returns which are inside the empirical range at longer time periods, except for some minor variances for 6-24 month range
- (c) In most cases where distribution returns are outside the empirical range, the distribution returns fit well to the statistically sampled returns

b) Analysis of the moments of the distributions

- (1) Appendix 4 compares the four moments for the monthly log total return data for the three distributions:
 - (a) Mean – average value
 - (b) Standard Deviation - measure of how widely values are dispersed from the average value (the mean).
 - (c) Skew - characterizes the degree of asymmetry of a distribution around its mean. Positive skewness indicates a distribution with an asymmetric tail extending toward more positive values. Negative skewness indicates a distribution with an asymmetric tail extending toward more negative values.
 - (d) Kurtosis - characterizes the relative peakedness or flatness of a distribution compared with the normal distribution. Positive kurtosis indicates a relatively peaked distribution. Negative kurtosis indicates a relatively flat distribution.
- (2) The ILN has only two non-zero moments, mean and standard deviation. Because it has no non-zero third and fourth moments (skew and kurtosis), the ILN does not produce tail values that are reasonably close to the empirical data.
- (3) For both the RSLN and SLV&D, all four moments are reasonably close to the empirical data. Therefore, both distributions produce a better fit to the tail of the empirical data.
- (4) While the RSLN and SLV&D produce moments which are a good fit to the empirical data, other models which allow volatility to vary may produce an even better fit to historical data. The Academy VAGLB Work Group does not want to mandate a single distribution which could preclude the use of such superior models, where appropriate.

5. VAGLB Reserve Analysis for alternative distributions

a) Reserve testing

- (1) GMAB reserves were tested for various contract durations and “in the money” percentages for the ILN and RSLN distributions.
- (2) Reserves for other VAGLB product designs and the SLV&D distribution were not completed due to time constraints. Based upon our knowledge of the benefits and the similarities of the characteristics of the distributions, however, the Academy VAGLB Work Group believes the results of these additional runs would be comparable.

b) Reserve testing conclusions

- (1) For those benefit designs analyzed, reserves in the early contract durations were immaterial for both distributions at all but the extreme percentiles.
- (2) At later durations, material reserve differences between the ILN and RSLN distributions occur at higher reserve adequacy percentiles (or at lower accumulation factor return percentiles) when the GMAB benefit is “in the money” at later durations.

6. Implementation of Distributions

a) ILN Distribution

- (1) ILN is the simplest distribution to implement.
- (2) The distribution is well understood and widely used by both the actuarial and investment communities.
- (3) Relatively easy to produce distribution returns or stochastically generated scenarios.
- (4) Allows for Keel simplification.

b) RSLN Distribution

- (1) Much more complex to implement.
- (2) While well documented by Mary Hardy’s paper, the method is currently not well-known nor widely used by the actuarial community.
- (3) Can stochastically generate scenarios but the distribution is complex to tabulate
- (4) Does not facilitate Keel method simplification

c) SLV&D Distribution

- (1) While the distribution could possibly generate the best fit, it is extremely complex to implement. Despite considerable effort, the Academy VAGLB Work Group has not yet finished fine tuning the necessary parameters to achieve an optimal fit.
- (2) Not well documented in actuarial literature, being almost unknown to the actuarial community.
- (3) Can stochastically generate scenarios, but the distribution has no simple closed form solution.
- (4) Does not allow for Keel Simplification

7. Calibration versus Standardized Models

- a) An alternative to mandating a Standardized Model such as ILN, RSLN, or SLV&D in AG MMM would be to allow the valuation actuary to have the ability to choose any stochastic model, as long as it produces returns which are at least as conservative as the specified calibration returns.
- b) Calibration points would have to be developed and would have to encompass both sides of the tail to accommodate ratchet-type (i.e., path dependent) designs. Additional requirements might also be needed to preserve the moments of the distribution.
- c) This calibration method is similar to the approach recommended by the CIA for segregated fund investment guarantees in Canada.
- d) This approach eliminates the necessity of having to decide which Standardized Model is the best one to use.
- e) It gives the valuation actuary the ability to use a model that is as simple or as complex as they feel is necessary, in their opinion, to account for the risk characteristics of a particular VAGLB design.

8. Academy VAGLB Work Group Conclusions

- a) There is no single distribution model that will optimally address both the issue of fit to empirical results and simplicity of implementation.
- b) Therefore, the Academy VAGLB Work Group recommends that the approach outlined above, where the valuation actuary chooses the stochastic model subject to calibration, be implemented.
- c) To accommodate this approach, a set of calibration points should need to be generated at several different percentiles and at several different time periods for each fund class.
 - (1) The thin tails produced by the ILN distribution and the difficulty of producing parameters for the SLV&D distribution make these distributions inappropriate for use in generating calibration points.
 - (2) Therefore, the RSLN distribution will be used as the starting point for generating the calibration points, with suitable adjustments as necessary.
- d) Draft AG MMMM should be modified to give the valuation actuary the responsibility to choose any stochastic model, as long as it produces returns that are at least as conservative as the specified calibration returns. Note that this calibration process may need to consider both sides of the tail to address a wide array of future product designs.

IV. Conditional Tail Expectation (CTE) vs. Percentile Approaches

1. Background
 - a) Draft AG MMMM requires VAGLB reserves to be based on the 83.33rd percentile ranking of stochastically generated fund return scenarios.
 - b) Because of the low probability, high impact nature of VAGLBs, reserves at the 83.33rd percentile may be small or even zero, while the reserve may be greater at higher percentiles.
2. Description of Conditional Tail Expectation (CTE) approach
 - a) The CTE approach sets reserve at the average cost over the tail of the distribution. For example, CTE (x) takes the average of the highest (100-x)% costs of the cases tested.
 - b) Appendix 5 shows an example of how a CTE reserve would be calculated.
 - c) The CTE approach has the ability to take into account low frequency, high impact events by giving some weight to all outcomes in the tail.
 - d) For monotonically increasing distributions, the results of a CTE (x) reserve calculation is at least as great as the reserve at the $((x + 100) / 2)^{\text{th}}$ percentile. For example, reserves based on CTE (66.66) are greater than or equal to reserves at the 83.33rd percentile.
3. Overall Recommendation - CTE versus Percentile
 - a) Since the CTE approach gives some weight to all outcomes in the tail, the Academy VAGLB Work Group recommends that this approach be strongly considered in the development of the new C-3 RBC (Phase II) Equity requirements.
 - b) While the use of CTE in the calculation of VAGLB reserves has theoretical merit, for practical reasons the Academy VAGLB Work Group recommends that a percentile approach continue to be used.
 - (1) The percentile approach better facilitates the use of the simplified alternatives such as the single scenario Keel Method.
 - (2) Given the existing seriatim CARVM framework, calculating VAGLB reserves using the CTE approach for each contract on a stochastic basis would be impractical for many companies to implement.
 - (3) Reserves based on the CTE method can be estimated by calculating reserves at the appropriate percentile.
 - (4) Draft AG MMMM is an interim solution, we believe the CTE reserve approach should be explored in the context of a new valuation law relying less on seriatim, formulaic approaches.

V. Conclusions and Recommended Next Steps

1. Complete calibration analysis for draft AG MMMM Stochastic Scenarios Methodology
 - a) There is no single distribution model that will optimally address both the issue of fit of generated returns to empirical results and the issue of simplicity in implementation.
 - b) Therefore, the Academy VAGLB Work Group recommends that a set of calibration points be generated at several different percentiles and at several different waiting periods for each fund class.
 - c) The RSLN distribution should be used as the starting point for generating the calibration points, with suitable adjustments as necessary.
 - d) Reserves will be tested for various contract durations and “in the money” percentages using returns calibrated to the different calibration points.
2. Develop simplified alternative methods to draft AG MMMM Stochastic Scenarios Methodology
 - a) Once a AG MMMM Stochastic Scenario model that meets the calibration point criteria discussed above is chosen by the valuation actuary, a smaller number of Representative Scenarios could be determined using the testing and compliance requirements in the current draft of AG MMMM.
 - b) In addition, the Academy VAGLB Work Group recommends that a simplified alternative, such as the Keel Scenario Method, be pursued for benefit designs that meet certain “safe harbor” criteria.
 - (1) The parameters of the Keel Scenario Method in the current draft AG MMMM could be modified to better “fit” the calibration points.
 - (2) The resulting “fitted lognormal” distribution could then be used in the manner described in the current draft of AG MMMM.
3. Modify Draft Actuarial Guideline MMMM as appropriate
 - a) Make changes as needed to reflect calibration methodology described above.
 - b) Remove retrospective floor “placeholder”, to reflect completion Academy Work Group theoretical work.
 - c) Recommend timely adoption MMMM to provide interim solution.
4. Continue work with the Academy Life RBC Task Force to pursue a long-term non-formulaic VAGLB solution that addresses both reserve and RBC consideration.

Appendices

1. Historical Database - 38 versus 40 year Periods
2. Comparison of Equity Return Distribution Models
3. Results of the Distribution Models versus the Empirical Data
4. Comparison of the Four Moments of the Empirical Data to the Three Chosen Distributions
5. Example of CTE Reserve Calculation

VAGLB June 2001 REPORT - Appendix 1 - Page1

Morningstar VA and Weighted Indices Data Historical Database Revisions - Net Assumed Returns

Historical Database - 38 versus 40 year periods**

Asset Class	Asset Class Weight (13 Years) 1986-98	Asset Class Weight (15 Years) 1986-00	38 Year Database				40 Year Database					
			38 Years 1961-98		38 Years 1961-98		First 38 Years 1961-98		Last 2 Years 1999-00		40 Years 1961-00	
			Overlapping		Non-Overlapping		Non-Overlapping		Non-Overlapping		Non-Overlapping	
			Mean	STD	Mean	STD	Mean	STD	Mean	STD	Mean	STD
Growth & Income	39.2%	33.2%	11.7%	14.1%	11.5%	13.2%	11.5%	13.6%	5.8%	13.4%	11.2%	13.6%
Growth	22.5%	29.5%	13.0%	15.3%	12.8%	14.8%	12.9%	14.7%	11.4%	18.0%	12.8%	14.9%
Aggressive Growth	6.1%	8.2%	17.7%	21.9%	16.8%	19.7%	16.7%	19.6%	17.2%	29.0%	16.8%	20.2%
International Equity	7.2%	8.0%	13.0%	16.7%	12.2%	13.0%	12.3%	13.0%	11.1%	19.1%	12.2%	13.4%
Total Equity	75.1%	79.0%	12.7%	14.4%	12.4%	14.2%	12.6%	14.6%	9.6%	17.3%	12.5%	14.7%
Corporate Bond	4.3%	3.3%	7.1%	8.2%	6.7%	6.3%	6.8%	6.3%	2.4%	3.2%	6.5%	6.2%
Government Bond	0.9%	0.7%	7.0%	6.1%	6.7%	4.9%	6.6%	4.9%	3.5%	3.1%	6.5%	4.8%
High Yield Bond	2.4%	1.4%	9.0%	9.0%	8.4%	6.7%	8.4%	6.8%	-3.6%	6.8%	7.8%	6.8%
International Bond	0.4%	0.2%	8.1%	7.7%	7.7%	5.6%	7.3%	5.3%	1.0%	5.0%	7.0%	5.3%
Total Bond	7.9%	5.6%	7.7%	7.6%	7.3%	6.2%	7.2%	6.2%	1.0%	4.2%	6.9%	6.1%
Balanced	11.9%	9.6%	9.9%	10.4%	9.6%	9.4%	9.6%	9.3%	4.8%	9.2%	9.4%	9.3%
Money Market	4.0%	4.0%	6.0%	2.9%	5.7%	0.8%	5.7%	0.8%	3.9%	0.2%	5.6%	0.8%
Specialty	1.2%	1.8%	11.1%	14.5%	10.6%	13.0%	10.5%	13.3%	13.3%	13.2%	10.7%	13.3%
All Classes Weighted	100.0%	100.0%	11.7%	12.5%	11.4%	12.4%	11.7%	13.0%	8.5%	15.0%	11.6%	13.1%

** 38 and 40 year Historical Data were a blend of Morningstar Principia Variable Annuity Net Returns over 1986-2000, and weighted representative indices over 1961-1986.

*** Morningstar historical data was only available from 1989-2000.

VAGLB June 2001 REPORT - Appendix 1 - Page2

Morningstar VA and Weighted Indices Data Historical Database Revisions - Net Returns Lognormal to Normal Translation

${}^L\mu$ = lognormal empirical mean return

${}^L\sigma$ = lognormal empirical standard deviation

${}^L\sigma^2$ = lognormal empirical variance

then,

${}^N\sigma^2 = \ln[1 + {}^L\sigma^2 / (1 + {}^L\mu)^2] =$ normal variance

${}^N\mu = \ln(1 + {}^L\mu) - {}^N\sigma^2/2 =$ normal mean return

Asset Class	38 Year Database Overlapping Data				38 Year Database Non-Overlapping Data				40 Year Database Non-Overlapping Data			
	Empirical Lognormal		Normal		Empirical Lognormal		Normal		Empirical Lognormal		Normal	
	Net Return	STD	Net Return	STD	Net Return	STD	Net Return	STD	Net Return	STD	Net Return	STD
Growth & Income	11.7%	14.1%	10.3%	12.6%	11.5%	13.2%	10.2%	11.8%	11.2%	13.6%	9.9%	12.2%
Growth	13.0%	15.3%	11.3%	13.5%	12.8%	14.8%	11.2%	13.1%	12.8%	14.9%	11.2%	13.1%
Aggressive Growth	17.7%	21.9%	14.6%	18.5%	16.8%	19.7%	14.1%	16.8%	16.8%	20.2%	14.0%	17.1%
International Equity	13.0%	16.7%	11.2%	14.7%	12.2%	13.0%	10.8%	11.6%	12.2%	13.4%	10.8%	11.9%
Total Equity	12.7%	14.4%	11.2%	12.7%	12.4%	14.2%	10.9%	12.6%	12.5%	14.7%	11.0%	13.0%
Corporate Bond	7.1%	8.2%	6.6%	7.6%	6.7%	6.3%	6.3%	5.9%	6.5%	6.2%	6.2%	5.8%
Government Bond	7.0%	6.1%	6.6%	5.7%	6.7%	4.9%	6.4%	4.6%	6.5%	4.8%	6.2%	4.5%
High Yield Bond	9.0%	9.0%	8.3%	8.2%	8.4%	6.7%	7.9%	6.2%	7.8%	6.8%	7.3%	6.3%
International Bond	8.1%	7.7%	7.6%	7.1%	7.7%	5.6%	7.3%	5.2%	7.0%	5.3%	6.7%	5.0%
Total Bond	7.7%	7.6%	7.2%	7.1%	7.3%	6.2%	6.8%	5.8%	6.9%	6.1%	6.5%	5.7%
Balanced	9.9%	10.4%	9.0%	9.5%	9.6%	9.4%	8.8%	8.5%	9.4%	9.3%	8.6%	8.5%
Money Market	6.0%	2.9%	5.8%	2.7%	5.7%	0.8%	5.6%	0.8%	5.6%	0.8%	5.5%	0.8%
Specialty	11.1%	14.5%	9.7%	13.0%	10.6%	13.0%	9.4%	11.7%	10.7%	13.3%	9.4%	12.0%
All Classes Weighted	11.7%	12.5%	10.4%	11.1%	11.4%	12.4%	10.2%	11.1%	11.6%	13.1%	10.3%	11.7%

** 38 and 40 year Historical Data were a blend of Morningstar Principia Variable Annuity Net Returns over 1986-2000, and weighted representative indices over 1961-1986.

*** Morningstar historical data was only available from 1989-2000.

VAGLB June 2001 REPORT - Appendix 1 - Page 3

Morningstar VA and Weighted Indices Data
 Historical Database Revisions - Gross Returns
 Non-Overlapping Data

Asset Class	38 Year Database Overlapping Data				38 Year Database Non-Overlapping data				40 Year Database Non-Overlapping data			
	Net Return	Expenses	Gross Return	STD	Net Return	Expenses	Gross Return	STD	Net Return	Expenses	Gross Return	STD
Growth & Income	10.3%	1.9%	12.2%	12.6%	10.2%	1.9%	12.1%	11.8%	9.9%	1.8%	11.7%	12.2%
Growth	11.3%	2.1%	13.4%	13.5%	11.2%	2.1%	13.3%	13.1%	11.2%	2.0%	13.2%	13.1%
Aggressive Growth	14.6%	2.2%	16.7%	18.5%	14.1%	2.2%	16.3%	16.8%	14.0%	2.1%	16.1%	17.1%
International Equity	11.2%	2.4%	13.6%	14.7%	10.8%	2.4%	13.2%	11.6%	10.8%	2.2%	13.1%	11.9%
Total Equity	11.2%	2.0%	13.2%	12.7%	10.9%	2.0%	12.9%	12.6%	11.0%	2.0%	13.0%	13.0%
Corporate Bond	6.6%	2.0%	8.5%	7.6%	6.3%	2.0%	8.3%	5.9%	6.2%	1.9%	8.1%	5.8%
Government Bond	6.6%	1.9%	8.5%	5.7%	6.4%	1.9%	8.3%	4.6%	6.2%	1.9%	8.1%	4.5%
High Yield Bond	8.3%	2.1%	10.3%	8.2%	7.9%	2.1%	9.9%	6.2%	7.3%	2.0%	9.3%	6.3%
International Bond	7.6%	2.3%	9.8%	7.1%	7.3%	2.3%	9.6%	5.2%	6.7%	2.3%	9.0%	5.0%
Total Bond	7.2%	2.0%	9.1%	7.1%	6.8%	2.0%	8.8%	5.8%	6.5%	2.0%	8.5%	5.7%
Balanced	9.0%	2.1%	11.0%	9.5%	8.8%	2.1%	10.9%	8.5%	8.6%	1.9%	10.5%	8.5%
Money Market	5.8%	1.8%	7.5%	2.7%	5.6%	1.8%	7.3%	0.8%	5.5%	1.8%	7.2%	0.8%
Specialty	9.7%	2.3%	12.0%	13.0%	9.4%	2.3%	11.7%	11.7%	9.4%	2.2%	11.6%	12.0%
All Classes Weighted	10.4%	2.0%	12.4%	11.1%	10.2%	2.0%	12.2%	11.1%	10.3%	2.0%	12.3%	11.7%

** 38 and 40 year Historical Data were a blend of Morningstar Principia Variable Annuity Net Returns over 1986-2000, and weighted representative indices over 1961-1986.

*** Morningstar historical data was only available from 1989-2000.

Comparison of Equity Return Distribution Models

	<u>LogNormal</u>	<u>Regime Switching LogNormal</u>	<u>Stochastic Volatility & Drift Lognormal Model</u>
1. Description	Text book lognormal distribution.	Lognormal distribution where the returns are based on different normal distributions in each "regimes". The model switches randomly between two regimes.	A complex model with separate (but correlated) stochastic mean-reverting processes for both drift and log volatility. Continuous analog of the RSLN model (i.e., infinitely many regimes)
2. Input	$\text{Log}(S(t+1) / S(t))$	$\text{Log}(S(t+1) / S(t))$	$\text{Log}(S(t+1) / S(t))$
3. Implementation Steps	Estimate Parameters Compute Distribution	Estimate Parameters Compute Distribution	Estimate Parameters Compute Distribution
4. Number of Parameters	2 Parameters: Mean Standard Deviation	6 Parameters: 2 Means (one for each regime) 2 Standard Deviations (one for each regime) 2 Transition probabilities (from one regime to another)	9 Parameters: 3 Drift parameters (target, reversion strength, std deviation) 3 Log Volatility parameters (target, reversion strength, std deviation) Correlation between drift and log volatility Initial Drift Initial Volatility
5. Parameter Estimation	Calculate sample mean and standard deviation. (easy)	Use optimization or Bayesian statistical estimation. (moderately difficult)	Use optimization or Bayesian statistical estimation. (very difficult without daily data)
6. Parameter Verification	Transparent, easy to review.	Not Transparent (somewhat black box). May require new ASOPs.	Not Transparent (somewhat black box). May require new ASOPs.
7. Computation of distribution	Table look - up (easy).	New computer programs needed (moderately difficult)	New computer programs needed (very difficult).
8. Comparison of tail values	Produced highest equity returns at all durations. Resulting tails are "thin" for longer duration return assumptions, resulting in very poor results being underweighted.	Produced equity returns at all durations below lognormal. Resulting tails are fatter than lognormal.	Produced equity returns at all durations below lognormal. Resulting tails are fatter than lognormal.
9. Fit to Empirical Results	Fairly good fit to empirical results for short duration returns, poor fit at longer term returns.	Good fit to empirical results until lowest percentiles.	Good fit to empirical results until lowest percentiles.
10. VAGLB Reserve Testing*	Reserves generally small or zero until extreme percentiles, or at later durations where contract was substantially " in the money". Usually produced lowest reserves, although material differences only typically occur when the contract is substantially "in the money".	Reserves generally small or zero until extreme percentiles, or at later durations where contract was substantially " in the money". Reserves generally greater than lognormal.	Not tested.
11. Keel Methodology	Relatively easy to implement	Difficult to implement	Very difficult to implement
12. Application to other fund classes.	Results consistent with equity class.	Results consistent with equity class.	Results consistent with equity class.

* Results are preliminary based on 10 year GMAB

Accumulation Factors - Total Equity Asset Class

Period	Return %tile (1)	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
1 mo	0.21%		0.788		0.788	0.906	0.843	0.870
	0.42%		0.840		0.878	0.914	0.859	0.886
	1.04%		0.902		0.904	0.925	0.889	0.907
	2.08%		0.920		0.920	0.935	0.914	0.924
	2.50%				0.925	0.937	0.921	0.928
	2.91%		0.927		0.934	0.940	0.927	0.931
	3.95%		0.939		0.940	0.945	0.937	0.939
	4.99%		0.943		0.943	0.949	0.945	0.945
	5.00%				0.944	0.949	0.945	0.945
	9.98%		0.962		0.962	0.962	0.963	0.962
	10.00%				0.962	0.962	0.963	0.962
	16.70%				0.976	0.973	0.976	0.975
	24.95%		0.986		0.986	0.984	0.988	0.986
	50.10%		1.012		1.012	1.009	1.012	1.011
	75.05%		1.036		1.036	1.035	1.036	1.034
	90.00%				1.056	1.059	1.058	1.058
	90.02%		1.056		1.056	1.059	1.058	1.058
	95.00%				1.070	1.074	1.072	1.075
	95.01%		1.070		1.070	1.074	1.072	1.075
	96.05%		1.072		1.072	1.078	1.076	1.080
97.09%		1.085		1.085	1.084	1.082	1.088	
97.50%				1.088	1.086	1.085	1.091	
97.92%		1.091		1.091	1.090	1.088	1.096	
98.96%		1.106		1.106	1.101	1.101	1.112	
99.58%		1.131		1.131	1.114	1.120	1.136	
99.79%		1.152		1.152	1.124	1.137	1.157	
6 mo	0.25%				0.753	0.816	0.699	0.741
	0.50%				0.782	0.833	0.733	0.772
	1.00%				0.813	0.853	0.773	0.803
	1.25%	0.722	0.797	0.841	0.824	0.859	0.787	0.812
	2.50%	0.794	0.832	0.860	0.856	0.882	0.831	0.849
	3.75%	0.834	0.854	0.869	0.878	0.897	0.859	0.868
	5.00%	0.846	0.865	0.888	0.894	0.908	0.880	0.883
	6.25%	0.866	0.882	0.899	0.906	0.917	0.897	0.896
	10.00%	0.897	0.923	0.945	0.934	0.939	0.930	0.925
	16.70%				0.967	0.966	0.967	0.959
	25.00%	0.978	1.004	1.016	0.996	0.993	1.000	0.990
	50.00%	1.054	1.070	1.082	1.063	1.056	1.068	1.062
	75.00%	1.119	1.124	1.131	1.132	1.124	1.136	1.135
	90.00%	1.175	1.199	1.240	1.196	1.189	1.198	1.207
	93.75%	1.185	1.223	1.264	1.224	1.217	1.224	1.240
	95.00%	1.203	1.240	1.294	1.237	1.229	1.236	1.255
	96.25%	1.224	1.254	1.309	1.252	1.245	1.251	1.274
97.50%	1.239	1.272	1.331	1.273	1.265	1.270	1.301	
98.75%	1.277	1.313	1.353	1.306	1.299	1.305	1.348	
99.50%				1.350	1.339	1.349	1.403	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Total Equity Asset Class

Period	Return %tile (1)	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
12 mo	0.25%				0.715	0.774	0.636	0.683
	0.50%				0.751	0.798	0.677	0.723
	1.00%				0.779	0.824	0.724	0.760
	2.50%	0.644	0.782	0.892	0.835	0.864	0.797	0.814
	3.00%				0.848	0.873	0.813	0.825
	4.00%				0.864	0.888	0.836	0.844
	5.00%	0.837	0.870	0.925	0.880	0.901	0.857	0.862
	10.00%	0.886	0.922	0.961	0.934	0.944	0.926	0.920
	16.70%				0.982	0.984	0.982	0.968
	25.00%	0.995	1.035	1.072	1.025	1.022	1.029	1.014
	50.00%	1.112	1.149	1.168	1.128	1.116	1.134	1.125
	75.00%	1.177	1.226	1.286	1.234	1.218	1.244	1.242
	90.00%	1.275	1.318	1.385	1.336	1.319	1.344	1.360
	95.00%	1.324	1.369	1.421	1.402	1.383	1.409	1.436
	96.00%				1.421	1.402	1.427	1.460
	97.00%				1.447	1.426	1.452	1.489
	97.50%	1.326	1.443	1.600	1.462	1.440	1.465	1.508
99.00%				1.533	1.511	1.532	1.601	
99.50%				1.587	1.561	1.576	1.667	
99.75%				1.642	1.609	1.627	1.727	
24 mo	0.25%				0.688	0.742	0.594	0.648
	0.50%				0.732	0.775	0.651	0.681
	1.00%				0.773	0.811	0.698	0.733
	2.00%				0.819	0.853	0.766	0.781
	2.50%				0.834	0.868	0.791	0.797
	3.00%				0.846	0.881	0.812	0.811
	4.00%				0.872	0.902	0.843	0.839
	5.00%	0.645	0.857	1.036	0.892	0.920	0.865	0.862
	10.00%	0.822	0.968	1.083	0.970	0.983	0.954	0.947
	16.70%				1.036	1.042	1.031	1.015
	20.00%	1.080	1.127	1.187	1.065	1.066	1.062	1.045
	50.00%	1.202	1.284	1.380	1.267	1.245	1.275	1.258
	80.00%	1.373	1.455	1.578	1.494	1.454	1.507	1.514
	90.00%	1.461	1.539	1.638	1.618	1.577	1.636	1.660
	95.00%	1.491	1.643	1.769	1.735	1.686	1.751	1.795
	96.00%				1.768	1.719	1.785	1.834
	97.00%				1.813	1.761	1.825	1.884
97.50%				1.840	1.787	1.852	1.911	
98.00%				1.867	1.818	1.880	1.953	
99.00%				1.958	1.911	1.976	2.084	
99.50%				2.039	2.001	2.070	2.205	
99.75%				2.148	2.088	2.143	2.348	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Total Equity Asset Class

Period	Return %tile (1)	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
60 mo	0.25%				0.677	0.764	0.568	0.655
	0.50%				0.762	0.817	0.623	0.703
	1.00%				0.831	0.879	0.733	0.754
	2.00%				0.896	0.951	0.817	0.822
	2.50%				0.920	0.978	0.853	0.863
	3.00%				0.959	1.000	0.880	0.897
	4.00%				1.000	1.039	0.939	0.936
	5.00%				1.049	1.072	0.976	0.981
	10.00%				1.172	1.191	1.137	1.123
	12.50%	0.817	1.153	1.347	1.219	1.238	1.193	1.178
	16.70%				1.293	1.306	1.269	1.250
	25.00%	1.222	1.436	1.681	1.435	1.422	1.431	1.394
	50.00%	1.604	1.850	2.117	1.795	1.730	1.808	1.759
	75.00%	1.910	2.164	2.451	2.208	2.106	2.276	2.260
	87.50%	2.120	2.485	3.382	2.550	2.419	2.636	2.687
	90.00%				2.651	2.513	2.761	2.792
	95.00%				2.936	2.794	3.070	3.124
	96.00%				3.034	2.881	3.145	3.271
	97.00%				3.151	2.993	3.347	3.420
	97.50%				3.230	3.062	3.414	3.492
98.00%				3.295	3.147	3.505	3.620	
99.00%				3.640	3.407	3.731	3.890	
99.50%				3.946	3.664	4.009	4.245	
99.75%				4.088	3.919	4.269	4.507	
120 mo	0.25%				0.791	0.942	0.743	0.726
	0.50%				0.889	1.036	0.868	0.832
	1.00%				1.058	1.148	0.976	0.974
	2.00%				1.190	1.285	1.148	1.083
	2.50%				1.232	1.335	1.203	1.127
	3.00%				1.286	1.380	1.235	1.174
	4.00%				1.345	1.456	1.313	1.264
	5.00%				1.433	1.520	1.366	1.320
	10.00%				1.718	1.766	1.642	1.573
	16.70%				2.033	2.011	1.984	1.892
	25.00%	1.217	1.959	3.030	2.325	2.268	2.314	2.231
	50.00%	2.331	3.454	4.628	3.241	2.994	3.231	3.123
	75.00%	3.394	4.452	5.819	4.287	3.953	4.427	4.418
	90.00%				5.555	5.076	5.885	5.992
	95.00%				6.392	5.895	6.900	7.059
	96.00%				6.551	6.158	7.219	7.366
	97.00%				6.901	6.497	7.670	8.018
	97.50%				7.128	6.712	7.892	8.337
	98.00%				7.467	6.977	8.204	8.595
	99.00%				8.666	7.806	8.977	9.250
99.50%				10.469	8.651	10.124	10.739	
99.75%				10.779	9.515	11.322	11.563	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Total Equity Asset Class

Period	Return %tile (1)	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
240 mo	0.25%				1.648	1.747	1.157	1.392
	0.50%				1.759	1.999	1.417	1.536
	1.00%				1.864	2.311	1.872	1.673
	2.00%				2.563	2.709	2.305	2.180
	2.50%				2.688	2.861	2.424	2.515
	3.00%				2.810	2.996	2.690	2.625
	4.00%				3.183	3.232	3.007	2.710
	5.00%				3.614	3.438	3.228	2.970
	10.00%				4.438	4.248	4.122	3.753
	16.70%				5.530	5.105	5.267	4.779
	25.00%				6.622	6.051	6.442	5.844
	50.00%				10.003	8.963	10.046	9.820
	75.00%				15.156	13.277	16.453	15.551
	90.00%				21.616	18.910	24.693	23.747
	95.00%				28.326	23.367	29.296	32.154
	96.00%				29.484	24.853	31.183	34.625
	97.00%				31.167	26.810	32.925	37.476
	97.50%				32.737	28.076	34.068	40.591
	98.00%				35.434	29.653	34.949	42.070
	99.00%				38.624	34.756	41.428	49.561
99.50%				42.523	40.193	50.347	54.125	
99.75%				49.587	45.989	55.629	59.132	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Accumulation Factors - Total Bond Asset Class

Period	Return %tile (1)	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
1 mo	0.21%		0.936		0.936	0.960	0.949	0.955
	0.42%		0.950		0.950	0.964	0.955	0.962
	1.04%		0.967		0.967	0.969	0.965	0.970
	2.08%		0.972		0.972	0.973	0.973	0.976
	2.50%				0.975	0.974	0.975	0.978
	2.91%		0.976		0.976	0.975	0.977	0.979
	3.95%		0.978		0.978	0.978	0.980	0.982
	4.99%		0.980		0.981	0.979	0.982	0.984
	5.00%				0.981	0.979	0.982	0.984
	9.98%		0.988		0.988	0.985	0.988	0.989
	10.00%				0.988	0.985	0.988	0.989
	16.70%				0.993	0.990	0.993	0.994
	24.95%		0.997		0.997	0.995	0.997	0.998
	50.10%		1.005		1.005	1.006	1.005	1.006
	75.05%		1.014		1.014	1.017	1.014	1.014
	90.00%				1.023	1.027	1.023	1.022
	90.02%		1.023		1.023	1.027	1.023	1.022
	95.00%				1.031	1.033	1.032	1.028
	95.01%		1.032		1.031	1.033	1.032	1.028
	96.05%		1.035		1.034	1.034	1.036	1.030
97.09%		1.039		1.038	1.037	1.040	1.033	
97.50%				1.039	1.038	1.043	1.034	
97.92%		1.044		1.044	1.039	1.045	1.036	
98.96%		1.060		1.060	1.044	1.054	1.042	
99.58%		1.086		1.086	1.049	1.065	1.051	
99.79%		1.102		1.102	1.053	1.072	1.058	
6 mo	0.25%				0.923	0.926	0.912	0.916
	0.50%				0.932	0.934	0.928	0.929
	1.00%				0.943	0.943	0.942	0.941
	1.25%	0.882	0.922	0.959	0.947	0.947	0.947	0.946
	2.50%	0.898	0.941	0.969	0.959	0.957	0.963	0.958
	3.75%	0.952	0.962	0.970	0.966	0.964	0.972	0.966
	5.00%	0.954	0.967	0.975	0.972	0.969	0.978	0.971
	6.25%	0.972	0.975	0.981	0.976	0.973	0.982	0.976
	10.00%	0.980	0.985	0.993	0.985	0.983	0.991	0.986
	16.70%				0.997	0.995	1.001	0.998
	25.00%	1.000	1.005	1.007	1.008	1.007	1.010	1.009
	50.00%	1.024	1.027	1.034	1.033	1.034	1.030	1.034
	75.00%	1.054	1.058	1.063	1.059	1.062	1.053	1.060
	90.00%	1.089	1.100	1.124	1.087	1.088	1.083	1.085
	93.75%	1.097	1.112	1.131	1.100	1.099	1.102	1.097
	95.00%	1.105	1.125	1.151	1.106	1.103	1.110	1.102
	96.25%	1.113	1.132	1.153	1.115	1.109	1.123	1.108
	97.50%	1.146	1.155	1.166	1.125	1.117	1.138	1.117
	98.75%	1.167	1.194	1.223	1.142	1.130	1.161	1.133
99.50%				1.165	1.145	1.190	1.153	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Total Bond Asset Class

Period	Return %tile (1)	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
12 mo	0.25%				0.916	0.914	0.902	0.900
	0.50%				0.928	0.926	0.924	0.918
	1.00%				0.940	0.939	0.944	0.933
	2.50%	0.896	0.943	0.968	0.960	0.959	0.970	0.958
	3.00%				0.963	0.963	0.975	0.961
	4.00%				0.971	0.970	0.983	0.969
	5.00%	0.951	0.968	0.988	0.977	0.976	0.987	0.975
	10.00%	0.976	0.991	0.997	0.997	0.995	1.005	0.997
	16.70%				1.014	1.013	1.018	1.014
	25.00%	1.014	1.024	1.034	1.030	1.030	1.031	1.030
	50.00%	1.045	1.053	1.058	1.068	1.069	1.061	1.070
	75.00%	1.105	1.114	1.129	1.109	1.110	1.097	1.109
	90.00%	1.156	1.177	1.199	1.148	1.149	1.147	1.148
	95.00%	1.190	1.237	1.303	1.176	1.172	1.194	1.174
	96.00%				1.185	1.179	1.208	1.182
	97.00%				1.195	1.188	1.225	1.191
	97.50%	1.223	1.313	1.358	1.201	1.193	1.235	1.197
99.00%				1.233	1.218	1.283	1.224	
99.50%				1.254	1.235	1.321	1.245	
99.75%				1.278	1.251	1.353	1.265	
24 mo	0.25%				0.916	0.916	0.904	0.908
	0.50%				0.933	0.933	0.938	0.924
	1.00%				0.950	0.952	0.970	0.949
	2.00%				0.972	0.972	0.992	0.967
	2.50%				0.980	0.980	0.998	0.972
	3.00%				0.985	0.986	1.003	0.980
	4.00%				0.996	0.996	1.013	0.992
	5.00%	0.930	0.990	1.035	1.003	1.004	1.019	1.001
	10.00%	0.976	1.016	1.048	1.034	1.033	1.042	1.033
	16.70%				1.061	1.059	1.062	1.060
	20.00%	1.028	1.051	1.085	1.072	1.070	1.070	1.071
	50.00%	1.094	1.118	1.153	1.142	1.143	1.128	1.143
	80.00%	1.225	1.263	1.310	1.221	1.222	1.206	1.224
	90.00%	1.300	1.363	1.442	1.264	1.265	1.273	1.269
	95.00%	1.379	1.477	1.589	1.304	1.302	1.350	1.307
	96.00%				1.314	1.313	1.371	1.319
	97.00%				1.330	1.326	1.402	1.333
97.50%				1.342	1.335	1.417	1.342	
98.00%				1.350	1.345	1.439	1.354	
99.00%				1.384	1.374	1.500	1.385	
99.50%				1.414	1.401	1.557	1.425	
99.75%				1.442	1.427	1.620	1.458	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Total Bond Asset Class

Period	Return %tile ⁽¹⁾	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
60 mo	0.25%				0.987	0.985	0.978	0.992
	0.50%				1.008	1.014	1.003	1.011
	1.00%				1.042	1.046	1.059	1.034
	2.00%				1.084	1.082	1.102	1.071
	2.50%				1.090	1.095	1.112	1.085
	3.00%				1.101	1.105	1.122	1.095
	4.00%				1.115	1.124	1.138	1.120
	5.00%				1.129	1.139	1.151	1.135
	10.00%				1.188	1.191	1.191	1.189
	12.50%	1.040	1.155	1.229	1.210	1.211	1.207	1.209
	16.70%				1.243	1.239	1.228	1.235
	25.00%	1.164	1.261	1.352	1.290	1.285	1.262	1.282
	50.00%	1.291	1.384	1.477	1.399	1.398	1.358	1.396
	75.00%	1.357	1.559	1.681	1.522	1.521	1.499	1.531
	87.50%	1.619	1.980	2.465	1.615	1.614	1.644	1.632
	90.00%				1.644	1.640	1.694	1.660
	95.00%				1.710	1.716	1.859	1.732
	96.00%				1.730	1.739	1.906	1.751
	97.00%				1.754	1.768	1.996	1.779
	97.50%				1.782	1.785	2.052	1.804
98.00%				1.807	1.806	2.090	1.825	
99.00%				1.876	1.869	2.213	1.894	
99.50%				1.922	1.928	2.342	1.952	
99.75%				1.968	1.984	2.407	1.983	
120 mo	0.25%				1.185	1.191	1.219	1.155
	0.50%				1.235	1.240	1.251	1.234
	1.00%				1.297	1.296	1.300	1.289
	2.00%				1.364	1.360	1.359	1.357
	2.50%				1.383	1.383	1.390	1.371
	3.00%				1.398	1.402	1.402	1.382
	4.00%				1.427	1.435	1.434	1.414
	5.00%				1.462	1.462	1.453	1.437
	10.00%				1.558	1.559	1.525	1.529
	16.70%				1.647	1.648	1.589	1.630
	25.00%	1.318	1.637	1.969	1.739	1.735	1.656	1.728
	50.00%	1.543	2.070	2.549	1.962	1.954	1.875	1.958
	75.00%	1.967	2.862	3.484	2.194	2.201	2.196	2.225
	90.00%				2.433	2.450	2.586	2.486
	95.00%				2.568	2.612	2.904	2.631
	96.00%				2.621	2.662	2.984	2.683
	97.00%				2.687	2.723	3.118	2.764
	97.50%				2.735	2.762	3.212	2.802
	98.00%				2.781	2.808	3.355	2.853
	99.00%				2.900	2.946	3.616	2.965
99.50%				3.023	3.079	3.802	3.056	
99.75%				3.128	3.207	4.143	3.126	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Total Bond Asset Class

Period	Return %tile ⁽¹⁾	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
240 mo	0.25%				1.954	1.895	1.927	1.911
	0.50%				2.010	2.008	2.047	1.980
	1.00%				2.155	2.137	2.105	2.095
	2.00%				2.262	2.287	2.189	2.241
	2.50%				2.347	2.341	2.212	2.302
	3.00%				2.375	2.388	2.250	2.350
	4.00%				2.508	2.467	2.347	2.433
	5.00%				2.576	2.533	2.377	2.490
	10.00%				2.804	2.773	2.582	2.730
	16.70%				3.017	3.001	2.797	2.984
	25.00%				3.261	3.227	2.998	3.199
	50.00%				3.852	3.819	3.588	3.855
	75.00%				4.468	4.519	4.532	4.574
	90.00%				5.134	5.258	5.818	5.351
	95.00%				5.564	5.757	6.908	5.897
	96.00%				5.729	5.911	7.107	6.087
	97.00%				5.924	6.106	7.641	6.237
	97.50%				6.045	6.228	7.798	6.373
	98.00%				6.173	6.376	7.967	6.608
	99.00%				6.795	6.824	9.157	6.990
99.50%				7.286	7.263	9.605	7.326	
99.75%				7.534	7.694	12.145	7.549	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Balanced Asset Class

Period	Return %tile (1)	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
1 mo	0.21%		0.869		0.869	0.933	0.908	0.916
	0.42%		0.903		0.935	0.939	0.920	0.926
	1.04%		0.941		0.941	0.947	0.935	0.940
	2.08%		0.949		0.953	0.954	0.948	0.951
	2.50%				0.955	0.956	0.952	0.954
	2.91%		0.955		0.955	0.958	0.955	0.957
	3.95%		0.960		0.963	0.961	0.960	0.961
	4.99%		0.965		0.965	0.964	0.964	0.965
	5.00%				0.965	0.964	0.965	0.965
	9.98%		0.974		0.974	0.974	0.976	0.976
	10.00%				0.975	0.974	0.976	0.976
	16.70%				0.985	0.982	0.985	0.985
	24.95%		0.992		0.992	0.989	0.992	0.992
	50.10%		1.009		1.009	1.008	1.008	1.008
	75.05%		1.024		1.024	1.026	1.024	1.023
	90.00%				1.038	1.043	1.040	1.039
	90.02%		1.038		1.038	1.043	1.040	1.039
	95.00%				1.051	1.053	1.050	1.050
	95.01%		1.051		1.051	1.053	1.050	1.050
	96.05%		1.054		1.054	1.056	1.053	1.054
97.09%		1.057		1.057	1.060	1.058	1.059	
97.50%				1.062	1.062	1.060	1.061	
97.92%		1.065		1.065	1.064	1.063	1.064	
98.96%		1.076		1.076	1.072	1.075	1.075	
99.58%		1.097		1.092	1.081	1.092	1.090	
99.79%		1.114		1.097	1.088	1.104	1.103	
6 mo	0.25%				0.847	0.870	0.818	0.828
	0.50%				0.867	0.883	0.841	0.852
	1.00%				0.887	0.898	0.868	0.873
	1.25%	0.794	0.861	0.898	0.894	0.903	0.876	0.881
	2.50%	0.900	0.906	0.919	0.915	0.920	0.904	0.905
	3.75%	0.902	0.916	0.930	0.928	0.931	0.922	0.919
	5.00%	0.911	0.926	0.943	0.938	0.939	0.935	0.929
	6.25%	0.916	0.934	0.950	0.945	0.946	0.944	0.937
	10.00%	0.940	0.963	0.973	0.963	0.962	0.964	0.957
	16.70%				0.984	0.982	0.986	0.980
	25.00%	0.997	1.004	1.013	1.003	1.001	1.006	1.000
	50.00%	1.044	1.048	1.050	1.047	1.046	1.049	1.047
	75.00%	1.081	1.088	1.091	1.092	1.093	1.092	1.094
	90.00%	1.125	1.136	1.165	1.135	1.137	1.132	1.141
	93.75%	1.140	1.158	1.188	1.154	1.156	1.150	1.162
	95.00%	1.142	1.165	1.196	1.163	1.165	1.158	1.172
	96.25%	1.156	1.184	1.226	1.173	1.175	1.169	1.184
	97.50%	1.187	1.205	1.238	1.187	1.189	1.183	1.201
	98.75%	1.213	1.248	1.300	1.211	1.211	1.209	1.230
	99.50%				1.238	1.238	1.242	1.266

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Balanced Asset Class

Period	Return %tile (1)	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
12 mo	0.25%				0.823	0.843	0.781	0.789
	0.50%				0.849	0.862	0.808	0.819
	1.00%				0.872	0.882	0.841	0.845
	2.50%	0.733	0.858	0.949	0.907	0.912	0.888	0.886
	3.00%				0.915	0.919	0.898	0.895
	4.00%				0.927	0.930	0.915	0.908
	5.00%	0.896	0.931	0.961	0.936	0.939	0.929	0.919
	10.00%	0.949	0.969	1.024	0.970	0.971	0.972	0.960
	16.70%				1.001	1.000	1.005	0.992
	25.00%	1.009	1.031	1.058	1.029	1.027	1.033	1.022
	50.00%	1.069	1.098	1.122	1.095	1.094	1.099	1.095
	75.00%	1.131	1.156	1.192	1.164	1.164	1.165	1.170
	90.00%	1.201	1.238	1.290	1.229	1.231	1.228	1.244
	95.00%	1.242	1.286	1.341	1.271	1.273	1.268	1.292
	96.00%				1.283	1.286	1.281	1.307
	97.00%				1.298	1.302	1.295	1.324
	97.50%	1.257	1.349	1.473	1.307	1.311	1.304	1.336
99.00%				1.354	1.356	1.354	1.390	
99.50%				1.384	1.388	1.385	1.431	
99.75%				1.418	1.418	1.425	1.464	
24 mo	0.25%				0.819	0.828	0.773	0.769
	0.50%				0.846	0.854	0.806	0.797
	1.00%				0.876	0.882	0.842	0.841
	2.00%				0.907	0.914	0.883	0.872
	2.50%				0.917	0.925	0.901	0.884
	3.00%				0.927	0.935	0.914	0.894
	4.00%				0.944	0.951	0.936	0.914
	5.00%	0.762	0.926	1.058	0.960	0.964	0.951	0.932
	10.00%	0.915	1.019	1.105	1.009	1.011	1.007	0.989
	16.70%				1.053	1.054	1.056	1.039
	20.00%	1.041	1.090	1.125	1.070	1.071	1.076	1.057
	50.00%	1.173	1.211	1.272	1.199	1.196	1.203	1.195
	80.00%	1.270	1.323	1.393	1.336	1.335	1.339	1.353
	90.00%	1.356	1.431	1.517	1.417	1.414	1.413	1.441
	95.00%	1.426	1.532	1.691	1.481	1.483	1.475	1.521
	96.00%				1.501	1.504	1.493	1.545
	97.00%				1.526	1.530	1.523	1.569
97.50%				1.542	1.546	1.539	1.591	
98.00%				1.562	1.565	1.556	1.614	
99.00%				1.616	1.622	1.608	1.685	
99.50%				1.662	1.676	1.674	1.763	
99.75%				1.705	1.727	1.725	1.833	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Balanced Asset Class

Period	Return %tile ⁽¹⁾	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
60 mo	0.25%				0.827	0.875	0.727	0.818
	0.50%				0.907	0.918	0.850	0.849
	1.00%				0.951	0.966	0.928	0.886
	2.00%				1.007	1.022	0.998	0.946
	2.50%				1.037	1.042	1.013	0.970
	3.00%				1.049	1.060	1.032	0.994
	4.00%				1.078	1.088	1.061	1.030
	5.00%				1.099	1.113	1.089	1.055
	10.00%				1.189	1.199	1.190	1.155
	12.50%	0.996	1.195	1.319	1.221	1.232	1.225	1.191
	16.70%				1.275	1.280	1.276	1.240
	25.00%	1.198	1.327	1.504	1.353	1.360	1.362	1.332
	50.00%	1.385	1.592	1.811	1.574	1.564	1.571	1.557
	75.00%	1.568	1.796	1.989	1.806	1.798	1.813	1.837
	87.50%	1.754	2.156	2.815	1.986	1.984	2.008	2.066
	90.00%				2.036	2.039	2.061	2.126
	95.00%				2.185	2.198	2.228	2.295
	96.00%				2.235	2.247	2.271	2.358
	97.00%				2.300	2.308	2.331	2.428
	97.50%				2.347	2.347	2.367	2.471
98.00%				2.406	2.393	2.407	2.527	
99.00%				2.540	2.531	2.569	2.681	
99.50%				2.667	2.666	2.715	2.836	
99.75%				2.881	2.796	2.778	2.937	
120 mo	0.25%				1.004	1.075	0.966	0.922
	0.50%				1.098	1.151	1.050	1.009
	1.00%				1.161	1.238	1.179	1.125
	2.00%				1.289	1.341	1.266	1.198
	2.50%				1.326	1.378	1.311	1.254
	3.00%				1.352	1.410	1.361	1.286
	4.00%				1.430	1.465	1.432	1.330
	5.00%				1.460	1.511	1.481	1.377
	10.00%				1.639	1.681	1.658	1.545
	16.70%				1.826	1.843	1.825	1.743
	25.00%	1.213	1.732	2.266	2.015	2.007	2.004	1.956
	50.00%	1.818	2.614	3.185	2.478	2.446	2.489	2.437
	75.00%	2.901	3.505	4.195	2.994	2.980	3.038	3.085
	90.00%				3.558	3.559	3.600	3.757
	95.00%				3.945	3.959	3.986	4.220
	96.00%				4.018	4.083	4.146	4.334
	97.00%				4.142	4.242	4.317	4.611
	97.50%				4.251	4.341	4.402	4.733
	98.00%				4.413	4.462	4.508	4.814
	99.00%				4.948	4.833	4.817	5.072
99.50%				5.271	5.199	5.180	5.567	
99.75%				5.686	5.563	5.382	5.880	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Balanced Asset Class

Period	Return %tile ⁽¹⁾	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
240 mo	0.25%				1.921	1.871	1.694	1.625
	0.50%				2.038	2.059	1.800	1.726
	1.00%				2.184	2.283	2.086	1.881
	2.00%				2.449	2.556	2.414	2.216
	2.50%				2.573	2.657	2.546	2.337
	3.00%				2.725	2.746	2.592	2.438
	4.00%				2.850	2.897	2.718	2.572
	5.00%				2.927	3.027	2.804	2.733
	10.00%				3.506	3.519	3.433	3.193
	16.70%				4.076	4.010	3.958	3.736
	25.00%				4.587	4.524	4.556	4.242
	50.00%				6.033	5.982	6.078	5.966
	75.00%				7.844	7.909	8.196	8.151
	90.00%				9.918	10.169	10.305	10.854
	95.00%				11.743	11.820	11.969	13.179
	96.00%				12.517	12.349	12.453	13.795
	97.00%				13.027	13.033	13.124	14.917
	97.50%				13.462	13.467	13.772	15.345
	98.00%				13.672	14.000	14.431	15.936
	99.00%				15.240	15.673	15.996	18.056
99.50%				17.314	17.379	16.703	19.229	
99.75%				17.678	19.125	18.566	19.990	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Money Market Asset Class

Period	Return %tile (1)	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
1 mo	0.21%		1.000		1.000	0.998	1.000	-
	0.42%		1.001		1.001	0.999	1.000	-
	1.04%		1.001		1.001	0.999	1.001	-
	2.08%		1.001		1.001	1.000	1.001	-
	2.50%				1.001	1.000	1.001	-
	2.91%		1.001		1.001	1.000	1.001	-
	3.95%		1.002		1.002	1.001	1.001	-
	4.99%		1.002		1.002	1.001	1.002	-
	5.00%				1.002	1.001	1.002	-
	9.98%		1.002		1.002	1.002	1.002	-
	10.00%				1.002	1.002	1.002	-
	16.70%				1.003	1.002	1.003	-
	24.95%		1.003		1.003	1.003	1.003	-
	50.10%		1.004		1.004	1.005	1.004	-
	75.05%		1.006		1.006	1.006	1.006	-
	90.00%				1.008	1.008	1.008	-
	90.02%		1.008		1.008	1.008	1.008	-
	95.00%				1.010	1.009	1.009	-
	95.01%		1.010		1.010	1.009	1.009	-
	96.05%		1.010		1.010	1.009	1.010	-
97.09%		1.011		1.011	1.009	1.010	-	
97.50%				1.011	1.009	1.010	-	
97.92%		1.012		1.012	1.009	1.010	-	
98.96%		1.012		1.012	1.010	1.011	-	
99.58%		1.013		1.013	1.011	1.012	-	
99.79%		1.013		1.013	1.011	1.012	-	
6 mo	0.25%				1.015	1.012	1.012	-
	0.50%				1.016	1.013	1.013	-
	1.00%				1.017	1.015	1.014	-
	1.25%	1.007	1.007	1.008	1.017	1.015	1.014	-
	2.50%	1.008	1.008	1.008	1.019	1.017	1.015	-
	3.75%	1.008	1.009	1.009	1.019	1.018	1.016	-
	5.00%	1.009	1.010	1.011	1.020	1.019	1.016	-
	6.25%	1.010	1.012	1.012	1.020	1.019	1.017	-
	10.00%	1.014	1.014	1.014	1.021	1.021	1.018	-
	16.70%				1.023	1.023	1.019	-
	25.00%	1.019	1.019	1.019	1.024	1.024	1.020	-
	50.00%	1.024	1.025	1.026	1.028	1.028	1.023	-
	75.00%	1.035	1.036	1.036	1.032	1.032	1.038	-
	90.00%	1.047	1.048	1.048	1.036	1.036	1.047	-
	93.75%	1.052	1.055	1.060	1.038	1.037	1.049	-
	95.00%	1.058	1.062	1.064	1.039	1.038	1.050	-
	96.25%	1.059	1.064	1.066	1.040	1.039	1.051	-
	97.50%	1.064	1.069	1.073	1.042	1.040	1.052	-
	98.75%	1.069	1.074	1.076	1.044	1.042	1.053	-
	99.50%				1.046	1.043	1.056	-

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Money Market Asset Class

Period	Return %tile (1)	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
12 mo	0.25%				1.037	1.034	1.030	-
	0.50%				1.039	1.036	1.031	-
	1.00%				1.040	1.038	1.032	-
	2.50%	1.015	1.016	1.017	1.043	1.041	1.034	-
	3.00%				1.043	1.042	1.035	-
	4.00%				1.044	1.043	1.035	-
	5.00%	1.017	1.020	1.024	1.045	1.044	1.036	-
	10.00%	1.026	1.028	1.029	1.047	1.047	1.038	-
	16.70%				1.049	1.049	1.039	-
	25.00%	1.037	1.038	1.039	1.052	1.052	1.041	-
	50.00%	1.050	1.051	1.052	1.057	1.058	1.046	-
	75.00%	1.069	1.072	1.075	1.063	1.063	1.077	-
	90.00%	1.095	1.099	1.107	1.069	1.068	1.093	-
	95.00%	1.112	1.125	1.137	1.073	1.072	1.098	-
	96.00%				1.074	1.072	1.100	-
	97.00%				1.075	1.074	1.101	-
	97.50%	1.121	1.144	1.155	1.076	1.074	1.102	-
	99.00%				1.080	1.077	1.106	-
	99.50%				1.083	1.080	1.108	-
	99.75%				1.086	1.082	1.110	-
24 mo	0.25%				1.087	1.083	1.070	-
	0.50%				1.089	1.086	1.071	-
	1.00%				1.091	1.089	1.072	-
	2.00%				1.094	1.093	1.074	-
	2.50%				1.095	1.094	1.075	-
	3.00%				1.096	1.095	1.075	-
	4.00%				1.098	1.096	1.076	-
	5.00%	1.034	1.041	1.053	1.099	1.098	1.077	-
	10.00%	1.053	1.061	1.069	1.103	1.102	1.080	-
	16.70%				1.106	1.106	1.083	-
	20.00%	1.070	1.075	1.079	1.108	1.108	1.084	-
	50.00%	1.099	1.107	1.114	1.118	1.118	1.094	-
	80.00%	1.143	1.164	1.185	1.129	1.129	1.169	-
	90.00%	1.198	1.224	1.253	1.136	1.135	1.191	-
	95.00%	1.238	1.280	1.296	1.141	1.139	1.200	-
	96.00%				1.143	1.141	1.202	-
	97.00%				1.144	1.142	1.204	-
	97.50%				1.145	1.144	1.206	-
	98.00%				1.147	1.145	1.208	-
	99.00%				1.151	1.148	1.212	-
99.50%				1.155	1.152	1.216	-	
99.75%				1.158	1.155	1.219	-	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Money Market Asset Class

Period	Return %tile ⁽¹⁾	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
60 mo	0.25%				1.264	1.258	1.201	-
	0.50%				1.266	1.263	1.205	-
	1.00%				1.272	1.269	1.208	-
	2.00%				1.277	1.275	1.211	-
	2.50%				1.279	1.277	1.213	-
	3.00%				1.281	1.279	1.214	-
	4.00%				1.283	1.282	1.215	-
	5.00%				1.285	1.284	1.217	-
	10.00%				1.293	1.293	1.222	-
	12.50%	1.150	1.174	1.205	1.296	1.296	1.224	-
	16.70%				1.301	1.300	1.227	-
	25.00%	1.172	1.211	1.245	1.307	1.307	1.233	-
	50.00%	1.308	1.326	1.346	1.323	1.323	1.275	-
	75.00%	1.337	1.434	1.556	1.339	1.339	1.390	-
	87.50%	1.474	1.673	1.725	1.351	1.350	1.474	-
	90.00%				1.354	1.354	1.498	-
	95.00%				1.365	1.362	1.543	-
	96.00%				1.367	1.365	1.550	-
	97.00%				1.372	1.368	1.559	-
	97.50%				1.374	1.370	1.563	-
98.00%				1.378	1.372	1.571	-	
99.00%				1.385	1.379	1.583	-	
99.50%				1.391	1.385	1.595	-	
99.75%				1.398	1.391	1.603	-	
120 mo	0.25%				1.635	1.630	1.470	-
	0.50%				1.643	1.639	1.472	-
	1.00%				1.650	1.650	1.481	-
	2.00%				1.665	1.661	1.486	-
	2.50%				1.668	1.665	1.489	-
	3.00%				1.670	1.669	1.490	-
	4.00%				1.677	1.674	1.495	-
	5.00%				1.680	1.679	1.497	-
	10.00%				1.696	1.694	1.509	-
	16.70%				1.710	1.708	1.525	-
	25.00%	1.405	1.539	1.676	1.722	1.720	1.547	-
	50.00%	1.546	1.821	2.075	1.749	1.750	1.689	-
	75.00%	1.972	2.332	2.433	1.781	1.780	1.885	-
	90.00%				1.810	1.808	2.079	-
	95.00%				1.828	1.824	2.210	-
	96.00%				1.835	1.829	2.236	-
	97.00%				1.843	1.835	2.266	-
	97.50%				1.848	1.839	2.295	-
	98.00%				1.852	1.843	2.335	-
	99.00%				1.870	1.856	2.384	-
99.50%				1.880	1.868	2.448	-	
99.75%				1.890	1.879	2.500	-	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Money Market Asset Class

Period	Return %tile ⁽¹⁾	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
240 mo	0.25%				2.805	2.769	2.215	-
	0.50%				2.821	2.792	2.229	-
	1.00%				2.835	2.817	2.239	-
	2.00%				2.854	2.845	2.250	-
	2.50%				2.862	2.855	2.256	-
	3.00%				2.866	2.863	2.264	-
	4.00%				2.876	2.876	2.275	-
	5.00%				2.888	2.887	2.288	-
	10.00%				2.930	2.925	2.359	-
	16.70%				2.965	2.958	2.481	-
	25.00%				3.000	2.989	2.593	-
	50.00%				3.067	3.062	2.948	-
	75.00%				3.138	3.137	3.383	-
	90.00%				3.214	3.206	3.890	-
	95.00%				3.266	3.248	4.252	-
	96.00%				3.273	3.260	4.379	-
	97.00%				3.293	3.275	4.491	-
	97.50%				3.306	3.285	4.542	-
	98.00%				3.318	3.296	4.634	-
	99.00%				3.348	3.328	4.992	-
99.50%				3.383	3.358	5.193	-	
99.75%				3.439	3.386	5.338	-	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Accumulation Factors - Specialty Asset Class

Period	Return %tile (1)	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
1 mo	0.21%		0.801		0.801	0.903	0.856	0.879
	0.42%		0.880		0.892	0.911	0.873	0.894
	1.04%		0.905		0.905	0.923	0.899	0.913
	2.08%		0.922		0.922	0.932	0.922	0.928
	2.50%				0.929	0.935	0.928	0.932
	2.91%		0.930		0.930	0.938	0.932	0.935
	3.95%		0.939		0.942	0.942	0.941	0.942
	4.99%		0.947		0.948	0.946	0.947	0.947
	5.00%				0.948	0.947	0.947	0.947
	9.98%		0.962		0.962	0.960	0.964	0.963
	10.00%				0.962	0.960	0.964	0.963
	16.70%				0.976	0.971	0.976	0.975
	24.95%		0.987		0.987	0.982	0.987	0.986
	50.10%		1.010		1.010	1.008	1.010	1.009
	75.05%		1.033		1.033	1.035	1.033	1.031
	90.00%				1.051	1.059	1.054	1.054
	90.02%		1.051		1.051	1.059	1.054	1.054
	95.00%				1.067	1.074	1.068	1.069
	95.01%		1.069		1.067	1.074	1.068	1.069
	96.05%		1.072		1.072	1.078	1.073	1.075
97.09%		1.077		1.077	1.084	1.078	1.082	
97.50%				1.084	1.087	1.081	1.085	
97.92%		1.086		1.086	1.090	1.085	1.089	
98.96%		1.109		1.109	1.102	1.099	1.105	
99.58%		1.126		1.126	1.116	1.122	1.127	
99.79%		1.144		1.126	1.125	1.143	1.145	
6 mo	0.25%				0.768	0.807	0.717	0.756
	0.50%				0.789	0.824	0.749	0.783
	1.00%				0.822	0.844	0.786	0.812
	1.25%	0.708	0.796	0.843	0.833	0.851	0.799	0.821
	2.50%	0.822	0.838	0.857	0.863	0.873	0.842	0.854
	3.75%	0.828	0.851	0.869	0.883	0.888	0.868	0.871
	5.00%	0.846	0.869	0.887	0.897	0.900	0.888	0.885
	6.25%	0.865	0.890	0.908	0.909	0.909	0.903	0.897
	10.00%	0.918	0.930	0.946	0.933	0.931	0.932	0.924
	16.70%				0.963	0.959	0.965	0.956
	25.00%	0.973	0.990	1.002	0.990	0.985	0.994	0.984
	50.00%	1.049	1.057	1.064	1.053	1.050	1.057	1.052
	75.00%	1.103	1.111	1.123	1.117	1.119	1.120	1.121
	90.00%	1.162	1.178	1.197	1.179	1.184	1.178	1.190
	93.75%	1.182	1.217	1.257	1.206	1.213	1.203	1.221
	95.00%	1.207	1.240	1.270	1.217	1.225	1.215	1.234
	96.25%	1.219	1.250	1.285	1.233	1.241	1.230	1.252
97.50%	1.237	1.279	1.336	1.255	1.262	1.249	1.277	
98.75%	1.253	1.307	1.356	1.287	1.296	1.283	1.321	
99.50%				1.329	1.337	1.327	1.372	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Specialty Asset Class

Period	Return %tile (1)	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
12 mo	0.25%				0.725	0.759	0.649	0.696
	0.50%				0.757	0.783	0.699	0.731
	1.00%				0.788	0.809	0.742	0.766
	2.50%	0.627	0.782	0.890	0.840	0.850	0.806	0.817
	3.00%				0.849	0.859	0.822	0.826
	4.00%				0.867	0.874	0.842	0.843
	5.00%	0.845	0.868	0.909	0.880	0.886	0.861	0.860
	10.00%	0.871	0.912	0.957	0.928	0.930	0.925	0.914
	16.70%				0.971	0.970	0.974	0.958
	25.00%	0.985	1.003	1.026	1.012	1.008	1.017	1.001
	50.00%	1.095	1.120	1.157	1.107	1.102	1.113	1.105
	75.00%	1.169	1.203	1.243	1.204	1.206	1.211	1.215
	90.00%	1.258	1.297	1.358	1.303	1.307	1.305	1.324
	95.00%	1.337	1.379	1.421	1.363	1.372	1.365	1.397
	96.00%				1.381	1.391	1.384	1.418
	97.00%				1.405	1.415	1.406	1.448
	97.50%	1.342	1.423	1.560	1.420	1.430	1.416	1.462
99.00%				1.491	1.502	1.482	1.546	
99.50%				1.541	1.552	1.533	1.609	
99.75%				1.589	1.601	1.575	1.663	
24 mo	0.25%				0.688	0.717	0.624	0.657
	0.50%				0.726	0.749	0.665	0.681
	1.00%				0.769	0.785	0.721	0.732
	2.00%				0.815	0.826	0.771	0.774
	2.50%				0.829	0.841	0.793	0.792
	3.00%				0.846	0.853	0.810	0.803
	4.00%				0.868	0.875	0.837	0.828
	5.00%	0.643	0.847	0.982	0.888	0.892	0.857	0.851
	10.00%	0.871	0.965	1.046	0.954	0.955	0.938	0.927
	16.70%				1.014	1.014	1.010	0.990
	20.00%	1.007	1.059	1.102	1.036	1.037	1.039	1.018
	50.00%	1.153	1.219	1.311	1.219	1.215	1.231	1.215
	80.00%	1.318	1.399	1.520	1.425	1.423	1.437	1.450
	90.00%	1.396	1.498	1.617	1.540	1.546	1.551	1.583
	95.00%	1.446	1.707	1.933	1.649	1.655	1.649	1.708
	96.00%				1.682	1.688	1.683	1.745
	97.00%				1.723	1.730	1.724	1.793
97.50%				1.746	1.756	1.747	1.825	
98.00%				1.774	1.787	1.774	1.859	
99.00%				1.850	1.881	1.862	1.963	
99.50%				1.938	1.972	1.942	2.084	
99.75%				2.005	2.059	2.015	2.210	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Specialty Asset Class

Period	Return %tile ⁽¹⁾	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
60 mo	0.25%				0.647	0.707	0.616	0.632
	0.50%				0.715	0.757	0.641	0.678
	1.00%				0.797	0.816	0.726	0.727
	2.00%				0.866	0.884	0.811	0.787
	2.50%				0.898	0.909	0.832	0.820
	3.00%				0.912	0.931	0.856	0.849
	4.00%				0.952	0.968	0.901	0.893
	5.00%				0.988	0.999	0.940	0.926
	10.00%				1.095	1.113	1.087	1.052
	12.50%	0.857	1.129	1.324	1.143	1.157	1.131	1.102
	16.70%				1.207	1.222	1.204	1.166
	25.00%	1.087	1.297	1.465	1.330	1.332	1.326	1.292
	50.00%	1.396	1.621	1.955	1.633	1.628	1.658	1.615
	75.00%	1.672	1.966	2.194	2.010	1.989	2.028	2.053
	87.50%	1.923	2.437	3.738	2.308	2.291	2.355	2.413
	90.00%				2.381	2.382	2.444	2.508
	95.00%				2.615	2.654	2.698	2.805
	96.00%				2.705	2.738	2.790	2.904
	97.00%				2.818	2.846	2.929	3.042
	97.50%				2.876	2.914	2.985	3.111
98.00%				2.946	2.996	3.033	3.212	
99.00%				3.210	3.249	3.273	3.446	
99.50%				3.445	3.499	3.559	3.746	
99.75%				3.674	3.748	3.726	3.945	
120 mo	0.25%				0.622	0.815	0.679	0.674
	0.50%				0.817	0.898	0.803	0.777
	1.00%				0.947	0.997	0.903	0.877
	2.00%				1.058	1.118	1.011	0.967
	2.50%				1.092	1.163	1.058	1.003
	3.00%				1.140	1.203	1.089	1.044
	4.00%				1.206	1.270	1.142	1.104
	5.00%				1.259	1.328	1.234	1.156
	10.00%				1.485	1.547	1.493	1.371
	16.70%				1.738	1.766	1.735	1.637
	25.00%	1.118	1.771	2.570	1.987	1.996	2.002	1.907
	50.00%	1.992	2.558	3.218	2.708	2.650	2.694	2.636
	75.00%	2.991	3.963	5.699	3.545	3.518	3.634	3.663
	90.00%				4.474	4.540	4.725	4.888
	95.00%				5.127	5.289	5.461	5.726
	96.00%				5.341	5.529	5.689	5.952
	97.00%				5.708	5.840	5.937	6.456
	97.50%				5.869	6.038	6.134	6.701
	98.00%				6.174	6.280	6.316	6.902
	99.00%				7.077	7.042	6.986	7.427
99.50%				7.735	7.820	7.782	8.672	
99.75%				8.190	8.618	8.885	8.916	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

Note: For a given time period, the Accumulation Factor equals 1 + the cumulative return.

Accumulation Factors - Specialty Asset Class

Period	Return %tile ⁽¹⁾	Historical Empirical Data Range			Distribution Model (3)			
		Min	Avg (2)	Max	Sampling	ILN	RSLN	SLV&D
240 mo	0.25%				1.297	1.325	1.311	1.092
	0.50%				1.561	1.520	1.395	1.188
	1.00%				1.829	1.763	1.492	1.337
	2.00%				2.028	2.073	1.923	1.726
	2.50%				2.133	2.192	1.979	1.866
	3.00%				2.225	2.298	2.119	1.981
	4.00%				2.436	2.482	2.282	2.040
	5.00%				2.641	2.643	2.339	2.220
	10.00%				3.173	3.280	3.049	2.803
	16.70%				3.929	3.956	3.764	3.507
	25.00%				4.706	4.705	4.697	4.253
	50.00%				7.071	7.024	7.152	6.966
	75.00%				10.459	10.486	11.206	10.861
	90.00%				14.654	15.039	16.207	16.242
	95.00%				17.277	18.662	19.585	21.526
	96.00%				18.689	19.873	20.473	23.224
	97.00%				20.117	21.470	21.854	24.931
	97.50%				20.977	22.504	22.289	26.353
	98.00%				22.080	23.793	22.646	28.440
	99.00%				26.708	27.976	26.969	33.564
99.50%				28.666	32.446	32.765	35.773	
99.75%				30.875	37.224	34.198	37.771	

- (1) Note that AG MMMM reserving percentile = 100% - Return Percentile
- (2) For the one-month time period, the "avg" column represents the historical empirical data
- (3) Values that appear in bold in the Distribution Model columns represent values that fall outside of the Empirical Data Range.

**COMPARISON OF THE FOUR MOMENTS OF THE EMPIRICAL DATA TO THE
THREE CHOSEN DISTRIBUTIONS****S&P 500**

Moment*	Empirical	Sampling	Independent Lognormal	RSLN	SLV&D
Mean	0.0094	0.0094	0.0094	0.0095	0.0094
Standard Deviation	0.0425	0.0425	0.0425	0.0426	0.0421
Skew	-0.6106	-0.6227	0	-0.5313	-0.1725
Kurtosis	2.9915	3.0310	0	2.3103	1.9412

* Independent lognormal moments were calculated analytically. Moments for RSLN and SLV&D were based on Monte-Carlo based sampling with 1,000 scenarios.

Example of CTE Reserve Calculation

<u>Scenario Number</u>	<u>Reserve</u>	<u>Contribution to CTE (1/20 x Reserve)</u>
81	0	0.00
82	0	0.00
83	0	0.00
84	0	0.00
85	0	0.00
86	0	0.00
87	0	0.00
88	0	0.00
89	2	0.10
90	12	0.60
91	30	1.50
92	50	2.50
93	80	4.00
94	110	5.50
95	155	7.75
96	200	10.00
97	350	17.50
98	500	25.00
99	750	37.50
100	1,000	50.00
TOTAL CTE (80) RESERVE		161.95

This can be depicted as follows:

