

Society of Actuaries

**RESULTS OF THE SURVEY ON
VARIABLE ANNUITY HEDGING
PROGRAMS FOR LIFE INSURANCE
COMPANIES**

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BACKGROUND AND SCOPE

With recent regulatory changes and the introduction of Sarbanes-Oxley, life insurance companies have become more interested in hedging programs as a way to limit income volatility and capital risk. In particular, companies have used hedging programs to minimize risk for product guarantees on Variable Annuities. With the continued introduction of hedging programs by companies as an effective risk management tool, a practical evaluation of the current implementation of these programs is especially relevant.

The Society of Actuaries' Committee on Finance Research together with the ALM Institute¹ conducted a survey of industry practices on the mechanics and implementation of hedging programs by life insurance companies. In particular, the survey examined programs for benefits associated with Variable Annuities. The survey focused on the following questions:

- A) What is the optimum way for a company to set up its own hedging program? For example, would a program be implemented differently for guarantees on specific types on annuity contracts?
- B) What implementation issues and challenges should a company consider before embarking on a hedging program?
- C) What are the expected resources needed, costs and ongoing maintenance requirements of a hedging program? What type of education or training is required for individuals that set up and those that maintain the hedging program?
- D) What special issues if any should small to medium size companies consider before developing and implementing a hedging program?
- E) Should liability hedges be contemplated as part of a hedging program? For example, can some non-Variable Annuity liabilities be considered implicit hedges for Variable Annuity risks? How would these be accounted for and would there be a credit for risk based capital purposes?
- F) How does the presence of reinsurance impact hedging programs?
- G) How are models for hedging programs calibrated and what techniques are used? Are certain models more easily calibrated? How can a model be calibrated to allow for both risk neutral and real world calculations consistently?

Survey Scope

The survey focused on the risk management of minimum guarantees on Variable Annuity products, such as death benefits, income benefits, withdrawal benefits, and maturity or accumulation benefits.

¹ The authors would like to acknowledge the valuable feedback received on the direction of the survey and an earlier version of the report from the Product Oversight Group comprising of Tim Bischof, Steven Craighead, Hubert Mueller, Ken Mungan, Xiaohong Mo, Max Rudolph and Frank Sabatini.

SUMMARY OF FINDINGS

The Society of Actuaries sent out a questionnaire on Variable Annuity hedging practices in June 2006 to the top 50 life insurance companies selling Variable Annuities. The questionnaire was also sent via email to 7,600 SOA members who indicated a finance and life insurance product primary area of practice. In total, 20 questionnaires were returned, of which 19 responding companies noted they were currently writing new business. Survey responses were analyzed by size of company classified as small, medium, or large based on the total amount of Variable Annuity account value.

Survey Participants

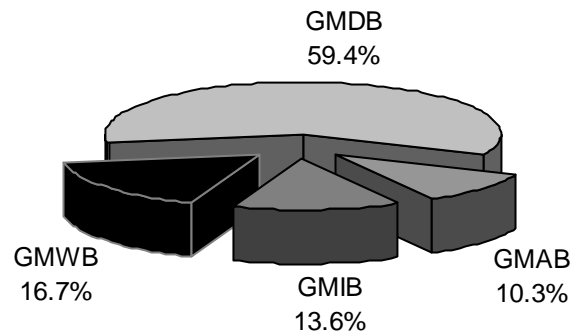
Of the 20 companies responding to the survey:

- 5 have total account value² (TAV) in excess of USD 40 billion
- 6 have a TAV between USD 10 billion and USD 40 billion
- 9 have TAV of less than USD 10 billion

Of the 19 companies currently writing new business:

- 95% write GMDB, 68% write GMIB, 89% write GMAB and 74% write GMWB
- Total new premium written by responding companies in 2005 was USD 76.0 billion which is approximately 65% of the industry³, and is distributed by benefit as shown in Figure I below⁴. Note that the premiums reported for GMDB are interpreted as the entire base premium for the contract, and not the incremental premium for this guarantee.

Figure I: Distribution of Total New Premiums for Responding Companies



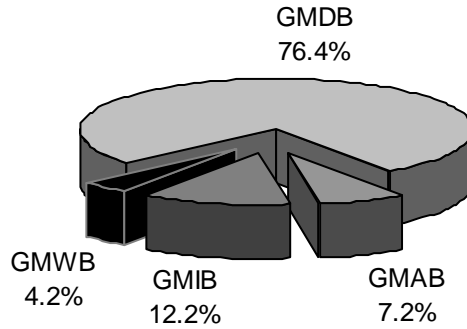
² This refers to the sum of the GMDB Account Value, GMIB Account Value, GMAB Account Value and GMWB Account Value.

³ VARDS May 2006 issue.

⁴ In preparing the survey results, the Research Team became aware of inconsistencies in the data received by participating companies for the exposure presentations on Figures I/II and 2A/B. In some cases, the actual totals included double counting. For example, one policy with 3 benefits could be counted 3 times.

- Total account value for responding companies as at December 31, 2005 was approximately USD 463 billion which is approximately 39% of the total account value of the industry⁵, and is distributed by benefit as shown in Figure II below.

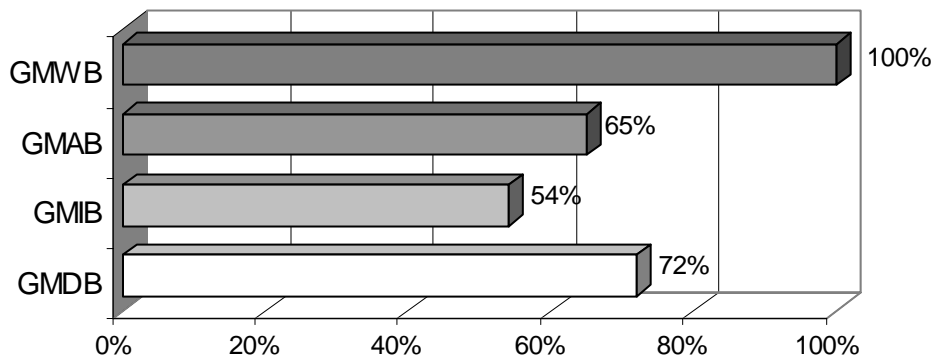
Figure II: Distribution of Total Account Value for Responding Companies



Hedging Programs

The majority of Variable Annuity writers responding to this survey perform some type of hedging of guarantees. All insurers hedge their GMWB business regardless of size. The proportion of Variable Annuity writers reporting some type of hedging of guarantees is shown below in Figure III.

Figure III: Proportion of Companies Hedging Guarantees



Hedging Objectives

Hedging objectives reflected:

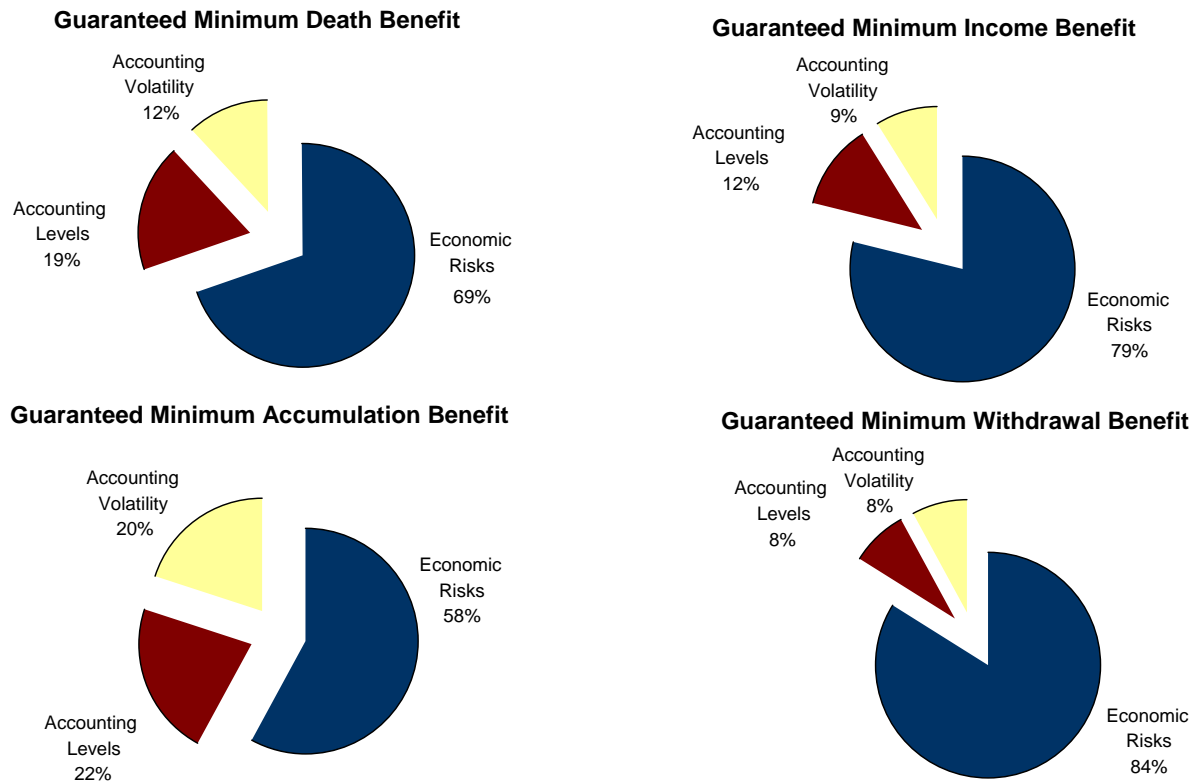
- the volatility of accounting results such as revenue, income, reserves and/or capital;
- the actual level of reserves and/or capital; and/or
- economic risk.

⁵ VARDS May 2006 issue.

For example, a hedge of the level or volatility of accounting results would be designed to reflect accounting principles relating to the treatment of financial derivatives, as well as to the accounting definitions of reserves, capital, etc. An economic hedge would be constructed within a “fair valuation” framework, whereby all asset, derivative and liability cash flows are valued using quantitative methods from finance, and reflecting the appropriate treatment of embedded options, as well as various market-based risks.

For each guaranteed benefit, Figure IV below shows the relative importance of each objective for the respective hedging programs, where the percentages shown represent the average weight reported by contributing companies.

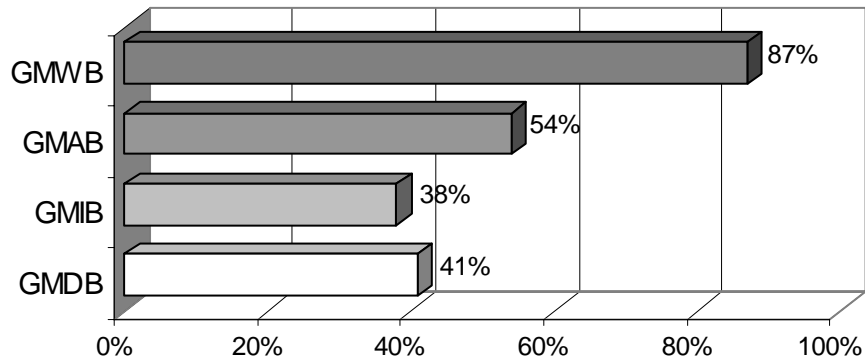
Figure IV: Hedge Objectives



For GMDB and GMIB writers, 17% and 38%, respectively, reported no opinion regarding whether hedging should be done on an economic or accounting basis.

Among those companies who perform some level of **economic risk** hedging, the averages of the percentage of risks hedged are presented in Figure V below.

Figure V: Percentage of Risk Hedged by Guarantee



For those companies hedging, the percentage of companies that hedge against movements or changes in various financial variables is shown below in Figures VI-X for each guarantee benefit. Note that Figures VI-X reflect all companies that have a hedging program, and not necessarily the subset of those exposed to the particular risks. This is especially relevant for Figure X.

Figure VI: Equity Market Values

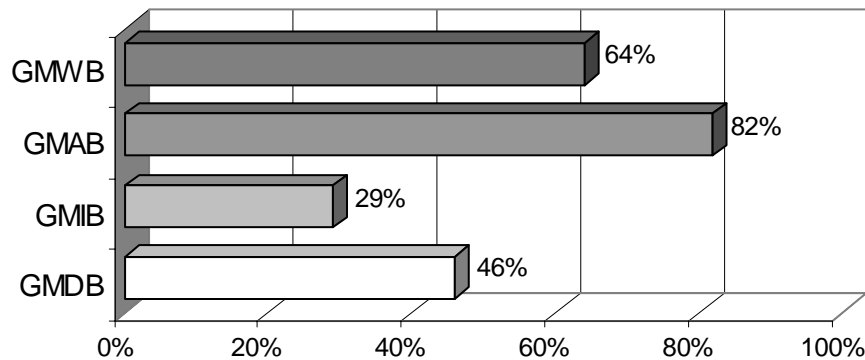


Figure VII: Equity Market Volatilities

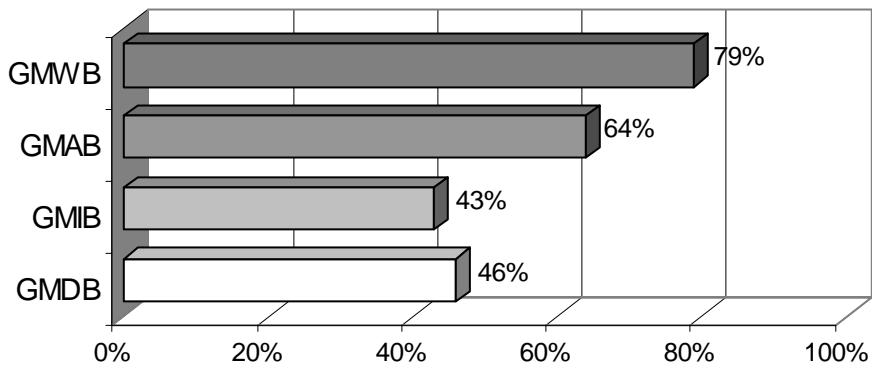


Figure VIII: Interest Rates

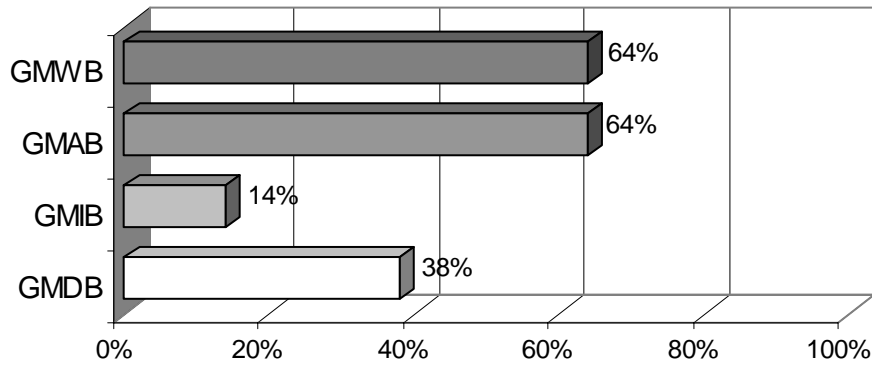


Figure IX: Interest Rate Volatilities

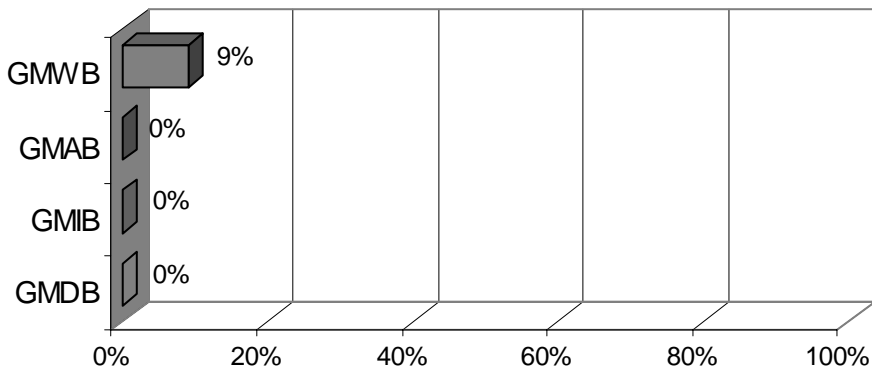
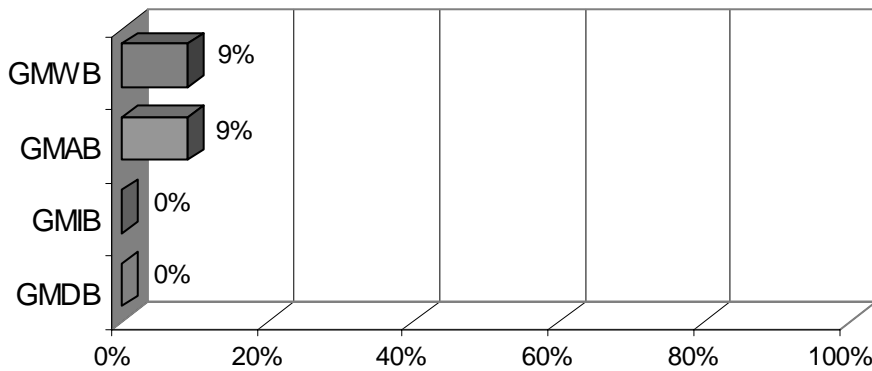
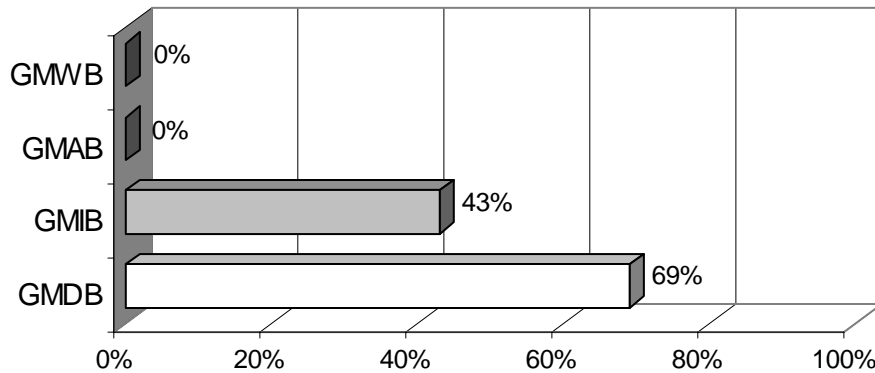


Figure X: Currencies and/or Currency Volatilities



Finally, Figure XI reports on the use of reinsurance.

Figure XI: Percentage of companies using some form of reinsurance:

Valuation and Attribution

Of the 16 companies performing regular valuations of assets and liabilities, all but two perform valuations with the same frequency (e.g. both assets and liabilities are valued monthly) across all product lines. These two companies perform daily asset valuations, with one valuing liabilities weekly and the other monthly across all the products.

In general, most companies valued assets and liabilities more frequently than quarterly.

About two-thirds of the companies perform some type of attribution analysis. Of those that do not, half of them have some hedging program in place.

Of those companies who do attribution analysis, most evaluate hedge effectiveness and the impact on the value of the hedge portfolio and the value of actual liabilities. In addition:

- 38% evaluate the impact of hedging on the value of the replicating portfolio
- 59% perform basis risk analysis

Internal Risk Management Controls

All but 1 company had a Derivatives Usage Plan in place. In addition:

- 59% of companies that have implemented a hedging program have had their risk-management program audited by an independent 3rd party.
- 65% of companies that have implemented a hedging program have a Sarbanes-Oxley compliant control structure in place.
- 72% of companies that have implemented a hedging program have a risk-management function that is independent of the day-to-day operations.
- 94% of companies that have implemented a hedging program send regular reports on risk-management activities to their boards.

- Of the 6 companies reporting that accounting rules had constrained their ability to hedge economic exposures, 5 cited SOP 03-1 as the rationale.

Implementation Issues

The top implementation challenges were:

- Implementing an effective attribution analysis
- Quantifying and projecting the impact of specific dynamic hedging strategies on an economic basis
- Quantifying and projecting the impact of specific dynamic hedging strategies under FAS 133
- Personnel acquisition and retention
- Calibrating financial market models

Almost 50% of the companies had developed an in-house system to project liabilities, calculate risk exposures, model hedging strategies, and measure basis risks, while another 25% had systems developed or customized by an independent consulting firm. Only 25% of companies used commercially available vendor software directly for these valuation functions. Of these companies, at least 50% of them have used an independent 3rd party to audit their risk-management functions.

SURVEY RESULTS

This section presents detailed results by survey question.

Question 1: Company Data

Please provide the information requested below on a statutory basis as of December 31, 2005. Please enter amount in millions.

Twenty companies contributed to this survey. One of these companies is no longer writing new business. Several companies have discontinued issuing some benefits.

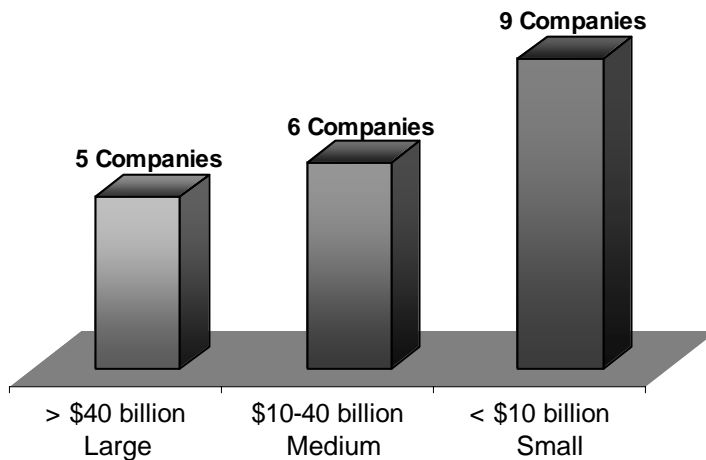
Average annual statement data for the contributing companies is presented in Table 1 below.

Table 1: Average Account Value (\$Millions)

	General Account Assets	Separate Account Assets	Statutory Surplus	RBC Required Capital
Large	90,015	57,801	8,115	1,604
Medium	26,893	13,372	1,989	824
Small	8,526	3,813	778	377
Total	125,434	74,986	10,882	2,805

For the purposes of analyzing industry practice based on size of company, companies were classified as Large, Medium or Small based on Variable Annuity account values. Figure 1 below defines the classifications and the number of companies in each category.

Figure 1: Classification by Variable Annuity Account Value



Question 2: Variable Annuity Guaranteed Benefits Information

List the approximate size of your company's total Variable Annuity book by line (understanding there may be some products with more than one guaranteed benefit). Please enter amount in millions.

- Information was submitted on GMDB, GMAB, GMIB and GMWB, where values were captured as of 12/31/05. Figure 2A and 2B show the distribution of business for each benefit by account value and new premiums respectively. Note that the premiums reported for GMDB are interpreted as the entire base premium for the contract, and not the incremental premium for this guarantee.

Figure 2A: Distribution of Total Account Value

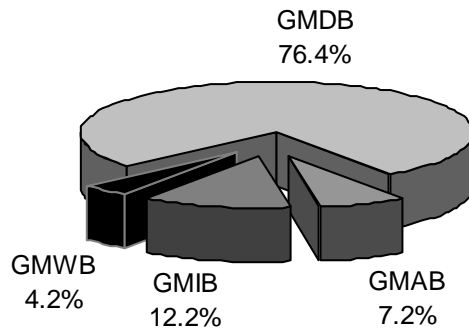
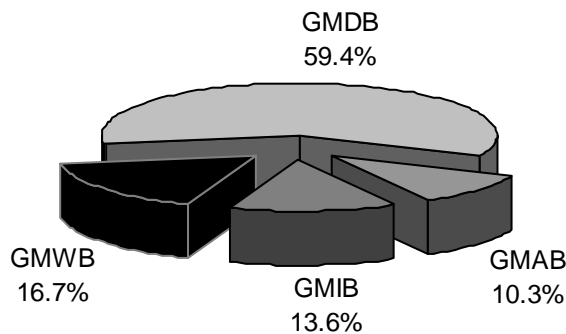


Figure 2B: Distribution of Total New Premiums



For each benefit, information was provided with respect to 2005 sales, account values and guaranteed values.

Table 2C below provides a breakdown of average GMDB business by size of company.

Table 2C: Average Company GMDB Account Values (\$Millions)

	2005 Sales	Account Values	Guaranteed Values	GV / AV
Large	6,235	46,991	44,562	95%
Medium	2,252	16,881	15,449	92%
Small	445	2,915	2,088	72%
Total	2,819	20,808	19,536	94%

Table 2D below provides a breakdown of average GMIB business by size of company.

Table 2D: Average Company GMIB Account Values (\$Millions)

	2005 Sales	Account Values	Guaranteed Values	GV / AV
Large	1,004	7,539	4,280	57%
Medium	670	4,464	4,157	93%
Small	330	519	505	97%
Total	1,035	5,144	3,549	69%

Table 2E below provides a breakdown of average GMAB business by size of company.

Table 2E: Average Company GMAB Account Values (\$Millions)

	2005 Sales	Account Values	Guaranteed Values	GV / AV
Large	733	3,799	3,353	88%
Medium	659	1,824	1,397	77%
Small	208	639	394	62%
Total	557	2,071	1,695	82%

Table 2F below provides a breakdown of average GMWB business by size of company.

Table 2F: Average Company GMWB Account Values (\$Millions)

	2005 Sales	Account Values	Guaranteed Values	GV / AV
Large	2,248	3,565	3,533	99%
Medium	668	516	223	43%
Small	38	37	33	91%
Total	1,157	1,627	1,539	95%

Question 3A: Hedge Objectives

For each type of guarantee benefit, indicate whether each of the objectives listed below represents a program objective by a providing a percentage that represents its relative importance. The percentages listed for any program should add up to 100%. For example, if two objectives are indicated, with one twice as important as the other, please enter 67% and 33% for those objectives.

Table 3A below summarizes the relative importance of each objective for the hedging program.

Table 3A: Hedge Objectives

	GMDB	GMIB	GMAB	GMWB
Minimize/manage accounting volatility (fees/revenues, GAAP income, reserves, capital, etc.)	12%	9%	20%	8%
Minimize/manage level of reserves and/or capital	19%	12%	22%	8%
Minimize/manage economic risk	70%	79%	58%	84%

In general, two strategies were apparent for all benefits, and within all company size groups: 1) consistent relative ranking importance to the above 3 objectives, and 2) heavy dominance (sometimes 100%) to economic value.

No discernable patterns were observed by company size-group.

It was interesting that while both GMWB and GMAB riders are marked-to-market for accounting purposes, less than 60% of the GMAB writers were focused on managing economic risks – a percentage that is less than for riders that are not marked-to-market.

Question 3B: Percentage Hedged

For all applicable objectives and benefits, estimate what portion (using percentages) of the given risk is hedged and/or reinsured to achieve the stated objective.

Although companies were asked to submit data on the percentage of risk hedged and/or reinsured for each of the hedge objectives listed in question 3A, the data submitted on accounting-type objectives was very sparse. Only economic objectives were reported on fully.

Table 3B.1 below shows the percentage of the economic risk that is hedged and/or reinsured for each benefit by company size.

Table 3B.1: Average Economic Risk Hedged and/or Reinsured

	GMDB	GMIB	GMAB	GMWB
Large	34%	38%	63%	72%
Medium	35%	40%	55%	93%
Small	56%	33%	45%	97%
Total	41%	38%	54%	87%

Table 3B.2 shows the distribution of the percentage of the economic risk hedged for all companies.

Table 3B.2: Distribution of Economic Risk Hedged and/or Reinsured

Percentage Hedged	GMDB	GMIB	GMAB	GMWB
0%	28%	54%	35%	0%
(0 – 25%]	17%	0%	0%	0%
(25 – 50%]	17%	15%	6%	14%
(50 – 75%]	17%	0%	18%	7%
(75 – 100]	22%	31%	41%	79%

Question 3C: Frequency of Benchmarking

For all applicable objectives, indicate the frequency of benchmarking. For example if it is important to manage the volatility in fees quarterly use "Q" to indicate the frequency to show when this "volatility" is computed. Similarly use "D" for daily benchmarking, "W" for weekly, "BW" for biweekly, "M" for monthly, "BM" for bi-monthly, "Q" for quarterly, "SA" for semi-annually, or "A" for annually.

Benchmarking refers to the comparison of the results achieved (for the chosen measure) over the period against the stated objectives. Benchmarking of accounting volatility, capital and/or reserve levels on any benefit was performed by fewer companies than economic risk benchmarking.

Table 3C.1 shows the number of companies performing benchmarking for each objective listed and for each benefit.

Table 3C.1: Benchmarking Objectives

Benchmarking Objective	GMDB	GMIB	GMAB	GMWB
Accounting Volatility	6	3	5	6
Capital and/or Reserve Levels	8	4	7	6
Economic Risks	13	6	14	14
Other	1	0	0	0
Not Benchmarking	5	7	3	0

The frequency of benchmarking for Accounting Volatility and Levels of Capital and/or Reserves were reported as “annual” or “quarterly” for all benefits.

Table 3C.2 provides a breakdown of the 20 responses of Accounting Volatility benchmarking, and 25 responses of Capital and/or Reserve Levels benchmarking.

	Accounting Volatility	Capital and/or Reserve Levels
Annual	1	9
Quarterly	12	12
Monthly	7	3
Weekly	0	0
Daily	0	1
Total	20	25

Table 3C.3 provides a breakdown of responses for Economic Value benchmarking.

	GMDB	GMIB	GMAB	GMWB
Annual	2	0	1	0
Quarterly	4	2	2	3
Monthly	2	3	3	4
Weekly	2	1	3	3
Daily	3	0	5	4
Total	13	6	14	14

Question 4: Fund Grouping and Hedge Portfolio Construction

As part of an internal hedging program, insurance companies generally group funds with similar management styles and compositions and construct a hedge portfolio for each of these fund groupings. The hedge portfolio is constructed by replicating the respective fund groupings using selected hedge instruments. How many equity/bond/balanced fund groupings are used? What criteria are used for determining how well the hedge portfolio replicates the fund groupings? How frequently is the hedge portfolio rebalanced? Do you measure basis risk? If so, how is basis risk measured?

Responses on the number of grouped equity, fixed income, and balanced fund portfolios that were constructed as the basis of hedging strategies were relatively consistent by company size.

Table 4A shows the average number of equity, fixed income and balanced fund groupings used for purposes of constructing the hedge portfolio.

Table 4A: Average Number of Fund Groups

	Equity	Fixed Income	Balanced
Large	4.3	3.3	2.3
Medium	4.8	3.5	1.0
Small	3.2	1.3	1.5
Total	4.0	2.7	1.9

Each fund group is typically represented by a common benchmark portfolio, such as the S&P 500 Index. This “replicating portfolio” is then utilized for hedging purposes.

Basis risk between the performance of the replicating portfolio and the actual portfolios assigned to the group is measured in a variety of ways. The most common method was based on a historical correlation or R-squared analysis, or by a related measure of “tracking error” between the fund and index performance.

Table 4B provides a breakdown by company size of the rebalancing frequency of the hedge portfolios maintained relative to the replicating portfolios. The research team interprets this response to mean that the given companies monitor their positions with the indicated frequencies, and that they then rebalance as needed.

Table 4B: Rebalancing Frequencies by Company Size

	Daily	Weekly	Monthly	Other
Large	1	1	1	2
Medium	3	1	0	2
Small	2	0	1	5
Total	6	2	2	9

The question also included a line for respondents to note “Other” information. Details provided in the “Other” response line included reports of quarterly and annual rebalancing; strategies which varied by benefit type; and the absence of rebalancing because the hedging program is not yet implemented.

Question 5A: Hedging Instruments Used

For each type of guarantee benefit indicate whether the hedging instrument listed is used by checking the box.

Table 5A summarizes the hedging instruments used by the various companies. For each benefit, the instruments reported by the insurers that were issuing and hedging the given benefit, as well as the number of issuers not hedging is listed. Not surprisingly, many companies are using more than one hedging instrument, as is evident by comparing the number of instruments reported to the number of insurers hedging (see last row).

Table 5A: Hedge Instruments

	GMDB	GMIB	GMAB	GMWB
Equity Futures	6	2	9	9
Equity Options	6	3	7	11
Interest Rate Futures and Swaps	5	1	7	9
Interest Rate Options	0	0	0	1
Currency Futures and Options	0	0	1	1
Reinsurance	9	3	0	0
Other	3	1	2	3
Insurers Not Hedging vs. Total Issuing	5 vs. 18	6 vs. 13	6 vs. 17	0 vs. 14

Question 5B and 5C: Details on Reinsurance Used

What percentage (approximately) of the in force is covered by reinsurance? What percentage (approximately) of the new issue risk is covered by reinsurance?

Table 5B summarizes the average percentage of the in force and new business covered by reinsurance for those companies reinsuring the risk. The number of companies using reinsurance is shown in parentheses.

Table 5B: Percentage of Risks Reinsured (Companies Reinsuring)

	GMDB	GMIB	GMAB	GMWB
In Force	27.7% (8)	62.5% (4)	0	0
New Issue	26.5% (2)	100.0% (2)	0	0

Question 6: Metrics Used for Determining Risk Limits

For each guaranteed benefit, indicate whether the risk metric listed is used for determining risk limits and whether this limit is a "hard limit" or "target only."

Hard limit means that the metric is used as an approved risk limit. Target only means that the metric is used as a target only. No means that the metric is not used.

Table 6C indicates the number of companies using the metrics listed either as a target or hard limit.

Table 6A: Risk Metrics Used

	GMDB	GMIB	GMAB	GMWB
Delta	8	3	10	12
Gamma	4	1	4	7
Vega	5	2	6	11
Rho	5	2	7	10
Theta	2	0	2	3
Other	2	2	2	3

"Other" risk metrics were related to various CTE values.

Table 6B presents the number of companies using the Risk Metrics as "hard limits".

Table 6B: Risk Metrics Used as Hard Limits

	GMDB	GMIB	GMAB	GMWB
Delta	5	2	7	7
Gamma	1	1	0	1
Vega	1	0	1	1
Rho	3	0	3	5
Theta	0	0	0	0
Other	1	1	1	1

Question 7A: Asset/Liability Monitoring Frequency

For each guarantee benefit, place an "A" corresponding to the appropriate frequency with which the asset values are computed and similarly place an "L" corresponding to the appropriate frequency with which the liability values are computed for purposes of monitoring the net risk exposure between the hedge portfolio and the liabilities. If both "A" and "L" are applicable, type "AL" in the appropriate box.

In general, companies reported that asset and liability values were computed with the same frequency. Two companies were exceptions to this consistent frequency. One company indicated they computed assets daily and liabilities weekly. The other company indicated they computed assets daily and liabilities monthly.

Table 7A presents the reporting frequency for the 14 companies that perform asset and liability valuations with the same frequency.

Table 7A: Companies Reporting Coincident Asset/Liability Valuations

	GMDB	GMIB	GMAB	GMWB
Daily	4	2	7	6
Weekly	1	0	1	1
Monthly	2	3	3	3
Quarterly	1	1	1	0

7B. Hedge Fund Portfolio Rebalancing

Question: For each guarantee benefit indicate the frequency that the hedge fund portfolio has been rebalanced.

Table 7B shows the frequency of rebalancing the derivatives positions in the hedge portfolio.

Table 7B: Companies Reporting Hedge Portfolio Rebalancing Frequencies

	GMDB	GMIB	GMAB	GMWB
Daily	6	1	7	7
Weekly	1	1	2	2
Monthly	3	2	3	4
Quarterly	0	0	0	0
Less Frequently than Quarterly	2	3	3	1

For the 6 companies who rebalance at least one benefit less frequently than quarterly, the following explanations were provided:

- A semi-static approach is used.
- Rebalancing is performed “as needed”.
- Not yet hedged.
- Risk is reinsured.
- Risk reviewed annually.

Question 7C: Rebalancing Triggers

Please describe what triggers are used for rebalancing the hedge portfolio. Is rebalancing done on a periodic basis only? Is the hedge portfolio rebalanced as soon as the risk limit is exceeded? If "no," what criteria determine when to rebalance?

All but two companies reported that their rebalancing triggers were risk based. The two exceptions reported calendar-based rebalancing.

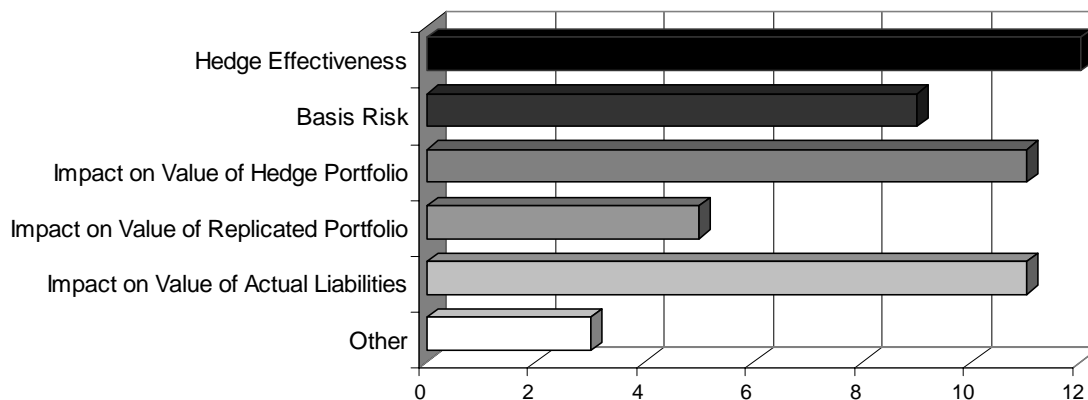
Question 8A and 8B: Attribution Analysis

Does your company perform an attribution analysis? If so, indicate what the attribution analysis attempts to measure. Please choose as many as applicable.

Overall, 13 of 20 contributing companies reported some form of performance attribution analysis. The results were fairly similar by company size with a greater tendency for large writers and, and less so for small writers.

Figure 8A shows the number of companies performing attribution analysis for each measure listed.

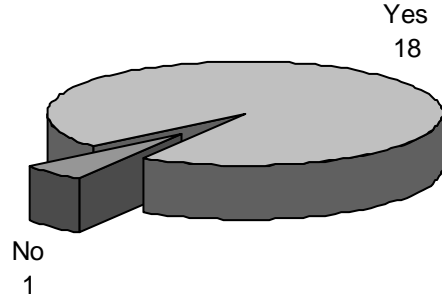
Figure 8A: Attribution Analysis



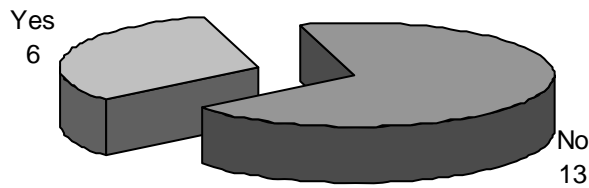
The "Other" category included attributions to changes in policyholder behavior, market parameters, model and assumptions changes, and various other "Greeks" (i.e., option sensitivities to various factors).

Question 9A: Information on Operational Issues

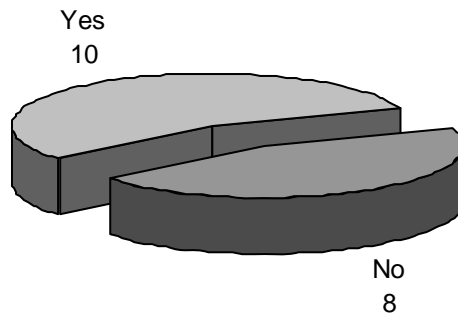
1) Do you have a derivative use plan or other policy approved by the Board?



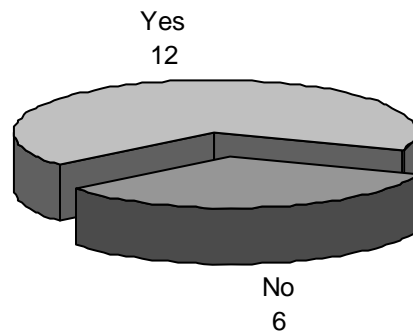
2) Have accounting rules prevented you from hedging your economic exposure on any of your guaranteed benefits?



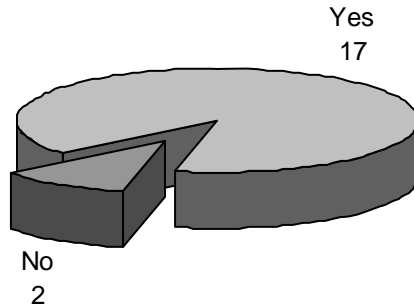
3) Has the hedging program been audited by an independent party?



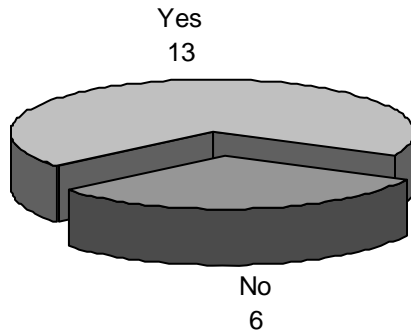
4) Is there a Sarbanes-Oxley compliant control structure in place?



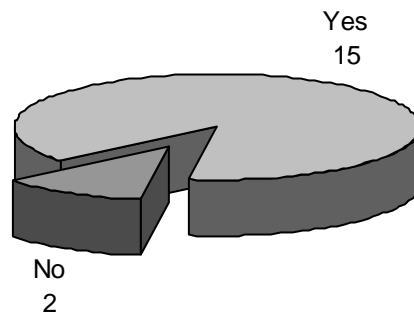
5) Do you manage reinsurance and/or derivative counterparty risks?



6) Is the risk management function independent from the day to day operations?



7) Does the Board receive regular reports on the hedging activities and results?



Question 9B: Details on Constraining Accounting Rules

If accounting rules have prevented you from hedging your economic exposure on any of your guaranteed benefits, please indicate which accounting rules?

Of the 6 companies reporting that accounting rules had prevented them from hedging their economic exposure on some of their guaranteed benefits (see responses to 9A), 5 identified SOP 03-1, while one of the 6 companies provided no detail. In July, 2003 the Financial Accounting Standards Board (“FASB”) approved for issuance the Accounting Standards Executive Committee (“AcSEC”) Statement of Position (“SOP”) 03-1: “Accounting and Reporting by Insurance Enterprises for Certain Nontraditional Long-Duration Contracts and for Separate Accounts”, which is effective for fiscal years that start after December 15,

2003. The purpose of the SOP was to distinguish the accounting treatment associated with derivative like products (riders) versus the non-derivative like products (riders).

One of the 5 such companies provided the comment that:

“SOP-03-01 discourages hedging because it does not require MTM (“mark-to-market”) of the liabilities so hedging introduces income volatility.”

Another company commented that:

“While SOP 03-01 for GMDB and GMIB has not prevented our economic hedging for delta hedging, it has made it challenging to explain the GAAP earnings volatility and expand the hedging beyond delta hedging for GMDB and GMIB.”

Question 10: Implementation Challenges

Score the list below using the following:

- 1 = extremely difficult; perhaps prohibitive**
- 2 = somewhat difficult; but can be managed**
- 3 = relatively easy; not a concern**

Table 10 below summarizes the total number of responses across companies for each aspect of an implementation challenge. Implementation challenges were ranked by scoring the level of difficulty as follows: Extremely Difficult = 3, Somewhat Difficult = 2, Relatively Easy = 1.

Table 10: Level of Difficulty of Potential Implementation Challenges

Rank	Description of Implementation Challenge	Extremely Difficult	Somewhat Difficult	Relatively Easy
1	Attribution analysis	3	12	1
2	Quantification and projection of impact of specific dynamic hedging strategies on economic basis	6	8	4
3	Quantification and projection of impact of specific dynamic hedging strategies under FAS 133	5	9	4
4	Personnel acquisition and retention	4	11	3
5	Calibrating models	4	12	3
6	Analysis of various risk management strategies	1	16	1
7	Development and/or acquisition of requisite systems and technology	2	14	2
8	Formulating specific hedging strategies	0	17	1

9	Sufficient in-house expertise to validate and distinguish between external service providers	2	12	4
10	Communicating results to senior management /Board	1	14	3
11	Prioritizing market value vs. accounting risks	2	12	5
12	Fund grouping and portfolio replication	0	15	3
13	Putting in place controls and procedures	0	14	4
14	Education concerning, and obtaining consensus to use derivatives	1	11	6
15	Selection of hedge instruments	0	13	5

Question 11: Systems Resources Required

What systems and/or software packages are used in the risk valuation, monitoring and management efforts?

Companies use a wide range of systems for different purposes related to their internal hedging programs. Table 11 below lists the number of companies using the different types of systems for each activity. Some companies used more than one of the systems choices noted.

Table 11: Companies Reporting Systems Used

	Commercial Vendor System	System Developed or Customized by Consultants	System Developed In-House	Other	N/A
Project liabilities	4	7	8	0	1
Calculate risk exposure and MTM for liabilities	4	5	7	0	3
Calculate risk exposure and MTM for hedge portfolio	3	5	8	0	3
Model and simulate specific hedging strategies	2	5	10	1	4
Measure basis risk	1	4	10	0	4
Perform attribution analysis	1	5	8	0	5

One large company respondent's comment is perhaps telling as to why the number of the first column responses is relatively low from the 20 companies:

“Currently, most long term liability projections and hedging strategy analysis are performed with various ad-hoc in house stochastic models/actuarial software packages. These ad-hoc systems are usually very slow and thus we are not yet able to quickly or properly evaluate comprehensive impacts of hedging strategies on pricing, capital and financial implications that is not overly simplified or unrealistic. Most of the existing

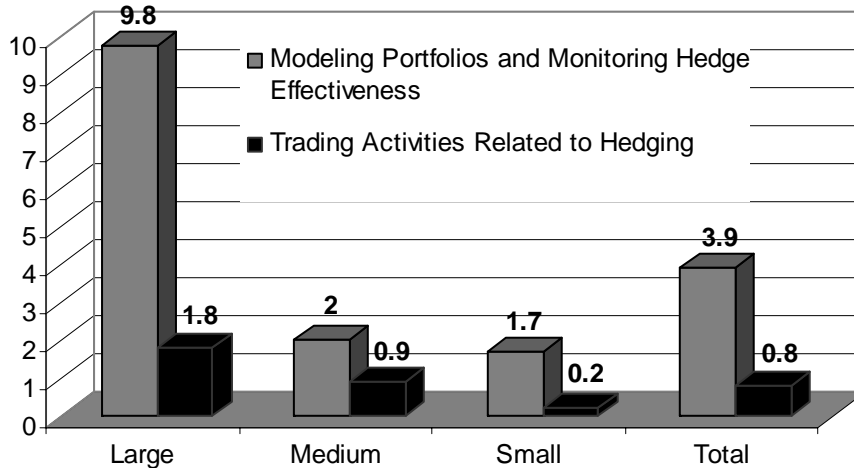
vendor systems can not meet our needs of sophisticated projections and strategy analysis. They are either too slow or limited in integration of actuarial modeling with capital market sophistication”.

Question 12: Professional Resources Required

How many full-time equivalents (“FTEs”) are needed for modeling portfolios and monitoring hedge effectiveness? What are the professional qualifications for these individuals? How many FTEs are needed for trading activities related to hedging? What are the professional qualifications for these individuals?

Figure 12 provides a breakdown by size of company of the average resources required for 1) modeling portfolios and monitoring hedge effectiveness and 2) trading activities related to hedging.

Figure 12: Resources Required – Number of FTEs



Note that the large company average of 9.8 for “modeling, etc.” was significantly impacted by one company, without which this average would have been 4.8 and the average for the Total: 2.4. Also, some of the small companies reported “0” for the given functions. Excluding these companies, the small company FTE values would have been 2.5 and 0.5, respectively, for the two functions.

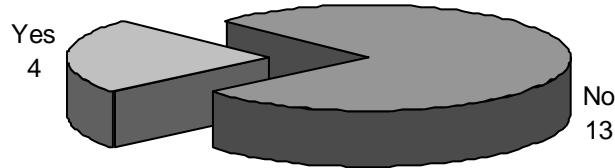
As to professional qualifications, actuarial designations: FSA/MAAA/ASA was listed prominently by all medium and large companies and half of the small companies as the primary qualification for “Modeling portfolios and monitoring hedge effectiveness”. In addition, in decreasing order of prevalence, companies listed Ph.D., CFA and various MS degrees and Risk Management designations.

For “Trading activities related to hedging”, the results were reversed, with CFA and Ph.D. degrees more prevalent than the various actuarial designations, followed by the various MS degrees and Risk Management designations.

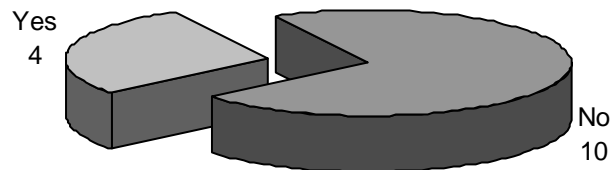
Question 13: Accounting of Hedging Programs

Several more detailed accounting questions were posed, which we summarize below. Note that 17 of the 20 companies responded to question 1, 14 responded to question 2, while 16 responded to questions 3-4:

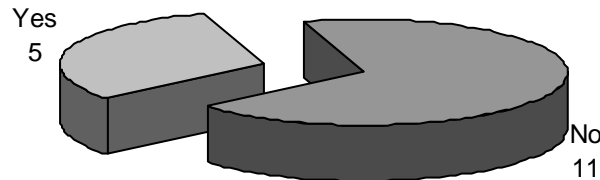
- 1) **Are offsetting risk exposures from other exposures in other segments and/or lines of business considered when setting the hedge portfolio?**



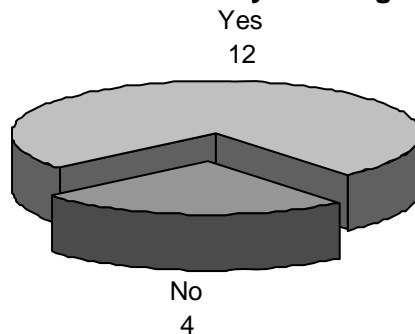
- 2) **Are these accounted for under FAS 133?**



- 3) **Do you claim a credit for risk based capital purposes for any offsetting exposures?**



- 4) **Does the hedging strategy employed qualify as a "Clearly Defined Hedging Strategy" under the new Variable Annuity RBC regulation (C-3 Phase II)?**



APPENDIX A – PARTICIPATING COMPANIES

AEGON

AIG

Allianz

Allstate Financial

Americo Financial

Ameriprise Financial

AmerUS Group

AXA Australia

Empire Life

Guardian

ING

Integrity/National Integrity

MassMutual

MetLife

Midland National Life

Nationwide Financial

Ohio National

Pacific Life

Penn Mutual

Sun Life

Symetra

Thrivent

APPENDIX B – DEFINITIONS

The following terms are defined:

Annuitization Rate refers to the prescribed rate used to determine the annuity under a GMIB.

Basis Risk refers to the risk that exists between the performance of the item hedged, and the performance of the hedging instrument, and is typically due the fact that the hedging instrument usually tracks a popular benchmark performance, such as the S&P 500 Index, whereas the item hedged will often be a more customized portfolio.

Frequency of Reset refers to the frequency the guaranteed death benefit can be reset at the greater of the prior or current underlying asset value.

Guaranteed Minimum Death Benefit (“GMDB”) guarantees a minimum lump sum payout upon death. A variety of GMDBs are offered today, from relatively low risk return of premium benefits to rich combination benefits that provide a guaranteed death benefit equal to the greater of an accumulation of premium at a prescribed % per annum and an annual ratchet.

Guaranteed Minimum Income Benefit (“GMIB”) guarantees a minimum account value for annuitization, generally based on the initial principal accumulated at a prescribed rate per annum, an annual ratchet or a combination of both. The minimum account value is used to purchase a payout annuity at conservative guaranteed purchase rates.

Guaranteed Minimum Withdrawal Benefit (“GMWB”) guarantees a minimum stream of income provided it is withdrawn within specified limits over time. A GMWB may guarantee that investors will receive their money back over a certain period at a rate not to exceed some prescribed % per annum.

Guaranteed Minimum Accumulation Benefit (“GMAB”) guarantees a minimum account value at maturity. A GMAB may require that policyholders follow certain asset allocation strategies and may impose restrictions on funds with high volatility.

Lifetime withdrawal refers to a benefit whereby an investor can receive a guaranteed lifetime income stream through systematic withdrawals equal to a specified percentage of the benefit base without having to annuitize the contract even if the contract value reaches zero.

Maturity of Benefit refers to the maturity date of the guaranteed benefit.

Maximum allowable time before 1st Withdrawal is in respect of a GMWB rider.

Net Amount at Risk (“NAR”) is defined at the policy level as the greater of a) guarantee balance minus account value and b) zero. NAR is an important measure as it bears information as to the guarantee’s in-the-moneyness. It cannot be derived at the aggregate

level by subtracting the total account value from the total guaranteed value due to the offsetting effect among individual policies.

Off Risk Age refers to the age when the guarantees are no longer applicable. For example, ratcheting will stop once the client reaches a certain age.

Ratchet Frequency refers to the frequency or period over which the guaranteed death benefit is reset at the greater of the prior or current underlying asset value.

Rollup Rate refers to the specified rate used in the accumulation of premiums (less any prior withdrawals) for purposes of determining the guaranteed death benefit.

Time of 1st Annuitization refers to the first anniversary or attained age that an annuitant can convert the guaranteed income base into an annuity.

Upfront Teaser refers to the interest paid upfront to the deposit as an enticement to the policyholder. For example, an insurance company might offer an immediate increase of 2-3% on a deposit.

Withdrawal Rate refers to the percentage of initial principal or amount guaranteed that the policyholder may withdraw every year regardless of the actual account value.

APPENDIX C – BIOGRAPHIES

Charles L. Gilbert is a founding partner of ALM Institute which provides investment risk management training and conducts research in leading techniques and practices to manage exposure and exploit risk opportunities.

Mr. Gilbert is president and founder of Nexus Risk Management Inc. (www.nexusriskmanagement.com) providing advanced risk management solutions to the financial services industry globally. Mr. Gilbert does a wide range of Asset Liability Management related work for several insurance and reinsurance companies worldwide. Through a number of joint ventures he executes ALM strategies and portfolio optimization for asset management clients, conducts on-going research and provides training.

Previously, Mr. Gilbert was the leader of the Asset Liability Management initiative for Tillinghast – Towers Perrin in North America and was also responsible for building the Equity Risk Management initiative for the firm.

Prior to joining Tillinghast, Mr. Gilbert was Assistant Vice President of Asset Liability Management and Corporate Actuary at ING Life where he was responsible for Asset Liability Management, as well as the valuation, pricing and financial management for investment products. He developed innovative strategies to immunize the interest rate risk exposure on universal life and other life products and researched various ways to manage the risk associated with investment guarantees on variable annuities and segregated funds. Other past work experience has included US and Canadian taxation, valuation and financial management.

Mr. Gilbert has over 20 years of experience in the life insurance industry and has trained over 500 ALM practitioners, regulators, rating agency analysts and senior management on Asset Liability Management worldwide.

Mr. Gilbert graduated cum laude from York University and has an honours B.A. in mathematics. He is a Fellow of the Canadian Institute of Actuaries, a Fellow of the Society of Actuaries and a Chartered Financial Analyst. He is currently a member of the Board of Governors of the Society of Actuaries, co-chairperson of the International Actuarial Association Task Force on Financial Economics, chairperson of the Canadian Institute of Actuaries Working Group on Asset Liability Management, chairperson of the Society of Actuaries Examination Committee for Course 8 Investments, chairperson of the Society of Actuaries Task Force on ALM Principles, and is the representative for both the Canadian Institute of Actuaries and the Society of Actuaries on the International Actuarial Association Financial Risks Committee. Mr. Gilbert is a past chairperson of the Canadian Institute of Actuaries Committee on Investment Practice, past secretary of the Society of Actuaries Investment Section Council, past treasurer of the Society of Actuaries Risk Management Section Council, past member of the Canadian Institute of Actuaries Practice Standards Council, past member of the Society of Actuaries Finance Practice Advancement Committee, past member of the Society of Actuaries Risk Management Task Force and recently served as a director of the Board of the Canadian Institute of Actuaries. He is a frequent speaker and moderator at industry gatherings worldwide.

K. (Ravi) Ravindran is a founding partner of ALM Institute which provides investment risk management training and conducts research in leading techniques and practices to manage exposure and exploit risk opportunities.

Dr. Ravindran is also the founding principal of Annuity Systems Inc. (www.annuitysystems.com) and the former Chief Executive Officer of RGA Financial Products. Dr. Ravindran works with companies worldwide in all aspects of the risk management process including trade execution. He has personally managed the risk exposure associated with Variable Annuity products on assets under management of over USD 100 billion and has provided risk management consulting on the equity exposure associated with assets under management of almost USD 200 billion. Dr. Ravindran has also helped risk-manage Equity Indexed Annuity business and has provided extensive risk management services to the energy markets. He is also known as the pioneer to apply derivatives-based hedging techniques from the capital markets to VAs and other equity/interest rate-based guarantee products. He has been involved in various aspects of risk management since 1991.

Dr. Ravindran ran the exotic derivatives desk for Toronto Dominion Bank globally and has executed derivatives trades for clients as part of his risk management services. He has traded and made markets in nearly every category including equity, interest rate, currency, commodity, mortality and credit.

Dr. Ravindran's experience blends exotic derivatives and portfolio management with real-time hands-on experience in building models, processes, systems, controls and hedges relating to managing risks both as a market maker and a hedger. Dr. Ravindran's primary expertise lies in risk-managing exotic and correlated risks in illiquid markets. He has used product development and securitization as a form of risk-management tool in various asset classes.

Dr. Ravindran is an Adjunct Professor at Reykjavik University in Iceland. In addition to previously holding Adjunct Professor appointments at the University of Waterloo and the University of Calgary, he also taught graduate courses and in executive programs at business schools around the world. He is the author of the book "Customized Derivatives: A Step-by-Step Guide to Using Exotic Options, Swaps, and Other Customized Derivatives" and is currently authoring an up-coming book that is tentatively entitled "Customized Derivatives And Their Applications To Hedging Insurance Liabilities". Dr. Ravindran is associate editor of the well-received book entitled "Handbook of Derivatives" and is the editor and author of a number of other papers and articles some of which have formed part of the Society of Actuaries examination syllabus.

Dr. Ravindran spends much of his time traveling, lecturing and selectively working on risk-management/trading consulting assignments around the globe. Additionally, he is also currently managing a private equity fund that arbitrages mispriced products across different markets in alternative asset classes.

Robert R. Reitano is a founding partner of ALM Institute which provides investment risk management training and conducts research in leading techniques and practices to manage exposure and exploit risk opportunities.

Dr. Reitano is Professor of the Practice in Finance at International School of Business, Brandeis University, where he specializes in Quantitative Finance. He is also Visiting Professor at Reykjavik University School of Business, where he teaches in the Master of Science in Investment Management Program.

Dr. Reitano is the Principal of Strategic Investment Risk Management, a consulting firm specializing in the development of strategic investment responses to asset/liability management problems and objectives, as well as staff training in the development, implementation and ongoing management of investment solutions.

Prior to his retirement in 2005, Dr. Reitano was Executive Vice President & Chief Investment Strategist of John Hancock/Manulife, where he was responsible for the Company's General Account Portfolios. In that capacity, Dr. Reitano managed the Global Investment Strategy Group of 50 investment research officers, investment and financial analysts between Boston and Toronto. At John Hancock, Dr. Reitano was a member of the Boards and Committees of Finance of John Hancock Life and several of its subsidiaries. He was Chairman of the investment committees responsible for the Company's Pension and 401(k) Plans, as well as the oversight committee for the John Hancock Variable Series Trust. He served as the Company's Derivative Supervisory Officer under the New York approved Derivative Use Plan.

Dr. Reitano's research interests include integrating risk capital objectives with global investment policy and asset allocation strategies, the "market" valuations of liabilities, and asset/liability risk management. This latter interest led to the development of generalized multivariate ("partial") duration and convexity measures which reflect the risk of general non-parallel yield curve shifts, as well as to an investigation of immunization and risk management strategies in this general context.

Dr. Reitano has been a member of several industry task forces and committees, has spoken at numerous industry seminars and events globally, and has presented and participated in many seminars on his research for the Society of Actuaries. His research papers have appeared in the Journal of Portfolio Management, the North American Actuarial Journal, the Transactions of the Society of Actuaries and the Actuarial Research Clearing House (see http://www.brandeis.edu/global/faculty_detail.php?faculty_id=91). His research has won an Annual Prize of the Society of Actuaries and two biennial F.M. Redington Prizes awarded by the Investment Section of the Society of Actuaries.

Dr. Reitano has a Ph.D. in Mathematics from Massachusetts Institute of Technology, is a Fellow of the Society of Actuaries, a Member of the American Academy of Actuaries and a member of the International Actuarial Association. He has served on the editorial staff and currently provides editorial support for several finance and actuarial journals, and was previously an Adjunct Professor in Boston University's Masters Degree program in Mathematical Finance.