Questions 1-4 pertain to the Case Study

1. (6 points)
   
   (a) Assess the consistency of the definition of a derivative in LifeCo’s operational guidelines with the definition under US GAAP.

   (b) Describe how LifeCo’s Derivative Policy addresses operational and legal risks.

   (c) Recommend additional controls to better address these risks.
2. (5 points) A new actuarial student at LifeCo is very excited about the "profit" your portfolio is generating with MBS. He views "profit" on an MBS bond as the difference between OAS and the liability required interest spread over Treasuries.

(a) Explain why "profit" may not equal the difference between OAS and the required interest spread with a Jump Z-bond.

(b) Explain why "profit" may not equal the difference between OAS and the required interest spread for more general securities.

The student recommends that LifeCo could be more profitable and better duration-matched by replacing the current MBS within the Traditional Life portfolio with Z-bonds. Z-bonds, the student argues, have a higher OAS, higher duration, and lower convexity than the current MBS.

(c) Evaluate this recommendation.
3. (13 points) LifeCo’s management is concerned by the losses arising from the dynamic hedging of the options embedded in its variable annuities. An external report highlighted that the target delta is currently based on a lognormal distribution with the volatility equal to the sample standard deviation of the fund investment return over the past 12 months.

(a) Describe the options embedded in the variable annuity product.

(b) Describe and compare the following models used to estimate the volatility from past data
   (i) sample standard deviation
   (ii) exponentially weighted moving average model
   (iii) generalized auto-regressive conditional heteroscedasticity

(c) Recommend ways to improve the dynamic hedging program.

(d) Describe strategies that can be used to minimize the model risk.

LifeCo is considering whether to continue its current dynamic hedging program or pursue another risk management strategy.

(e) Review alternative strategies for managing the embedded option exposure.

(f) Recommend which of these strategies would be most appropriate if the dynamic hedging strategy is discontinued. Justify your recommendation.
4. (10 points) You have recently been promoted to Chief ALM Officer at LifeCo. The CEO has called a meeting with you and the pricing actuary to discuss the launch of a new universal life product.

(a) (2 points) The CEO, an accountant by training, emphasizes the importance of statutory and GAAP measures to determine the economic value of the insurer. Critique this standpoint.

(b) (4 points) Explain how to coordinate LifeCo’s investment and product management strategies for future retentions for this new product to protect LifeCo’s shareholder value from interest rate risk.

(c) (1 point) The pricing actuary expects to increase future credited rates as interest rates rise. Explain how LifeCo’s investment strategy should be adjusted to protect shareholder value from interest rate risk.

(d) (1 point) LifeCo’s key competitors keep credited rates unchanged regardless of changes in interest rates. Assess how their approach could affect your strategy in part (c).

(e) (2 points) Propose a method for LifeCo to implement the changes in parts (c) and (d) that would minimize transaction costs.
5. (7 points) The table below has the 10 largest capital requirements at issue from 100 scenarios for a variable annuity with a GMDB of a return of premium. Requirements are given for the real world and risk-neutral approaches. A negative value indicates a surplus.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Real World</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Real World</td>
<td>-0.35%</td>
<td>-0.30%</td>
<td>-0.25%</td>
<td>-0.10%</td>
<td>-0.10%</td>
<td>-0.10%</td>
<td>0.40%</td>
<td>1.10%</td>
<td>2.70%</td>
</tr>
<tr>
<td>Risk-Neutral</td>
<td>-0.30%</td>
<td>-0.28%</td>
<td>-0.26%</td>
<td>-0.24%</td>
<td>-0.21%</td>
<td>-0.17%</td>
<td>-0.10%</td>
<td>0.00%</td>
<td>0.20%</td>
</tr>
</tbody>
</table>

Based on this data, the CEO suggests allocating capital based on the real world approach at a quantile of 91% but if the market performs poorly to switch to the risk-neutral approach with a CTE at 95%.

(a) Define the quantile risk measure.

(b) Calculate the 91% and 95% quantile measures for each approach.

(c) Define the CTE risk measure.

(d) Calculate the 91% and 95% CTE measures for each approach.

(e) Calculate the standard error for a 64% confidence interval for the 95% quantile risk measure under the actuarial approach.

(f) Appraise the CEO’s suggested mix strategy.
6. \textit{(4 points)} You have been given the following assumptions for one of AnnuityCo’s fixed-income asset portfolios:

<table>
<thead>
<tr>
<th>Obligor (A)</th>
<th>Loss Given Default ($\text{LGD}_A$)</th>
<th>Expected Loss Over the Next Year ($\text{EL}_A$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>165,000</td>
<td>660</td>
</tr>
<tr>
<td>2</td>
<td>235,000</td>
<td>940</td>
</tr>
<tr>
<td>3</td>
<td>700,000</td>
<td>1,050</td>
</tr>
<tr>
<td>4</td>
<td>900,000</td>
<td>1,800</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,000,000</strong></td>
<td><strong>-</strong></td>
</tr>
</tbody>
</table>

Unit of exposure for banding \( L = 100,000 \)

One-year risk-free rate \( r = 3\% \)

(a) Using the Actuarial Approach (CreditRisk+) to measuring credit risk, calculate the probability that the loss occurring over the next year is 300,000 or less.

(b) A colleague has suggested that the CreditRisk+ approach avoids the limitations of the CreditMetrics and KMV approaches. Evaluate this comment.
7. (4 points) You are on assignment with the portfolio management team that has been investing in equities primarily in the USA. The team is interested in implementing an expanded international equity strategy.

Identify the issues you should consider prior to investing in countries or markets with which you are not familiar.
8. (6 points) You are given the following securities for a 1-year period:

<table>
<thead>
<tr>
<th>Security</th>
<th>Price</th>
<th>Payoff in “Up” State</th>
<th>Payoff in “Down” State</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>1.5</td>
<td>0.7</td>
</tr>
<tr>
<td>B</td>
<td>15/11</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>?</td>
<td>1.8</td>
<td>0.85</td>
</tr>
</tbody>
</table>

Calculate the price of Security C.
9. (5 points) CMP Life’s marketing group is introducing a new product that allows the policyholder to allocate premiums between an accumulation fund and a payout annuity.

- Premium inflow: $20 million per month
- Accumulation fund:
  - 35% investment grade convertible bonds
  - 65% investment grade corporate bonds
- Payout annuity: 20 year certain, level payments

(a) List the assumptions you would need from the pricing actuaries to help you construct investment guidelines for the investment managers.

(b) Describe the information you will provide to the investment managers on an on-going basis.

(c) Explain whether a benchmark of the universe of all convertible securities (including both investment and non-investment grade) would be appropriate for the accumulation portion of the portfolio.

(d) Describe the considerations you would have to make when instructing the asset managers if CMP Life stops selling this product after 10 years and there are no additional premiums.

**END OF EXAMINATION**

MORNING SESSION
10. (7 points) You are the Chief Risk Officer for a US life insurance company which owns a portfolio of corporate bonds. The ALM committee has proposed a reduction in the credit exposure of their portfolio through the use of derivatives. You have been asked to analyze 4 potential solutions:

(i) Asset Swaps
(ii) Single Name Default Swaps
(iii) Basket Default Swaps
(iv) Portfolio Default Swaps

(a) (5 points) Describe each derivative and the advantages and disadvantages of each.

(b) (2 points) Assuming you decide to recommend a default swap, outline the accounting considerations.
11. (6 points) Over the past several days, ABC Corporation's stock has been trading around $25.50.

You are given the following financial information for ABC Corporation.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Income</td>
<td>250,000</td>
</tr>
<tr>
<td>Goodwill Amortization</td>
<td>40,000</td>
</tr>
<tr>
<td>Interest Expense</td>
<td>45,000</td>
</tr>
<tr>
<td>Capital Expenditures</td>
<td>30,000</td>
</tr>
<tr>
<td>Tax Rate</td>
<td>35%</td>
</tr>
<tr>
<td>Company Beta</td>
<td>1.2</td>
</tr>
<tr>
<td>Risk-Free Rate</td>
<td>6.0%</td>
</tr>
<tr>
<td>Market Risk Premium</td>
<td>5.0%</td>
</tr>
<tr>
<td>Market Value of Debt</td>
<td>2,000,000</td>
</tr>
<tr>
<td>Pre-Tax Cost of Debt</td>
<td>10.0%</td>
</tr>
<tr>
<td>Estimated Perpetual Growth Rate of Cashflows</td>
<td>4.0%</td>
</tr>
<tr>
<td>Number of Shares Outstanding</td>
<td>100,000</td>
</tr>
</tbody>
</table>

ABC's capital structure is 20% debt and 80% equity.

Use the economic model approach to calculate ABC's market value per share and determine whether or not the share price is currently over- or under-valued.
12. (4 points) You are given the projected liability cash flows of a company and decide to use the direct method to calculate its fair value. The discount rate used in your initial calculation was determined as the risk-free rate plus the credit spread corresponding to the company’s rating.

(a) Analyze the arguments for and against adding the firm’s credit spread to the risk-free rate in calculating fair value of liabilities.

(b) Explain how the indirect method of estimating insurance liabilities can be linked to the Modigliani and Miller proposition and put-call parity.
13. **(4 points)** Your company enters into a one year forward contract to sell 100 U.S. dollars for 130 Euro in New York.

You are given the following:

- contract is initially at-the-money
- one year dollar risk-free rate of interest is 5% per annum
- one year dollar rate of interest at which the counterparty can borrow is 5.5% per annum
- exchange rate volatility is 12% per annum
- defaults are recognized only at the end of the life of the contract
- recovery rate is zero when default occurs

(a) Calculate the percentage loss from defaults during the life of the contract.

(b) Calculate the value of an at-the-money call option to buy 130 Euro in one year.

(c) Estimate the present value of the cost of defaults on the forward contract.
14. (6 points)

(a) Explain the difference between the net present value approach and the risk-neutral valuation approach for valuing a capital investment project.

(b) List the advantages of the risk-neutral valuation approach for valuing real options.

(c) Describe the impact on the expected return and volatility in moving from real world to risk-neutral world.

(d) Distinguish between the real world and the risk-neutral approaches of valuing a derivative.

(e) Describe the conditions under which both approaches in (d) give the same value of a derivative.
15. *(4 points)* A one-step binomial tree is used to model the impact of an important announcement on the stock price of Company XYZ. There is a 50% chance that the announcement will be positive for the company. The Company does not pay dividends.

- Current stock price = $20
- Stock price after good news = $30
- Stock price after bad news = $15
- Time period = 3 months
- Risk-free rate (continuous compounding) = 5%

(a) Calculate the price of a 3-month call option on the Company stock with strike price equal to $22.

(b) The call writer decides to dynamically delta-gamma hedge the option based on a standard lognormal model. Evaluate the effectiveness of this approach in this context.
16. (8 points) You are consulting to a P&C company regarding the fair value of their insurance liabilities. You are examining a single one-year policy with an uncertain claim payment payable at the end of the year. Your analysis determines the following:

- The expected claim payment is $2,000.
- The expected annual return of the asset portfolio backing the liability is 7%.
- The one-year risk-free rate is 5%.
- The company’s tax rate is 35%.
- The ratio of equity to liabilities for similar products in the marketplace is 20%.
- The return on equity for similar products in the marketplace is 15%.

(a) Calculate the fair value of the liability at the beginning of the policy year using the cost-of-capital approach.
(b) Calculate the Market Value Margin that will produce the same fair value when discounting at the risk-free rate.
(c) Identify the assumptions underlying perfect markets that may not hold in the real world with respect to insurance risks.
(d) List two reasons why U.S. Treasury securities may not be appropriate as the risk-free rate for fair valuation.
17. (7 points) You have been asked to apply the Excess Spread approach to evaluate the static credited rate reset strategy and the dynamic reset strategy.

(a) Define Excess Spread and Required Spread on Assets (RSA).

(b) List the risks associated with an SPDA policy.

(c) List the steps when measuring interest rate risk with the Excess Spread approach.

(d) Calculate the Excess Spreads of the following two strategies:

- The static credited rate reset strategy:
  RSA = 80 bp
  Spread on assets is 150 bp, credit risk is 5 bp, and expense is 15 bp.

- The dynamic reset strategy:
  RSA = 70 bp
  Spread on assets is 160 bp, credit risk is 10 bp, and expense is 20 bp.

(e) Appraise the use of each of the two strategies for setting the SPDA credited rates.
18. (4 points) You are performing an actuarial valuation of a defined benefit pension plan. Your results are showing the plan to be under-funded, with a funding ratio of 70%. The plan sponsor wishes to find an asset portfolio using the surplus frontier approach that will correct the problem.

You are given the following:

- Liability beta = 0.8
- Risk-free rate = 4.0%
- Market portfolio excess return over risk-free rate = 8%
- Alpha = 0

(a) Explain the Minimum Surplus Variance Portfolio.

(b) Compute the minimum asset beta required to give a positive surplus return.

(c) Assess the appropriateness of this strategy.
19. *(7 points)* You work for a publicly traded company with a defined-benefit pension plan. Your CFO read recently that shifting pension assets from stocks to 100% bonds reduces risk, and creates a tax arbitrage, resulting in gains to shareholders. You are given the following:

- Current pension assets = $10,000,000
- Current pension liabilities = $10,000,000
- Current pension asset allocation: 60% stocks, 40% bonds
- Corporate tax rate = 35%
- Personal tax rate on stocks = 18%
- Personal tax rate on bonds = 28%
- Estimated stock return = 11%
- Estimated bond return = 7%

(a) Compare the Tepper arbitrage and the Black arbitrage.

(b) Compute the theoretical shareholder gain using both methods.

(c) Outline the challenges and arguments your CFO may face in moving to 100% bonds.
20. *(3 points)* As the CFO of your life insurance company, you have been asked to provide a single measure of risk associated with a portfolio of whole life insurance products.

The current value of the portfolio is $61,125,856. Most of the value of the portfolio can be explained by a set of monthly observable independent variables.

The 95% confidence level of VaR for the portfolio value over a two-year time horizon is $30,170,914.

Critique this approach as a measure of portfolio risk.

**END OF EXAMINATION**

AFTERNOON SESSION
Solution 1

(a) A derivative is a financial contract whose payoff depends on the underlying asset or underlying reference rate or index. The derivative in US GAAP should have a notional amount, underlying asset or provision payment. The initial payment for a derivative is zero or very small. The derivative may permit net settlement. Some derivatives may be embedded in other contracts.

The derivative defined in the Case Study is not consistent with that defined in US GAAP. It does not mention that the initial premium is zero or very small. It does not define the settlement method, either.

(b) Operational risks arise from system inefficiency, human errors, management failure, and model errors. To manage operational risk, Life Co does the following:

1. Set up an ALM committee with clear definition of responsibility
2. Set up guideline on which derivatives can be used
3. Set limits on risk exposure
4. Has written request in place for derivative acquisition
5. Good transaction documentation and control procedures
6. Follow required accounting practices
7. Disclose balance sheet effect
8. Has Investment administration system to maintain derivatives
9. If system cannot support, it is documented in a report

All these measures control the operational risks.

Legal risks include

1. Unenforceability – derivative contract cannot be enforced
2. Illegality – terms of the contract violate regulation
3. Close-out netting and insolvency

To address this risk, Life Co

1. Set requirement for approved counterparties
2. Has transaction documentation and control procedure to verify terms of transaction and review them
3. Need approval from Investment Department employee. Make employee accountable for transactions
4. Set limits on risk exposure
Solution 1 (continued)

(c) Life Co can add these operational risk controls, independent risk management, independent audit and checks.

For legal risk controls, Life Co can address the uncertain legality and authority of counterparties.
Solution 2

(a)

1. OAS is a dynamic value, sensitive to the input/assumptions made.
2. haven’t quite established that high OAS securities must be better than lower OAS’s.
3. The result is only as good as the model exposed to model risk and no model is a fully realistic representation of reality, assumption/simplification must be made.
4. OAS is a single number. We should consider it within a big background, how the distribution of “PASS” looks like “PASS” = Price and spread specific Price (Ave of “PASS” = MV of Asset) gives you OAS.

Jump Z-bond: Have event risk under certain conditions (high prepayment period). Z-bond could jump from interest-accrual to principal payment status. Could be sticky or non-sticky, non cumulative or cumulative. Jump-Z bonds are the support bonds for PACS so Jump Z-bond is very interest-sensitive, even modeling under stochastic model still not 100% sure its behavior. So “profit” = OAS- Required of Jump-Z bond is not a 100% reliable profit that should be gathered at the inception. Better see the market conception of specific securities.

(b)

Similar to 2 (a) all models have limitations.
1. Simplification
2. Assumption
3. Time horizon
4. Sampling space
5. Human error
6. Bad solution scheme for good model
7. Software/hardware bugs
8. Observed or deduced value of market variable

Also, nature of CF of securities:
1. callable
2. putable
3. extendable
4. jump or tricky
5. seniority

All these have impact on the calculation and analysis.
Solution 2 (continued)

OAS will vary over time due to
level of yield curve
prepayments
credit risk

OAS provides only a summary of what may happen, actual results may be an outlier

(c) Regular Z-bond does have longer duration. It is a good matching to long liability. High OAS is a credit, but based on 2 (a) (b), we know it is 100% reliable measure. Regular Z-bond less call/extension risk, more stable CFs, high yield, increase liquidity.
So the student is sort of right this time.
But have to understand the payment structure better to make the final decision:
1. collateral
2. Prepayment history
3. Coupon Rate vs. Market Rate
4. Seasoned or new issue
5. Agency
6. Definition of other classes in the same pool.

High OAS does not necessarily mean better investment

It is difficult to compare OAS of different securities
Solution 3

GMBD: the policyholder is guaranteed a minimum benefit upon death based on the accumulation of premiums at 5%.
This is a payoff of the fund value with an embedded put option

(b)

i) \[ \sigma_n^2 = \frac{1}{m} \sum_{i=1}^{m} u_{n-i}^2 \] in its simplified form where \( u_i = \log \left( S_i / S_{i-1} \right) \)

Equal weight to all past data, dismissing the fact that the more recent data may be more relevant. The estimate does not incorporate a long-term variance.

ii) EWMA: \[ \sigma_n^2 = \lambda \sigma_{n-1}^2 + (1 - \lambda) u_{n-1}^2 \]
Reflects autocorrelation or variance
Does not incorporate a long-term variance
Special case of GARCH

iii) GARCH: \[ \sigma_n^2 = \gamma V_t + \alpha u_{n-1}^2 + \beta \sigma_{n-1}^2 \]
mean-reversion to a long-term average \( V_t \)
model may have parameter estimation problem but in general better than EWMA

(c) Current program only hedges delta, ignoring other risks like
- gamma (rate of change of delta vs. underlying stock price)
- vega (measure impact of change in volatility)
- rho (measure impact of change in interest rate)
- Theta (time decay impact) is usually ignored

These greeks should be monitored and eventually hedged. We would need to use options to hedge gamma and vega.

Consider estimating volatility using a GARCH model. The lognormal assumption should be reviewed as well and compared to other models like RSLN
Solution 3 (continued)

(d) Develop model using an inter-disciplinary approach since many areas of expertise are needed (finance, pricing, investments, etc.).
Test boundary cases and simple cases first.
Do not ignore small discrepancies as they may signal bigger problems.
Pride of ownership is important for modelers.
Distribute model outward slowly to increase chance of catching errors.

(e) - Running the risk naked: assume that guarantees will be covered by fees
Risky approach as potential loss can be high.

- Static hedging: use put options to create an initial hedge. Still exposed to
over and under hedging and counterparty risk. May be expensive.

- Reinsurance: transfer risk to reinsurer. Subject to availability and
counterparty risk.

- Securitization

- Make market by offering offsetting risks

(f) Buying exchange traded options is a better alternative as it will be cheaper than
reinsurance. This will provide a reasonable hedge given a good estimation of
policyholder deaths and withdrawals. Credit enhancement can be used to reduce the credit risk.
Solution 4

(a) The CEO, an accountant by training, emphasizes the importance of statutory and GAAP measures to determine the economic value of the insurer.

Critique this standpoint

- Statutory and GAAP measures:
  o are open to manipulation by management to smooth earnings
  o ignore realized and unrealized gains and losses
  o ignore new business

- The real economic value of the firm equals:
  o PV (Asset Cash Flows) – PV (Liabilities Cash Flows)

- The market sees through earnings and reporting management and focuses on free cash flows

- However, we cannot ignore the impact of statutory and GAAP measures because
  o these measures are reviewed by regulators and rating agencies (GP=1)
  o these measures impact taxes (GP=1)

(b) Explain how to coordinate LifeCo's investment and product management strategies for future business for this new product to protect LifeCo's shareholder value from interest rate risk.

- To immunize shareholder value against interest rate changes, we should set the duration of assets such that
  \[ V(A) D(A) + V(FR) D(FR) = (1+k) V(R) D(R) \]
  Where \( V(A) \) = market value of assets
  \( D(A) \) = duration of assets
  \( V(FR) \) = market value of future retentions
  \( D(FR) \) = duration of future retentions
  \( V(R) \) = present value of reserves
  \( (D)R \) = duration of reserves
  \( kV(R) \) = committed value of surplus

- If the premiums of the new product are interest sensitive, then the duration of future retentions is positive (i.e. \( D(FR)>0 \)); if our premiums are not interest sensitive, then \( D(FR)<0 \)
Solution 4 (continued)

- The duration of assets, D(A) should be increased or decreased to compensate for changes in D(FR) as per the above formula
- The product management and investment areas should ensure that the liability crediting rates are supportable

(c) The pricing actuary expects to increase credited rates as interest rates increase. Devise an appropriate investment strategy to protect shareholder value from interest rate risk.
   - Since future credited rates vary directly with changes in interest rates, then future retentions will have a positive duration, D(FR)>0
   - The duration of assets, D(A), should be reduced to compensate

(d) One of LifeCo’s key competitors, ACME Life is more prone to maintain premiums regardless of changes in interest rates. Assess how their approach would impact your strategy in part c).
   - If competitors maintain premiums regardless of interest rate changes, Life Co’s D(FR) will be reduced
   - To compensate, LifeCo’s D(A) should be increased

(e) Propose a method to implement the changes in parts c) & d) that would minimize transaction
   - Interest rate swaps may be used to adjust the durations of bonds
   - Transaction costs to enter into a swap are minimal
   - Swaps have counterparty risk
   - Since the changes to asset duration to parts c) & d) are offsetting, we can adjust duration on a net basis rather than completing two separate transactions
Solution 5

The $\alpha$-quantile risk measure for a loss random variable $L$ is $V_\alpha$ such that, for $0 \leq \alpha \leq 1$,

$$V_\alpha = \min \{ V : P[L \leq V] \geq \alpha \}$$

(b) 

<table>
<thead>
<tr>
<th>$\alpha$</th>
<th>Real World $\alpha$-Quantile</th>
<th>Risk Neutral $\alpha$-Quantile</th>
</tr>
</thead>
<tbody>
<tr>
<td>91%</td>
<td>-0.35%</td>
<td>-0.30%</td>
</tr>
<tr>
<td>95%</td>
<td>-0.10%</td>
<td>-0.21%</td>
</tr>
</tbody>
</table>

(c) The $\alpha - CTE$ Risk measure for a loss random variable $L$, for $0 \leq \alpha \leq 1$, is

$$CTE_\alpha = E[L|L \geq V_\alpha]$$ provided $V_\alpha$ does not lie in a probability mass for the loss $L$,

where $V_\alpha$ is the $\alpha$-quantile.

If $V_\alpha$ lies in a probability mass

$$CTE_\alpha = \frac{(1 - \beta^\prime)E[L|L \geq V_\alpha] + (\beta^\prime - \alpha)\beta^\prime}{1 - \alpha}$$

$$\beta^\prime = \max \{ \beta : V_\alpha = V_\beta \}$$

(d) 

<table>
<thead>
<tr>
<th></th>
<th>Real World $\alpha$-CTE</th>
<th>Risk Neutral $\alpha$-CTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>91%</td>
<td>0.36%</td>
<td>-0.07%</td>
</tr>
<tr>
<td>95%</td>
<td>0.80%</td>
<td>0.07%</td>
</tr>
</tbody>
</table>
Solution 5 (continued)

(e) Using the Normal approximation to the binomial distribution, the 64% Confidence Interval is \( \left[ L_{0.95-\delta}, L_{0.95+\delta} \right] \) where

\[
\Phi \left( \frac{A}{\sqrt{100(0.95)0.05}} \right) - \Phi \left( \frac{-A}{\sqrt{100(0.95)0.05}} \right) = 0.64
\]

\[
\Rightarrow \frac{A}{\sqrt{100(0.95)(0.05)}} = \Phi^{-1} \left( \frac{1.64}{2} \right)
\]

\[
\Rightarrow A = 1.99 \quad \text{use } A = 2 \quad \text{for } \left( L_{0.95}, L_{0.91} \right)
\]

that is (-0.25\% 0.10\%) is a non-parametric 64\% CI for the 95\% quantile

(f) Risk-neutral scenarios should not be used for calculating risk measures. The risk-neutral distribution is for pricing and valuation under hedging.

The CTE is a more robust measure than the quantile measure. It would be better to start and stick with the CTE.

The cost of changing measure standards after a market downturn would be substantial – the numbers above would no longer apply.

The idea of this risk measure is to choose a standard (e.g. 95\%) and an approach (e.g. CTE) and stay with it.
Solution 6

(a)

Group into exposure bands:

<table>
<thead>
<tr>
<th>Band j</th>
<th># Obligors</th>
<th>Expected Loss</th>
<th>Default Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>.0066 + .0094 = .0160</td>
<td>.0080</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>.0105</td>
<td>.0015</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>.0180</td>
<td>.0020</td>
</tr>
</tbody>
</table>

CreditRisk+ approach uses the Poisson distribution,

For loss to be <= 300000 can have at most one default, which must be in band 2.

\[
P(\text{no defaults in bands } 2,7,9) = (e^{-0.008})(e^{-0.015})(e^{-0.002})
\]
\[
= 0.9920 \times 0.9985 \times 0.9980 = 0.9885
\]

\[
P(\text{1 default in band 2, none in 7,9})
\]
\[
= (.008 \times e^{-0.008}) \times (e^{-0.015}) \times (e^{-0.002})
\]
\[
= 0.0078
\]

\[
P(\text{loss } \leq 300,000) = P(\text{no defaults in bands } 2,7,9) + P(\text{1 default in band 2, none in 7,9})
\]
\[
= 0.9885 + 0.0078
\]
\[
= 0.9963
\]

(b)

CreditRisk+ has advantages
- easy to implement
- closed form expression possible
- few inputs needed
- CreditMetrics can’t reflect firm-specific factors
- KMV needs assumptions for capital structure plus measurement of equity value

Disadvantages:
- Relies on historical information
- Ignores downgrade/migration risk
Also shares some limitations of KMV, CreditMetrics
- no relationship between credit risk and market risk
- can’t handle nonlinear product like options
Solution 7

Factors to consider:
understand the market
understand the index
understand the trading cost
compare nationally
rule, regulations, procedures may not be published
know how closing level is calculated
know how index level is calculated
small index may be dominated by a few issues
fee and commission
bid-ask spread
price differential below quote driven and market-driven
how well they are managed
compare historical data

Factor with the most effect
Legal protection to investor
corporation management objective goal
reliability of information/communication with investor

To improve the above factors
understand local market
understand legal structure
understand goal of management
effective communication, obtain reliable information
experience staffs
research
location (centrally)
use of analytical tool

Financial info should be questioned/cannot rely totally on if not understand local accounting procedures

Historical return data cannot be meaningfully compared if you do not understand how closing level determined (index dividend may other cost may impact closing level).

Company in need of capital inflow may be willing to disclose all the information in order to attract capital should watch out for the reliability of that info.

Can also hedge foreign currency exposure in foreign market
Use option – for company with fair amount of capital (w/upside potential)
Use future – lock in fix spread, (w/o upside potential)
Consider how much CF generated from overseas
Solution 7 (continued)

Can also look at political stability in foreign market by looking at:
- Human capital (higher more stable)
- Agriculture (higher as a % of GDP less stable)
- Competitiveness (Export/import)/GDP (higher, more stable)
- Per capita DGP (higher more stable)
- Trauma (country with historical trauma usually stable (more successful)
- Democracy (lack of, less stable)
- Quality of life (life expectancy) (higher, more stable)
- Distribution of income (infant mortality) (less equally distributed, less stable)
- Rental income (higher, less stable)
- Predictability (ability to predict wholesale price ∆ for stability)
Solution 8

First find the state prices for the known securities
\[ 1 = 1.5\tau(1) + 0.7\tau(2) \]
\[ \frac{15}{11} = 2\tau(1) + \tau(2) \]

solving system we get \( \tau(1) = \tau(2) = \frac{5}{11} \)

Now solve for the risk free rate, \( r \)
\[ 1 = (1 + r)\left(\frac{5}{11}\right) + (1 + r)\left(\frac{5}{11}\right) \Rightarrow r = 10\% \]

Using security ‘A’ calculate the probability of ‘Up’ and ‘Down’
\[ (1 + r) = 1.5p + 0.7(1 - p) \Rightarrow p = 0.5 \]

The Deflator for state ‘s’ is \( U(s) = \frac{\tau(s)}{p(s)} \)

So \( D(‘Up’)=D(‘Down’)=\frac{5}{11} = \frac{10}{11} \)

Now, \( C = \sum_{s} p(s)D(s)C(s) \)
\[ = 0.5\left(\frac{10}{11}\right)(1.8) + 0.5\left(\frac{10}{11}\right)(85) \]
\[ = \frac{53}{44} \]

So, the price of security ‘C’ is \( \frac{53}{44} \)
Solution 9

(a)  
1. Cash flows from new Premium  
2. Fund allocation levels between accumulation fund and payment annuity  
3. Overall level of future expected cash flows in and out  
4. Lapse, surrender and mortality expected  
5. Guaranteed rates  
6. Assumed earned rate in pricing  
7. Product features that may effect required return and future cash flows

(b)  
1. Cash flow levels  
2. Possible alternative investment types  
3. Any special risk or regulatory limitations  
4. Effect of investments on product competitiveness  
5. Any features of existing portfolio fit this product

(c)  
1. This benchmark is not appropriate because it includes non-investment grade assets  
2. Also does not include corporate bonds which is 65%  
3. Because of this will not track with returns or credit risk  
4. Will not be able to measure effectiveness of manager

(d) Consideration when stop selling  
1. no future premium coming in  
2. Must forecast match of asset and liability cash flows  
3. can change investment strategy to shorten duration and more definite match  
4. Keep more liquidity in assets  
5. If have to sell assets, consider accounting concerns  
tax concerns  
ALM concerns  
Effect of existing policy holders
Solution 10

(i) **Asset Swaps**
Hedges out interest rate risk by swapping fixed to floating

**Advantages**
- Reduces interest rate exposure
- Takes advantage of mispricings in FRN market
- Over the counter (very liquid)
- Can purchase credit protection in future cheaply through a forward asset swap
- Gains access to foreign currency market with little interest or credit risk

**Disadvantages**
- Retains credit exposure

(ii) **Single Name default swaps**
Bilateral contract to buy credit protection against default of specific asset
- After credit event buyer receives payment of par – recovery value
- Protection buyer pays fee or premium up front over life of contract
- Negotiated contract – must define reference asset credit event and payoff

**Advantages**
- Customized
- Access to credit market with no up front cost (unfunded)
- Hedges large concentrations of risk
- Asset protection without shorting asset
- Arbitrage possibilities
digital or binary can reduce recovery risk

**Disadvantages**
- Par product only
- Replicating strategy does not always exist
Solution 10 (continued)

iii) Basket Default Swap
Similar to single Name Default Swap
Except credit event is a combination of assets in a basket
Can be first-to-default or second to default
Pricing dependent on correlations of assets

Advantages
Diversification
Cheaper to use second to default

Disadvantages
Historical correlations difficult to measure
Basket spread is 2-3 times avg. spread of assets (very expensive)
No static hedge strategy, need dynamic

iv) Portfolio Default swap
Similar to basket but takes a portfolio of credit names
Redistributes to a tranche structure
Riskier tranche is that which reduces principal on first default, similar to equity
Works best for 40-100 names in portfolio
Redistribution of risk is tied to amount of loss (% of portfolio) rather than 3 of osses

Advantages
Easier to understand than Bucket default swap
Investors can choose their own risk/reward profile

Disadvantages
will need to pay higher spread on equity tranche

(b) Accounting Considerations
Must follow FAS 133 or IAS39 if adopted
Must mark-to-market (fair value) derivative contracts
Hedge accounting to apply if can demonstrate effectiveness
If fair value hedge, both MTM of derivative and offsetting item booked through income
If cashflow hedge, MTM booked through OCI in equity
Must document all hedging transactions and compliance with FAS 133
**Solution 10 (continued)**

Default swap is treated as a fair value hedge
Must separate interest component from credit risk component
Credit risk defined as full price risk less benchmark interest rate risk
Any hedging gains/losses recorded in income as ineffectiveness
Solution 11

The cost of equity
- based on CAPM, \( r_e = r_f + \beta (r_m - r_f) \)
- where \( r_f \) = risk free rate
- \( \beta \) = company beta
- \( r_m - r_f \) = market risk premium
- Therefore, \( r_e = 0.06 + 1.2(0.05) = 12\% \)

The cost of capital = (1- Tax Rate) (Cost of debt) (proportion of debt)
+ (cost of equity) (proportion of equity)
= (1-0.35)(10\%)(20\%)+12\%(80\%)
= 10.9\%

The economic model approach will consider the cash flows of the company instead of just the income level.

The total cash flows to the company
= (Net income)+(goodwill amortization)+(interest after tax expense)-(capital expenditures)
= 250,000+40,000+45000 x(1-35\%); -30,000
= 289,250

Under a perpetual growth scenario, the market value of the firm =
cash flow / (cost of capital - growth rate)
= 289,250(1+0.04)
= 0.109 - 0.04
= 4,359,710

The share price = (firm market value - market value of debt) / number of shares outstanding
= 4,359,710 - 2,000,000
= 100,000
= 23.60

Given that the stock has been trading around $25.5, the share price is currently over valued.
Solution 12

(a) For
- a liability is someone’s asset, thus should be under the same valuation platform
- Fail to include credit rate in liability means company can manipulate earnings by trading on its own debt
- No compelling reason to suggest that financial liabilities should be treated differently from publicly issued debt
- Value of liability cannot be greater than value of asset from the owner’s point of vies.

Against
- Involve credit rate means higher earnings when credit falls.
- Liabilities are not traded, thus asset valuation does not apply
- Actual exit price does not make sense to insurance liability since insurance liability must be settled
- Financial Statement with no credit adjustment to liability is more useful to user.

(b) Indirect method: \[ FML_i = MVA_i - DDE_i - DTL_i \]

Put call parity: \[ S_o + p = Ke^{-rt} + C \]

According to Modigliani and Miller (MM), value of a firm does not change by amount or structure of debt. It assumes a world where market is perfect, no tax.

Equity can think of as a call on value of a firm debt can think of as a combination of a risk-free asset plus a put (since firm can default).

In this case we have the following

\[ So = C + Ke^{-rt} - p \]

This is the actual put-call parity stated earlier.
Solution 12 (continued)

In Indirect method, in a world without tax we have:

\[ FVL_t = MVA_t - DDE_t, \]

\[ MVA_t = DDE_t = FVL_t \]

firm value       equity       debt
              to shareholder   to bondholder

This is in the same structure as shown by the put-call parity above.
Solution 13

(a) \[ u = 1 - e^{-(0.035 - 0.05) \times 1} \]
\[ = 0.004988 \]

(b) \[ v = 130 \left[ FN(d1) - KN(d2) \right] e^{-rT} \]
\[ d1 = \frac{\ln(F/K + \sigma^2 \cdot T/2)}{\sigma \sqrt{T}} \]
\[ d2 = d1 - \sigma \sqrt{T} \]
\[ F = K = 0.76923 \]
\[ \sigma = 0.12 \]
\[ T = 1 \]
\[ r = 0.05 \]
\[ d1 = 0.06 \]
\[ d2 = -0.06 \]
\[ v = 130 \times 0.035009 \]
\[ = 4.55111 \]

(c) cost of default = \( uv \)
\[ = 0.004988 \times 4.55111 \]
\[ = 0.02270 \]
Solution 14

(a) NPV: project net cash flows (which derived from project operations net of new capital injection) in the real world, then discounting them at risk-adjusted rate (which may reflect the investor's risk/reward profile, may be derived by CAPM or simply judgment) at initial point. Then subtract the initial investment. If the result is a positive number then this capital investment project is desirable. Risk-neutral valuation: project net cash flows in risk-neutral world (assume investors are all risk-neutral), then discount them at risk-free rate at inception.

(b) Advantages of RN valuation: simply, eliminating the subjectivity of selection of appropriate discount rate. Assume every investment project will earn risk-free rate. Avoid difficulties in stochastic simulation of projected cash flows. The spot rate of CFs just equal to short rate more appropriate for real options.

(c) Moving from real world to risk-neutral world, expected return changes from \( \mu \), risk-adjusted return, to \( r \), risk-free rate, while the volatility remains unchanged.

(d) To value derivatives, risk-neutral approach projects expected net cash flows in risk-neutral world, then discounts at risk-free rate; real world approach (actuarial approach) projects cash flows in real world (using unadjusted probability based on historical data) then also discount at risk-free rate.

(e) When real world and risk neutral world give the same cash flows, then above two approaches give the same value. This will be the case when derivatives risk is complete unsystematic.
Solution 15

(a)

Anticipated Stock Prices

\[
\begin{array}{ll}
2 & 0 \\
3 & 0 \\
1 & 5 \\
\end{array}
\]

I = 3/12 \quad r = 0.05

Option Payoffs

\[
\begin{array}{ll}
? & 8 \\
0 & 0 \\
\end{array}
\]

\[f = e^{-rT} \left[ pf_u + (1 - p) f_d \right]\]

\[p = \frac{e^{rT} - d}{u - d}\]

\[c = e^{-0.05 \times 0.25} \left[ 0.35 \times 8 + (1 - 0.35) \times 0 \right]\]

C = 2.766

(b)

Lognormal is not appropriate as it assumes smooth changes in price. Regime switching lognormal might be more appropriate.
Delta-gamma hedge is not appropriate as an announcement is expected that will make the stock price jump.
Dynamic hedging assumes continuous price movement.
Solution 16

(a) \[ r_A = 7\%, r_f = 5\%, r_E = 15\%, e = 20\%, t = 35\% \]
\[ r_t = r_A - \left[ e \times \frac{r_A}{(1-t)-r_A} \right] \]
\[ r_t = 7\% - \left[ 20\% \times \frac{15\%}{(1-35\%) - 7\%} \right] \]
\[ r_t = 3.7846\% \]

The fair value of the liability at the beginning of the policy year is the present value of cash flows discounted at rate \( r_t \)
\[ \frac{C}{(1+r_t)} = \frac{2000}{1.037846} = 1927.07 \]

(b) \[ (C + MVM)/(1+r_f) = C/(1+r_t) \]
\[ MVM = C \times \frac{(r_f - r_t)}{(1+r_t)} \]
\[ MVM = 2000 \times (5\% - 3.7846\%) / 1.037846 \]
\[ MVM = 23.42 \]

(c) From economic theory, the risk adjustment or insurance should be zero. Yet, the risk adjustment is not zero in the real world. Assumptions that may not hold in the real world include the following:

i.) The risks may have highly skewed distributions. There may be a very small probability of an extremely large loss. It is difficult to reduce through diversification for such risks.

ii.) The risks may not be diversifiable. The risk due to the unknown level of true expected claims can be hard to diversify. Financial instruments that allow easy and inexpensive trading of such risks do not exist in most cases.

iii.) The theory depends on costless bankruptcy, which means that all assets of a failed entity are available to settle its liabilities. In reality, there are substantial legal costs that reduce the amount of assets available to settle liabilities.

iv.) The theory depends on a well-defined market portfolio. World financial markets have not converged to the point where such a market portfolio can be clearly defined and its covariance matrix determined.
Solution 16 (continued)

(d) (i) U.S. Treasuries are not really risk-free because they are denominated in dollars. They have inflation risk.

(ii) U.S. Treasuries are very liquid, thereby implicitly including an option to sell at current market value before maturity. Liquidity is not a requirement of a default-free security with cash flows that are certain.
Solution 17

(a)  
- An excess spread is used to measure the profitability in terms of a spread between the earned returns on the assets and the required rate on the assets to satisfy the liabilities.
- RSA is the required spread on assets, which is the spread over Treasuries that must be earned on assets to satisfy the liabilities.
- There are five steps to calculate RSA:
  - Calculate the market value of the asset portfolio as of a certain date
  - Calculate the Treasury forward rates as of the same date
  - For interest-rate sensitive liabilities, develop a set of interest rate paths
  - Calculate the liability and expense cash flows
  - Determine the spread that, when added to the corresponding Treasury rates, will discount the liability and expense cash flows to the market value of assets. This spread is RSA.
- Excess Spread = Spread on Asset
  - Credit Risk
  - Investment expenses
  - RSA

Where Spread on assets is a spread of the actual assets held over Treasuries.

(b)  
- SPDA is an insurance product with the following risks faced by the company:
  - Interest risk
  - Surrender risk
  - New business rate/sales volume
  - Expense risk
  - Mortality risk

(c)  
- Interest rate risk can be measured by the effect on excess spread of parallel shocks in interest rates.
- The first step is to select the shock levels
- Then calculate the new market value of the assets at each shock level.
- The second step is to generate a set of interest rate paths for each interest rate shock.
- Then to calculate the RSA as in a)
Solution 17 (continued)

(d)  
- ES (static) = 150-5-15-80=50BP
- ES (dynamic) = 160-10-20-70=60BP

(e)  
- Here is better to choose the dynamic strategy which has a higher ES.
- but the one with the highest ES may not be the best strategy as the goal is to maximize the total profits
- So the effects on sales volume should be considered: the one that maximizes the total profit should be the best strategy.
Solution 18

(a) The Minimum Surplus Variance Portfolio (MSV) is the portfolio that minimized surplus volatility:
- traditionally ALM has focused on asset side
- The true health of the plan should look at economic surplus
- Must decide how much $\beta$ (hedgeable risk) and $\alpha$ risk to take.
- Cash flow or duration matched portfolios can be viewed as proxies for the MSV
- You use Markowitz mean-variance method to construct surplus efficient frontier
- The MSV is the point that is at the left most efficient point on the EF
- In practice asset only EF is very close to surplus EF.
- Can view liability as short on asset and look at asset only view
- liabilities have a market $\beta$ just like all assets

(b) $r_A = r_f + \beta_A (r_p) + \alpha$
   $r_L = r_f + \beta_l (r_p) + \alpha$

   $r_p$ is the market risk premium
   $r_f$ is risk free rate
   $\alpha$ is alpha risk (conditional being able to pick skilled managers

   $r_{s(l)} = \frac{A}{L} r_A - r_L$

   $r_{s(l)}$ is the liability relative surplus return
   Thus is required because if surplus is zero you get division by zero problems

\[ \Rightarrow \beta_s = \frac{A}{L} \beta_A - \beta_l \]

given $\beta_l = 8$  \[ \frac{A}{L} = 70\% \]

$\alpha = 0$

$r_p = .08$

$r_f = .04$

$r_A = .04 + \beta_A (.08) + 0$

$r_L = .04 + .8(.08) + 0 = .104$

$r_{s(l)} \geq 0 \Rightarrow \frac{A}{L} r_A - r_L \geq 0$

\[ \Rightarrow .7r_A - .104 \geq 0 \Rightarrow r_A \geq \frac{.104}{.7} = .1485 \]
Solution 18 (continued)

⇒ 0.14857 = 0.04 + 0.08βₐ
⇒ βₐ = 1.35714

(c) βₐ = 1.35714

- You need to take on a large amount of risk. Surplus variance may go up; could do very poorly.
- This may not be appropriate; does depend on size of DB plan relative to corporate assets.
- Investment policy is just one lever. You also have contribution and benefit policy.
- Investment policy is the weakest of the Three levers.
- You may want to consider changing contribution and/or benefit policy.
Solution 19

(a) Tepper arbitrage:
The company will shift assets from equity to debt in the pension plan, and for
every dollar the company shifts, the shareholders shift $(1-corporate tax rate)$
from debt to equity in their personal accounts. By doing so, the net gain to
shareholders is $(1-t_c)r_b(t_{pb} - t_{ps})$, or \[
\frac{(1-t_c)(t_{pb} - t_{ps})}{(1-t_{pb})}
\] in perpetuity

Black arbitrage:
Instead of shareholders shifting money from debt to equity, company can change
its capital structure to achieve the goal. Specifically, the firm shifts from equity,
to debt in the pension plan, and for every dollar shifted. The firm issues $(1-t_c)$
debt and buys back $(1-t_c)$ stock. By doing so, the net gain to shareholders (in
perpetuity) is \[
\frac{(1-t_{ps})t_c(1-t_c)}{1-t_{pb}}
\]

(b) Tepper:
\[
\frac{(1-t_c)(t_{pb} - t_{ps}) \times 60 \times 10,000,000}{1-t_{pb}}
\]
\[t_c = \text{corporate tax rate} = .35\]
\[t_{pb} = \text{personal tax rate on bonds} = .28\]
\[t_{ps} = \text{personal tax rate on stocks} = .18\]
\[
\frac{(1-.35)(.28 -.18) \times .60 \times 10,000,000}{1- .28} = \$541,667
\]

Black:
\[
\frac{(1-t_{ps})t_c(1-t_c)}{1-t_{pb}} \times 60 \times 10,000,000
\]
\[\frac{(1-.18)(.35)(1-.35)}{1-.28} \times 60 \times 10,000,000 = \$1,554,583\]
Solution 19 (continued)

(c)

- Pension liabilities are long term, stocks are expected to earn more than bonds in the long run
- Vested interests by actuaries and fund managers
- Current accounting rules allow manipulating earnings with expected returns on the plan portfolio
- Compensation ties to plan performance
- Equities considered a good hedge against salary inflation
- ERIS requires prudent person approach, i.e., diversifications
Solution 20

The company use VaR to measure risk of portfolio. VaR is attractive as a risk measurement tool in that it provides management a single number to summarize the risk in portfolio. It tried to make the statement like: “we are x% certain that the loss during the next N days would not exceed V dollars.”

The company provide 95% CI for VaR over the two-year time horizon. Time horizon is too long, and it’s almost meaningless to set such risk measure.

There are many advantage and use of VaR:
1. useful for financial reporting
2. set position limit for traders
3. measure return on risk adjusted basis
4. evaluate model
5. investment recommendation.

There are also some limitations of VaR.
1. VaR measure varies significantly with the assumption and methodology used.
2. Risk management result gives management false sense of security, especially when they see how wildly the risk exposure can change as conditions change.
3. There are some risks not captured by quantitative VaR calculation like liquidity risk, operational risk, etc.
4. It’s not very meaningful to compare VaR from different analysis.
5. VaR should be supplemented with checks, balances, procedures, audits.
6. Quantitative risk management tools is also necessary for correctly manage risk.
7. VaR currently lack standardization. Standardization will improve the quality of risk management, but may also inhibit the development of new risk management tools and techniques.

VaR should also be reported with confidence interval. Stress testing and back testing should also be carried to see how VaR perform under extreme market movement and see how VaR performed in the past.
The Education and Examination Committee provides study notes to persons preparing for the examinations of the Society of Actuaries. They are intended to acquaint candidates with some of the theoretical and practical considerations involved in the various subjects. While varying opinions are presented where appropriate, limits on the length of the material and other considerations sometimes prevent the inclusion of all possible opinions. These study notes do not, however, represent any official opinion, interpretations or endorsement of the Society of Actuaries or its Education and Examination Committee. The Society is grateful to the authors for their contributions in preparing the study notes.
COURSE 8 - INVESTMENTS
CASE STUDY

LifeCo

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BACKGROUND AND HISTORY

LifeCo is a multinational stock life insurance company and has general account assets totaling $5 billion supporting three main lines of business: Individual Life and Annuity, Institutional Pensions and Group Benefits. Its assets are internally segmented in eleven major portfolios defined below. Each portfolio is fully integrated in the accounting databases with full income statements and balance sheets produced monthly. LifeCo has recently implemented guidelines for Asset Liability Management and is in the process of identifying strategies for mitigating its exposure to interest rate and other risks.

LINES OF BUSINESS

Individual Life and Annuity
- Traditional Life
- Non-Traditional Life
- Accumulation Annuity
- Equity-Linked GIC
- Separate Account for Variable Annuity and Variable UL

Institutional Pensions
- Payout Annuity
- GIC
- Separate Account for Institutional GICs

Group Benefits
- Long Term Disability
- Other A&H

Surplus Account
- Surplus Capital

DESCRIPTION OF LIABILITIES

Individual Life and Annuity

Traditional Life includes all non-interest-sensitive individual life products and is predominantly comprised of non-par term and whole life. Guaranteed interest on whole life policies ranges from 3% to 6%. Policyholders can take out policy loans against any cash surrender value. A maximum loan rate of 7% exists on older policies. The duration of the traditional life liability cash flows tends to be fairly long. It has been difficult to find assets with suitable characteristics to effectively match these liabilities. The liabilities in the traditional life segment are supported by $300 million of assets.

Non-Traditional Life consists entirely of universal life. Universal life policyholders can direct their investments into a number of interest bearing or equity-linked accounts.
Interest bearing accounts generally credit a portfolio average rate and have a minimum credited interest guarantee of 4% across the board. Because LifeCo incurs significant costs associated with the acquisition of this business, even though the present value of future fund profits exceeds the present value of all future benefits and expenses, it will not have the hard assets to invest at issue in order to match the interest rate exposure of the liabilities. This situation creates significant reinvestment rate risk. To further complicate matters, the embedded options present in universal life mean that the liability cash flows will not be fixed and will vary with interest rates. The liabilities in the non-traditional life segment are supported by $400 million of assets.

**Accumulation Annuity** contains all individual flexible and single premium deferred annuities. Assets total $1.5 billion. Most funds are available for withdrawal at a book value basis. Surrender charges decline to 0% over a 5-7 year period. Minimum guarantees are generally in the 3-4% range but there is a $500 million block of annuities that have a 5% minimum guarantee. This latter block was sold with a 6% cliff surrender charge and will be reaching the end of the surrender charge period in the next year (i.e. the surrender charge will go from 6% to 0%). There is also a $250 million block of MVA (market value adjusted) annuities included in this segment. The Accumulation Annuity portfolio has been the subject of much modeling scrutiny over the years to better understand the product profitability and risk profile. Actuaries at LifeCo have internally flagged each asset purchase in the portfolio to a particular product in order to support a more detailed level of analysis.

**Equity Linked GICs** offer the return of principal after five years, plus 75% of the percentage increase of the S&P 500 total return index over that five-year period (if positive). As of December 31st:

- assets total $55 million
- remaining term to maturity of GICs is 4.5 years
- current percentage increase of the S&P 500 total return index since issue is 6%
- volatility of the S&P 500 index equals 18%
- S&P 500 total return index is expected to grow at 15% / year

**Variable Annuities** include a guaranteed minimum death benefit, which, upon death of the policyholder, will pay the maximum of the current account value and the deposits accumulated at 5%. Upon surrender, the market value less surrender charges is paid. The benefit is reduced dollar-for-dollar on partial surrenders. For example, assume a policyholder elects to take a $10 partial surrender of the $100 Account Value when the GMDB is $110 after the surrender charge wears off. As a result of the partial withdrawal, the Account Value would be reduced by $10 to $90 and the GMDB would also be reduced by $10 to $100. Therefore, the dollar amount of the GMDB exposure in excess of the Account Value remains constant, but increases as a percentage of the Account Value.

**Separate Accounts for Variable Annuity and Variable Universal Life** assets are invested in various externally managed mutual funds. Policyholders may transfer between the funds offered, make new deposits, and withdraw money, subject to a surrender charge.
Institutional Pensions

**Payout Annuity** contains pension buyout annuities in both immediate and deferred status, supplementary contracts arising from life and annuity contracts, and structured settlement annuities. This segment was established to hold intermediate to long-term income payment streams that may or may not include life contingencies. Structured settlement annuities contain standard and substandard life contingent annuities, non-life contingent streams and some COLA (cost-of-living adjustment) escalators. Assets total $700 million.

**Guaranteed Investment Contract (GIC)** includes both single deposit and window GIC’s. This segment holds $1.5 billion of assets. $200 million of the portfolio consists of funding agreements that are putable with 60 days notice. $100 million of the portfolio consists of floating rate-funding agreements, payable in Euros, which mature over the next 5 years. The remaining liabilities are benefit-sensitive contracts with institutional pension plans, which mature over the next 5 years.

**Separate Account Institutional GIC** offers single deposit and window GICs to larger institutional clients. For accounts larger than $150 million, the company will offer to set up a separate portfolio for one client, with its own asset allocation targets. Administrative fees are reduced for the commingled accounts, which are available to clients with at least $25 million. While the institutional client owns the market value of its share in the separate account, the individual participants receive interest credited to the book value of their individual accounts. LifeCo annually resets the crediting rates, so that the market value gains and losses in the commingled account are shared with participants. The general formula used to set the credited rate is as follows:

\[
\text{Credited rate} = \text{Market yield of separate account} - \text{Administration fees} + \frac{(MV \text{ separate account} - BV \text{ individual accounts})}{(\text{Duration of separate account})}
\]

In addition, LifeCo guarantees that the market value of each separate account will never be less than 80% of the book value of the individual accounts associated with it. LifeCo does not offer synthetic GICs.

**Group Benefits**

**Group Long-Term Disability** pays up to 70% of an employee’s salary prior to the disability claim. Premiums are paid through payroll deduction. Premium rates are guaranteed for 2 years. Claims incurred stay with LifeCo even if the employer changes its insurance carrier for new business. The current product provides “own occupation” benefits generally for two years from the date of incurring, after which payments continue only if the claimant is unable to work at all. LifeCo offers rehabilitative services and counseling where it may be effective, usually through the first four years of a claim. Claim runoff is such that reserves at claim duration 10 are expected to be about 10% of
the reserve at date of incurrence. There is no cash surrender benefit to either individual claimants or group policyholders. The claim liabilities and unearned premium in respect of the group LTD segment are backed by $500 million of assets.

*Other A&H* includes short-term group medical, dental, and term life products. These products are sold through the same group benefits general agents who distribute the company's LTD product. The company competes on strong underwriting and customer service. The products are repriced at least annually to meet profitability targets. While investment margins are material, they are seen as independent of underwriting margins. Earned premium to surplus leverage is low, at about 4/1. The claim reserves and unearned premium in respect of the other A&H segment are backed by $130.8 million of assets.

**Surplus Account** contains the surplus capital. The Surplus Account is managed to maximize total rate of return growth over time subject to a series of constraints related to liquidity, bond ratings and operating income versus surplus income concerns. Company guidelines require an asset mix of 10-70% in equities, 0-50% in real estate, and 5-90% in bonds. The target asset mix is 50% equities, 35% real estate, and 15% public and private bonds.

**RATINGS OF COMPANY**

Mud & Poor's (M&P) Rating Agency uses the following rating categories:

AAA, AA, A, BBB, BB, B, etc

LifeCo is currently rated "AA-". One year ago, M&P raised concerns about LifeCo and placed the company under ratings review. LifeCo was not downgraded at that time.

M&P's report at that time included the following rationale for the review:

**Capital:** LifeCo's capital position of 3.6% of assets is weak relative to the other insurers rated "AA-".

**Liquidity:** LifeCo's liquidity position appears weak. Given that the GICs will mature over the next few years and that a significant portion of the new sales are directed to separate account products, the company would appear to have a higher than usual liquidity risk.

**Credit Risk:** LifeCo is exposed to C1 risk because of its investments in: below investment grade bonds, commercial mortgages, equity, and real estate. LifeCo also has a high percentage of total assets invested in CMO's, which exhibit cashflow volatility.

**Growth/Profitability:** LifeCo's business mix is shifting to less capital-intensive lower margin products.
PERFORMANCE HISTORY

LifeCo was established in 1945; however most of LifeCo’s growth has taken place in the last ten years.

Although LifeCo has been profitable on both a Statutory and GAAP basis for the past 6 years, profits have fluctuated. Return on Equity (ROE) has averaged 8% over the past 5 years compared to an ROE of 12% for the industry. LifeCo’s stock has returned an average of 5% on a total return basis over the past 3 years.

ENVIRONMENT

In surveys, the company has generally received positive reviews from its customers for service and for value. One weakness of the company has been its public relations department. Early in 1999, LifeCo took steps to deal with this weakness by hiring one of the top public relations specialists in the country.

The insurance industry in general has received some bad press of late due to perceived market conduct problems. As a result, financial service companies that are not perceived as insurers have taken business away from companies perceived as insurers. LifeCo is definitely viewed as an insurer.

Because of the rapid changes in product design, LifeCo has 16 products running on 6 different administrative systems. With the strong stock market and declining interest rates, money has been moving from the fixed account to the variable accounts for both the variable annuity and the variable life products. The variable life market has been growing recently. The variable annuity market has also been growing, but it has been adversely affected by tax law changes. Additionally, changes in regulation have allowed banks to underwrite variable annuities, and several large banks are offering low load versions of this product. These changes have resulted in a dramatic slowing of variable annuity sales for LifeCo. At the same time, many reinsurers have taken a second look at offering reinsurance for the risk associated with the investment guarantees offered on these products and are either not willing to provide reinsurance on this business at all or are only willing to do so at a much higher cost than was previously assumed in pricing.

DESCRIPTION OF ASSETS

*General Fund Assets Backing Individual Life & Annuity and Institutional Pensions*
LifeCo invests in private placement bonds, public bonds (including CMO’s), commercial mortgages, equities and real estate. For private placement bonds, LifeCo tries to maintain a 75% investment grade, 25% below investment grade mix. The current mix is worse than these percentages because of downgrades in the portfolio. Thirty percent of the private placement bonds are callable.
For public bonds, LifeCo tries to maintain an 80% investment grade, 20% below investment grade mix. Currently, LifeCo maintains a higher credit quality for the bonds to offset the current mix for the private placement bonds. Seventy-five percent of the public bonds are callable.

General account assets are segmented into portfolios supporting the liability lines. LifeCo’s asset mix backing its pension business is: 83% bonds, 13% commercial mortgages, 2% equities and 2% cash and short term. All bonds and mortgages are denominated in U.S. dollars. LifeCo’s asset mix backing its individual life and annuity business, including the liability arising from the guaranteed minimum death benefit, is: 74% bonds, 10% commercial mortgages, 5% equities, 7% real estate, 2% policy loans and 2% cash and short term. LifeCo’s asset mix backing its Group Life and Health business is: 85% bonds, 8% commercial mortgages, 5% equities and real estate, and 2% cash and other.

**Separate Accounts Variable Annuities and Variable UL Policies**
The overall distribution is 70% US equity, 15% US bonds, 5% money market, and 10% international bonds/equity for the variable annuity block. Assets total $2.4 billion for variable annuities, and $1.1 billion for variable universal life.

<table>
<thead>
<tr>
<th>Fund Type</th>
<th>Volatility</th>
<th>Equity</th>
<th>Bond</th>
<th>Mortgage</th>
<th>Asian</th>
<th>Global</th>
<th>Money Market</th>
<th>Balanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity</td>
<td>18%</td>
<td>1</td>
<td>0.00%</td>
<td>0.00%</td>
<td>25.00%</td>
<td>70.00%</td>
<td>0.00%</td>
<td>95.00%</td>
</tr>
<tr>
<td>Bond</td>
<td>4%</td>
<td>0.00%</td>
<td>1</td>
<td>80.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Mortgage</td>
<td>3%</td>
<td>0.00%</td>
<td>80.00%</td>
<td>1</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Asian</td>
<td>21%</td>
<td>25.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>1</td>
<td>45.00%</td>
<td>0.00%</td>
<td>25.00%</td>
</tr>
<tr>
<td>Global</td>
<td>19%</td>
<td>70.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>45.00%</td>
<td>1</td>
<td>0.00%</td>
<td>70.00%</td>
</tr>
<tr>
<td>Money Market</td>
<td>0%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>1</td>
<td>0.00%</td>
</tr>
<tr>
<td>Balanced</td>
<td>9%</td>
<td>95.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>25.00%</td>
<td>70.00%</td>
<td>0.00%</td>
<td>1</td>
</tr>
<tr>
<td>Unit Value</td>
<td>Variable Annuities ($ millions)</td>
<td>Variable UL ($'millions)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------</td>
<td>--------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fund Value</td>
<td>Delta</td>
<td>Gamma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equity</td>
<td>18.2</td>
<td>1,042</td>
<td>(189,993)</td>
<td>5,287</td>
<td>258</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bond</td>
<td>13.1</td>
<td>294</td>
<td>(98,102)</td>
<td>4,263</td>
<td>460</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortgage</td>
<td>11.1</td>
<td>37</td>
<td>(6,467)</td>
<td>66</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>9.5</td>
<td>49</td>
<td>(10,105)</td>
<td>130</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global Equity</td>
<td>14.8</td>
<td>343</td>
<td>(11,559)</td>
<td>6,992</td>
<td>56</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Money Market</td>
<td>10</td>
<td>123</td>
<td>(470,985)</td>
<td>896</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balanced</td>
<td>15.2</td>
<td>564</td>
<td>(505,539)</td>
<td>30,797</td>
<td>258</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,452</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
<td><strong>1,122</strong></td>
<td><strong>-</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The Delta and Gamma applies to the minimum guaranteed death benefit included in the variable annuity product.

<table>
<thead>
<tr>
<th>($ millions:)</th>
<th>Reported Book Value</th>
<th>DAC</th>
<th>Net Book Value</th>
<th>PV of Cash-Flows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable Annuities</td>
<td>2459</td>
<td>(74)</td>
<td>2,385</td>
<td>2,360</td>
</tr>
<tr>
<td>Variable UL</td>
<td>1122</td>
<td>(28)</td>
<td>1,094</td>
<td>1,085</td>
</tr>
</tbody>
</table>

The derivatives contracts used to hedge the delta exposure are held in the General Fund.

*Separate Account Institutional GIC*

In total this line of business holds $1.2 billion in market value of assets. Each commingled account offers a different target asset allocation.

**Account 1**
- Treasuries: 5%
- AA/AAA public corporates: 35%
- A public corporates: 15%
- BBB public corporates: 10%
- Govt/Agency MBS passthroughs: 25%
- High grade private corporate debt: 10%

**Account 2**
- Treasuries: 5%
- AA/AAA public corporates: 10%
- A public corporates: 15%
- BBB public corporates: 15%
- High yield public corporates: 15%
- Convertible securities: 10%
- Govt/Agency MBS passthroughs: 15%
- High grade private corporate debt: 10%
- Other private debt: 5%
**Group Long-Term Disability**
The asset portfolio is designed to have relatively low liquidity and high total return, with a duration target of 7 years. The target asset allocation is as follows:

<table>
<thead>
<tr>
<th>Asset Category</th>
<th>Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treasuries</td>
<td>5%</td>
</tr>
<tr>
<td>Inv Grade public corporates</td>
<td>35%</td>
</tr>
<tr>
<td>Govt/Agency MBS passthroughs</td>
<td>20%</td>
</tr>
<tr>
<td>High yield public corporates</td>
<td>10%</td>
</tr>
<tr>
<td>Commercial mortgages</td>
<td>10%</td>
</tr>
<tr>
<td>High grade private corporate debt</td>
<td>10%</td>
</tr>
<tr>
<td>Other private debt</td>
<td>5%</td>
</tr>
<tr>
<td>Real estate partnerships</td>
<td>5%</td>
</tr>
</tbody>
</table>

**Other A&H**
Invested assets are managed for high liquidity and high total return.

<table>
<thead>
<tr>
<th>Asset Category</th>
<th>Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treasuries</td>
<td>10%</td>
</tr>
<tr>
<td>Inv Grade public corporates</td>
<td>50%</td>
</tr>
<tr>
<td>Federal/Agency MBS passthroughs</td>
<td>25%</td>
</tr>
<tr>
<td>High yield public corporates</td>
<td>10%</td>
</tr>
<tr>
<td>Public equities</td>
<td>5%</td>
</tr>
</tbody>
</table>
### Total Company (excluding Separate Accounts)

<table>
<thead>
<tr>
<th>Assets</th>
<th>Reported Book Value</th>
<th>Book Yield</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bonds (total)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1a Gov't</td>
<td>202.4</td>
<td>5.97%</td>
<td>202.8</td>
<td>6.1</td>
<td>1.0</td>
</tr>
<tr>
<td>A1b Public Corporate (Inv. Grade)</td>
<td>1573.7</td>
<td>6.76%</td>
<td>1621.0</td>
<td>6.5</td>
<td>23.6</td>
</tr>
<tr>
<td>A1c Public Corporate (below Inv Grade)</td>
<td>399.8</td>
<td>7.21%</td>
<td>419.0</td>
<td>4.5</td>
<td>20.0</td>
</tr>
<tr>
<td>A1d Private Corporate (Inv Grade)</td>
<td>790.3</td>
<td>6.99%</td>
<td>829.1</td>
<td>6.0</td>
<td>15.8</td>
</tr>
<tr>
<td>A1e Private Corporate (below Inv Grade)</td>
<td>437.7</td>
<td>7.54%</td>
<td>470.1</td>
<td>4.6</td>
<td>30.6</td>
</tr>
<tr>
<td>A1f Pass-throughs</td>
<td>274.2</td>
<td>6.88%</td>
<td>288.0</td>
<td>4.4</td>
<td>8.2</td>
</tr>
<tr>
<td>A1g CMO's</td>
<td>219.2</td>
<td>6.60%</td>
<td>227.5</td>
<td>3.6</td>
<td>6.6</td>
</tr>
<tr>
<td><strong>Bonds Subtotal</strong></td>
<td>3897.2</td>
<td>6.90%</td>
<td>4057.5</td>
<td>5.8</td>
<td>105.8</td>
</tr>
<tr>
<td>A2 Cash &amp; short term</td>
<td>103.0</td>
<td>4.75%</td>
<td>103.0</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>A3 Commercial Mortgages</td>
<td>554.0</td>
<td>8.39%</td>
<td>595.0</td>
<td>5.4</td>
<td>27.7</td>
</tr>
<tr>
<td>A4 Derivative securities</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.0</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>A5 Equities</td>
<td>249.3</td>
<td>1.66%</td>
<td>249.3</td>
<td>5.6</td>
<td>49.9</td>
</tr>
<tr>
<td>A6 Real Estate (unleveraged)</td>
<td>237.0</td>
<td>9.70%</td>
<td>274.1</td>
<td>5.0</td>
<td>35.6</td>
</tr>
<tr>
<td><strong>Invested Assets Subtotal</strong></td>
<td>5040.5</td>
<td>6.89%</td>
<td>5278.8</td>
<td>5.7</td>
<td>219.3</td>
</tr>
<tr>
<td>A7 Accrued investment income</td>
<td>50.3</td>
<td>0.00%</td>
<td>50.3</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>A8 Policyholder Loans</td>
<td>52.5</td>
<td>7.17%</td>
<td>52.5</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>A9 Provision for asset default</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.0</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>A10 Other</td>
<td>75.5</td>
<td>0.00%</td>
<td>75.5</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>A11 Total Assets</strong></td>
<td>5218.8</td>
<td>6.73%</td>
<td>5457.1</td>
<td>5.5</td>
<td>219.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Liabilities</th>
<th>Reported Book Value</th>
<th>Req Interest</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 Benefit liabilities</td>
<td>5030.8</td>
<td>6.27%</td>
<td>5220.0</td>
<td>5.3</td>
<td>155.5</td>
</tr>
<tr>
<td><strong>B Total Liabilities</strong></td>
<td>5030.8</td>
<td>6.27%</td>
<td>5220.0</td>
<td>5.3</td>
<td>155.5</td>
</tr>
<tr>
<td>C PreTax Equity</td>
<td>188.0</td>
<td></td>
<td>237.1</td>
<td>10.69</td>
<td></td>
</tr>
</tbody>
</table>

### Tax and Other Adjustments

| D1 Future tax payments                      | 65.8                |              | 83.0           |                   |             |
| D2 Other adjustments                        |                     |              |               |                   |             |
| **D Subtotal, tax and other adjustments**   | 65.8                |              | 83.0           |                   |             |

**Net Value (C-D)**                          | 122.2               | 154.1        |
### Surplus Account

#### Assets

<table>
<thead>
<tr>
<th></th>
<th>Reported Book Value</th>
<th>Book Yield</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1a Gov't</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td>0.00</td>
</tr>
<tr>
<td>A1b Public Corporate (Inv Grade)</td>
<td>9.2</td>
<td>7.53%</td>
<td>4.3</td>
<td>2.20</td>
<td>0.14</td>
</tr>
<tr>
<td>A1c Public Corporate (below Inv Grade)</td>
<td>4.9</td>
<td>9.17%</td>
<td>8.8</td>
<td>3.90</td>
<td>0.25</td>
</tr>
<tr>
<td>A1d Private Corporate (Inv Grade)</td>
<td>3.5</td>
<td>8.01%</td>
<td>5.9</td>
<td>3.80</td>
<td>0.07</td>
</tr>
<tr>
<td>A1e Private Corporate (below Inv Grade)</td>
<td>10.8</td>
<td>9.82%</td>
<td>18.4</td>
<td>5.30</td>
<td>0.76</td>
</tr>
<tr>
<td>A1f Pass-throughs</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>A1g CMO's</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td><strong>A1 Bonds Subtotal</strong></td>
<td><strong>28.4</strong></td>
<td><strong>8.74%</strong></td>
<td><strong>37.4</strong></td>
<td><strong>3.87</strong></td>
<td><strong>1.21</strong></td>
</tr>
<tr>
<td>A2 Cash &amp; short term</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>A3 Commercial Mortgages</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>A4 Derivative securities</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>A5 Equities</td>
<td>101.5</td>
<td>2.61%</td>
<td>101.5</td>
<td>4.00</td>
<td>20.30</td>
</tr>
<tr>
<td>A6 Real Estate (unleveraged)</td>
<td>58.0</td>
<td>7.23%</td>
<td>95.1</td>
<td>6.00</td>
<td>8.71</td>
</tr>
<tr>
<td><strong>Invested Assets Subtotal</strong></td>
<td><strong>188.0</strong></td>
<td><strong>4.96%</strong></td>
<td><strong>196.6</strong></td>
<td><strong>9.45</strong></td>
<td><strong>38.9</strong></td>
</tr>
<tr>
<td>A7 Accrued investment income</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>A8 Policyholder Loans</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>A9 Provision for asset default</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>A10 Other</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td><strong>A11 Total Assets</strong></td>
<td><strong>188.0</strong></td>
<td><strong>4.96%</strong></td>
<td><strong>234.0</strong></td>
<td><strong>9.45</strong></td>
<td><strong>38.9</strong></td>
</tr>
</tbody>
</table>

#### Liabilities

<table>
<thead>
<tr>
<th></th>
<th>Reported Book Value</th>
<th>Req Interest</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 Benefit liabilities</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td><strong>B Total Liabilities</strong></td>
<td><strong>0.0</strong></td>
<td><strong>0.0</strong></td>
<td><strong>0.0</strong></td>
<td><strong>0.0</strong></td>
<td><strong>0.0</strong></td>
</tr>
</tbody>
</table>

#### PreTax Equity

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C PreTax Equity</strong></td>
<td><strong>188.0</strong></td>
</tr>
</tbody>
</table>

#### Tax and Other Adjustments

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D1 Future tax payments</td>
<td>0.0</td>
</tr>
<tr>
<td>D2 Other adjustments</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>D Subtotal, tax and other adjustments</strong></td>
<td><strong>0.0</strong></td>
</tr>
</tbody>
</table>

#### Net Value (C-D)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Value (C-D)</strong></td>
<td><strong>188.0</strong></td>
</tr>
</tbody>
</table>
### Individual Life & Annuity - Traditional Life

#### Assets

<table>
<thead>
<tr>
<th>Assets</th>
<th>Reported Book Value</th>
<th>Book Yield</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bonds (total)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1a Gov't</td>
<td>6.5</td>
<td>6.10%</td>
<td>6.45</td>
<td>13.9</td>
<td>0.03</td>
</tr>
<tr>
<td>A1b Public Corporate (Inv. Grade)</td>
<td>51.6</td>
<td>6.90%</td>
<td>54.44</td>
<td>15.0</td>
<td>0.77</td>
</tr>
<tr>
<td>A1c Public Corporate (below Inv Grade)</td>
<td>12.9</td>
<td>7.30%</td>
<td>13.61</td>
<td>7.0</td>
<td>0.65</td>
</tr>
<tr>
<td>A1d Private Corporate (Inv Grade)</td>
<td>28.4</td>
<td>7.00%</td>
<td>29.94</td>
<td>12.0</td>
<td>0.57</td>
</tr>
<tr>
<td>A1e Private Corporate (below Inv Grade)</td>
<td>15.5</td>
<td>7.50%</td>
<td>16.33</td>
<td>5.0</td>
<td>1.08</td>
</tr>
<tr>
<td>A1f Pass-throughs</td>
<td>7.1</td>
<td>7.00%</td>
<td>7.45</td>
<td>4</td>
<td>0.21</td>
</tr>
<tr>
<td>A1g CMO's</td>
<td>7.1</td>
<td>7.10%</td>
<td>7.52</td>
<td>4.5</td>
<td>0.21</td>
</tr>
<tr>
<td><strong>Bonds Subtotal</strong></td>
<td>129.0</td>
<td>7.01%</td>
<td>135.74</td>
<td>11.7</td>
<td>3.53</td>
</tr>
<tr>
<td><strong>Invested Assets Subtotal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2 Cash &amp; short term</td>
<td>6.0</td>
<td>4.75%</td>
<td>6.00</td>
<td>0.1</td>
<td>0.02</td>
</tr>
<tr>
<td>A3 Commercial Mortgages</td>
<td>39.0</td>
<td>8.00%</td>
<td>41.93</td>
<td>5.0</td>
<td>1.95</td>
</tr>
<tr>
<td>A4 Derivative securities</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A5 Equities</td>
<td>75.0</td>
<td>1.00%</td>
<td>75.00</td>
<td>7.0</td>
<td>15.00</td>
</tr>
<tr>
<td>A6 Real Estate (unleveraged)</td>
<td>21.0</td>
<td>10.50%</td>
<td>21.00</td>
<td>5.0</td>
<td>3.15</td>
</tr>
<tr>
<td><strong>Invested Assets Subtotal</strong></td>
<td>270.0</td>
<td>5.71%</td>
<td>279.7</td>
<td>8.7</td>
<td>23.6</td>
</tr>
<tr>
<td>A7 Accrued investment income</td>
<td>3.0</td>
<td>0.00%</td>
<td>3.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A8 Policyholder Loans</td>
<td>22.5</td>
<td>7.00%</td>
<td>22.50</td>
<td>0.1</td>
<td>0.00</td>
</tr>
<tr>
<td>A9 Provision for asset default</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A10 Other</td>
<td>4.5</td>
<td>0.00%</td>
<td>4.50</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Total Assets</strong></td>
<td>300.0</td>
<td>5.66%</td>
<td>309.7</td>
<td>7.8</td>
<td>26.8</td>
</tr>
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</table>

#### Liabilities

<table>
<thead>
<tr>
<th>Liabilities</th>
<th>Reported Book Value</th>
<th>Req Interest</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Benefit liabilities</strong></td>
<td>300.0</td>
<td>6.10%</td>
<td>318.00</td>
<td>13.0</td>
<td>2.00</td>
</tr>
<tr>
<td><strong>Total Liabilities</strong></td>
<td><strong>300.0</strong></td>
<td><strong>6.10%</strong></td>
<td><strong>318.0</strong></td>
<td><strong>13.0</strong></td>
<td><strong>2.0</strong></td>
</tr>
<tr>
<td><strong>PreTax Equity</strong></td>
<td>0.0</td>
<td></td>
<td>-8.3</td>
<td>205.14</td>
<td></td>
</tr>
<tr>
<td><strong>Tax and Other Adjustments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1 Future tax payments</td>
<td>0.0</td>
<td></td>
<td>-2.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2 Other adjustments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal, tax and other adjustments</strong></td>
<td><strong>0.0</strong></td>
<td></td>
<td><strong>-2.9</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Net Value (C-D)</strong></td>
<td>0.0</td>
<td></td>
<td>-5.4</td>
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<td></td>
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</table>
### Individual Life & Annuity - Non Traditional Life

#### Assets

<table>
<thead>
<tr>
<th>Assets</th>
<th>Reported Book Value</th>
<th>Book Yield</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonds (total)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1a  Gov't</td>
<td>13.8</td>
<td>6.20%</td>
<td>13.75</td>
<td>12.8</td>
<td>0.07</td>
</tr>
<tr>
<td>A1b  Public Corporate (Inv. Grade)</td>
<td>110.0</td>
<td>7.00%</td>
<td>114.95</td>
<td>15.5</td>
<td>1.65</td>
</tr>
<tr>
<td>A1c  Public Corporate (below Inv Grade)</td>
<td>27.5</td>
<td>7.50%</td>
<td>29.01</td>
<td>7.5</td>
<td>1.38</td>
</tr>
<tr>
<td>A1d  Private Corporate (Inv Grade)</td>
<td>60.5</td>
<td>7.10%</td>
<td>63.83</td>
<td>12.5</td>
<td>1.21</td>
</tr>
<tr>
<td>A1e  Private Corporate (below Inv Grade)</td>
<td>33.0</td>
<td>7.60%</td>
<td>34.82</td>
<td>5.2</td>
<td>2.31</td>
</tr>
<tr>
<td>A1f  Pass-throughs</td>
<td>15.1</td>
<td>7.00%</td>
<td>15.88</td>
<td>4</td>
<td>0.45</td>
</tr>
<tr>
<td>A1g  CMO's</td>
<td>15.1</td>
<td>7.30%</td>
<td>16.03</td>
<td>4.5</td>
<td>0.45</td>
</tr>
<tr>
<td>A1   Bonds Subtotal</td>
<td>275.0</td>
<td>7.12%</td>
<td>288.27</td>
<td>12.0</td>
<td>7.52</td>
</tr>
<tr>
<td>A2   Cash &amp; short term</td>
<td>8.0</td>
<td>4.75%</td>
<td>8.00</td>
<td>0.1</td>
<td>0.02</td>
</tr>
<tr>
<td>A3   Commercial Mortgages</td>
<td>44.0</td>
<td>8.00%</td>
<td>47.30</td>
<td>5.0</td>
<td>2.20</td>
</tr>
<tr>
<td>A4   Derivative securities</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A5   Equities</td>
<td>5.0</td>
<td>1.00%</td>
<td>5.00</td>
<td>7.0</td>
<td>1.00</td>
</tr>
<tr>
<td>A6   Real Estate (unleveraged)</td>
<td>28.0</td>
<td>10.50%</td>
<td>28.00</td>
<td>5.0</td>
<td>4.20</td>
</tr>
<tr>
<td>Inv. Assets Subtotal</td>
<td>360.0</td>
<td>7.35%</td>
<td>376.6</td>
<td>10.3</td>
<td>14.9</td>
</tr>
<tr>
<td>A7   Accrued investment income</td>
<td>4.0</td>
<td>0.00%</td>
<td>4.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A8   Policyholder Loans</td>
<td>30.0</td>
<td>7.30%</td>
<td>30.00</td>
<td>0.1</td>
<td>0.00</td>
</tr>
<tr>
<td>A9   Provision for asset default</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A10  Other</td>
<td>6.0</td>
<td>0.00%</td>
<td>6.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A11  Total Assets</td>
<td>400.0</td>
<td>7.17%</td>
<td>416.6</td>
<td>9.3</td>
<td>19.1</td>
</tr>
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</table>

#### Liabilities

<table>
<thead>
<tr>
<th>Liabilities</th>
<th>Reported Book Value</th>
<th>Req Interest</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 Benefit liabilities</td>
<td>400.0</td>
<td>6.30%</td>
<td>406.00</td>
<td>4.0</td>
<td>4.00</td>
</tr>
<tr>
<td>B Total Liabilities</td>
<td>400.0</td>
<td>6.30%</td>
<td>406.0</td>
<td>4.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

#### PreTax Equity

| PreTax Equity                | 0.0                 | 10.6         | 211.44        |

#### Tax and Other Adjustments

| D1 Future tax payments       | 0.0                 | 3.7          |
| D2 Other adjustments         |                     |              |
| D Subtotal, tax and other adjustments | 0.0 | 3.7        |

#### Net Value (C-D)

| Net Value (C-D)               | 0.0                 | 6.9          |
## Individual Life & Annuity - Accumulation Annuity

<table>
<thead>
<tr>
<th>Assets</th>
<th>Reported Book Value</th>
<th>Book Yield</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonds (total)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1a  Gov't</td>
<td>58.7</td>
<td>6.20%</td>
<td>58.69</td>
<td>5.0</td>
<td>0.29</td>
</tr>
<tr>
<td>A1b  Public Corporate (Inv. Grade)</td>
<td>469.5</td>
<td>7.00%</td>
<td>481.24</td>
<td>4.9</td>
<td>7.04</td>
</tr>
<tr>
<td>A1c  Public Corporate (below Inv Grade)</td>
<td>117.4</td>
<td>7.50%</td>
<td>120.90</td>
<td>4.5</td>
<td>5.87</td>
</tr>
<tr>
<td>A1d  Private Corporate (Inv Grade)</td>
<td>258.2</td>
<td>7.10%</td>
<td>267.26</td>
<td>5.3</td>
<td>5.16</td>
</tr>
<tr>
<td>A1e  Private Corporate (below Inv Grade)</td>
<td>140.9</td>
<td>7.60%</td>
<td>148.60</td>
<td>4.3</td>
<td>9.86</td>
</tr>
<tr>
<td>A1f  Pass-throughs</td>
<td>64.6</td>
<td>7.00%</td>
<td>67.14</td>
<td>4.6</td>
<td>1.94</td>
</tr>
<tr>
<td>A1g  CMO's</td>
<td>64.6</td>
<td>7.10%</td>
<td>67.46</td>
<td>5.2</td>
<td>1.94</td>
</tr>
<tr>
<td><strong>Bonds Subtotal</strong></td>
<td><strong>1173.8</strong></td>
<td><strong>7.11%</strong></td>
<td><strong>1211.28</strong></td>
<td><strong>5.0</strong></td>
<td><strong>32.10</strong></td>
</tr>
<tr>
<td>A2   Cash &amp; short term</td>
<td>30.0</td>
<td>4.75%</td>
<td>30.00</td>
<td>0.1</td>
<td>0.09</td>
</tr>
<tr>
<td>A3   Commercial Mortgages</td>
<td>135.0</td>
<td>8.00%</td>
<td>143.10</td>
<td>4.3</td>
<td>6.75</td>
</tr>
<tr>
<td>A4   Derivative securities</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A5   Equities</td>
<td>18.8</td>
<td>1.00%</td>
<td>18.75</td>
<td>5.0</td>
<td>3.75</td>
</tr>
<tr>
<td>A6   Real Estate (unleveraged)</td>
<td>105.0</td>
<td>10.50%</td>
<td>105.00</td>
<td>4.0</td>
<td>15.75</td>
</tr>
<tr>
<td><strong>Invested Assets Subtotal</strong></td>
<td><strong>1462.5</strong></td>
<td><strong>7.31%</strong></td>
<td><strong>1508.1</strong></td>
<td><strong>4.8</strong></td>
<td><strong>58.4</strong></td>
</tr>
<tr>
<td>A7   Accrued investment income</td>
<td>15.0</td>
<td>0.00%</td>
<td>15.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A8   Policyholder Loans</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A9   Provision for asset default</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A10  Other</td>
<td>22.5</td>
<td>0.00%</td>
<td>22.50</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>A11 Total Assets</strong></td>
<td><strong>1500.0</strong></td>
<td><strong>7.13%</strong></td>
<td><strong>1545.6</strong></td>
<td><strong>4.7</strong></td>
<td><strong>74.2</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Liabilities</th>
<th>Reported Book Value</th>
<th>Req Interest</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1   Benefit liabilities</td>
<td>1500.0</td>
<td>5.90%</td>
<td>1575.00</td>
<td>4.7</td>
<td>15.00</td>
</tr>
<tr>
<td><strong>Total Liabilities</strong></td>
<td><strong>1500.0</strong></td>
<td><strong>5.90%</strong></td>
<td><strong>1575.0</strong></td>
<td><strong>4.7</strong></td>
<td><strong>15.0</strong></td>
</tr>
<tr>
<td>C    PreTax Equity</td>
<td>0.0</td>
<td></td>
<td>-29.4</td>
<td>4.96</td>
<td></td>
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</tbody>
</table>

### Tax and Other Adjustments

| D1   Future tax payments                    | 0.0                 |              | -10.3          |                   |             |
| D2   Other adjustments                      |                     |              |                |                   |             |
| **D Subtotal, tax and other adjustments**   | 0.0                 |              | -10.3          |                   |             |

| Net Value (C-D)                             | 0.0                 |              | -19.1          |                   |             |
## Institutional Pensions - Payout Annuity

<table>
<thead>
<tr>
<th>Assets</th>
<th>Reported Book Value</th>
<th>Book Yield</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonds (total)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1a Gov't</td>
<td>16.9</td>
<td>6.40%</td>
<td>17.26</td>
<td>10.4</td>
<td>0.08</td>
</tr>
<tr>
<td>A1b Public Corporate (Inv Grade)</td>
<td>135.4</td>
<td>7.20%</td>
<td>144.20</td>
<td>7.0</td>
<td>2.03</td>
</tr>
<tr>
<td>A1c Public Corporate (below Inv Grade)</td>
<td>33.9</td>
<td>7.60%</td>
<td>36.56</td>
<td>6.5</td>
<td>1.69</td>
</tr>
<tr>
<td>A1d Private Corporate (Inv Grade)</td>
<td>74.5</td>
<td>7.40%</td>
<td>80.06</td>
<td>6.7</td>
<td>1.49</td>
</tr>
<tr>
<td>A1e Private Corporate (below Inv Grade)</td>
<td>40.6</td>
<td>7.90%</td>
<td>44.28</td>
<td>6.0</td>
<td>2.84</td>
</tr>
<tr>
<td>A1f Pass-throughs</td>
<td>18.6</td>
<td>7.10%</td>
<td>19.55</td>
<td>4.0</td>
<td>0.56</td>
</tr>
<tr>
<td>A1g CMO's</td>
<td>18.6</td>
<td>7.30%</td>
<td>19.83</td>
<td>5.0</td>
<td>0.56</td>
</tr>
<tr>
<td>Bonds Subtotal</td>
<td>338.5</td>
<td>7.33%</td>
<td>361.73</td>
<td>7.1</td>
<td>9.26</td>
</tr>
<tr>
<td>A2 Cash &amp; short term</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3 Commercial Mortgages</td>
<td>286.0</td>
<td>8.75%</td>
<td>308.88</td>
<td>6.0</td>
<td>14.30</td>
</tr>
<tr>
<td>A4 Derivative securities</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A5 Equities</td>
<td>44.0</td>
<td>1.00%</td>
<td>44.00</td>
<td>7.0</td>
<td>8.80</td>
</tr>
<tr>
<td>A6 Real Estate (unleveraged)</td>
<td>0.0</td>
<td>10.50%</td>
<td>0.00</td>
<td>5.0</td>
<td>0.00</td>
</tr>
<tr>
<td>Invested Assets Subtotal</td>
<td>682.5</td>
<td>7.46%</td>
<td>728.6</td>
<td>6.7</td>
<td>32.4</td>
</tr>
<tr>
<td>A7 Accrued investment income</td>
<td>7.0</td>
<td>0.00%</td>
<td>7.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A8 Policyholder Loans</td>
<td>0.0</td>
<td>7.00%</td>
<td>0.00</td>
<td>0.1</td>
<td>0.00</td>
</tr>
<tr>
<td>A9 Provision for asset default</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A10 Other</td>
<td>10.5</td>
<td>0.00%</td>
<td>10.50</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>A11 Total Assets</strong></td>
<td><strong>700.0</strong></td>
<td><strong>7.28%</strong></td>
<td><strong>746.1</strong></td>
<td><strong>6.5</strong></td>
<td><strong>32.4</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Liabilities</th>
<th>Reported Book Value</th>
<th>Req Interest</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 Benefit liabilities</td>
<td>700.0</td>
<td>6.75%</td>
<td>759.50</td>
<td>7.3</td>
<td>2.00</td>
</tr>
<tr>
<td><strong>B Total Liabilities</strong></td>
<td><strong>700.0</strong></td>
<td><strong>6.75%</strong></td>
<td><strong>759.5</strong></td>
<td><strong>7.3</strong></td>
<td><strong>2.0</strong></td>
</tr>
<tr>
<td>C PreTax Equity</td>
<td>0.0</td>
<td></td>
<td>-13.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Tax and Other Adjustments

| D | Subtotal, tax and other adjustments | 0.0 | -4.7 |

### Net Value (C-D)

| Net Value (C-D) | 0.0 | -8.7 |
### Institutional Pensions - GIC

<table>
<thead>
<tr>
<th>Assets</th>
<th>Reported Book Value</th>
<th>Book Yield</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonds (total)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1a  Gov't</td>
<td>71.6</td>
<td>5.60%</td>
<td>71.63</td>
<td>2.5</td>
<td>0.36</td>
</tr>
<tr>
<td>A1b  Public Corporate (Inv Grade)</td>
<td>573.0</td>
<td>6.40%</td>
<td>584.46</td>
<td>2.8</td>
<td>8.60</td>
</tr>
<tr>
<td>A1c  Public Corporate (below Inv Grade)</td>
<td>143.3</td>
<td>6.75%</td>
<td>146.83</td>
<td>3.0</td>
<td>7.16</td>
</tr>
<tr>
<td>A1d  Private Corporate (Inv Grade)</td>
<td>315.2</td>
<td>6.80%</td>
<td>329.33</td>
<td>4.3</td>
<td>6.30</td>
</tr>
<tr>
<td>A1e  Private Corporate (below Inv Grade)</td>
<td>171.9</td>
<td>7.30%</td>
<td>181.35</td>
<td>4.0</td>
<td>12.03</td>
</tr>
<tr>
<td>A1f  Pass-throughs</td>
<td>78.8</td>
<td>6.80%</td>
<td>83.51</td>
<td>5.0</td>
<td>2.36</td>
</tr>
<tr>
<td>A1g  CMO’s</td>
<td>78.8</td>
<td>5.80%</td>
<td>79.58</td>
<td>1.3</td>
<td>2.36</td>
</tr>
<tr>
<td>A1   Bonds Subtotal</td>
<td>1432.5</td>
<td>6.58%</td>
<td>1476.59</td>
<td>3.4</td>
<td>39.18</td>
</tr>
<tr>
<td>A2   Cash &amp; short term</td>
<td>30.0</td>
<td>4.75%</td>
<td>30.00</td>
<td>0.1</td>
<td>0.09</td>
</tr>
<tr>
<td>A3   Commercial Mortgages</td>
<td>0.0</td>
<td>8.00%</td>
<td>0.00</td>
<td>5.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A4   Derivative securities</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A5   Equities</td>
<td>0.0</td>
<td>1.00%</td>
<td>0.00</td>
<td>7.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A6   Real Estate (unleveraged)</td>
<td>0.0</td>
<td>10.50%</td>
<td>0.00</td>
<td>5.0</td>
<td>0.00</td>
</tr>
<tr>
<td>Invested Assets Subtotal</td>
<td>1462.5</td>
<td>5.54%</td>
<td>1506.7</td>
<td>3.4</td>
<td>39.3</td>
</tr>
<tr>
<td>A7   Accrued investment income</td>
<td>15.0</td>
<td>0.00%</td>
<td>15.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A8   Policyholder Loans</td>
<td>0.0</td>
<td>7.00%</td>
<td>0.00</td>
<td>0.1</td>
<td>0.00</td>
</tr>
<tr>
<td>A9   Provision for asset default</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A10  Other</td>
<td>22.5</td>
<td>0.00%</td>
<td>22.50</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A11  Total Assets</td>
<td>1500.0</td>
<td>6.38%</td>
<td>1544.2</td>
<td>3.3</td>
<td>39.3</td>
</tr>
</tbody>
</table>

### Liabilities

<table>
<thead>
<tr>
<th>Liabilities</th>
<th>Reported Book Value</th>
<th>Req Interest</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1       Benefit liabilities</td>
<td>1500.0</td>
<td>6.60%</td>
<td>1537.50</td>
<td>3.1</td>
<td>7.50</td>
</tr>
<tr>
<td>B        Total Liabilities</td>
<td>1500.0</td>
<td>6.60%</td>
<td>1537.5</td>
<td>3.1</td>
<td>7.5</td>
</tr>
</tbody>
</table>

| C        PreTax Equity             | 0.0                 |              | 6.7           |                    |             |

### Tax and Other Adjustments

<table>
<thead>
<tr>
<th>D        Subtotal, tax and other adjustments</th>
<th>0.0</th>
<th>2.3</th>
</tr>
</thead>
</table>

### Net Value (C-D)

| Net Value (C-D) | 0.0 | 4.4 |

15
### Group Business

#### Assets

<table>
<thead>
<tr>
<th>Assets</th>
<th>Reported Book Value</th>
<th>Book Yield</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonds (total)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1a Gov't</td>
<td>35.0</td>
<td>6.00%</td>
<td>35.00</td>
<td>8.9</td>
<td>0.18</td>
</tr>
<tr>
<td>A1b Public Corporate (Inv Grade)</td>
<td>225.0</td>
<td>6.70%</td>
<td>237.38</td>
<td>12.0</td>
<td>3.38</td>
</tr>
<tr>
<td>A1c Public Corporate (below Inv Grade)</td>
<td>60.0</td>
<td>7.20%</td>
<td>63.30</td>
<td>5.0</td>
<td>3.00</td>
</tr>
<tr>
<td>A1d Private Corporate (Inv Grade)</td>
<td>50.0</td>
<td>6.80%</td>
<td>52.75</td>
<td>8.0</td>
<td>1.00</td>
</tr>
<tr>
<td>A1e Private Corporate (below Inv Grade)</td>
<td>25.0</td>
<td>7.30%</td>
<td>26.38</td>
<td>6.0</td>
<td>1.75</td>
</tr>
<tr>
<td>A1f Pass-throughs</td>
<td>90.0</td>
<td>6.80%</td>
<td>94.50</td>
<td>3.9</td>
<td>2.70</td>
</tr>
<tr>
<td>A1g CMO's</td>
<td>35.0</td>
<td>6.70%</td>
<td>37.10</td>
<td>4.5</td>
<td>1.05</td>
</tr>
<tr>
<td>A1 Bonds Subtotal</td>
<td>520.0</td>
<td>6.77%</td>
<td>546.40</td>
<td>8.8</td>
<td>13.05</td>
</tr>
<tr>
<td>A2 Cash &amp; short term</td>
<td>15.0</td>
<td>4.75%</td>
<td>15.00</td>
<td>0.1</td>
<td>0.05</td>
</tr>
<tr>
<td>A3 Commercial Mortgages</td>
<td>50.0</td>
<td>8.00%</td>
<td>53.75</td>
<td>5.0</td>
<td>2.50</td>
</tr>
<tr>
<td>A4 Derivative securities</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A5 Equities</td>
<td>5.0</td>
<td>1.00%</td>
<td>5.00</td>
<td>7.0</td>
<td>1.00</td>
</tr>
<tr>
<td>A6 Real Estate (unleveraged)</td>
<td>25.0</td>
<td>10.50%</td>
<td>25.00</td>
<td>5.0</td>
<td>3.75</td>
</tr>
<tr>
<td>Invested Assets Subtotal</td>
<td>615.0</td>
<td>6.92%</td>
<td>645.20</td>
<td>8.2</td>
<td>20.3</td>
</tr>
<tr>
<td>A7 Accrued investment income</td>
<td>6.3</td>
<td>0.00%</td>
<td>6.31</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A8 Policyholder Loans</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.1</td>
<td>0.00</td>
</tr>
<tr>
<td>A9 Provision for asset default</td>
<td>0.0</td>
<td>0.00%</td>
<td>0.00</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A10 Other</td>
<td>9.5</td>
<td>0.00%</td>
<td>9.46</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>A11 Total Assets</td>
<td>630.8</td>
<td>6.75%</td>
<td>660.9</td>
<td>8.0</td>
<td>24.1</td>
</tr>
</tbody>
</table>

#### Liabilities

<table>
<thead>
<tr>
<th>Liabilities</th>
<th>Reported Book Value</th>
<th>Req Interest</th>
<th>PV Cash Flows</th>
<th>Effective Duration</th>
<th>Req Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 Benefit liabilities</td>
<td>630.8</td>
<td>5.90%</td>
<td>624.00</td>
<td>6.5</td>
<td>125.00</td>
</tr>
<tr>
<td>B Total Liabilities</td>
<td>630.8</td>
<td>5.90%</td>
<td>624.0</td>
<td>6.5</td>
<td>125.0</td>
</tr>
<tr>
<td>C PreTax Equity</td>
<td>30.8</td>
<td></td>
<td>36.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Tax and Other Adjustments

| D Subtotal, tax and other adjustments | 10.8 | 12.9 |

#### Net Value (C-D)

|                           | 20.0 | 24.0 |
I. Overall Objective for the ALM Function

ALM is the ongoing process of formulating, implementing and monitoring strategies with respect to assets and liabilities to attain our financial objectives for a given set of risk tolerances and constraints.

As with all financial services companies, risk is an inherent part of doing business. Over the normal course of business LifeCo is exposed to credit risk, interest rate risk, foreign exchange rate risk, off-balance sheet risk, pricing risk, liquidity risk, as well as other various market risks. ALM is a vital ongoing process that requires the management of all these risks.

The principal risk management objectives are to eliminate excessive and unacceptable risk and optimize the risk/return profile of the total company. A key focus of the ALM function at LifeCo is interest rate risk.

As a result of timing differences in the repricing of assets and liabilities, fluctuations in market interest rates can affect both accounting earnings and the market value of assets, liabilities and off-balance sheet items and hence the economic value and net worth of LifeCo. The objectives in managing interest rate risk are to:

- Maximize the value of LifeCo’s stock subject to stated risk tolerances and constraints (see ALM Guidelines).
- Support the achievement of business strategies while protecting earnings and liquidity.
- Minimize the potential for significant loss as a result of changes in interest rates.
- Manage interest rate risk of current and future earnings to a level that is consistent with the mix of businesses and that limits such exposure to a percentage of the book value of assets.

A key focus of the ALM function at LifeCo is market risk. Market risk arises whenever financial results can be adversely affected by changes in the equity markets. The most extreme exposure to market risk occurs when investment guarantees are offered. The risk exposure associated with these guarantees is managed by using a dynamic delta hedging strategy.

Liquidity risk is the risk that LifeCo will be unable to maintain cash flows that are adequate to fund its operations and meet all present and future financial obligations on a timely and cost effective basis.

A separate Liquidity Policy details the management of LifeCo’s liquidity risk.
**Foreign exchange rate risk** arises whenever future payments are expected in a foreign currency. A loss occurs if there is an appreciation (in the case of foreign dollars owed) or depreciation (in the case of foreign dollars due) of the local currency relative to the foreign currency. The objective is to eliminate any foreign exchange rate risk. This is accomplished through the use of currency swaps.

**Credit risk** includes the risk of default on scheduled payments of either interest or principal. Credit quality guidelines are determined by the Investment Department of LifeCo, approved by the Board of Directors and are specified in the Investment Policy. The credit quality of the assets is monitored by the Investment Department of LifeCo and reported to the Board of Directors.

**Off-balance sheet risk** refers to the risk associated with derivative instruments. The Operational Guidelines for Use of Derivatives provides control procedures and details the management of LifeCo's exposure to derivatives risk.

**II. ALM Process**
The ALM process consists of four fundamental steps:

**Identify the level of risk exposure**
It is a requirement that at all times the exposure to all risks be quantified. This is accomplished by regular measurement and monitoring of the exposure to various risks.

**Decide whether the risk exposure is appropriate**
The purpose of ALM is not necessarily to eliminate or even minimize risk. The level of risk will vary with the return requirement and financial objectives. Return objectives and risk tolerances are determined by LifeCo and reviewed from time to time.

**Modify the existing risk**
This is accomplished by rebalancing the portfolio or through the use of interest rate swaps, currency swaps or other hedging techniques to offset risk.

**Optimize the risk/return profile of the business**
For a given level of risk, financial objectives are maximized. Optimization ensures that portfolios lie on the risk/return efficient frontier for LifeCo's stated return objectives, risk tolerances and constraints.

**III. ALM Committee Purpose**
Risk tolerances are determined by the ALM Committee and approved by the Board of Directors. Asset/liability management strategies as well as the policies and guidelines for the management of the aforementioned risks are established by the ALM committee. The ALM committee discusses limits on potential earnings fluctuations that could arise from interest rate risk as well as on- and off- balance sheet accrual positions. The ALM committee monitors exposures in view of market developments and LifeCo's financial condition, provides guidance for interest rate risk management decisions and monitors
liquidity and capital adequacy. ALM policy is established by the ALM Committee, reviewed by the Board of Directors at least annually and is implemented by the Investment Department in conjunction with the Corporate Actuarial Department and the Finance division.

IV. ALM Committee Composition/Frequency of Meetings
The ALM committee meets monthly and consists of the CEO, CFO, Chief Actuary, CIO, VP Risk Management and includes representation from functional areas as appropriate. Committee proceedings are chaired and recorded by the VP Risk Management.

V. ALM Guidelines
LifeCo's exposure to interest rate risk is quantified by calculating price sensitivity statistics such as effective duration, dollar duration, convexity, partial durations, delta, and by performing scenario testing and cash flow analysis. A pure dedication strategy of matching asset and liability cash flows is widely recognized as costly, unnecessary and would not be appropriate for LifeCo. Negative net cash flows are identified and assessed from a liquidity perspective only. Exposure to interest rate risk is monitored for each product line and for all major products. Although ALM is performed at both the product and product line level, specific guidelines are set for Accumulation Annuities in total, Traditional Life Products in total, Non-Traditional Life Products in total and total company surplus.

(a) Accumulation Annuities

Dollar Duration of Assets less Dollar Duration of Liabilities < 30% x book value of assets

Partial Duration Sensitivity < 0.02% x book value of assets for any and all partial durations

Worst Case Scenario at 95% Confidence Level < 0.50% x book value of assets

(b) Variable Annuities

Delta of liability less delta of assets <10% of delta of liability

Gamma Unhedged

Vega Unhedged

Rho (Rho of liability less rho of assets) <5% of rho of liability
(c) **Traditional Life Products**

Dollar Duration of Assets less Dollar Duration of Liabilities \(< 100\% \times \) book value of assets

Partial Duration Sensitivity \(< 0.10\% \times \) book value of assets for any and all partial durations

Worst Case Scenario at 95% Confidence Level \(< 5.00\% \times \) book value of assets

(d) **Non-Traditional Life Products**

Dollar Duration of Assets less Dollar Duration of Liabilities \(< 100\% \times \) book value of assets

Partial Duration Sensitivity \(< 0.10\% \times \) book value of assets for any and all partial durations

Worst Case Scenario at 95% Confidence Level \(< 5.00\% \times \) book value of assets

(e) **Institutional Pension - Payout**

Dollar Duration of Assets less Dollar Duration of Liabilities \(< 100\% \times \) book value of assets

Partial Duration Sensitivity \(< 0.10\% \times \) book value of assets for any and all partial durations

Worst Case Scenario at 95% Confidence Level \(< 5.00\% \times \) book value of assets

(f) **Institutional Pension - GIC**

Dollar Duration of Assets less Dollar Duration of Liabilities \(< 30\% \times \) book value of assets

Partial Duration Sensitivity \(< 0.02\% \times \) book value of assets for any and all partial durations

Worst Case Scenario at 95% Confidence Level \(< 2.00\% \times \) book value of assets

(g) **Group Business**

Dollar Duration of Assets less \(< 100\% \times \) book value of assets
Dollar Duration of Liabilities

Partial Duration Sensitivity < 0.1% x book value of assets for any and all partial durations

Worst Case Scenario at 95% Confidence Level < 5.00% x book value of assets

(h) Total Company

Dollar Duration of Assets less Dollar Duration of Liabilities < 100% x book value of assets

Partial Duration Sensitivity < 0.05% x book value of assets for any and all partial durations

Worst Case Scenario at 95% Confidence Level < 2.00% x book value of assets

(i) Surplus

Dollar Duration of Actual Assets less Dollar Duration of Benchmark < 100% x book value of assets

Where the effective duration of the benchmark is assumed to be 10 years and the present value of the benchmark is assumed equal to the present value of the assets.

In order to ensure that the above guidelines are met for each product line, it may be necessary to rebalance the portfolio by trading assets or through the use of financial engineering. Rebalancing is performed periodically for Accumulation Annuities and for Life Products. In addition to meeting the above guidelines, for rebalancing purposes, each asset segment should have assets that do not exceed the liabilities by more than +/- $2,000,000.

The Investment Department has discretion to position the portfolio within the above guidelines.
I. Reporting

Corporate Actuarial reports on LifeCo's ALM position to the Investment Department and the ALM Committee on a quarterly basis. For Accumulation Annuities the ALM position is monitored on a weekly basis and reflects all asset commitments from the time at which they are priced. Corporate Actuarial reports on LifeCo's ALM position to the Board of Directors at each of its meetings.

The quarterly reports include a discussion of exposure to interest rate risk, changes in market interest rates during the period, the results of scenario testing and various technical notes. Attached to the report are the following:

- price sensitivity statistics including effective duration, dollar duration, convexity, and partial duration sensitivity analysis
- cash flow analysis
- a comparison of the mismatch provision for the past 12 months
- book values and market values of assets and liabilities
- a comparison of the term structure of interest rates for the current and prior periods

Appendix D contains a sample ALM report

II. Allocation of Asset Commitments

Status of Commitments
Portfolio management prepares a weekly report on the status of asset commitments which contains information on the following stages of commitment:

1. Under Review/Negotiation
2. Under Application/Recommended for Investment
3. Internal Approval - Not Yet Committed
4. Committed - Not Yet Priced
5. Priced
6. Funded

Allocation of Commitment to Product Lines
Once an asset reaches the committed stage, Portfolio Management reviews each of the product line portfolios in terms of the liability characteristics and ALM guidelines and allocates the commitment to the most suitable product line. Once an asset reaches the committed stage the Investment Department will determine whether a hedge transaction will be needed between the time the commitment is priced and the time it is funded.

Determination of Method of Funding
The committed asset is added to the portfolio for purposes of measuring exposure to interest rate risk. Portfolio management examines the impact of various funding alternatives and recommends the purchase of asset(s) that optimizes the portfolio with respect to LifeCo's financial objectives within the approved ALM guidelines.
**Priced Commitments**
Committed assets are not reflected for ALM purposes until they become priced. Until this point there is no exposure to interest rate risk. If a hedge transaction was previously deemed necessary, it will be affected once the asset becomes priced.

**III. Hedging**

**Measurement**
A hedge is the assumption of an additional risk exposure that offsets an existing risk. The intended effect of a hedge is to reduce the overall portfolio risk (e.g. currency or interest rate risk). Thus the impact on the overall risk exposure of the portfolio is examined for all hedges. Although hedges are examined at the portfolio level, care must be taken to ensure that any derivatives transactions are appropriately arranged to qualify for hedge accounting treatment where intended.

**IV. Priced Commitments**
A newly priced commitment will add exposure to interest rate risk to a portfolio. Before a hedge is affected for this transaction the overall impact on the portfolio must be examined.

**V. Portfolio Rebalancing**
From time to time, portfolio rebalancing will be required to keep the assets in balance with the liabilities and in accordance with ALM guidelines specified in the ALM Policy Statement. Formally, all portfolios are reviewed quarterly with the exception of the Accumulation Annuities portfolio that is reviewed monthly. Optimization is also performed in order to maximize LifeCo’s expected returns subject to its risk tolerances and constraints. Portfolio rebalancing and optimization may involve asset trades and/or the use of financial engineering. Any asset transfer between asset segments must be done at market value and requires the physical sale and purchase of assets. Transfers at book value are strictly prohibited.

**VI. Interest Rate Sensitivity**
A number of tools are used to measure the interest rate sensitivity of the assets and liabilities.

**Effective duration** provides a measure of the interest rate sensitivity in percentage terms of the market value of the assets and liabilities for a parallel change in interest rates. For example, if the effective duration of an asset is 4, then for a 100 basis point increase in interest rates the market value of the asset will decline by approximately 4%. Effective duration will explicitly recognize interest sensitive cash flows whenever a suitable model is available, otherwise expected cash flows will be used.

**Dollar duration** provides a measure of the interest rate sensitivity in dollar terms of the market value of the assets and liabilities for a parallel change in interest rates. For example, if the dollar duration of assets is $100 million greater than the dollar duration of liabilities, then for a 100 basis point increase in interest rates for all terms to maturity
across the yield curve, the market value of assets will decrease by approximately $1 million more than the market value of liabilities. The measurement of dollar duration is consistent with effective duration.

**Convexity** measures the rate of change of effective duration. Effective duration only provides an approximation of the price sensitivity to changes in interest rates. The precision of the approximation deteriorates as the change in interest rates increases. Including convexity improves the approximation. In general, assets with greater convexity are more desirable than assets with less convexity. This is because as interest rates decrease the increase in the market value of the assets increases at a faster rate. Conversely, as interest rates increase the rate of decrease in the market value of the assets decreases. It is therefore desirable to have assets which have higher convexity than the liabilities.

**Partial durations** provide measures of the interest rate sensitivity in percentage terms of the market value of the assets and liabilities for a change in each portion of the yield curve. The sum of partial durations is equal to the effective duration described above.

**Partial duration sensitivity** measures the impact on market value of changes in interest rates at various terms to maturity along the yield curve. It is a dollar duration type of calculation using partial durations. This is a valuable tool as interest rates seldom move in a parallel fashion.

**Cash flow analysis** assumes no renewal or reinvestment of cash flows and must be interpreted with care. It is not necessary or advisable to be perfectly cash flow matched; however, large net cash outflows must be considered in the context of liquidity available in the portfolio.

**Scenario testing** is performed on a deterministic basis and involves measuring the sensitivity of economic value to both parallel and non-parallel yield curve shifts.

**Asset Quality**
Credit quality guidelines are contained in the Investment Policy and specify maximum holdings of individual credits for new purchases (these maximums decline as credit quality declines). The guidelines also specify an average quality constraint on the total portfolio. It is the philosophy of LifeCo that the credit risk exposure of the Company’s assets should be highly diversified, actively managed, and under continuous review by the Investment Department. The ALM committee will be informed by the Investment Department of the credit risk exposure of the Company’s assets to monitor compliance with the credit quality guidelines.

**VII. Liquidity**
Cash flow analysis is performed which provides an indication of the potential liquidity requirements of the portfolio. In addition, asset mix is monitored with respect to renewal and surrender experience to ensure that sufficient liquid assets exist to meet anticipated cash outflow requirements.
VIII. Capital Adequacy
Target capital is 150% of regulatory capital required.

IX. Profitability
Profitability is measured in terms of return on total company surplus. Economic value is the central focus of ALM, with the impact on GAAP income a constraint.

X. Specific Responsibilities

ALM Committee
The ALM Committee is responsible for overall policy formulation as detailed in the Policy Statement. The ALM Committee is also responsible for monitoring the ALM position of LifeCo and reporting whether all guidelines are being adhered to.

ALM Sub-Committees

Portfolio Rebalance Subcommittee
All asset trades affect the statutory reserve and mismatch provision under GAAP, the measurement of profitability, the economic value of surplus, partial duration sensitivity, capital requirements and the return on capital. In addition to determining whether a trade increases the yield to maturity - or even the total rate of return - of a portfolio, the aforementioned considerations need to be taken into account whenever any asset trade is contemplated. The function of this subcommittee is to examine portfolio changes, quantify the impact of derivatives and asset trades, monitor and measure the exposure to interest rate and other risks and perform optimization of all portfolios. This subcommittee meets a minimum of once per quarter and consists of a representative from the Investment Department, Corporate Actuarial and Finance.

Rate Setting Subcommittee
The function of this subcommittee is to determine crediting rates for both Life and Accumulation Annuities. This subcommittee meets weekly and consists of a representative from the Investment Department, Corporate Actuarial, Finance, Marketing Actuarial and Accumulation Annuities Marketing.

Product Managers
The Life and Investment Product vice-presidents are responsible for the execution of business strategies decided at ALM Committee.

Corporate Actuarial
Corporate Actuarial is responsible for monitoring ALM policy to see whether ALM guidelines are adhered to. Corporate Actuarial projects asset and liability cash flows, calculates all price sensitivity statistics, performs partial duration sensitivity analysis and scenario testing, and determines reserves and mismatch provisions. Corporate Actuarial assists the Investment Department in the selection of asset trades and the use of financial engineering.
Investment Department

The Investment Department is responsible, with input from Corporate Actuarial, for the determination and execution of all trades, financial engineering and hedging strategies in accordance with the guidelines specified in the ALM Policy Statement. The Investment Department communicates all transactions including forward commitments to Finance and Corporate Actuarial and distributes a quarterly report on the status of mortgage and private placement commitments and related hedging arrangements.

Finance

Finance is responsible for recording all transactions and keeping the asset accounting system up to date. Finance provides electronic files of bonds and private placements on a quarterly basis.
OPERATIONAL GUIDELINES FOR USE OF DERIVATIVES

I. Overview
LifeCo, by the nature of its business activities and products, is routinely exposed to risks such as those described in sections V through VIII.

LifeCo portfolio managers purchase derivatives to manage the risks that are identified by the liability product managers, Finance, and/or Corporate Actuarial. Derivatives may not be purchased for speculative purposes.

The guiding principle in the use of derivatives is that LifeCo is a limited end-user acting primarily to reduce risk. Strategies that involve the writing of options by LifeCo are specifically excluded, with the exception of options embedded in LifeCo’s products or issued company debt.

II. Definition of Derivatives
For purposes of these guidelines, derivatives are defined as contracts that the company enters into with a counterparty, where the contract value derives from the value of an underlying asset or underlying reference rate or index. Such indices include, but are not limited to, LIBOR, U.S. Treasury instruments, and the S&P 500 index. This definition of derivatives includes instruments as described in section IX. This definition does not include asset classes such as mortgage-backed securities, collateralized mortgage obligations, asset-backed securities, and other structured assets that are treated as bonds for statutory accounting and regulatory purposes.

III. Responsibilities
The ALM Committee is responsible for reviewing the type and amount of each derivative purchase. The Investment Department is responsible for the purchase of derivatives. The Finance Department is responsible for derivatives accounting and reporting. The ALM Committee is responsible for all board reports relating to derivatives activity.

IV. Objectives
The primary objective of derivatives use at LifeCo is to reduce potential volatility in the future operating income of the lines of business. Depending on the source of the volatility and the type of derivative purchased, the derivative may reduce both upside and downside earnings volatility, or may reduce only downside earnings volatility.

V. Business Exposures Managed
LifeCo’s life insurance and accumulation annuity products have minimum interest guarantees. In an extended period of low interest rates, profit margins would be reduced, and possibly even be negative.
The life insurance and accumulation products allow surrenders at book value, possibly with a book value surrender charge. In periods of rapidly rising interest rates, the assets backing these products would not support a credited rate that is competitive with new money rates. If the company chose to maintain competitive credited rates, then profit margins would be reduced or even be negative. If the company chose to maintain profit margins with an uncompetitive credited rate, then policy surrenders could increase, leading to a loss of future profit margins and market value losses on asset sales to pay the surrender benefits.

LifeCo’s equity-linked GIC credits a rate that is linked to the performance of the S&P 500 equity index. This product also guarantees the return of principal. LifeCo’s investments need to meet both of these guarantees.

LifeCo’s variable annuities contain a GMDB benefit. This benefit exposes the company to equity market risk. In an extended period of low or negative equity market returns, death claims may be greater than the corresponding account values of the variable annuities. This risk is managed through a dynamic delta hedging strategy. The company matches the delta on its variable annuity block to the delta of a book of S&P 500 futures. The futures position is updated weekly for changes in the in-force as well as changes in the market and the fund returns relative to the market. The gamma and vega are unhedged.

VI. Mismatch risk
The company’s assets and liabilities are not cash flow matched. In time periods where the company’s asset cash flows exceed the liability cash flows, there is reinvestment risk. For example, the assets allocated to the payout annuity business are shorter than the liability cash flows. Since the payout annuity benefits cannot be changed, reinvestment risk would be realized if interest rates were low at the time of the asset reinvestment.

In time periods where the company’s liability cash flows exceed the asset cash flows, there is funding risk. For example, if assets have to be sold to pay excess benefits at a time when interest rates are high, market value losses will be realized on the asset sales. There is also potential mismatch risk in LifeCo’s equity-linked GIC. If the assets allocated to this business do not match the performance guarantee relative to the S&P 500 index, then the profits may vary substantially from the product’s pricing assumption.

VII. Mortgage commitment risk
LifeCo’s Investment Department commits to funding commercial mortgage loans weeks in advance of disbursing funds for the loan. These commitments require a loan rate to be locked in at that time for the mortgage. If interest rates rise between this commitment date and the disbursement date, then the earned rate on these assets acquired on the disbursement date will be lower than the earned rates that the liability pricing areas would expect the Investment Department to be able to achieve in then current interest rate environment.
VIII. Foreign exchange risk
The Investment Department may invest in assets denominated in foreign currencies. In addition, the funding agreement program produces future liability cash flows denominated in more than one currency. As currency exchange rates fluctuate, the value of LifeCo’s investment income and operating income will also fluctuate unless the currency risk is hedged.

IX. Approved Derivative Classes
The Board of Directors has currently approved the purchase, subject to the guidelines detailed below, of the types of derivatives listed below. Derivatives not in these categories may be purchased only with the prior approval of both the Chief Investment Officer and Chief Executive Officer of LifeCo.

Interest rate swaps: interest rate swaps are bilateral agreements between LifeCo and a counterparty to exchange a series of cash flows at specified intervals. The cash flows may be fixed or floating. Floating-rate cash flows would be calculated based on a set formula and reference index. Swap terms and conditions such as a reference index, frequency of payments, expiry date of the contract, and notional amount of the contract are set at the time of the swap purchase.

Government bond futures: a futures contract obligates its owner to buy a specified amount of a specified government bond at a specified price on a specified date. These contracts are used by LifeCo in either “long” positions (an agreement to buy a government bond) or “short” positions (an agreement to sell a government bond). Futures contracts are entered into directly with an exchange clearinghouse.

Purchased options on government bond futures: these options give LifeCo the right, but not the obligation, to buy (or sell, depending on the type of option) government bond futures at a set price on a set future date. These options allow LifeCo to benefit from favorable price movements in government bond futures. LifeCo’s loss on unfavorable price movements is limited to the premium paid to purchase the option.

Forward rate agreements: these agreements are similar to the futures described above, but they are negotiated with other financial institutions rather than an exchange clearinghouse. They are agreements that a certain interest rate will apply to a certain principal amount for a certain time period in the future.

Foreign currency swaps: these are bilateral agreements between LifeCo and a counterparty whereby interest and principal in one currency are exchanged for interest and principal in another currency.

Foreign currency forward rate agreements: forwards are transacted over-the-counter, typically with a domestic Schedule I bank. LifeCo agrees to buy or sell a specific amount of foreign currency at a specified rate of exchange on a specified date.

Foreign currency futures: LifeCo agrees to buy or sell a specific amount of foreign currency at a specified rate of exchange on a specified date. The actual currency
transaction being hedged seldom coincides with the maturity of the futures contract. The futures are usually sold prior to maturity and the gain or loss on the contract is used to offset the increase or decrease in the value of the currency transaction being hedged.

**Purchased interest rate caps and floors:** interest rate caps protect LifeCo in rising interest rate environments by paying the excess, if any, of a prevailing reference rate at a future date over the strike rate in the contract. The contract has a set notional amount, maturity date, payment dates, and reference rate. Since only positive differences are paid to LifeCo, LifeCo’s only outlay is the premium paid for the cap. Interest rate floors are similar to caps, but protect LifeCo in falling rate environments by paying the excess, if any, of the contract’s strike rate over the prevailing reference rate at a future date.

**Equity index futures:** LifeCo agrees to buy or sell the value of the S&P 500 index on a specified maturity date. The futures are usually sold prior to maturity and the gain or loss on the contract is used to offset the increase or decrease in the value of the variable annuity block. Each futures contract is for $250 times the S&P 500 index.

**Equity index options:** European-type call options on the S&P 500 index give LifeCo a payment at maturity equal to the excess, if any, of the value of the index over the option’s strike price. Each call option contract is for $100 times the value of the index. LifeCo’s only outlay is the premium paid for the call option.

**Credit Default Swaps:** These contracts establish an economic value for transferring credit risk between parties in isolation from other risks (such as interest rate, market price, and foreign currency). They allow investors to hedge credit risk by buying credit protection or assume credit risks on individual names or a basket of securities to enhance yield and diversification. The elements of such contracts include: counterparty, notional, reference entity (whose credit risk is transferred), obligation (class of debt instruments whose credit risk is transferred), credit event (event triggering payment), premium fee (payable for the protection), maturity (or tenor) of the swap, and settlement (details of how the protection buyer is paid on the occurrence of a credit event).

**Swaptions:** These are options on interest rate swaps, which give LifeCo the right to enter into a certain interest rate swap at a certain time in the future. A receiver (or call) swaption is such a contract in which LifeCo has purchased the right to enter into a receive-fixed rate swap for a specified period at a predetermined option exercise date in the future, while a payer (or put) swaption is a contract in which LifeCo has purchased the right to enter into a pay-fixed rate swap. These instruments may be used as alternatives to purchasing interest rate floors and caps as hedges in falling or rising rate scenarios.

**Spread Locks:** Spread locks may be used as a hedge against the risk of corporate and swap spreads widening that may result from the flattening of the yield curve. A typical application would be in the case of an investor’s concern with the spread exposure resulting from a high allocation to credit-sensitive securities. The contract has a set notional, maturity date, spread lock, and the tenor (or maturity) of the interest rate index whose spread is being measured. The payoff from this instrument is equal to the notional
times the duration of the interest index times the spread difference between the actual spread level and the spread lock.

X. Acquisition of Derivatives
Interest rate swaps may be entered into in combination with a floating rate asset to achieve a fixed rate of return. The procedures and policies are then the same as the procedures and policies for acquiring fixed rate assets. If an interest rate swap is used for other ALM purposes, the ALM Committee must submit a written request to the Investment Department.

Purchases of interest rate caps and floors and equity options must be in the form of a written request from the ALM Committee to the Investment Department. The Investment Department must obtain a minimum of two quotes from approved counterparties.

XI. Transaction Approval
Each derivative purchase will result in a written sheet with the terms and conditions (the “confirmation sheet”) of that derivative. This sheet must be signed by the Investment Department employee responsible for that purchase.

XII. Exposure Limits
The net market value exposure of all interest rate and currency swaps with any one counterparty will not exceed $250 million. The market value of all equity call options with any one counterparty will not exceed $100 million. The market value of all interest rate caps and floors with any one counterparty will not exceed $100 million.

XIII. Transaction Documentation and Control Procedures
Each derivative purchase results in a confirmation sheet (see section XI). A copy of this sheet is sent by the Investment Department to the Finance Department. The Finance Department maintains a file for all derivatives. The Finance Department documents all payments made and received under swap contracts and verifies the calculation of these payments. The Finance Department also verifies the amounts of payments, if any, due from the counterparty on all caps and floors each time a payment, if any, is due. The Vice President of Finance reviews and initials all of these payment calculations.

XIV. Accounting and Disclosure
LifeCo will follow all required accounting practices for derivatives and disclose the balance sheet effect of derivatives in all shareholder reports and other required reports for securities regulators.

XV. Communication of Purchases
The Board of Directors will be notified of each derivative purchase at the next scheduled board meeting following such purchase.

XVI. Approved Counterparties
Counterparties must have a credit rating of at least BBB from Mud & Poor’s Agency. LifeCo must have a master ISDA agreement signed with the counterparty prior to the
derivative purchase. Each agreement is subject to the approval of LifeCo's Secretary and General Counsel.

XVII. Market Valuation
Each December 31st, the Investment Department will obtain market valuations for each derivative from the counterparty for that derivative. A report showing the market values and market values from the prior December 31st will be provided to the ALM Committee.

XVIII. Administration
All derivatives will be maintained where possible on LifeCo's Investment Administration System. If a derivative cannot be administered on this system, it will be identified in an exception report, which will be submitted by the Finance Department to the ALM Committee each December 31st. This report will show, for each derivative not administered on the Investment Administration System, the type of derivative, the counterparty, the purchase date, the notional amount, and the current market value as provided by the Investment Department.

XIX. Sample Term Sheets
Term Sheet for a Credit Default Swap:

Counterparties: Party A (Buyer of Credit Protection)  
Party B (Seller of Credit Protection)

Notional Amount: $10,000,000

Reference Entity: Entity / obligor whose credit risk is to be transferred (e.g., IBM, GM, US corporate index)

Obligation: Class of debt instruments whose credit risk is transferred (e.g., senior unsecured long-term debt obligations)

Credit Event: Bankruptcy, failure to pay coupon or principal on time, or a Restructuring

Premium Due: 140 basis points

Maturity (or Tenor): 5 Years

Settlement: Physical delivery or cash settlement

Term Sheet for a Spread Lock

Counterparties: Party A (Buyer of Spread Protection)  
Party B (Seller of Spread Protection)

Notional Amount: $10,000,000
Maturity: “N” Years

Interest Index: Index whose spread is being measured (e.g., 5-year Constant Maturity Swap, 10-year Baa corporate index)

Spread Lock: 150 basis points

**Term Sheet for a Swaption:**

Counterparties: Party A (Floating Rate Payer)
                          Party B (Fixed Rate Payer)

Type of Swaption: Receiver or Payer Swaption

Notional Amount: $10,000,000

Maturity of Swap: “N” Years

Fixed Rate: Predetermined fixed rate (or strike rate)

Fixed Rate Payment Frequency: Semi-annual, 30/360 basis

Floating Rate: 3-month Libor flat

Floating Rate Payment Frequency: Quarterly, 30/360 basis

Exercise Option Date: Some date in the future

Option Cost: Upfront cost in basis points or Annual cost in basis points

Settlement: Physical delivery or Cash Settlement
Asset Liability Management Report for

December 31, 2000

This report details the ALM position for all of LifeCo’s products and focuses on the company’s exposure to interest rate risk. The ALM guidelines specified in the company’s ALM Policy Statement and Procedure Manual reflect the company’s tolerance to interest rate risk.

Interest Rates

![Risk Free (Government) Spot Rate Curve](image)

Implied Forward Curve

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### Stress Scenario #1 Forward Rates

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<td>2.5</td>
<td>4.32</td>
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<tr>
<td>3.0</td>
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<td>3.5</td>
<td>4.89</td>
</tr>
<tr>
<td>4.0</td>
<td>5.11</td>
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<tr>
<td>4.5</td>
<td>5.29</td>
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<td>5.0</td>
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</tbody>
</table>

### Stress Scenario #3 Forward Rates

<table>
<thead>
<tr>
<th># of Years From Today</th>
<th>Treasury Yields By Maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
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<tr>
<td>0.0</td>
<td>1.47</td>
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<td>1.0</td>
<td>3.33</td>
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<tr>
<td>2.0</td>
<td>4.93</td>
</tr>
<tr>
<td>2.5</td>
<td>5.46</td>
</tr>
<tr>
<td>3.0</td>
<td>5.89</td>
</tr>
<tr>
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<tr>
<td>5.0</td>
<td>7.03</td>
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Baa Corporate Spreads

<table>
<thead>
<tr>
<th># of Years From Today</th>
<th>Nominal Spreads Over Treasuries of Comparable Maturity</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>0.0</td>
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</tr>
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<td>4.0</td>
<td>110</td>
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<tr>
<td>4.5</td>
<td>115</td>
</tr>
<tr>
<td>5.0</td>
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Summary of ALM Position
At December 31, significant mismatches existed in the Life and Group Benefit portfolios, all other portfolios were within the guidelines specified in the ALM Policy Statement and Procedure Manual. Various ways are being investigated to reduce asset liability mismatches. It is anticipated that extensive rebalancing of the affected asset portfolios will be required. A summary of the ALM position for LifeCo follows.
<table>
<thead>
<tr>
<th></th>
<th>Book Value ('000)</th>
<th>Present Value ('000)</th>
<th>Effective Duration</th>
<th>Dollar Duration ('000)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TRADITIONAL LIFE PRODUCTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assets</td>
<td>300,000</td>
<td>309,700</td>
<td>7.8</td>
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</tr>
<tr>
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<tr>
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<td>-5.2</td>
<td>-1,710,000</td>
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<tr>
<td>Guideline</td>
<td>&lt; 2,000</td>
<td>&lt; 300,000</td>
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<tr>
<td><strong>NON-TRADITIONAL LIFE PRODUCTS</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assets</td>
<td>400,000</td>
<td>416,600</td>
<td>9.3</td>
<td>3,859,000</td>
</tr>
<tr>
<td>Liabilities</td>
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<td>406,000</td>
<td>4.0</td>
<td>1,624,000</td>
</tr>
<tr>
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<td>0</td>
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<td>5.3</td>
<td>2,235,000</td>
</tr>
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<td>Guideline</td>
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<td>&lt; 400,000</td>
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<td></td>
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<tr>
<td><strong>ACCUMULATION ANNUITIES</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Assets</td>
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<td>1,545,600</td>
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<td>7,257,000</td>
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<tr>
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<td>7,403,000</td>
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<td>0.0</td>
<td>-146,000</td>
</tr>
<tr>
<td>Guideline</td>
<td>&lt; 2,000</td>
<td>&lt; 450,000</td>
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<td></td>
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<tr>
<td><strong>INSTITUTIONAL PENSION – PAYOUT</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Assets</td>
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<td>746,100</td>
<td>6.5</td>
<td>4,870,000</td>
</tr>
<tr>
<td>Liabilities</td>
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<td>759,500</td>
<td>7.3</td>
<td>5,544,000</td>
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<tr>
<td>Difference</td>
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<td>-13,400</td>
<td>-0.8</td>
<td>-675,000</td>
</tr>
<tr>
<td>Guideline</td>
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<td>&lt; 700,000</td>
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<td></td>
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<td><strong>INSTITUTIONAL PENSION – GIC</strong></td>
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<td></td>
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<tr>
<td>Assets</td>
<td>1,500,000</td>
<td>1,544,200</td>
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<td>300,000</td>
</tr>
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<td>Guideline</td>
<td>&lt; 2,000</td>
<td>&lt; 450,000</td>
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<td></td>
</tr>
<tr>
<td><strong>GROUP BENEFITS</strong></td>
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<tr>
<td>Assets</td>
<td>630,800</td>
<td>660,900</td>
<td>8.0</td>
<td>5,262,000</td>
</tr>
<tr>
<td>Liabilities</td>
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<td>624,000</td>
<td>6.5</td>
<td>4,368,000</td>
</tr>
<tr>
<td>Difference</td>
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<td>36,900</td>
<td>1.5</td>
<td>1,206,000</td>
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<td>Guideline</td>
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<td>&lt; 630,000</td>
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<tr>
<td><strong>SURPLUS ACCOUNT</strong></td>
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<tr>
<td>Assets</td>
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<td>243,020</td>
<td>9.5</td>
<td>2,211,000</td>
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<td>Target</td>
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<tr>
<td>Difference</td>
<td>188,000</td>
<td>243,020</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guideline</td>
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<tr>
<td><strong>TOTAL COMPANY</strong></td>
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<td></td>
</tr>
<tr>
<td>Assets</td>
<td>5,218,800</td>
<td>5,457,100</td>
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<td>30,063,000</td>
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<td>27,527,000</td>
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<tr>
<td>Difference</td>
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<td>237,100</td>
<td></td>
<td>2,535,000</td>
</tr>
<tr>
<td>Guideline</td>
<td></td>
<td>&lt; 5,219,000</td>
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<td></td>
</tr>
</tbody>
</table>
ACCUMULATION ANNUITIES
Effective Duration (Price Sensitivity to Parallel Shifts in the Yield Curve)
The effective duration of assets is longer than the duration of liabilities by less than 0.01. The difference between the dollar duration of assets and liabilities is (146 million). This is within the approved guideline of +/- 450 million.

Partial Duration Sensitivity Analysis (Price Sensitivity to Specific Rate Changes)
For all points along the curve partial duration sensitivities are within the approved guideline of 300 thousand.

Scenario Testing
Worst Case Scenario
The worst-case scenario that was tested was an increase followed by a decrease in interest rates. If this scenario were realized, it would result in a loss of $7.6 million in economic surplus.

Cash Flow Analysis
The accompanying graph does not represent actual cash outflows but rather interest rate reset dates for the assets and liabilities. No renewals or new sales are projected and asset maturities are not reinvested. Thus the usefulness of this analysis is limited to studying interest rate risk exposure. This would represent an extreme adverse scenario for measuring liquidity risk exposure.
**Portfolio Rebalance**
Rebalancing is performed on a monthly basis for Accumulation Annuities. At the end of December, except for cash reallocation there was no rebalancing required for Accumulation Annuities.

**Asset Mix**
The target mix calls for more bonds and private placements and less mortgages. The C1 capital requirement for the Accumulation Annuities portfolio excluding additional requirements for troubled assets is approximately $11.7 million at the end of December. In comparison, the C1 requirement based on the target asset mix would be $11.2 million.
TRADITIONAL LIFE PRODUCTS
Effective Duration (Price Sensitivity to Parallel Shifts in the Yield Curve)
The effective duration of assets is shorter than the duration of liabilities by 5.2 years. This reflects the difficulty in finding assets that match the extremely long duration of the liabilities. The difference between the dollar duration of assets and liabilities is (1.71 billion) which exceeds our approved guideline of +/- 300 million.

Partial Duration Sensitivity Analysis (Price Sensitivity to Specific Rate Changes)
We are exposed to rates falling at the 20, 25 and 30-year terms and to rates increasing at earlier terms. Exposure is large yet exceeds guidelines of 300 thousand for the 25 year term only.

Scenario Testing
The maximum decline in economic surplus at the 95% confidence level was $89.7 million at the end of December. The scenario that gives rise to this exposure is a decrease in long-term interest rates.

Cash Flow Analysis
The large positive spikes represent the maturity of the long zero coupon bonds that were purchased to extend the duration of the assets.
Portfolio Rebalance
At the end of December rebalancing was necessary as a result of the lengthening of the liabilities due to assumption changes.

Asset Mix
The target mix does not reflect policy loans, calls for more government bonds, and less private placements. The C1 capital requirement for the Traditional Life Products portfolio excluding additional requirements for troubled assets is approximately $0.5 million. In comparison, the C1 requirement based on the target asset mix would be $0.5 million. The asset mix does not reflect the assumed equity position.
NON-TRADITIONAL LIFE PRODUCTS

Projection of Cash Flows
Based on December 31 assets and liabilities, net cash flows are projected to be an average of $1.3 million per month going forward.

Margin Squeeze
Interest sensitive cash flows have been modeled to vary for given changes in interest rates (i.e. the margin squeeze will be reflected in the price sensitivity statistics). The impact of the margin squeeze for a 1% decrease in interest rates is a $10.3 million loss in economic value.

Effective Duration (Price Sensitivity to Parallel Shifts in the Yield Curve)
The effective duration of assets is longer than the duration of liabilities by 5.3 years. The difference between the dollar duration of assets and liabilities is $2.235 billion. This significantly exceeds the guideline of ±$400 million.

Partial Duration Sensitivity Analysis (Price Sensitivity to Specific Rate Changes)
Significant exposure exists to an increase in interest rates between the 7 and 20-year rates, a result of the duration mismatch between the assets and liabilities. The company is exposed to a decrease in interest rates for early durations. The guideline of 400 thousand is exceeded in both directions for 4 points on the rate curve.

Scenario Testing
The maximum decline in economic surplus at the 95% confidence level decreased from $129.3 million to $122.1 million at the end of December. The scenario that gives rise to this exposure is a gradual decrease in long-term interest rates.
Cash Flow Analysis
Note that cash flows for both the fixed life and variable UL products are shown together.

Portfolio Rebalancing
At the end of December the need for rebalancing was identified to deal with the growing duration mismatch between assets and liabilities. Implementation was postponed due to a lack of resources to analyze and explain the mismatch.
INSTITUTIONAL PENSION - PAYOUT
Effective Duration (Price Sensitivity to Parallel Shifts in the Yield Curve)
The effective duration of assets is shorter than the duration of liabilities by 0.8 years. The
difference between the dollar duration of assets and liabilities is (675 million) and is
within the approved guideline of ±700 million.

Partial Duration Sensitivity Analysis (Price Sensitivity to Specific Rate Changes)
Due to the efficiency of the immunization strategy, no significant interest rate exposure
exists on that line of business.

Scenario Testing
The maximum decline in economic surplus at the 95% confidence level stands at $5.96
million, and is the result of a gradually increasing interest rate for the first 20 years
followed by a sharp increase.

Cash Flow Analysis
INSTITUTIONAL PENSION - GIC

Effective Duration (Price Sensitivity to Parallel Shifts in the Yield Curve)
The effective duration of assets is longer than the duration of liabilities by 0.20 years.
The difference between the dollar duration of assets and liabilities is 300 million. This is
within the approved guideline of ± 450 million

Partial Duration Sensitivity Analysis (Price Sensitivity to Specific Rate Changes)
Due to the efficiency of the immunization strategy and the short duration of the liabilities,
no significant interest rate exposure exists on that line of business.

![Partial Duration Sensitivity Chart]

---

Scenario Testing
The maximum decline in economic surplus at the 95% confidence level stands at $5.2
million, and is the result of an immediate, large increase in interest rates.

![Maximum Decline in Economic Surplus Chart]

Cash Flow Analysis

![Cash Flow Chart]

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45
Currency Exposure
The Euro-denominated liabilities are valued at $100 million using exchange rates in effect as of December 31. This is approximately 20% higher than the value at last year-end. This liability exposure has not been hedged given the relatively small size of the exposure and the previously stable Euro/U.S. dollar exchange rate relationship over its short history.
GROUP BENEFITS

Effective Duration (Price Sensitivity to Parallel Shifts in the Yield Curve)
The effective duration of assets exceeds the duration of liabilities by 1.51 year. The
difference between the dollar duration of assets and liabilities is 1.206 billion. This
significantly exceeds the guideline of ±630 million.

Partial Duration Sensitivity Analysis (Price Sensitivity to Specific Rate Changes)
The exposure tends to be at the longer durations, where an increase in interest rates will
create a loss. All measures are within the 630 thousand guideline.

Scenario Testing
The maximum decline in economic surplus at the 95% confidence level stands at $1.1
million, and is the result of a slow decrease in interest rates.

Cash Flow Analysis