

Course 8
Finance and Enterprise Risk Management Core Segment Solutions

Solution 1

a)

LIABILITIES

Non-Par Whole Life

Whole life has "savings element" in early years due to deposits being larger than claims. Must invest those reserves

Interest rate is locked in at policy inception

Withdrawal features contribute to lapses and are integral to product pricing

May have flexible premium option which permits additional deposits at the option of the policyholder

A policy loan option may allow policyholder to withdrawal funds early and borrow against cash value at a predetermined interest rate (or formula)

SPDA

Interest rate risk is the number one risk during the accumulation phase of the liability

May have very liberal withdrawal features

A "Put Option" is given to policyholder allowing for early surrender at accumulated value less surrender charge

Disintermediation risk can result in liquidity issues due to ability to cash out at a surrender value

Renewal rate is important as high renewals dampen "surrender activity" and low renewals appear to elevate it

May have a settlement option in terms of taking an annuity or lump sum at the end of the accumulation phase

ASSETS

Many bonds have call options which can be exercised by the issuer against the bondholder if rates fall materially. For insurers this is bad as cash would then need to be reinvested at then current interest rates

Mortgages have prepayment risk. Principal can be returned early.

Option typically exercised when rates fall.

Maturity mismatch risk is a risk embedded here in that the duration of assets may exceed liabilities by up to 2.0 years

Solution 1 (continued)

b)

Maturity mismatch risk is one that is present from the investment policy. Investment policy permits that assets to be longer than liabilities by up to 2.0 years

Longer assets than liabilities can lead to liquidation of assets at depressed values in times of higher than expected interest rates

Due to option risk embedded with assets and liabilities the rate of change of the duration due to changes in interest rate (convexity) is not being measured or managed

Segmentation can be a valuable tool to separate liabilities and good asset management but Retro Life shows no signs of this

Convexity is 2nd order measurement and can lead to frequent rebalancing if not monitored

Key rate durations can be used to deal with non-parallel shifts of the yield curve which more closely matches real-world experience, but Retro does not use that

Option pricing is not used at Retro which allows multiple paths to be projected and associated cash flows

Retro ignores VaR analysis

Not using holistic techniques which try to capture the synergies of different products within the life insurance company

Cashflow testing not used at Retro. It can flag problems before they arise by building into the interest rate scenarios, lapses and asset/liability values.

By measuring duration at 12/31, there is no limit on durational mismatch at other points throughout year. This may allow gaming of the system.

c)

DFA considers entire financial position of insurance company over time and inter-dependencies due to stochastic nature of the analysis.

DFA not only projects what is expected to happen but also what other outcomes are as well

DFA considers product design as part of the analysis

DFA considers Holism when looking at the "big picture". Holism can focus around risk or return

Solution 1 (continued)

DFA can develop an efficient frontier to optimize risk vs. reward with particular products, etc.

DFA will consider change in shape of yield curves as well by bringing in convexity

DFA is utilized as a going concern analysis

DFA can create results on different measures such as Stat, GAAP, tax, etc.

DFA results in multiple path outcomes vs. a single answer

d)

DFA is very complex compared to traditional asset liability matching

Model sophistication can lead to widely varying results.

Simple interest rate models may overlook many plausible outcomes and not provide insight to managing key risks

Complex models can be expensive to run in terms of understanding and the technology used to run such models

Admittedly costs are coming down now for technology.

There is no representative case but rather a continuum of outcomes

There is a chance that it could come down to “garbage in, garbage out” if careful monitoring of inputs and assumptions is not done

Can not help where risks are not identified and therefore not quantified

No model can be 100% accurate but being aware of strengths and weaknesses will be key to implementing

Consider model and it's output as support for decision making and not the sole piece

Must decide whether or not do analysis in house as outsourcing implies less control

Communicating the output can be as complicated as creating the model in the first place so much attention must be paid here

No standardization exists for ALM or DFA within life insurance industry so cross company comparisons may be difficult.

Solution 2

a)

Use CAPM $E(r_j) = r_f + \text{Beta}_j [E(r_m) - r_f]$

$$E(r_j) = .06 + 1.5[.12 - .06] = .15 = 15\%$$

b)

Expected cash flow = $0.55 * \$8,121,500 + 0.45 * \$3,827,000 =$
 $\$6,188,975$

Discount factor = $1.15^{(-4)} =$
 0.5718

$$\text{NPV} = \frac{-3,500,000 + 0.55 * 8,121,500 + 0.45 * 3,827,000}{1.15^4}$$

$$= -1,104,940$$

c)

Need risk-neutral probabilities

$$p = \frac{S(1 - r_f)^4 - S^-}{S^+ - S^-}$$

$$p = \frac{100.00(1.06)^4 - 52.20}{174.90 - 52.20} = 0.6035$$

$$1 - p = 0.3965$$

Cash flow in up market = max of the following:

$$2 * 8,121,500 - 7,000,000 = \mathbf{9,243,000}$$
 (expansion)

$$8,121,500 - 2,000,000 = 6,121,500$$
 (neither option)

$$(0.5) * 8,121,500 - 1,400,000 = 2,660,750$$
 (contraction)

Cash flow in down market = max of the following:

$$2 * 3,827,000 - 7,000,000 = 654,000$$
 (expansion)

$$3,827,000 - 2,000,000 = \mathbf{1,827,000}$$
 (neither option)

$$(0.5) * 3,827,000 - 1,400,000 = 513,500$$
 (contraction)

Discount factor = $1.06^{(-4)} = 0.7921$

$$\text{NPV (CCA)} = -3,500,000 + \frac{0.6035 * 9,243,000 + 0.3965 * 1,827,000}{1.06^4}$$

$$= 1,492,215$$

Solution 3

a) **Securitization of assets:**

- Borrower received funding upon initiation of transaction, repays principal and interest over time.
- Originator (issuer) is exposed to borrower (investor)'s credit risk, but not vice versa
- Sale of loans to another financial institution does not have material effect on borrower's economic position; thus a true sale of assets is allowed, extinguishing originator's financial interest entirely.

Securitization of liabilities:

- Policyholder is exposed to financial institution's credit risk. Thus selling policy obligation to another party can significantly affect buyer's economic position because it could increase his exposure to default risk.
- This reversal of credit risk exposure is a barrier to a true sale of liabilities. Regulators usually will not allow insurers to enter transactions that wipe out their liability to policyholders.
- Thus liability "securitizations" are really monetizations as there is not a true sale of the liability.
- An ongoing direct relationship continues between the policy holder and the insurer.
- These transactions are typically "on balance sheet."

b) **Income statement**

- Insurer passes on cash flows to investors
- Mortality, longevity, and persistency risk are also passed on to the investors.

Balance Sheet

- Free up capital which can be used for other investment
- The insurer passes on insurance risk to the capital markets
- Might improve RBC ratio because capital intensive products are removed

c) **XXX securitization**

- Need to be at certain size to be economically worth while
- Securitization is costly: (incl. Legal fees, investment banking fees)
- Model cash flows may be complex and time-consuming
- Free up the capital for other use
- Insurer passes on all insurance risks: mortality, lapse, investment risk

Solution 3 (continued)

YRT reinsurance

- More straightforward and less costly than securitization
- Only reinsures mortality risk (remaining risks are still held by direct insurer)
- No surplus relief is given, thus capital is still tied up

Solution 4

- a) For cash flows that involve zero risk, discount at risk-free rate.
Risk affects the interest rate
Risk-free rate refers to risk-free spot curve
PV taken at the risk-free rate is useful as a dividing line
For risky cash flows, PV estimate should include a risk adjustment to reflect market price of risk.
Three approaches to include risk adjustment:
1. Adjust the discount rate
If discount rate > risk-free rate, implies negative risk adjustment to reflect adjustment and vice versa.
 2. Use option-pricing techniques to weight the results under various scenarios
Discount PV of future CFs by averaging diff scenarios for interest rates
 3. Adjust the cash flows being discounted
Preferred method; use a market value margin (MVM)

Must include all cash flows.

Future CFs that could occur under the contract

Costs to be incurred in carrying out the obligation

Disclose that the accounting situation differs from fair value to prevent misinterpretation

- b) Expected Net Cash Flow = Premiums – Expenses – Expected Claims

$$CF_1 = 1500 - 225 - 1050 = 225$$

$$CF_2 = 1350 - 210 - 940 = 200$$

$$CF_3 = 1275 - 200 - 900 = 175$$

$$r_L = r_A - e \left(\frac{r_E}{(1-t)} - r_A \right)$$

$$\text{Assets to Liability} = (E + L) / L$$

$$\text{So } E/L = 125\% - 1 = 25\% = e$$

Solution 4 (continued)

$$\text{After-tax cost of debt} = 8\% \times (1 - 40\%) = 4.8\%$$

$$\text{Cost of equity} = r_f + \beta(r_M - r_f) = 4.5\% + 1.1 \times 6.5\% = 11.65\%$$

$$\text{Cost of capital} = r_E = (\% \text{ debt} \times \text{after-tax cost of debt}) + (\% \text{ equity} \times \text{cost of equity}) = 0.15 \times 0.048 + 0.85 \times 0.1165 = 10.6225\%$$

$$r_L = 7.5\% - \left[25\% \times (10.6225\% / (1 - 40\%) - 7.5\%) \right] = 4.949\%$$

$$\begin{aligned} \text{PV of CFs} &= \frac{CV_1}{(1+r_L)} + \frac{CV_2}{(1+r_L)^2} + \frac{CV_3}{(1+r_L)^3} \\ &= 225 / (1.04949) + 200 / (1.04949)^2 + 175 / (1.04949)^3 = 547.36 \end{aligned}$$

$$c) \quad \frac{MVM_{2009} + C_{2009}}{1+r_f} = \frac{C_{2009}}{1+r_L}$$

$$MVM_{2009} = C_{2009} \left(\frac{1+r_f}{1+r_L} - 1 \right)$$

$$MVM_{2009} = C_{2009} \left(\frac{r_f - r_L}{1+r_L} \right) = 175 * (4.5\% - 4.949\%) / (1.04949) = -0.75$$

$$L_{2008} = \frac{C_{2009} + MVM_{2009}}{1+r_f} = (175 - 0.75) / (1.04949) = 166.75$$

$$MVM_{2008} = (L_{2008} + C_{2008}) \left(\frac{r_f - r_L}{1+r_L} \right) = (166.75 + 200) * (4.5\% - 4.949\%) / (1.04949) = -1.57$$

$$L_{2007} = \left(\frac{L_{2008} + C_{2008} + MVM_{2008}}{1+r_f} \right) = (166.75 + 200 - 1.57) / (1.04949) = 349.45$$

$$MVM_{2007} = (L_{2007} + C_{2007}) \left(\frac{r_f - r_L}{1+r_L} \right) = (349.45 + 225) * (4.5\% - 4.949\%) / (1.04949) = -2.46$$

Solution 5

a)

1. "info" costs:

- arise from outsiders' inability to monitor risk-taking inside the firm
- financial firms tend to depend on proprietary financial technology, and their balance sheet tends to be relatively liquid (can be subject to change)
- these firms cannot be operated transparently
- because financial firms are difficult to monitor, guarantors face costs related to adverse selection and moral hazard
- such costs can be reduced thru greater reliance on equity capital

2. higher taxes and the "agency costs of free cash flow"

- agency costs is the tendency of companies to waste excess capital on low-return projects because they have too much equity capital.
- agency costs can be reduced by having debt holders and external guarantors provide more of the firm's risk capital.

b)

AL: Risk Cap = \$100, Expected Profit = \$40, Dead Weight Cost=(20), Net Profit 20

NA: Risk Cap = \$100, Expected Profit = \$10, Dead Weight Cost=(20), Net Profit (10)

- AL + NA: Expected Profit = \$50
- AL + NA: standard deviation of combined earnings is square root of Risk Capital = $100 \times (2)^{0.5} = \$141.4$
- AL + NA: Dead Weight Cost = $(0.2) \times 141.4 = \$28$

c)

- on a stand-alone basis, AL is profitable, but NA loses money
- Increased Expected Profit = \$10, Increased Dead Weight Cost = \$(8); Increased Net Profit = \$2
- combined, AL+NA makes \$2M more in profits net of dead weight capital costs than AL alone
- thus, acquiring NA is a good decision for AL

Solution 5 (continued)

- d) stand-alone: VUL Exp PM = \$40, VUL S-A Cap = \$100, VUL S-A RoC = 40%
stand-alone: DA Exp PM = \$10, DA S-A Cap = \$100, DA S-A RoC = 10%
stand-alone: Combo Exp PM = \$50, Combo S-A Cap = \$141.4, Combo S-A RoC = 35%

fully allocated: VUL Exp PM = \$40, VUL F-A Cap = \$70.7, VUL S-A RoC = 57%

fully allocated: DA Exp PM = \$10, DA F-A Cap = \$70.7, DA S-A RoC = 14%

fully allocated: Combo Exp PM = \$50, Combo F-A Cap = \$141.4, Combo S-A RoC = 35%

marginal: VUL Exp PM = \$40, VUL Marginal Cap = \$41.4, VUL Marginal RoC = 121%

marginal: DA Exp PM = \$10, DA Marginal Cap = \$41.4, DA Marginal RoC = 24%

marginal: Combo Exp PM = \$50, Combo Marginal Cap = \$82.8, Combo Marginal RoC = 60%

- "standard" RAROC evaluates projects according to their required returns on risk capital
- RAROC allocates an amt of risk capital proportional to a project's VaR
- for normally distributed profits, risk capital is proportional to the standard deviation of profits -> similar to this model
- RAROC then calculates the ratio of expected future profits to allocated risk capital and then compares this ratio to a hurdle rate
- this model is similar to RAROC in that it relates the ratio of profits to risk capital to a hurdle rate
- however for this model, the numerator is the economic value of profits - the value of profits calculated using market-based required return
- the denominator is the project's marginal rather than its stand-alone risk capital
- this model is more consistent w/ economic criteria: it is the price of insuring against losses
- finally, the hurdle rate measures the firm's deadweight cost of risk capital
- if there are no deadweight costs, this rule reduces to the standard NPV criterion
- under RAROC the stand-alone ROC for NA is only 10%, and would reject it as being below the 15% hurdle rate

Solution 6

a)

i) X = expected one-year forward value assuming BB credit rating at year end

$$X = 5 + 5v_1 + 5v_2^2 + 105v_3^3$$

$$v_i = (1+s_i)$$

$$(1+s_i) = (1+f_0) \dots (1+f_{i-1})^{1/i}$$

$$X = \$101.26$$

ii) Y = expected one-year forward value assuming the bond is in default at year end

$$Y = \text{recovery rate} * \text{face value}$$

$$\text{Recovery rate for senior subordinated corporate bond} = 39.71\%$$

$$Y = \$39.71$$

b)

Mean value = summation $[EV_i * w_i]$ where i = each year end credit rating

$$\text{Mean} = \$104.87$$

$$\text{Variance} = \text{summation} [w_i * (EV_i - \text{Mean})^2]$$

$$\text{Variance} = \$10.70$$

Standard Deviation = square root of variance

$$\text{Standard Deviation} = \$3.27$$

c)

A. Shape of distribution

- equity returns are relatively symmetric (normal distribution)
- mean & standard deviation are sufficient to understand market risk and quantify percentile levels for equity portfolios
- credit returns are highly skewed and fat-tailed
- require more than mean & std deviation to fully understand credit portfolio's distribution

B. Modeling correlations

- for equities, correlation can be directly estimated by observing high-frequency liquid market prices
- for credit quality, lack of data makes it difficult to estimate credit correlation directly from history

Solution 6 (continued)

d)

- Earnings - can be measured by interest coverage (EBIT or EBITDA divided by interest expense)
- Cash Flows
- Asset Values
- Liquidity
- Leverage - can be measure by current ratio or debt-to-net worth ratios
- Financial size
- Flexibility
- Debt capacity

e)

- Account Operations - quality & timeliness of reporting? Does the company honor its obligations?
- Assess Management - sufficient management skills? Track record? Depth?
- Environmental assessment - management awareness and compliance with all relevant environmental regulations and practices
- Contingent liabilities - litigation and warranty claims

Solution 7

a)

Economically, this transaction results in a predictable and stable profit stream

FAS 133 dictates that all derivatives are held on the balance sheet at fair value.

FAS 133 dictates that changes in FV for derivatives run through the income statement barring any hedge accounting.

Bond and MTN are not being marked to market through the income statement.

FAS 133 takes an economically stable profit stream and creates income volatility on a GAAP basis as derivatives are marked to market with no offset.

Over time, GAAP and economic profits will be equal

b)

Net result of pay fixed swap and fixed rate bond is a net variable rate bond.

Future value is not sensitive to changes in interest rates.

Fair Value hedge relationship could be set up.

All documentation, disclosure, and testing requirements need to be met.

Changes in Bond market values due to changes in interest rates would also run through the income statement to provide an offset to the derivative.

Given the offset, income statement volatility would be reduced.

Net result of pay fixed swap and variable rate MTN is a net fixed rate MTN.

Cash flow not sensitive to changes in interest rates.

Cash Flow hedge relationship could be set up.

All documentation, disclosure, and testing requirements need to be met.

For cash flow hedge relationships, change in derivative fair value can be placed in other comprehensive income instead of run through the income statement.

Taking the marked to market aspect of the derivative out of the income statement will reduce the income statement volatility.

c)

At inception of hedge, create formal documentation of the hedging relationship and the entity's risk management objective and strategy for undertaking the hedge including:

- identification of the hedging instrument
- identification of the hedged item
- nature of the risk being hedged
- how the hedging instrument's effectiveness in offsetting the exposure to changes in the hedged item's fair value of cashflows will be assessed

Solution 7 (continued)

Other General Disclosures in financial statements include:

- the entity's objectives and strategies for holding or issuing derivatives
- a description of the entity's risk management policy
- the net gain or loss recognized in earnings during the period which represent the total amount of the hedge's ineffectiveness
- events resulting in the recognition of earnings from gains/losses derived in accumulated other comprehensive income
- an estimate of earnings that will be released from accumulated other comprehensive income over the next 12 months

Solution 8

- a) Beantown should examine the following elements to assess its liquidity risk which may be broadly defined as the ability to meet all expected and unexpected cash needs at a reasonable cost.
- Day-to-day liquidity, a Treasury function to manage cash needs
 - Ongoing liquidity in the future 6-24 months trying to avoid surprises and any large restructuring costs
 - Ability to handle any short term catastrophic cash needs

In this analysis one has to consider a number of items such as surrender provisions, impact of distribution channels, target markets, competing products, operational cash flows, debt obligations of the company, potential contingent claims, dividend needs, and asset concentrations.

- b) The Universal Life product will have liquidity needs primarily dictated by the design of its surrender provisions. Buyers may be more oriented to the investment aspects than the insurance components and lapse the policy to obtain a better yield. S&P assigns the liquidity needs of this product as 30% immediate and 50% ongoing.

A Major Medical policy has no surrender provision other than the return of any unearned premium. Therefore, S&P assigns a 50% factor to the unearned premium reserve and 100% to the claim reserve.

- c) Standard and Poor's analysis of assets would rank them in the following order:
1. Cash and other short term assets – 100% liquid
 2. US Government bonds – 100% liquid
 3. Canadian Bonds – 100% liquid
 4. AA+ Bonds – 100% liquid
 5. Agency pass-throughs – 100% liquid
 6. B-rated bonds – reduced values, smaller market
 7. Russian government bonds – subject to market uncertainties
 8. Unaffiliated common stock – usually liquid but price very volatile
 9. CMO – Z tranches – small aftermarket means hard to sell
 10. Funds withheld – no market at all

Where the liquidity is the same, the rankings show the impact of market value variability.

Solution 8 (continued)

- d) We have 6 month problem here and this dictates what should be done. First off Beantown Life and Health should assess its asset maturities and consider asset repurchases or the issuance of commercial paper if projected cash flow will not cover the extent of the extra claims.

Longer term Beantown should consider implementing the S&P or Moody liquidity models, implement an ALM approach if not already in place, establish a liquidation plan, work with a bank to get a line of credit. As a last resort, the company could consider securitizing some its assets or entering into reinsurance.

Solution 9

a)

Claims Dilution Problem

- Management increases shareholder value at the expense of the bondholder by
 - Increasing debt, therefore reducing the value of outstanding bonds
 - Adding debt senior to that in question

Reducing the claims dilution Problem

- Puttable Bonds
 - Put bond back to issuer if interest rates rise or issuer's credit standing falls
 - Call option on interest rates and an option on the credit spread of the issuer

Or

- Floating rate, rating sensitive notes
 - Explicit option on issuer's credit standing
 - May Increase probability of default because increases debt burden

Asset Substitution Problem

- Management invests in risky projects to save the firm

Reducing the asset substitution problem

- Convertible Bonds
- Bondholders participate in increase in shareholder value
- Reduce the probability that companies forgo valuable investment opportunities

b)

Economic Reasons

- Provide Investors with a "play"
- "Arbitrage" tax and/or regulatory authorities
- Obtain accrual accounting treatment for risk management (hedge accounting)

Solution 9 (continued)

How Hybrid can help

"Play"

- Forward contract (dual currency bond)
- More commonly is an option embedded in the bond, longer maturity

or "Arbitrage"

- Take advantage of asymmetries in tax treatment or regulation in different countries or markets
- US Firms issued zero coupon yen bonds for tax arbitrage and hedge yen exposure with dual currency bond for regulatory arbitrage

or "Accrual Accounting"

- Obtain accrual accounting instead of marked to market (usually used for hedge)
- Reduce volatility of reported income

c)

Strategic Exposure

A firm has strategic exposure if changes in interest rates affect the firm's market value

Measures

- Duration
 - change in V / % change in $(1 + r)$
 - Used by financial institutions
- Maturity Gap
 - Sensitivity of net interest income to changes in interest rates
 - Used by financial institutions
- Flow Measures
 - Sensitivity of income flows to changes in financial prices
 - Simulation models
 - Used by non financial institutions
- Stock Measures
 - Market Valuation
 - Sensitivity of a firm's stock price movements to changes in the general market (beta)
 - Can expand model to measure diversifiable risk

Solution 9 (continued)

d)

(Candidates could select from a number of instruments including forwards, futures, swaps, etc.) Some possibilities include:

- ✓ Forward, Future or Swap to neutralize the risk
- ✓ At the money option to minimize adverse outcome
- ✓ Out-of-the-money option to get lower cost insurance
- ✓ Buy and sell options to eliminate out of pocket costs
- ✓ Use a forward/future/swap with options to provide customized solutions
- ✓ Forward or delayed start swap
- ✓ Floating floor-ceiling swap
- ✓ Fixed floor ceiling swap
- ✓ Combining financial instruments with a debt instrument to create a hybrid security

Solution 10

- a)
- marketing driven organization
 - aggressive pricing
 - regulatory drivers appear to be a low priority
 - sloppy information and data management
 - poor corporate governance standards driven by Chairman/CEO

Determinants of Organizational Architecture

1. Technology that affects products, methods of production and information systems
 - Zoolander's information technology is unacceptable
 - Poor data pre demutualization which has not been converted
 - Only one year's reporting by business segment
 - Spotty projection information which have not been updated regularly nor monitored
2. Market structure affecting customers, competitors, suppliers
 - Price competition in all products
 - Marketing appears to drive decision making rather than actuarial/accounting
 - Board practices too informal with too much decision making in hands of closely knit group of execs
 - 3P project overrun – poor management of external supplier
3. Regulation (taxes, antitrust, international etc)
 - senior management is not focused on regulatory inquiries (ex. delegation to marketing manager)
 - aggressive accounting & tax avoidance being encouraged by CEO (ex. JV)
 - lax/poor process for appointing accountants
 - very poor governance of investment department
 - no meetings last year
 - establishment of derivatives profit center without supervision

Solution 10 (continued)

b)

1. Assignment of Decision Rights within the firm
 - Maximum vacation time for key employees (CEO should not be out for over 2 months!)
 - Increased focus on management accounting information
 - projections
 - product line and business segment reporting
 - clear internal deadlines, regular reporting
 - Board level changes
 - increased formality required
 - need to break up “clubby” executives
 - need for more independent scrutiny (ex. by having more independent members)
 - Need to have a robust process to decide on whether auditors should be retained
 - robust process should be implemented for any derivatives. Also they should be used for hedge purposes rather than as a profit center
 - should implement more rigorous oversight of relationship with regulators
 - Eagle Joint Venture should be a board level decision
 - various committees should be required to meet more than once a year
 - Chairman/CEO role split in order to limit control
2. Structure of Systems to evaluate performance
 - each executive position should have its own clear benchmarks for success identified in advance
 - need to implement a more robust computer/information system before it can be used as a management tool
 - too much decision making authority in the hands of too few execs/board needs to take the lead on key issues
 - unclear what experience Mrs. Holstein-Palomino could possibly have which could be relevant to the board
3. Methods of Rewarding Individuals
 - need to tie performance to pay more clearly
 - management compensation appears excessive, particularly post IPO
 - unclear decision making function/governance structures to be clarified

Solution 10 (continued)

Potential Risks each of the above

- Disruption as the above are implemented
- Alienation of the existing board members/senior management
- Lack of management talent within the organization as all meaningful decisions are taken by Chairman/CEO often without the board's knowledge
- Increased costs (i.e. audit, systems, etc)

Solution 11

a)

Under US GAAP, acquisition costs are capitalized. GAAP follows the matching principle (revenues are matched with expenses). In traditional policies, DAC is amortized against premiums Current assumption policies (e.g. UL) amortize DAC as gross profits emerge over the life of the policy. As the expenses are charged, the value of the deferred capital asset is reduced accordingly.

Expenses that are directly related to and varying with sales are deferrable.

A k factor, $k = PV(\text{deferrals})/PV(\text{revenue})$ is used to amortize DAC.

b)

The 0.50% first year commission is deferrable. Initial deferrable expenses for '06, '07, and '08 are \$250,000, \$300,000, and \$350,000.

For 2006 sales the DAC balance is $\$50 \text{ M} \times .5\% \times 61\% \times (38\% / 55\%) = \105 K

For 2007 sales the DAC balance is $\$60 \text{ M} \times .5\% \times 82\% \times (55\% / 75\%) = \180 K

For 2008 sales the DAC balance is $\$70 \text{ M} \times .5\% \times 75\% = \263 K

Total DAC as of 12/31/08 \$548 K

GICs are treated as investment contracts under SFAS 97, with DAC amortized against gross profits. The k factor is revised as actual profits emerge. DAC may be written off under loss recognition.

c)

GAAP and Fair Value differ in timing of recognition of gains and losses on the sale of new business and from asset/liability mismatches. Fair value accounting: recognizes all gains and losses in the period which they arise. US GAAP: recognizes the gains and losses over the life of the liability. Under fair value accounting system, income statement volatility is higher.

Solution 11 (continued)

A major benefit of fair value accounting is the ability to identify problems much earlier. GAAP is based on historical costs while fair value is based on prospective (market-based) values. GAAP assumptions often include provisions for adverse deviation (PADs) while fair value assumptions are current best estimates. GAAP assumptions are locked in at issue under SFAS60 (unless loss recognition occurs) while fair value assumptions are not locked in. GAAP provides for deferral of acquisition costs (DAC) while fair value expenses these costs in the period in which they occur.

If assets are not matched to its liabilities, the earnings reported on the fair value income statement will differ significant from those shown on the US GAAP income statement, especially under changing interest rate scenarios. The full impact of any mismatch is reported immediately in the earnings under fair value accounting, while under US GAAP accounting, the effects of any mismatch will be recognized only slowly in income over the remaining life of the liabilities. It will be costly to implement a new accounting system, but Industry convergence to fair-value reporting may be one reason to switch.

I'd recommend a switch to fair value accounting as a means to improve asset-liability management, and to allow management to identify and act on problems on a more timely manner.

Solution 12

a)

Observation/Issue	Concerns	Recommendation
Zoolander's credit rating.	Although Zoolander and Lyon clearly want to maintain the highest Kelly rating grade, the ratings have declined to the lower end A- and have a negative outlook. Dodo does not seem to take a potential downgrade too seriously. Kelly did not properly rate them last year and has left a negative implication in place for 2 years. Concern whether Kelly Ratings is a proficient rating company and diligent/independent enough for Zoolander.	Work on improving credit rating, perhaps use a different agency.
Board should have good committee structures, staffed by independent directors	Concern that although Zoolander has the core committees-audit, compensation, and nominations-they are represented by 3 directors that are different combination's of the same 5 directors. One director (Holstein-Palomino) lacks expertise. Concern that audit committee not independent as they vacationed together. Concern that nominating committee voted down expansion of Board with more independent members, as recommended by only (departing) independent director (Dauphin) Concern that Zoolander's only independent director, Dauphin, term expires; the others are not independent.	Recommend that a number (5+) of independent directors be brought in; recommend changing composition of audit committee; recommend termination of Holstein-Palomino.

Solution 12 (continued)

<p>Insurance Company boards should have strong oversight of its financial, actuarial, and investment risks/risk management practices.</p>	<p>Concern that Investment committee did not meet for an entire year; that Board voted to delay vote on Dauphin’s recommendation of creating an ERM officer, a unanimous recommendation of RM committee.</p>	<p>Recommend Board vote and approve ERM Officer position asap; recommend requirement of frequent Investment committee meetings; recommend staffing committees with independent members</p>
<p>Board should be staffed with industry-knowledgeable directors (approx 9-12 members)</p>	<p>Concern regarding Zoolander’s small board size; 5 members; Concern that, while 4 members are industry-knowledgeable, only one is independent (Dauphin)</p>	<p>Recommend that 5+ new, independent directors be hired that have industry knowledge.</p>
<p>Independence of the Chief Actuary</p>	<p>Not clear how independent Foxx is? Dodo very confident of getting actuarial sign-off on financial projections they don’t agree with.</p>	<p>Recommend giving Chief Actuary dotted line reporting relationship to expanded Board and its committees.</p>
<p>Does Board go through a checkbox approach to their work (granular board-approval of investment decisions) rather than taking a broad strategic approach?</p>	<p>Concern that Board is doing neither, as Investment committee have not met all year</p>	<p>Recommend new, knowledgeable and independent members form investment committee to add strategic direction</p>
<p>Regulatory attention to insurance sales and brokerage practices.</p>	<p>Concern that Zoolander’s sales practices have come under the scrutiny of state attorney general. Concern that Board left Wolfe (who is not objective) to handle, and Wolfe may obstruct justice to “protect the company”.</p>	<p>Recommend a new, independent Audit committee take control of regulatory investigation.</p>

Solution 12 (continued)

b)

Lesson 1: Know Your Business

- Everyone involved in the business, from board of Directors to front-line supervisors & employees are obligated to “know the business”
- Is an integral component of risk management
- Business managers should be knowledgeable about all aspects of the business, including high-level business & operational processes, key drivers of revenue & cost, and the major risks & key exposures involved (“know the risks”)
- e.g. Metallgesellschaft case where senior management did not understand cash flow implications of hedging strategy
- Peter Fish is setting up a derivatives operation, perhaps profit center without understanding derivatives strategies of Badger, whom he supervises
- Sean Basset does not understand what is driving the increase in profit margin projections in the 2006 marketing plan

Lesson 2: Establish Checks & Balances

- A requirement of effective risk management is that there should be a system of checks & balances to prevent any given individual, or group, from gaining excessive power to take risks on behalf of company
- A system of checks & balances, along with the segregation of key duties, is not only a safeguard against errors made by people, processes, and systems, but it is also fundamental to sound business management
- Include appointing an independent Board of Directors, creating effective audit committees, and simple things like proofreading documents
- e.g. Barings Bank/Leeson led banking regulators to establish “segregation of duties” & “independent risk management” as core principles in risk management, and company’s established risk management and back-office ops that were independent of the profit centers
- Badger should not be in charge of both the front and back derivatives office: no segregation of duties
- Wolfe should not be able to go to Lyon to override Finch’s delay of new product launch
- Zoolander does not have an independent Board, and its audit committee is non-independent, small, and has one inexperienced member

Solution 12 (continued)

Lesson 3: Set Limits & Boundaries

- Risk limits and boundaries tell a business “when to stop”
- It is widely accepted that risk limits are an integral part of a sound risk management program
- In addition to limits on financial & operation risk boundaries should be established to control business risks, such as standards for sales practices and product disclosures
- Boundaries should also be established to control organizational risks, such as the company’s hiring policies
- Eg. Metallgesellschaft case: company failed to set appropriate limits on hedging activities
- Zoolander seems to already be in trouble over past sales practices
- Marketing seems willing to risk selling new products to customers whom may end up with a tax problem
- Board postponed decision on ERM Officer decision, despite known risk management issues

Lesson 4: Keep Your Eye on the Cash

- Make sure that there are appropriate safeguards for managing cash positions and cash flows
- These include basic controls, such as authorized signatures to initiate, approve, and make cash transfers
- They also include the development of internal processes to measure, monitor, reconcile, and document cash transactions and positions
- Inadequate cash management & accounting systems represent opportunities for potential fraud to go undetected, as well as “blind spots” for trading and operational errors
- Badger should not be trading and overseeing accounting thereof: huge exposure to fraud

Lesson 5: Use the Right Yardstick

- The “measures of success” used (or not used) by a company to track individual and group performance are a key driver of behavior, and by extension, of risk
- If management is to gain a proper risk/return perspective, it is important that risk measures (similar to those alluded to in Lesson 3) are incorporated in the processes that generate management reports and measure performance

Solution 12 (continued)

- An integrated set of risk measures should provide management with timely information on all types of risks faced by the company, including actual (ex-post) and “early warning” (ex-ante) risk indicators
- The executive bonus program only takes risk into account with respect to requiring a minimum rating from Kelly
- No incentive to address the risk management concerns uncovered by Dauphin

Lesson 6: Pay for the Performance You Want

- Need to take a close and careful look at how compensation and incentives are designed and implemented, and whether or not they reinforce desired behavior and performance
- Performance goals used to grant employee stock options not balanced with risk measurers
- Immediate vesting of executive stock awards may lead to S-T focus
- Lyon effectively approving his own compensation

Lesson 7: Balance the Yin and the Yang (infrastructure vs. “soft” risk management)

- Much of risk management focus has been on building infrastructure or “hard side” (the yin) however, it is equally important that company’s focus on “soft” side (the yang) or risk management
- “soft” initiatives include: - setting the tone from the top and building awareness thru demonstrated senior management commitment; - establishing principles that will guide the company’s risk culture and values; - facilitating open communication for discussing risk issue
- Soft side focuses on the people skills, culture values, and incentives
- The components of the soft side are the key drivers of risk-taking activities while the components of the hard side are enablers, which support risk management activities
- Board seems to be self-serving, non-independent and resists any attempts to change
- Board resisting putting in appropriate risk management infrastructure, let alone the soft risk management needs
- Company seems to preach ethics, values, people development etc., but Lyon does not seem to practice particularly with respect to Board and committee activities.

Solution 12 (continued)

c)

Operational Failure Risks/Internal:

1. People

- T. Lyon IV, the Chairman, President, CEO and COO is 80 years old.
- High risk of his untimely death or sudden retirement without a successor.
- Recommend Lyon only be President & CEO and hire new COO and Chairman.
- Groom COO/CIO for succession planning to replace CEO

2. Processes

- The financial planning process is producing unrealistic results.
- High risk that projections are unrealistic and unachievable as actuarial does not want to sign off, marketing does not know source of increased profitability
- Recommend that actuarial has more independence, that sales be a smaller component of bonus measure, and add some risk metric with the return goals.

3. Technology

- PPP system development is behind schedule and over budget.
- High risk of not being able to properly administer product transactions.
- Recommend paying up to speed development and testing.

Operational Strategic Risks/External:

4. Regulation

- NY AG and others are investigating Zoolander's sales practices.
- High risk of being fined and harm to reputation.
- Audit current sales practices and review new product launches carefully

5. Taxation

- Beneficial tax treatment of new product may not apply to all potential customers
- Risk of violating sales practice regulations; reputation risk if sell inappropriate products to customers
- Do not launch new product until tax treatment clarified

Solution 13

a)

Actuarial Approach

- losses come from poor equity performance
- upside potential
- reserves less than DH due to low confidence levels
- more downside risk
- heavily reliant on expected returns

Dynamic Hedging

- loss from discrete rebalancing (hedge error) and transaction costs, and assumptions not materializing as expected
- no upside potential
- less downside risk
- risk-neutral methodology

b)

	F_{t^-}	F_{t^+}
0	100.00	99.80
1	95.81	95.0
2	101.60	101.40
3	100.40	

$$F_t = F_{(t-1)^+} \left(\frac{S_t}{S_{t-1}} \right)$$

$$F_{t^+} = F_{t^-} (1 - m) = F_{t^-} (.998)$$

$L_t = \text{Expected Guarantee Payment}_t - \text{margin offset}_t$

Expected

$$\text{Margin offset}_t = (.0004) {}_t p_x^T F_t$$

0	.0400
1	.0381
2	.0402
3	No offsets as charged at beginning of year

Expected GMDB

$$\text{Guarantee payment}_t = {}_t q_x^d (G - F_{t^-})^+$$

0	Deaths at end of year
1	$(.0003)(100 - 95.81) = .0013$
2	0
3	0

Solution 13 (continued)

Expected GMMB _t = ${}_t p_x^T (G - F_{3^-})^t$		Total Expected CF = margin offset - guaranteed payment	
0	0	0	.04
1	0	1	.0381 - .0013 = .0368
2	0	2	.0402
3	$(.98)(100 - 100.4)^t = 0$	3	0

$$\text{PV Expected cash flows} = \frac{.04}{1.004} + \frac{.0368}{1.004} + \frac{.0402}{1.0042} = .1165$$

Margin is sufficient to cover expected guarantee costs

c) Hedging cost = ${}_t p_x^T BSP_3$

$$BSP_3 = Ke^{-r(T-t)}\Phi(-d_2) - S\Phi(-d_1)(1-m)^{(T-t)}$$

$$= 100e^{-(.004)3}\Phi(-d_2) - 100(.998)^3\Phi(-d_1)$$

$$d_1 = \frac{\ln\left(\frac{S_0(1-m)^T}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}} = \frac{\ln\left(\frac{100(.998)^3}{100}\right) + \left(.004 + \frac{.0025}{2}\right)3}{.05\sqrt{3}} = .1125$$

$$d_2 = .1125 - .05\sqrt{3} = .0259$$

$$\Phi(-d_1) = \Phi(-.1125) = .875\Phi(-.1) + .125\Phi(-.2) = 0.4553$$

$$\Phi(-d_2) = \Phi(-.0259) = .74/\Phi(0) = .259\Phi(-.1) = 0.4897$$

$$p_0 = 100e^{-.004 \times 3}\Phi(-d_2) - 100(1 - .002)^3\Phi(-d_1) = 100e^{-.012} \times .4897 - 99.401 \times .4553$$

$$p_0 = 3.1285$$

$$\text{Cost} = p_0 \times {}_t p_x^T = 3.1285 \times .98 = 3.065$$

Solution 14

The S&P FPC model is additive & modular in design. Risks that aren't specifically included in these 3 categories may be analyzed using S&P's traditional capital modeling and added to the capital adequacy requirements determined by the FPC model. The FPC model is used in place of S&P's traditional insurance capital adequacy model for interest rate & credit risk (an RBC based model). The RBC model does not consider hedging strategies used to reduce credit or financial market risks.

S&P's use of the model is limited to insurance companies that analyze and report their risks on a comprehensive & sophisticated basis & manage risk with the intention of creating a conservative risk profile. They use sophisticated hedging strategies and conservative underwriting practices to reduce market and credit risk to a level below the industry norm. After applying the FPC model to measure a company's actual risk profile resulting from its risk management practices, S&P may be able to gain comfort in significantly lowering a company's expected capital requirements relating to a specific institutional book,

Gross Capital Charge

Buckets	Comb DVo1s	Vols Applied	Comb. Exp. G/L	Gross Incr. Cap Chg
1-12 mos	1,600	220	352,000	352,000
24 mos	-7,900	200	-1,580,000	1,580,000
36-60 mos	8,100	190	1,539,000	1,539,000
Total				3,471,000

Product of Expected Losses on Risk Buckets (\$millions)

	1-12 mos	24 mos	36-60 mo
1-12 mos	123,904	-556,160	541,728
24 mos	-556,160	2,496,400	-2,431,620
36-60 mos	541,728	-2,431,620	2,368,521

Covariance Matrix

	1-12 mos	24 mos	36-60 mo
1-12 mos	1	0.9	0.8
24 mos	0.9	1	0.95
36-60 mos	0.8	0.95	1

Solution 14 (continued)

Product of Expected Losses and Covariance (Calc'd) \$millions:

	1-12 mos	24 mos	36-60 mo
1-12 mos	123,904	-500,544	433,382
24 mos	-500,544	2,496,400	-2,310,039
36-60 mos	433,382	-2,310,039	2,368,521
Totals	56,742	-314,183	491,864

Sum of Totals (\$millions)	234,424
Square Root of Sum (\$'000s)	484
Gross Capital Charge(\$'000s)	3,471
Net Capital Charge	484
Difference	2,987
'50% Cov Factor	1,493
Total Capital Adequacy for mismatch risk (MR-1):	1,978

Calc of CR-1 Incremental Charge Relating to Credit Derivatives: 3-year Tenor

	Rating	Notional	Def. Factor (%)	Gross Cap. Chrg
Incremental capital adequacy for credit derivative that creates credit exposure				
"Short" CDS	A	10,000,000	1%	100,000
Adjmt to incr'l capital adequacy for purchase of credit derivatives that mitigate exposure				
"Long" Bond	BBB	20,000,000	2%	400,000
Cntrpty to CDS	A	20,000,000	1%	200,000
		Product of		
		Default Factors:	0.02%	
		Covariance		
		Multiplier:	3	
		Adj. Applied		
		Factor:	0.06%	12,000
			Total	112,000

Solution 15

a)

The following features of stochastic interest rate models are important in selecting a model for a particular application.

Number of factors

- Single factor vs. multi-factor

Arbitrage-free vs. equilibrium

- Arbitrage-free models the term structure of interest rates.
- Arbitrage-free may be preferred in managing a fixed income portfolio or performing ALM.

Normal vs. lognormal

- Normal has interest rate volatility independent of the level of interest rates over a short time interval.
- Research shows a weak correlation between interest rate volatility and level for rates below 10%.

Mean reversion

- Explicit mean reversion has short-term rates with partial adjustments to long-term expected rate.
- Research shows yield curve does not follow a random walk. Rates tend to rise when they are low and fall when they are high.

Continuous vs. discrete

- Not significant.
- May choose discrete for ease of implementation.

I recommend the Hull-White model for this application.

$$dr(t) = \alpha(t) - \beta r(t)dt + \sigma dW(t)$$

Features of the Hull-white model:

- Single-factor
- Arbitrage-free
- Normal
- Explicit mean reversion
- Continuous

Solution 15 (continued)

b)

$$\alpha\text{-quantile} = L_{N\alpha}$$

$$N\alpha = 500(.99) = 495$$

$$L_{495} = 810$$

100 β confidence interval for α -quantile = $(L_{N\alpha - A}, L_{N\alpha + A})$, such that

$$A = \Phi^{-1}((1+\beta)/2)(N\alpha(1-\alpha))^{1/2} = \Phi^{-1}(.975)(495(.01))^{1/2} = 1.96(4.95)^{1/2} = 4.36$$

Round A to 4.

$$\text{C.I.} = (L_{495 - 4}, L_{495 + 4}) = (L_{491}, L_{499}) = (590, 920)$$

c)

$$\text{Conditional Tail Expectation} = \text{CTE}_\alpha = E(L_j : j > N\alpha)$$

$$N\alpha = 500(.99) = 495$$

$$\text{CTE}_{99\%} = E(L_j : j > 495)$$

$$\text{CTE}_{99\%} = (850 + 860 + 890 + 920 + 1200)/5 = 944$$

$$\text{Estimate for sample error} = \text{SD}(L_j : j > N\alpha)/(N(1-\alpha))^{1/2}$$

$$N(1-\alpha) = 500(.01) = 5$$

$$\text{SD}(L_j : j > 495)/5^{1/2} =$$

$$((850-944)^2 + (860-944)^2 + (890-944)^2 + (920-944)^2 + (1200-944)^2)^{1/2} / 5^{1/2} = 130.3$$

Solution 15 (continued)

d)

Coherence properties are given by:

		Quantile	CTE
1.	Bounded above by maximum loss	Yes	Yes
	$H(x) \leq \text{Max}(X)$		
2.	Bounded below by mean loss	No	Yes
	$H(X) \geq E(X)$		
3.	Scalar additive and multiplicative	Yes	Yes
	$H(aX + b) = aH(X) + b$ for $a, b > 0$		
4.	Subadditive	No	Yes
	$H(X + Y) = H(X) + H(Y)$		