Solution 1

Case Study question on reinsurance. The calculations for the funds-withheld coinsurance follow closely from the examples given in the text. In the latter part of the question, the student should realize that new reinsurance proposal is aimed at a completely different risk exposure than Zoolander's prior reinsurance coverage. It is important that candidates support whatever recommendation is made in Part C.

(a)

(i) Income statement after reinsurance

	Projected 2005	
Premiums		
Gross	33,000,000	
Ceded	33,000,000	← normally should be set to be the policy reserve. Here uses gross prem as initial reins prem
Net Premiums	0	
Investment Income		
Gross	1,650,000	
Ceded	0	← ceding company holds assets
Net Investment Income	1,650,000	
Reinsurance Allowance	3,300,000	← 10% of ceded premium
Total Revenue	4,950,000	
Claims & Surrenders		
Gross	19,000,000	
Ceded	19,000,000	
Net Claims & Surrenders	0	
Reserve Increase		
Gross	11,000,000	
Ceded	11,000,000	
Net Reserve Increase	0	
Total Benefits	0	
Expenses & Commissions	3,500,000	
Gain from Operations	1,450,000	

(ii) Beginning Balance = initial expense allowance = -3,300,000

Reinsurer gain during 2005 = 33,000,000-3,300,000-19,000,000-11,000,000 = -300,000

Solution 1 (continued)

a) Beginning Surplus Account	$0
Plus stat gain from ops (Cranberry)	-300,000
Less inv income on surplus	0
Less risk coverage (1% of outstanding surplus 2004)	0
Ending Surplus Account	-300,000

(b) YRT benefits

1) can transfer mortality risk
2) relatively easy to administer
3) no investment risk involved
4) less expensive
5) less regulatory scrutiny

100% funds withheld coinsurance benefits

1) Have surplus relief
2) No reserve credit problem (up to amount of assets withheld)
3) No cash changes hands at the beginning and minimal cash flow throughout treaty

(c) Recommendation

Zoolander should retain the risk and manage it themselves

Risk inherent in term insurance consists mainly of mortality risk and this risk is diversifiable.

Law of large numbers when there is a big enough pool of insureds, the expected cost arising from this pool will be close to the mean

Since there is no investment risk which is systematic and non-diversifiable – this is a feasible option

Company has long history of profitability in the term life market

This also presents an opportunity for the company in that no other YRT reinsurer is out there offering this product at a reasonable cost

Solution 1 (continued)

One way for the company to diversify business operations is by developing reinsurance expertise and entering that market. May help management achieve aggressive growth target.

Furthermore, history in this market gives them foundation

Cost and administrative complexity associated with funds withheld coinsurance makes the option extremely unattractive.

Also would have regulatory concerns.

Solution 2

This Case Study question asked students to evaluate the appropriateness of capital allocation models found in the Course syllabus. The second half of the question is very similar to some asked on prior years' exams. The student must calculate which of Zoolander's lines of business are earning their cost of capital and generating free cash flow. For many candidates, one difficult element was determining the correct weighted average cost of capital.

(a) Required surplus formulas are a convenient and easy way to allocate capital. The formulas attempt to measure each major type of risk the company faces. Allocating capital by line of business allows Zoolander to monitor the return on capital of each line of business, plus they can plan the amount of investment in each line, and control the amount of capital used. This also allows Zoolander to allocate capital to the most strategic uses and take action if results do not equal plan.

(b) GAAP required surplus is more useful than statutory required surplus because it takes into account investment in acquisition costs and surplus strain. Actuary needs to be aware of how GAAP is distorting results. GAAP has limitations:

a. GAAP ROE may not correspond to IRR used in pricing.
b. Interest rate used to amortize acquisition costs is yield on invested assets, but for pricing it is based on IRR.
c. GAAP allows for margins for adverse deviations.

(c)

Line of Business	Projected ROE (proj 2004 earnings/2003 capital)	Equity Growth Rate (EGR)
Annuity	10 / 100 = 10%	(103 – 100) / 100 = 3%
Disability	0 / 150 = 0%	(160 – 150) / 150 = 6.67%
Life	30 / 200 = 15%	(240 – 200) / 200 = 20%
Variable	20 / 215 = 9.30%	(225 – 215) / 215 = 4.65%
Corporate	40 / 367.6 = 10.88%	(390 – 367.6) / 367.6 = 6.09%

Weighted average cost of capital:
Cost of equity capital = 11%
Cost of debt capital = 5%
Desired capital structure = 30% debt.
WACC = 0.3 x 0.05 + 0.7 x 0.11 = 9.20%

Annuity:
ROE > WACC, creating economic value.
ROE > EGR, generating free cash flow.

Solution 2 (continued)

Disability:
ROE < WACC, destroying economic value.
ROE < EGR, destroying free cash flow.

Life:
ROE > WACC, creating economic value.
ROE < EGR, destroying free cash flow.

Variable:
ROE > WACC, creating economic value.
ROE > EGR, generating free cash flow.

Corporate:
ROE > WACC, creating economic value.
ROE > EGR, generating free cash flow.

(d) Annuity: Growth is desirable, allocate more capital.
Disability: Growth is undesirable. Cash sink, should reduce growth and try to increase profitability.
Life: Growth is desirable. Since creating economic value, this line is ok.
Variable: Growth is desirable. Should allocate more capital here.
Corporate: Growth is desirable. Should allocate more capital here

Solution 3

Large corporate governance question using information from the Case Study. The first part was keyed on the bonus program and stock option incentives. The second half of the question asked the student to consider stakeholders inside and outside the company. Zoolander has some major problems on the corporate governance side. However, they were doing some things correctly. Students who related their answers specifically to the Case Study scored higher than those that merely repeated a list from the Course reading

(a) Bonus target

New Sales > $500 Million
- Creates incentives to boost sales at expense of profitability
- Encourages under-pricing

Gross Investment Return > 6%
- Considers return but not risk
- May explain the increase in mortgages and junk
- May encourage asset/liability mismatch or liquidity risk
- 6% may not be a sufficient benchmark to add value

Assets Under Management > $9,750
- May encourage continuation of unprofitable lines (disability)
- May encourage under-pricing new business

Expense management is not rewarded by bonus program

The bonus target is all or nothing so management has no incentive to exceed the goal.

Restricted Option Program

The restricted options and bonus are awarded for items beyond the management's control.

Stock options can dilute ownership

(b) The compensation system fails to align incentives.

Does not provide decision makers with incentive to increase value
- Encourages growth without profitability
- No expense control
- Risky, mismatched assets

Solution 3 (continued)

Added Costs without improved incentive
- Easily attained goals
- Incentive pay to non-decision makers in areas beyond their control
- No benchmarks or reflection of economic factors such as inflation

(c) Role in preventing company failure
- Shareholders
  - Control through voting rights
  - Select Board
  - Institutional investor role in monitoring performance
- Board of Directors
  - Act as agents of shareholders
  - Hire/fire/compensate CEO and managers
  - Possess sufficient expertise to advise management
  - Create proper incentive system for rewarding manager
  - Set overall corporate policy, risk control, risk appetite
- Management
  - Invest in projects that increase shareholder value
  - Reject unprofitable activities
  - Manage and control risks
  - Proper contracting
  - Optimal disclosure, reporting
- Rating Agencies
  - Acts as agent for investor
  - Provide credible information from independent source
  - Provide benchmark
  - Allow for cheaper debt or capital issue
  - Prevention and detection of insolvencies
  - Review strength, business profile

(d) Not Meeting Obligations
- Shareholders
  - Not much individual shareholder can do since management owns 49%
  - However, management ownership should align his interests
  - No active monitoring. Inability to control Board or CEO

Solution 3 (continued)

- Board
  - Loyalty to CEO who is Chairman of Board
  - Board is too cozy. Vacation together. (Even a pair of spouses).
  - Audit Committee and information flow controlled by CEO
  - Entrenched Auditor selected without Board input
  - Need to set up better monitoring/controls
  - Need to set up better management compensation

- Management
  - Pursuing self-interest (agency costs)
  - Continuing unproductive line of business
  - Poor incentives and control
  - Focus on sales before resolving tax questions
  - Failure to forecast
  - Incomplete information by line of business

- Rating Agency
  - Insufficient review last year since company on watch
  - Slow to react to increased risks
  - Skipped interview, only used public information
  - Not inquisitive about lack of clear business plan

Solution 4

Integrated question pulling together the concepts of Real Options, Signaling Theory and Derivatives. The calculations in Part B required the student to demonstrate they understood the different financing implications. Many had problems applying the correct discount rate for the possible future cash flows

(a)

	Advantages	Disadvantages
Equity	-raise large sums -additional risk bearing capital	-negative signal to market -dilitutive to existing stockholders -SEC disclosure/costs
Public Debt	-tax deductibility of interest -make management more disciplined -positive signal to market -raise large sums	-increased chance for default -SEC disclosure/costs -public disclosure of confidential information -covenants
Private Debt	-more positive signal to markets -keep proprietary info confidential -flexibility w/rsp to terms -no SEC disclosure/costs	-increased chance for default -raise smaller sums -covenants
Hybrid Debt	-use embedded derivative that provides offset to lower fuel costs -reduce chance of default so get better financing -market may be willing to offer better financing rate if they want the exposure	-complexity -basis risk

(b) Common Stock
use risk-neutral valuation

$V_0 = \{ [250(.6) + 30(.4)] / 1.03 \} - I_0$
$V_0 = 157.3 - 100$
$V_0 = 57.3$

Solution 4 (continued)

½ Stock and ½ Debt
pay debt in 1 year = 50(1.06)=53
Can default on debt, this creates value

$V_0 = \{ [\text{Max}(250-53,0)(.6) + \text{Max}(30-53,0)(.4)] / 1.03 \} - I_0$
$V_0 = 114.76 - 50$
$V_0 = 64.76$

All debt
pay debt in 1 year = 100(1.06)=106

$V_0 = \{ [\text{Max}(250-106,0)(.6) + \text{Max}(30-106,0)(.4)] / 1.03 \} - I_0$
$V_0 = 83.9 - 0$
$V_0 = 83.9$

(c) All debt adds most value to existing shareholders
83.9 > 64.76 > 57.3

debt is also advantageous because:
- interest is tax-deductible
- makes management more disciplined
- positive signal to market

Would issue private debt over public debt because
- even more positive signal than public debt
- flexibility in setting up terms

(d) Yes, makes debt more likely
- make debt more attractive because reduces chance of bankruptcy which should decrease financing costs
- need to weigh this against any cost of the derivatives (i.e., options)
- smooth earning patterns reduce present value of expected tax liabilities

Solution 5

Focused question on Asset-Liability Management. The assumptions were selected in order to keep the calculations reasonable. One of the teaching points was that it is difficult to optimize multiple criteria and there is no one method that is ideal for every situation. Part C of the question allowed well-prepared candidates to demonstrate that they understood how other techniques from the Course reading could be applied to this situation

(a)

(i) $x(1) + (1-x)(8) = 2.5$
$x = 78.6\%$ should be allocated to short-term bonds to match effective duration of liabilities

(ii) Holistic matching involves allocating on a firm-wide basis.
Current Duration (Eff) of Assets

$$= \frac{7(6)+4.5(4.8)+2.5(0)+1(7.4)+3(1)}{18} = 4.111$$

$$\text{Current Duration (Eff) of Liabilities} = \frac{7(3.5)+3(8.6)+5(4.2)}{15} = 4.75$$

w/ SPDA included: = 4.49

$$4.49 = \frac{x(1)(2)+(1-x)(8)(2)+74}{20}$$

$15.8 = 2X + 16 - 16X$ $\quad X = 1.43\%$ Allocated to ST bonds

(iii) Minimization of effective duration of surplus entails 100% investment of Short-Term bonds – as this decreases overall duration of surplus

(b) Limitations: In general, the following are limitations of duration matching:
- Assumes parallel shifts of yield curve
- interest rate risk minimized only for small changes in the interest rate.

(i), (ii), (iii) All include the above, plus:
(i) ignores correlation of different lines of business
(ii) will include interest rate risk because assets > liabilities.
An increase in rates will still cause a loss of surplus.
(iii) minimizing duration may force company's investment returns to decline

Solution 5 (continued)

(c) Specific Approaches to ALM:

VAR methodology: surplus to give a percent chance of insolvency (within a confidence interval)

Investment Policy: invest with duration of surplus in mind
limits on exposures, duration mismatches

Product Design: integrate product design with ALM, ensure a product design with interest rate risks in mind

Dynamic Hedging: constantly hedging to minimize overall effects
Invest in assets that have opposite market characteristics
Managing the "greeks"

Option Pricing: use to price/value (embedded) options with liabilities. Based on Black-Scholes Theory

Securitization: create asset-backed securities

Segmentation: duration matching each product or line separately

Holism: mentioned in example

Optimization: mentioned in example

Price Sensitivity Statistics: use key rate duration or account for non-parallel shift in A&L.

Cash Flow Methods
Cash flow testing: test impact of CF's under deterministic or stochastic scenarios

Cash flow marketing: invest so that CF's for assets and liabilities match/eliminates interest rate risk

Dynamic Financial Condition Analysis: analyze multiple risks-holistic approach

Reinsurance: may be used to reinsure equity-indexed/based death benefits

Solution 6

Fairly straightforward test of the student's understanding of basic CARVM definition and concepts in the first half. The second half of the question focused on how deficiency reserves arise and what can be done to minimize them.

(a) Primary issues are related to how to take account of various options available to policyholder.

CARVM Definition
The greatest of the respective excesses of the present values, at the date of valuation, of the future guaranteed benefits, provided by such contracts at the end of each respective contract year, over the present value, at the date of valuation, of any future valuation considerations derived from future gross considerations, required by the terms of the contract, that become payable prior to the end of such contract year.
Can be considered a "worst" case scenario.
Curtate CARVM based on the assumption that contract-holder may exercise his various options only at the end of the year.
Only elective benefits give rise to multiple benefit streams; non-elective benefits assumed to occur based on the valuation standard.

Continuous CARVM
In practice, surrender charge reduces on first day of specified contract years. The PV on last day of contract year may be significantly less than PV of non-forfeiture benefits on first day of the following contract year.
Some states require that reserves based on greatest PV on any day of each respective contract year.

(b) Death and Disability Benefits
Common practice to calculate a separate reserve for these benefits and add it to the basic CARVM reserve

Bailout Provision
If current non-guaranteed interest rate falls below some level, then all or a portion of surrender charges will be waived for some period
Project guaranteed benefits twice choosing the lesser reserve:

(1) use contractually guaranteed interest rate, ignore surrender charges
(2) use minimum rate that would not be less than the bailout rate and recognize surrender charges

Solution 6 (continued)

Market Value Adjustment

Annuity Purchase Guarantees
NAIC Model Reg requires the reserve to be no less than 93% of contract fund value for contracts which contain this provision

Valuation Interest Rates
NAIC valuation law provides for range of interest rates depending on the duration of any guarantees and the nature of the cash settlement provisions contained in the annuity.

(c) Characteristic of simplified net premium reserves that valuation net premium may be larger than the premium actually charged to the policyholder.
May occur either because pricing assumptions are less conservative than the valuation assumptions or because the slope of the premiums does not match the slope of the benefits

(d) Under the Unitary Method lapses are ignored, and valuation net premiums are a uniform percentage of gross premiums
By having steep premium increases in later durations, it is possible to reduce the valuation net premium at earlier durations

Solution 7

Application of using puts and calls to hedge a simple risk. Asks students to draw the payoff profile similar to what was done in the reading. A fair number of candidates confused which side of the deal they were taking so their graphs were backwards. Higher scoring students labeled points on the graph correctly

(a) The insurance company is subject to financial risk and has chosen to hedge that risk. Financial risks can be managed using options. Options are different from a forward, future, or swap in that they give the buyer a right, not an obligation, to buy or sell. The seller has the obligation to buy or sell if the buyer chooses to do so.

The company could purchase a European call option on the S&P 500 index expiring in one year with a strike price equal to 110% of the initial level of the S&P 500 index. If the index ends the year at a level above 110% of the starting point of the index, the company can exercise the option and be paid any excess of the ending index over the 110% level. The company would receive nothing if the index ends the year at less than 110% of the starting point. Exercise of the option would result in value to the insurance company if the index ends the year above 110%.

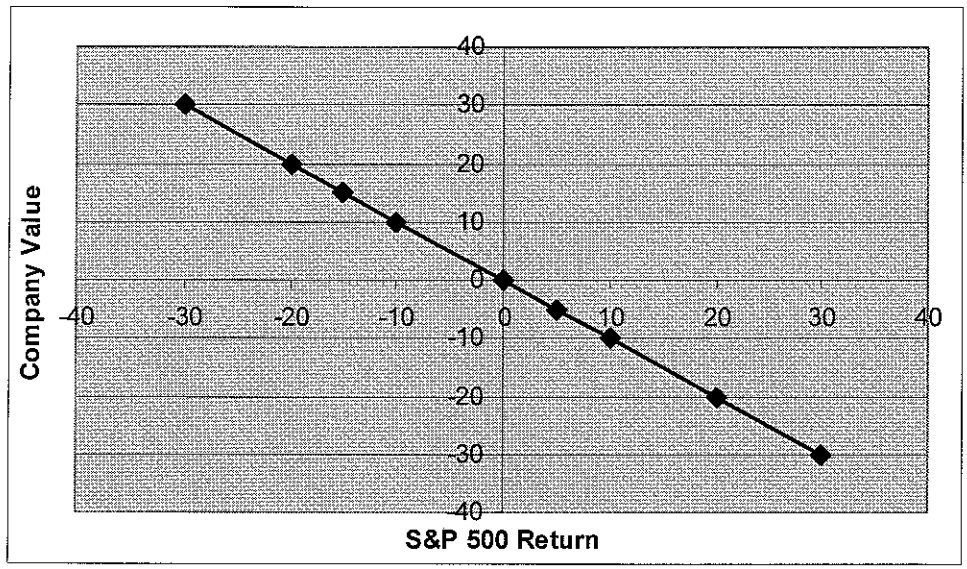
The company has accepted risk up to a 10% increase in the index. Purchasing an out of the money option provides less downside protection, but the option premium is significantly less.

(b) Sell a European put option on the S&P 500 index with an expiration date in one year. Choose a low strike price (assume 85% of the index's starting value). This option gives the purchaser the right to sell the index at the strike price and results in value to the purchaser if the option falls by more than 15%. This results in a loss to the insurance company as it pays the excess of the strike price over the value of the index. The insurance company could adjust the strike price of the put option to further offset the cost of the call option in part A. By using these options in a building block approach, the company has minimized the effect of unfavorable outcomes while still allowing (up to a certain level) the possibility of gaining from favorable outcomes

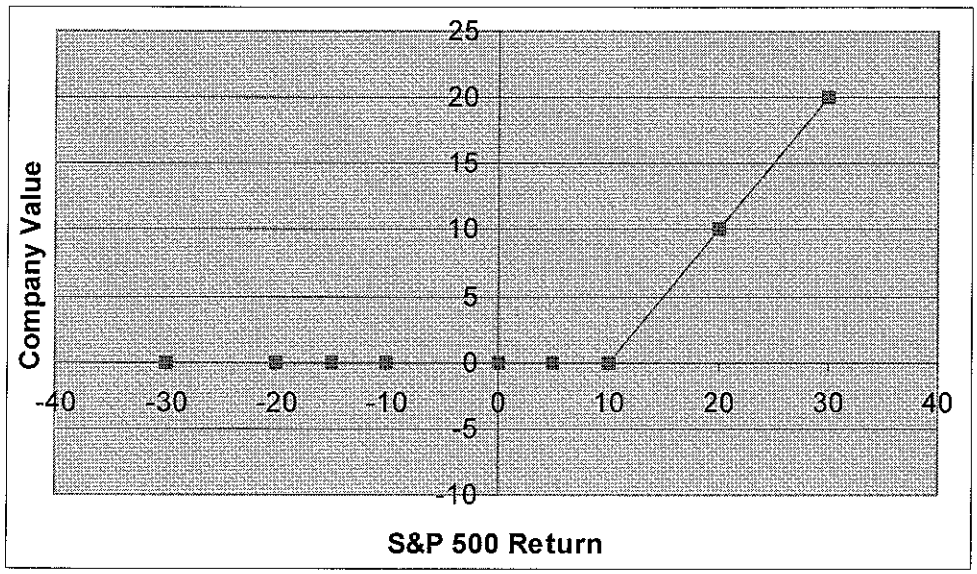
Solution 7 (continued)

(c) Graphs

Impact to company from liability value

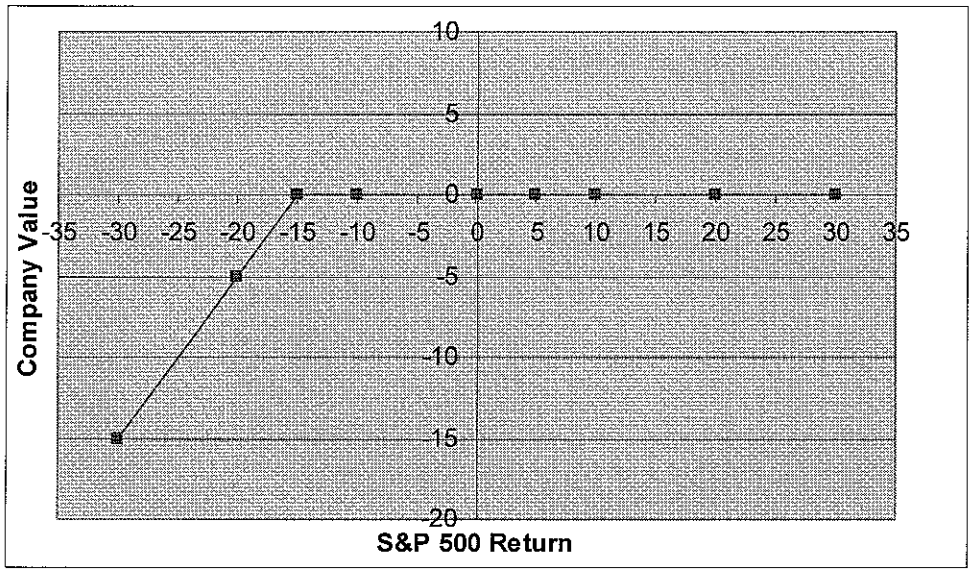


Value of call option / results for Company

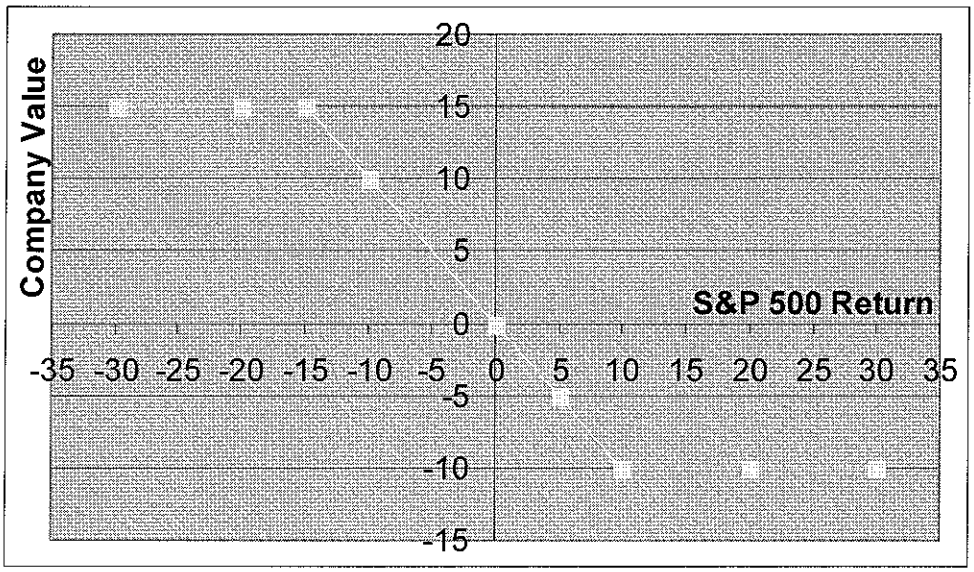


Solution 7 (continued)

Results of writing put option.



Combined results



Solution 8

Fair Value of Liabilities question. Since there is no ready market for insurance liabilities, students should describe other methods for determining fair value. The assumptions were selected to make the calculation of Tug Boat Life's GICs fairly simple. Stronger candidates noted that the discount rate had to be adjusted for the credit premium and liquidity premium

(a)

Use Market Value

Market Value may not be Fair Value:

if market is not deep, wide, and open
if liabilities are not traded freely (i.e., subject to trade restrictions)
if size of transaction can influence value

- but there is no market value for insurance contracts, so not appropriate

Use Market Value of similar instruments

find instruments with same risk profile and related characteristics as the liabilities
construct "measurement portfolio"
-but there is no replicating portfolio for insurance risks, so not appropriate

Use the Present Value of future cash flows, if there is no Market Value available

PV model is flexible, with multiple approaches

if cash flows have no risk, must include adjustment for risk:

1) adjust discount rate
2) use option pricing to weight results across scenarios
3) adjust the cash flows (certainty equivalents)
can reflect multiple risks with this method

include all cash flows that could occur under the contract
include costs incurred in fulfilling obligations

-insurance contracts have risk, so must include risk adjustment
-must reflect all cash flows, including non-guaranteed dividends and floors

Solution 8 (continued)

(b)

$r_A = r_f +$ Credit Premium + Liquidity Premium

$r_A = 4\% + 1.25\% + 0.15\%$

$r_A = 5.40\%$

e =Equity/Liabilities

Equity = Assets – Liabilities = 5% * Assets

Liabilities = 95% * Assets

e =(5% * Assets)/(95% * Assets)=5.263%

$$r_L = r_A - e\left(r_E/(1-t) - r_A\right)$$

$$r_L = 5.4\% - 5.263\%\left(12\%/(1-35\%) - 5.4\%\right)$$

$$r_L = 4.713\%$$

Fair Value = PV of Cash Flows at r_L

$$\text{FVL} = \frac{400}{(1.04713)} + \frac{600}{(1.04713)^2} + \frac{750}{(1.04713)^3}$$

FVL = \$1,582.42 million

Solution 9

Large Integrated question that pulled together Variable Annuities, minimum guarantee risks, hedging and a fund value calculation. The reserve calculation was difficult for many candidates. One of the teaching points for this question was that pricing assumptions are seldom realized and the actuary should understand the source of any differences. Another was that while there are many ways to hedge, perhaps the first question to be asked is whether hedging the risk make sense for the company.

(a)

- EIAs are generally shorter-term contracts than VAs
- EIAs are general account products generally invested in risk free investments with a call option on an index.
- VAs are invested in segregated accounts (i.e., stock funds) and have put option for Guarantee Minimum Death Benefit
- EIAs are typically in the money at maturity and VAs are not.
- EIAs are generally "price" indices and don't include dividends while VAs use total return including dividends, so must compensate for that.

(b)

- Fund Value Calculation
- $F_t = F_{t-1} \times S_t / S_{t-1} \times {}_1p_x \times (1- m)$
- Death Benefit$_t$ = Max$\{0, G_t - F_{t-1} \times S_t / S_{t-1} \times (1 - m)\} \times (1 - p_x)$
- Reserve$_1$ = Max(PV of DB$_i$) where i = 2 to 5 using valuation rate for PV calculation
- Calculation Details

Assumptions at issue

t	0St	0Ft	Exp. DB	PV0	0Gt
0	100	$ 1,000.00	$ -	$ -	$ 1,000.00
1	105	$ 1,029.08	$ -	$ -	$ 1,024.85
2	103	$ 989.36	$ 0.28	$ 0.26	$ 1,050.32
3	112	$ 1,054.38	$ 0.08	$ 0.07	$ 1,076.42
4	120	$ 1,107.18	$ -	$ -	$ 1,103.17
5	135	$ 1,220.76	$ -	$ -	$ 1,130.58
Reserve at T=0 is max PV(0)				$ 0.26	

Assumptions at T=1

1St	1Ft	Exp DB	PV1	$_1G_t$
100	1000			$ 1,000.00
80	$ 784.06			$ 1,024.85
89	$ 853.17	$ 1.32	$ 1.27	$ 1,048.21
100	$ 937.63	$ 0.90	$ 0.83	$ 1,072.09
110	$ 1,008.81	$ 0.56	$ 0.50	$ 1,096.53
120	$ 1,076.42	$ 0.26	$ 0.22	$ 1,121.52

Anticipated Reserve at Time 1 $ 0.27 ***Reserve at Time 1 is max PV(1) $ 1.27***

	t0 Assumptions	t1 Assumptions
Guar Accum Rate	3%	3%
Prob of Death per annum	0.50%	0.70%
Prob of Survival per annum	0.995	0.993
Annual mgmt expense	1.50%	1.50%
Valuation Rate	4%	4%
Actual death rate in yr 1	0.50%	

Solution 9 (continued)

(c)
- Reinsurance – buy options and pass the risk to a 3rd party. This method completely eliminates the risk but most if not all of the profit would be lost with the cost of the reinsurance.
- Dynamic Hedging – Create a hedge that exactly duplicates the value of the expected liability using Black-Scholes. Must continually rebalance hedge. Investment is the cost of the option. The hedge is not perfect so errors erupt.
- Actuarial Approach – Use stochastic simulation to determine a distribution of liabilities from the option. Use long-term fixed rate of interest to discount liabilities.
- Ad-hoc Method – This method is used when there is almost no risk of a liability. This is a very poor method if there is any risk because the size of the liability is very large if there is a claim.

(d)
- Cost of the hedge
- Management expectations of the market
- Additional capital and costs required if there is no hedge
- Size of possible loss
- Is product still profitable with the hedge?
- Extent strategy relies on assumptions about policyholder behavior
- Overhead expenses
- Counterparty risk exposure

(e)
- This product can still be more profitable as new liabilities from today will be priced with today's market and future outlook.
- GMDB does not imply that actual economic losses will be at those levels. Could vary based on actual deaths and market performance.
- Hedging can make a difference in financial and economic terms. Can hedging be done prudently and cost effectively?
- To really analyze product and make recommendations, must do stochastic analysis to support the assumptions.

Solution 10

This 10 point Case Study question required the candidate to apply the material on operational risk from the Lam and Crouhy texts to a product development scenario. The scenario was presented in the case study in a series of e-mails with additional information provided in the stem of the question. While the answer did not require a great deal of writing, it did require the candidate to spend a fair amount of time in synthesizing the information and then logically apply the material to the situation presented. It is expected that this type of question will be more prevalent on future exams. In this particular question there were many candidates who missed the distinction between part a, which focused on the product development process, vs. part b, which dealt with the actual implementation of the product. In addition to the answers provided in the model solution, credit was given for additional risks that were identified as long as they were reasonable, logical, and appropriate to that portion of the question.

(a) Concerns with the product development process include:

1. the time allowed (2 months) seems insufficient for such a complex product
2. the product team is small and did not include disciplines other than marketing
3. complex issues were not thoroughly researched
4. no apparent risk analysis was done
5. it appears model and pricing were done under one scenario

Best practices would dictate the identification of all key business and risk management assumptions underlying the new product. Each of these assumptions should be tested and reviewed. There should also be a full understanding of the implications should any one of the assumptions not meet expectations. In addition pricing should include not only the direct expenses, but also the costs of the risks associated with the product.

(b) Potential risk exposures are:

<u>People</u>

1. training- is the staff, especially the sales staff due to the complexity of the product, sufficiently trained?
2. level of staffing- is there sufficient staff to handle the high volume of transactions expected?
3. capabilities- does the company have the necessary talent to implant this product (e.g. does the investment area have the ability to implement the investment strategy needed)?

Solution 10 (continued)

Process

1. model exposure- is the model used correct and were different scenarios tested?
2. legal issues- is the tax interpretation correct, and what are the implications if it is not?
3. regulatory risk- have the marketing materials been reviewed and are they in compliance with disclosure requirements?
4. capabilities- can we handle the necessary transactions and deliver the required quarterly statements?

Technology

1. readiness- will the system be ready in time?
2. capacity- can the system handle the anticipated volume?
3. capabilities- is the system designed to handle this product?

(c) The key components of an operational risk assessment report are:

1. identification and review of internal and external risk exposures according to a common set of factors
2. a review of interdependencies among risk exposures
3. an evaluation of the likelihood of an operational failure for each of the risk exposures identified
4. an assessment of the severity of the failure of each risk exposure
5. a measure to aggregate the combination of likelihood of operational failure and severity of failure to each exposure and to the overall project.

Solution 11

The first part of this question dealt with basic aspects of an ERM program: benefits - Lam Text - and elements required for its success - Crouhy Text. The second part required the candidate to apply the material to the situation presented. The candidate could find appropriate responses for this part contained in the Crouhy and Lam texts as well as the Moody's study note. Reasonable and appropriate responses drawn from the candidate's own experience and background were also given credit

(a)

1) Benefits of a centralized Risk Management function include:
Risk management function (RMF) increases organizational effectiveness, providing the coordination necessary to make various functions manage risk effectively. RMF better addresses not only the individual risks, but also the interdependence between risks.

RMF eliminates excessive insurance coverage or "overhedging" by taking a portfolio view of risk within the company. This allows the company to formulate an integrated risk transfer strategy that keeps the overall risk exposures at a desirable level.

RMF enables better risk reporting, prioritizing the level and content of risk reporting for senior management. It provides an enterprise-wide perspective on key exposures, develops early warning indicators and avoids inconsistent or contradictory report. RMF minimizes the chance of neglected risks from individual units.

The RMF approach optimizes business performance by supporting pricing and product development. It facilitates key management decisions (e.g. mergers and acquisitions) and supports resource and capital allocation.

2) Elements required for successful implementation:
Elements required for successful implementation of RMF include commitment of top management / sponsorship at the board level. The company needs to establish a clear philosophy for the risk management function by defining the ultimate objectives of the risk management process and clearly laying out both short and long-term deliverables. Ultimately, the goal is to have business units utilize the RMF infrastructure as a management and planning tool.

Sponsor needs to agree on the risk management organizational infrastructure which include:

- Identify the roles and responsibilities of each risk unit
- Agreement on the risk management policies
- Agreement on the risk measurement methodologies
- Build a risk management information system

Solution 11 (continued)

(b)

Titanic faces a broad spectrum of risks which warrants a centralized RMF. These risks include:

The risks associated with any business (market, credit and operational) as well as risks facing a multi-national company. Multi-national risks include currency/exchange risk, regulatory / legal risks in different jurisdictions and geo-political risks.

The particular risks facing an insurance company, including pricing/underwriting risk (new product), liquidity risk, market conduct risk and risks associated with reinsurance contracts. As a multi-line company, Titanic faces additional risks including asset/liability match risk, competition risk, and technology risk.

Solution 12

This question, dealing with the benefits and risks of hedging, was based on the material in the Chew text (Chapter 29). The first part of the question was very straight forward and was taken directly from the text. The second part, which paralleled the example given in the text, required the candidate to determine which hedging strategy may be more beneficial under two sets of different criteria. Candidates were expected to state which hedging strategy would be more appropriate under each scenario

(a) There are three major costs associated with higher variability of earnings and cash flow:

1. higher expected bankruptcy costs
2. higher expected costs to corporate "stakeholders"
3. higher expected tax payments

1) In the extreme case a company with significant amounts of debt could experience a sharp downturn in operating cash flow and be forced to file for bankruptcy. The costs of bankruptcy include direct costs of administration, legal fees, and reorganization and the indirect costs of interference from the bankruptcy court in the company's investment and operating decisions. If the company's shareholders view bankruptcy as a real possibility, then the expected present value of these costs will be reflected in the company's current market value. A risk management program that costlessly eliminates the risk of bankruptcy effectively reduces these costs to zero and increases the value of the firm. Hedging can reduce the variability of cash flow and firm value to the degree that default is no longer possible.
2) Stakeholders who have a large dependence on the financial success of the firm and who can not easily diversify away this large financial exposure (e.g. owners of closely held companies, managers, employees, customers, and suppliers) are likely to require added compensation for the greater risk of their interests being lost because of financial distress. To the extent risk management can protect the investments of each of these stakeholders; the firm can improve the terms on which it contracts with them and so increase firm value.
3) By reducing fluctuations in taxable income, risk management can lead to lower tax payments by ensuring that over a complete business cycle, the largest possible proportion of corporate income fall within this optimal range of tax rates.

Solution 12 (continued)

(b) The low credit rating with the stock options creates a business problem for management. A BBB company faces a significant probability that it will face financial distress. As a result, the cost of having a bet turn sour can be substantial since this would almost certainly imply default. In this case, even if management felt there was an opportunity to profit from its information, selective hedging would not be the prudent course to take and a full cover hedge would make more sense.

The one sided payoff from stock options effectively rewards management for taking bets and so increasing volatility. In this situation, the reduction in volatility from full cover hedging makes management's option worthless or less valuable. By using the selective hedge, management increases the probability of a large stock options payoff if they guess correctly on a shift in oil prices.

Solution 13

In this question candidates were asked to demonstrate their knowledge of credit risk models by calculating the credit spread for a given set of data using two different approaches. This mathematical question required the candidate to apply the material covered in chapters 9 and 10 of the Crouhy Text. Substantial credit was given for stating the approach under each model and defining terms and equations. The third part of the question further tested the candidates' understanding of the material by asking them to contrast the theory underlying the two approaches.

(a)

KMV calc

PV(risk-free CF) = Σ CF(t) x (1 - LGD) x discount factor at risk-free rate

LGD=1 - recovery rate = 1 - 40% = 60%

t=1: $5 x 40% x 0.970874 = $1.941748

t=2: $105 x 40% x 0.942596 = $39.589032

PV(risk-free CF) = $1.941748 + $39.589032 = $41.530780

PV(risky CF) = Σ CF(t) x LGD x (1-Q(t)) x discount factor

t=1: $5 x 60% x (1- 0.02) x 0.970874 = $2.854370

t=2: $105 x 60% x (1- 0.04) x 0.942596 = $57.008206

PV(risky CF) = $2.854370 + $57.008206 = $59.862576

PV = PV(risk-free CF) + PV(risky CF) = $41.530780 + $59.862576 = $101.393356

Bond yield = y such that PV of bond CFs at y equals $101.393356

I.e. 101.393356 = 5/(1+y) + 105/(1+y)^2

using quadratic solution y = (-b +/- sq root { b^2 - 4 x a x c})/ (2 x a)

y = 0.042585

since risk-free rate is 3%, credit spread = 4.2585% - 3% = 1.2585%

Solution 13 (continued)

(b)

Reduced-Form calc

$\lambda(t) = FS(t) / LGD$

LGD=1 - recovery rate = 1 - 40% = 60%

t=1: $\lambda(1) = FS(1)/60\% = 0.90/0.60 = 1.5\%$

t=2: $\lambda(2) = FS(2)/60\% = 1.26/0.60 = 2.1\%$

$P(t) = P(t-1) + (1 - P(t-1)) \times \lambda(t)$

t=1: $P(1) = 0 + (1 - 0) \times \lambda(1) = 1.5\%$

t=2: $P(2) = P(1) + (1 - P(1)) \times \lambda(2) = 1.5\% + 98.5\% \times 2.1\% = 3.5685\%$

$p(t) = (1 - P(t-1)) \times \lambda(t)$

t=1: $p(1) = (1 - 0) \times \lambda(1) = 1.5\%$

t=2: $p(2) = (1 - P(1)) \times \lambda(2) = 98.5\% \times 2.1\% = 2.0685\%$

$Loss = \Sigma$ CF(t) x LGD x p(t) x discount factor at risk-free rate

t=1: \$5 x 60% x 1.5% x 0.970874 = \$0.043689

t=2: \$105 x 60% x 2.0685% x 0.942596 = \$1.228349

\$Loss = \$0.043689 + \$1.228349 = \$1.272038

the credit spread, S, is such that S x PV of CFs at risk free rate equals credit loss

$S \times ((5/1.03) + (105/1.03^2)) = 1.272038$

$S \times 103.826950 = 1.272038$

thus S = 0.012252 or a credit spread of 1.2252%

(c)

KMV

derives default frequency based on Merton model/Black-Scholes

probability of default is a function of the firm's capital structure, volatility of asset returns and current asset value

EDF is firm specific

transition probabilities are embedded in EDF

Reduced-Form Approach

probability for defaults follows a Poisson distribution

timing of default assumed to take bondholders by surprise

default is treated as a stopping time with a hazard process

calibrated using credit spreads that are observable

Solution 14

Question 14 tested the candidate's knowledge with respect to the implementation and monitoring of a risk policy and system. The material for the first part of this question was covered in the Lam text. The second part of the question, which dealt with the internal controls required under the Basle framework, came from the material in the Basle Committee study note. A well prepared candidate was expected to identify and discuss the key elements presented in the material

(a)

First Bank should document Board approved policies setting out the roles and responsibilities for market risk management. The policies should include the following:

- Authority and limits

Who has the authority, for what products, and up to what limits?

- Risk measurement and reporting

  Define measures and reporting. Define periodic reporting and immediate escalation of exceptions (limits or unauthorized trades).

- Accurate valuation (bid, ask, or mid market).

Detail procedures for bids and back testing of model.

- Hedging

What risks are hedged? What instruments are used to hedge? How is hedge effectiveness measured?

- Liquidity Policy

Include plans to address contingencies.

- Exception management (e.g. positions over limit or unauthorized trades)

Monitoring, reporting, approval, and resolution.

Solution 14 (continued)

(b)

An adequately designed system of internal controls with respect to interest rate risk that will be expected of First Bank under a Basle management framework should contain the following concepts:

1. A strong control environment including
   a. Adequate process for identifying and evaluating interest rate risk
   b. Control activities-e.g. policies, procedures, methodologies
   c. adequate information systems
   d. continual review of adherence to polices and procedures
2. Regular evaluation and review that policies and procedures are followed
   a. ensure that procedures accomplish objectives
   b. appropriate follow up where limits exceeded
   c. review by individuals who are independent of the functions being reviewed
   d. changes implemented in a timely manner
3. Periodic review of assumptions, parameters, methodologies
   a. Frequency and extent of review should reflect nature of interest rate exposure
   b. Review should attempt to ensure that risk measurement system is sufficient to capture all material elements of interest rate risk
   c. report should include: quantity and quality of interest rate risk
   d. assessment of documentation and compliance with policies controls, and procedures
   e. assessment of whether assumptions are documented, and accurately processed
   f. assessment of staffing adequacy to conduct a sound risk management process
4. Periodic review by external auditors