AFE Illustrative Solutions
Spring 2008

1.

Learning Objectives:

This question tested the candidate's knowledge about issues that Zoolander would face in meeting its product sales plan and in developing new products.

1 – a. Explain why an insurance institution would develop certain products, and provide an analysis of the product-development process, including the effects of taxation and regulation on product design.
1 – b. Identify all risks, including all hidden and embedded risks, categorize, and evaluate potential sources if risk in products offered by both insurance companies and other financial institutions.

Source(s)
FE-C115-07 Atkinson & Dallas, Life Insurance Products and Finance, Ch. 2, 3, and 13.1-13.4
"Fixed Annuities in a Low Interest Rate Environment", PD Newsletter July 2004

Grader Comments:

Comments are numbered corresponding to the question part they pertain to:

1. Students did not limit their responses to the sales / competitiveness specific impact of a low interest rate environment.
2. While some students provided a more developed response to this question, the poorer students tended to make one statement regarding each of the sections in question 2 rather than provide an explanation / description of elements (i) through (iv). There tended to be limited assessment of these elements in a Zoo specific context. The students did worse on items (iii) and (iv) and much better on items (i) and (ii).
3. A fair number of students got the product development process steps with fewer students commenting on Zoo's adherence to these steps. In general, the assessment / discussion of Zoo specific responses to this question was limited / superficial. Few students developed an argument for whether Zoo did or not adhere to these elements. Instead, students tended to make one or two statements and moved on to the next question.

1. (Learning Objectives) continued

4. Same as 3, students could have done a better job developing a Zoo specific response.
5. Students tended to make brief and limited statements, perhaps indication that this was part 5 of a rather long question? Some of the more obvious statements regarding mortality variation by age, gender, smoking class, etc. were not mentioned by a fair number of students.

Solution:

(a)

(i)

- Sales for VA will decrease and current VA policyholders may surrender their policies.
- Existing policyholders will move monies into GA option to take advantage of guaranteed rates.
- Insurers may need to limit GA options, reduce guaranteed rate on a go forward basis or consider the addition of surrender charges
- Insurer faces revenue risk as M&E base is reduced

(ii)

- EIA may benefit and have an increase in sales as people move from VA to products with downside risk protection
- Insurer may offer first year bonus rate or FY premium bonus
- The embedded guarantees will be more attractive to policyholders are equity market declines

(iii)

- Impact to sales will be increase in competitiveness
- Agents may volunteer to cut commissions
- Insurer will be exposed to reinvestment risk / negative spread
- From a surplus standpoint, valuation rate may exceed pricing

(b)

(i)

- It is important to define the market you wish to serve, ideally this should include:
  - Precise definition / characterization of target market
  - Clear method to reach the target
  - Members of target market should have similar habits, needs, etc
  - Target should be large enough to make it worth targeting
- Doing this will help you design products which are attractive to your target, fit their needs.

1. **(b) continued**

- Avoids developing products:
  - with limited appeal to your target
  - with lack of demand from the market
  - which satisfy the sales / marketing needs but do not satisfy market needs

- For Zoolander:
  - Zoo is targeting more affluent market, this is a new market for Zoo as they typically target the "average man", how well do they know this market?
  - Unsure whether Zoo's agents can reach / serve this market given their specialization in term (but also exposure to VA sales)
  - It is possible that this product is developed to address desires of Sam and Alex rather than market needs

(ii)

- A product should build on the company's strengths / leverage the company's competitive advantages
- Core competencies may include:
  - low cost of capital
  - financial strength
  - operational efficiency
  - u/w expertise and discipline
  - high persistency
  - investment mgmt expertise
  - speed / flexibility / adaptability
  - quality of distribution / control of distrib'n / low-cost distrib'n / sophisticated distrib'n
  - sophisticated home office staff
- Company will not have all these strengths
- Company may need to target new competencies / strengths internally or hire out items that they are not well suited to do themselves

For Zoo:

- While it is clear Zoo is an innovator in term products, they may not have inherent advantages on the immediate annuity
- It is not clear whether Zoo's agents will be able to reach this market, have the sophistication to market to the affluent given their strengths in the middle income markets (term products, GIC)
- Zoo's VA line may be targeted at more affluent market but it is not clear that this market will be attracted to BingBang topic

1. (b) continued

(iii)

- Any new products should be consistent with the company's mission / vision / strategy
- New products should not be a diversion but should be viewed as a major decision with intent to make long term commitment
- Product risks (type of risk, size, concentration) should fit or compliment the company's current risk profile
- Alternately, the risks should be transferred / reinsured / mitigated in a manner which they are managed by parties better suited to do so

For Zoo:

- BBang seems to have been thrown together, no evidence in case study that product risks were assessed / reviewed at a company level to be in line with Zoo risk preferences, mission, strategy, etc.
- No evidence that risks were thoroughly assessed for BBang product e.g. different mortality assumption made for two products covering same insured, this is not appropriate

(iv)

Targeting new markets needs to achieve a balance between (a) enough experimentation to try and discover / develop new opportunities and (b) caution to not stray too far from core competencies / company vision and strategy.

- Too much experimentation can be a distraction.
- Care should be taken to control costs for new products i.e. minimize the expense of learning new lessons / targeting new markets as some of these will fail

For Zoo:

- Zoo is innovator in term life for middle market with some expertise in VA and less expertise in DI
- Term portion of BBang should fit well with Zoo markets but care should be taken to understand the differences between T20/T30 and the new T100 product.
- It is not clear that BBang fits into Zoo's current strategy, it seems like a stretch from current focus on more common forms of term insurance and middle market
- This is evident from difficulties Zoo is having in product development process (i.e. poor assumptions used in pricing document, issues regarding taxation)

1. continued

(c)

Once market research has been done, the next step is to begin preliminary product design. This requires:

- Develop a consensus on as many aspects of the prod as possible
  - No consensus seems to have been achieved at Zoo given the amount of disagreement on tax issue
- Determine the feasibility of the product.
  - No evidence that feasibility study was done showing that product would be economically viable
- Perform preliminary pricing and develop estimates of sales and profits.
  - Some preliminary pricing is presented in the pricing memo but does not consider items like volume of sales
- Perform a cost/benefit analysis and decide whether to proceed to final product design.
  - No evidence that cost / benefit study was done

(d)

(i)

- the team should be comprised of highly competent and knowledgeable people who collectively possess all the needed skills and knowledge required to launch the product successfully
- the "official" product team consists of Danielle Wolfe (VP, Chief Marketing Officer), Teresa Cricket (Field Vice President, Variable Products) and Sam Roach (Field Vice President, Annuity Products)
- although Z is using a team approach which is beneficial, it is only composed of those with marketing expertise
  - this marketing team may be pushing the ESA product as it is a competitive product with high agent compensation, but are not focused on profitability
  - the marketing-only team seems to be unaware or unconcerned with the effect of their decisions on implementation of the new product in light of new regulations and unclear tax effects
- a better team might include people from marketing, actuarial, implementation, and legal abilities
- each team member should have more than a rudimentary knowledge of the tasks and skill sets of the other team members
- the ESA product development team only needs one marketing rep and should have included Wanda Fox (Chief Actuary) and Odette Bird (Administration), with more "official" involvement from Kate Finch/Legal due to the new regulations and tax effects, as well as Investments with regards to the guarantees embedded in the equity-indexed annuity

1. (d) continued

- the team should have the authority, responsibility and accountability to make product-related decisions within broadly defined parameters
- the team should be led by someone who moves the team along quickly, overcomes obstacles w/ other areas of the co., and does not dominate the decision-making process

(ii)

- senior mgmt's primary role should be to give guidance by clarifying how the co's mission, vision, strategy, and goals relate to the product being developed
- they should get involved early in the process, not just for "final review"
- ideally, senior mgmt should intervene only when the team has deviated from guiding principles and should not second-guess the team's decisions
- it does not appear that senior mgmt has played a role in the ESA product development process at all
  - as the ESA is an innovative GIC/annuity product, it does not seem to line up with Z's strategy to innovate in Term Ins and Disability Ins
  - however, in terms of its earnings goals across all product lines, and given the lack of sales in GICs last year, a new product may be necessary to meet production and earnings targets

(iii)

- the ESA product development team appears to have been formed on an ad-hoc basis. However, it should have been comprised of a team representing more areas of practice within Zoo (actuarial, legal, systems, etc.)
- with ad-hoc:
  - there may be no continuity in product development, since the people involved tend to change from product to product
  - the co might not build product development experts, especially ones with insights into several key areas of knowledge
  - without full-time focus, the prod development process tends to be reinvented for each new prod; there is little process improvement; the same mistakes tend to be repeated
  - there is a strong tendency toward interdepartmental conflict

1. **continued**

(e)

(i)

- for accumulation annuities, mort assumptions can range from unimportant to moderately important, depending on the extent of the death benefit
- while some prods may be modeled using mortality based on average issue age, a greater understanding of profitability by age can be gained by pricing a range of issue ages
- both mortality and persistency vary significantly by age
- for investment products, unless a materially higher benefit is paid in the event of death, mortality rates can be added to lapse rates and o/w ignored

(ii)

- for income annuities, the mortality risk is a longevity risk: the risk of living longer than the insurance co expects i.e., for income annuities, using lower mort rates creates a conservative mort assumption
- it is prudent to assume something more than past mortality improvement when pricing income annuities
- sex-distinct mortality tables are normally used, except where unisex rates are mandatory
- mortality assumptions for income annuities are highly dependent on the market for annuities
- since individual annuities are freely purchased, only healthy lives generally choose to purchase life annuities
- standard industry tables exist for individual annuitant mortality but these should be adjusted for company experience

(iii)

- the most important assumption when pricing life insurance product is often the mortality assumption
- the mort assumption determines what could potentially be the most costly policy owner benefit to be paid: death benefits
- mortality can vary significantly by product, primarily because of anti-selection
- mortality varies widely from co to co because of many factors, such as target mkts and u/w standards
- some mortality variations are well known:
  - Females have lower mortality than males, ceteris paribus
  - Non-tobacco users have lower mortality than tobacco users
  - Education and income levels have an effect on mortality
  - Size of policy is an important indicator
- Term to 100 has very low lapse rates, especially at the higher issue ages

2.

Learning Objectives:

This question tested the candidate's understanding of the embedded options facing Zoolander with respect to aspects of the Eagle Joint Venture, including the nature of the risks and how these risks might be hedged, as well as hedge accounting implications.

3 – a. The candidate will be able to analyze a specific company financial situation by demonstrating advanced knowledge of balance sheet and income statement structures.

5 – c. Demonstrate how derivatives, synthetic securities, and financial contracting may be used to reduce risk or assign it to the party most able to bear it.

Source(s)

Hardy, *Investment Guarantees,* Ch. 8, 9 (pp. 157-169), 13
8FE-412-05

Grader Comments:

2 – a. Most candidates gave major topics and not enough details (minor points)

2 – b. Most candidates used lattice method structure, but did not use a risk-neutral approach. Some of the candidates got more than half of the assigned points; most only got about 15% of the assigned points.

2 – c.Most of the points assigned for this question were correctly filling in the values for the given formula and the subsequent intermediate calculated values. Most candidates just wrote down the formula, so little or no points. Some of the candidates got 75% of the assigned points but most got only about 15% of the assigned points.

2 – d. Most candidates gave major topics and not enough details (minor points)

2 – e. Most candidates gave major topics and not enough details (minor points)

2 – f. This was a tough question, and most candidates could not pull the concept together. There were only a few candidates that clearly understood and could apply the formula.

2. continued

Solution:

(a)

(i)

The Zoolander guarantee resembles an investment guarantee because:

- Underlying amount is invested in the 'separate account' rather than in a fixed account
- A put option not unlike a GMMB
- Put option expected to be out of the money at maturity
- Guarantee is not equity-indexed guarantee

(ii)

The bonus fund resembles an equity index guarantee because:

- Provides an indexation benefit
- Underlying amount is not invested in risky asset
- A call option on the performance of the underlying asset
- Call option is expected to be in the money at maturity

(b)

Use risk neutral

$$2P = e^{-2r} E_Q\left[\left(G - S_2\right)^+\right]$$

$$= (0.8869)\left[\left((0)\left(1-p^2\right)\right)+\left((0)(1-p)(p)\right)+\left((40.544)\left(p^2\right)\right)\right]$$

$$= (0.8669)\left[(40.544)(0.3401)\right]$$

$$= 12.23$$

$$P = 6.115$$

(P = 6.153 if G is computed using continuous interest)

Or

Use lattice method
Value at node 1 down is 0, node 2 down is 0, and node 3 down is 20.27 and probability is .583

Portfolio replication relies on the premise that one can take a position in both the risky and risk free assets and balance the mix of these two in your replicating portfolio Zoolander cannot buy/sell units of the risky asset to hedge this position

2. continued

(c)

Using BS formula:

$$
\begin{aligned}
2P &= Ge^{-2r}\Phi(-d_2) - S_0\Phi(-d_1) \\
&= (73.034)(0.8869)\Phi(-0.04) - (100)\Phi(-0.93) \\
&= (73.034)(0.8869)(0.484) - (100)(0.176) \\
&= 31.35 - 17.60 \\
P &= 6.87
\end{aligned}
$$

$$
\begin{aligned}
d_1 &= [\log(S_0/G) + (r + \sigma^2/2)t]/[\sigma\ sqrt(t)] \\
&= [\log(100/73.034) + (0.06 + 0.4/2)(2)]/[(0.6325)sqrt(2)] \\
&= 0.93
\end{aligned}
$$

$$
\begin{aligned}
d_2 &= d_1 - \sigma\sqrt{t} \\
&= 0.93 - (0.6325)\sqrt{2} \\
&= 0.04
\end{aligned}
$$

The value is larger than that arrived at using the risk neutral probabilities

- Volatility
- Lognormal Distribution
- Continuous

(d)

Contains an underlying variable

- Underlying value is “mark to market”

Contains a notional amount or payment provision

- Notional amount is initial capital investment
- Payment provision specifics payment begin at 2011

Requires no initial investment

- No initial payment is made to/from Zoolander
- Eagle makes no initial investment to purchase hedge

Requires net settlement
Exclusion for contracts indexed to one’s own stock and classified as equity
Exclusion for contracts issued in connection with stock based comp arrangements
Exclusion for contracts as contingent consideration resulting from a business combination
Conclusion neither would qualify as SFAS 133 derivatives

2. continued

(e)

Hedgeable risks include

- Market price, interest rate, foreign exchange, credit risk
- Cannot hedge at a macro basis

Hedge Criteria

Formaul documentation, at inception, of

- Hedging instrument
- Hedged item
- Nature of hedged risk
- Hedge effectiveness

At inception and ongoing, the hedging relationship is expected to be highly effective

Hedged item presents an exposure to change in fair value or cash flows that could affect reported earnings

Hedged item is not related to

- An asset or liability that is/will be remeasured with changes in FV attributed to the hedged risk reported currently in earnings
- An investment that is/will be accounted for by the equity method
- A present/future minority interest in a subsidiary
- Present/future equity investment in subsidiary
- Future business combination
- An equity instrument issued by the entity and classified in stockholders equity

If qualifies for hedging, then gains/losses recognized in earnings

Otherwise depends on whether hedge is cash flow / fair value / net investment in foreign operation hedge

- For FV hedge, any difference between FV of instrument and hedge is forced through earnings
- For cash flow hedges, the effective gain / loss on the instrument is reported as other comprehensive income and reclassified into earnings in the same period during which the hedged forecasted transaction affects earnings
- For net investment in foreign operation hedge, the gain/loss is reported in other comprehensive income

2. continued

(f)

Similar to PTP valuation

Where $S_0 = \dfrac{\$100,000,000}{10,000,000} = \$10$

Additional Bonus Benefit: $\{P(1+\alpha(S_2/S_0-1))-G\}^+$

$P = \$0.5\text{M}, G = \$0.5\text{M}, \alpha = 1.5, n = 2$

B = S strike price: $K^{PTP} = \left(\dfrac{S_0}{\alpha}\right)\left(\dfrac{G}{P} - (1-\alpha)\right)$

$$= \frac{10}{1.5}\left(\frac{0.5\text{M}}{0.5\text{M}} - (1-1.5)\right)$$

$$= \frac{10}{1.5}(1+0.5)$$

$$= 10$$

Number of call options: $\dfrac{P\alpha}{S_0} = \dfrac{0.5\text{M}\times 1.5}{10} = 75,000$ options

Cost / Value of option at time 0: $H_0 = \dfrac{\alpha P}{S_0}\left(S_0\Phi(d_1) - K^{PTP}e^{rn}\Phi(d_2)\right)$

$d_1 = [\log(S_0/K^{PTP}) + (r+\sigma^2/2)n]/[\sigma\ sqrt(n)]$

$= [\log(10/10) + (0.06+0.4/2)(2)]/[(0.6325)\ sqrt(2)]$

$= \dfrac{0+0.52}{0.8944}$

$= 0.5814$

$d_2 = d_1 - \sigma\sqrt{n}$

$= 0.5814 - (0.6325)\sqrt{2}$

$= -0.313$

App Value $= \dfrac{\alpha P}{S_0}\left[S_0\Phi(d_1) - K^{PTP}\exp(-rn)\Phi(d_2)\right]$

$$= \frac{1.5\times 0.5\text{M}}{10}\left[10\Phi(0.5814) - (10)\exp(-0.12)\Phi(-0.3130)\right]$$

$$= (0.75\text{M})\left[(0.719) - (0.8869)(0.378)\right]$$

$$= (0.75\text{M})(0.719 - 0.33526)$$

$$= 0.75\text{M}\times 0.3837$$

$$= \$287,808$$

Exp Bonus Pool Value at time $0 = \$287,808 + \$500,000\exp(-0.12) = \$731,268$

3.

Learning Objectives:

This question tested the candidate's ability to apply a rating agency analysis framework to Zoolander's current situation and possible management actions, and anticipate the impact to Zoolander's rating. It also tested more general knowledge about NRSRO's, and how they may or may not be of benefit to Zoolander at this time.

8 – g. Describe the role of rating agencies in evaluating credit risk.
2 – d. Identify the goals and methodologies of rating agencies and how their activities affect financial institutions.
2 – e. Describe how rating agencies affect the choice of capital structure.

Source(s)

FE-C141-07 Role and Function of Rating Agencies
FE-C111-07 Standard & Poor's Insurance Liquidity Model for 2000
FE-C112-07 S&P's Insurance Earnings Adequacy Model
FE-C113-07 New Insurance Capital Model Embraces Trends in Risk Management

Grader Comments:

Section (a) was not satisfactorily answered by most. Most candidates did not attempt to calculate any ratio values using the extensive data given to support their assessment, but did receive some credit for correct qualitative descriptions. Section (b) was not generally answered in sufficient detail. Sections (c) and (d) were generally answered OK.

Solution:

(a)

Cash & ST
Crash: 100% x 5.2 = 5.2
Bleed: 100% x 5.2 = 5.2

CMOs –seqs
Crash: 80% x 463.5 = 370.8
Bleed: 80% x 463.5 = 370.8

NAIC 1 Public Corp Bonds
Crash: 98% x 50% x 2315.2 = 1134.45
Bleed: 100% x 50% x 2315.2 = 1157.60

NAIC 2 Public Corp Bonds
Crash: 96% x 50% x 2315.2 = 1111.30
Bleed: 100% x 50% x2315.2 = 1157.60

3. (a) continued

BIG Public Corp Bonds
Crash: 0% x 1565.5 = 0
Bleed: 25% x 1565.5 = 391.38

NAIC 1 Private 144A Bonds:
Crash: 80% x 25% x 355.3 = 71.06; Bleed: 90% x 25% x 355.3 = 79.94
NAIC 2 Private 144A Bonds:
Crash: 65% x 75% x 355.3 = 173.21; Bleed: 75% x 75% x 355.3 = 199.86
BIG Private 144A Bonds:
Crash: 0% x 575.6 = 0; Bleed: 20% x 575.6 = 115.12

Available Assets Crash = 5.2 + 370.8 + 1134.45 + 1111.3 + 0 + 71.06 + 173.21 + 0 = 2866.02
Available Assets Bleed = 5.2 + 370.8 + 1157.60 + 1157.60 + 391.38 + 79.94 +199.86 + 115.12 = 3477.50

Liabilities
Crash 100% CSV x Surr Factor = 100% x 6500 x SF
Bleed 100% CSV x SF = 100% x 6500 x SF

MVA Liabilities
Crash 100% x 2300 x 45% = 1035
Bleed Same

SC > 5%
Crash 100% x 500 x 60% = 300
Bleed Same

SC < 5%
Crash 100% x 2100 x 90% = 1890
Bleed Same

No SC
Crash 100% x 100% x 1100 = 1100
Bleed Same

Potential Liabilities
Crash 1035 + 600 + 1890 + 1100 = 4625
Bleed Same

Liquidity Ratio = Available Assets / Potential Liabilities

3. (a) continued

Crash Liq Ratio $= 2866.02 / 4625 = 62.0\%$

Bleed Liquidity Ratio $= \dfrac{3477.50}{4625} = 75.2\%$

Both of these are well below the 100% ratio of B (Troubled) co's, including all potential favorable adjustments

Earnings Ration GICS

Ratio = Pre-Tax Earnings / Adjusted Earnings

Adjusted Earnings = Reserve x 0.60% (GIC Factor)

Wtd Avg Ratio = $0.4R(0)+0.2R(-1)+0.2R(-2)+0.2R(-3)$

$$\text{2007 Ratio} = \frac{14.4}{6658.4\left(\text{or } 6671.8\right)\times 0.60\%} = 36.04\%\left(\text{or } 35.97\%\right)$$

$$\text{2006 Ratio} = \frac{\left(\dfrac{13.1}{0.65}\right)}{6296\times 0.60\%} = 53.35\%$$

$$\text{2005 Ratio} = \frac{\left(\dfrac{9.8}{0.65}\right)}{4992\times 0.60\%} = 50.34\%$$

$$\text{2004 Ratio} = \frac{\left(\dfrac{8.8}{0.65}\right)}{4417\times 0.60\%} = 51.08\%$$

$$\text{2003 Ratio} = \frac{\left(\dfrac{6.0}{0.65}\right)}{3012\times 0.60\%} = 51.08\%$$

Wtd Avg Ratio 2007

$= 0.4(36.04)+0.2R(53.35)+0.2R(50.34)+0.2R(51.08) = 45.37\%\left(\text{or } 45.34\%\right)$

Wtd Avg Ratio 2006

$= 0.4(53.35)+0.2R(50.34)+0.2R(51.08)+0.2R(51.08) = 51.84\%$

Zoolander's results for 2007 were weaker than 2006, particularly wrt earnings, and no new business in the GIC operation, both concerns in Kelly's rating, suggesting a downgrade

3. **continued**

(b)

(i)

Advantages

- NRSRO provides independent, credible assessments of the credit-worthiness of securities & issuers
- A rating of Z by C&C would be more credible to potential investors in Z
- NRSRO ratings are increasingly used in safety and soundness and eligible investment regulations for banks, insurance companies and other financial institutions
- Z would benefit from not being excluded as a potential investment (Currently equity, potentially debt in future) by institutions that require an investment-grade NRSRO
- IF Z decided to issue debt, it would be cheaper, more liquid and more successful if it carried a NRSRO rating
- Can potentially get a conditional rating wrt a contemplated M&A / restructuring from NRSRO
- Z could potentially get C&C to rate their investment in Eagle, in advance of a final decision / structure

(ii)

Disadvantages

- Probably a lower rating by C&C
- NRSRO needs more resources for analysis
- Perceived conflict of interest in NRSRO charging a fee

(c)

(i)

More Junk and MBS

- While this would likely raise the earnings ratio in the near term, it would also reduce the liquidity ratio
- It would also reduce the capital ratio by increasing the Required Capital wrt C-1
- It may also increase sales of GICS, and improve profitability, 2 concerns of Kelly wrt the negative implications on their rating
- If the benefits of securing profitable GIC sales in 2008 (no sales in 2007), then this may outweigh the negative impact of the liquidity ratio and capital effect versus the improvement in earnings on a total co basis
- If incremental sales were not realized, this would have a definite drag on rating ratios, and thus on the rating

3. (c) continued

(ii)

Hedge credit risk with CDS

- Hedging credit risk would reduce Z's credit exposure, but also its earnings due to the costs of hedges
- Under the Kelly model, this would cause a drag on the earnings ratio, and potentially new sales, and thus potentially hurt the ratings
- Under the C&C FPC model, Z would get full credit for its hedging program within the GIC portfolio
- On the other hand, the underlying asset portfolio is badly matched wrt existing asset mix, which would likely outweigh any credit risk hedging benefit under the C&C FPC model

(d)

Recommendation

(i)

- Recommend improving A/L matching, risk management techniques, including hedging, with a view to switching C&C ratings to benefit from an NRSRO rating
- C&C rating is more credible, useful in M&A, useful in issuing debt
- Once ALM and robust risk management was in place, Z would benefit from an FPC model approach and enjoy reduced Risk Charges in its non-life businesses

(ii)

- Recommend adding term-matching Junk / MBS allocation in conjunction with removal of mismatched assets by term / direction such as RE, and other illiquid assets
- Try to improve the A/L match to improve Liquidity Ratio, while maintaining Earnings ratio and sales prospects
- Z can afford some additional Capital Risk

4.

Learning Objectives:

This question tested the candidates' knowledge of the financial economic view of Defined Benefit pension plans and its implications for the investment management of Zoolander's Defined Benefit pension plan

5 – Risk Management (on one product or risk)
5 – f. Compare and contrast the risk in the pension plan itself versus the risk of a pension plan on the corporation

Sources:

Accounting / Actuarial Bias Enables Equity Investment by Defined Benefit Pension Plans
Creating Value in Pension Plans (Or, Gentlemen Prefer Bonds)

Grader's comments:

Part (a) is an enumeration on characteristics that candidates either knew or did not. Not too bad for most candidates.
Part (b) the worst part for most candidates, apparently did not know how to apply economic approach
Part (c) Some candidates did learn how to apply approach and correctly provided all details, calculations and formulas
Part (d) answers were not in a format in line with the enumeration requested. Candidates' actual responses adapted to grading outline.
Part (e) here each candidate was able to provide an opinion but did not offer much substantiation.

Solution:

(a)

The accounting / actuarial or "opaque" pricing principles

uses the expected rate of return to calculate cost. It anticipates the risk before the risk is borne and spreads the deviation over several years. It helps to smooth the plans contributions. The difference between the expected and actual experience is amortized over several years. This leads to an overstatement of earnings with apparent higher equity returns with no corresponding risk. Plan managers are more inclined to invest pension assets in equities.

4. **(a) continued**

The financial or "transparent" pricing principles

is based on pricing by arbitrage and the discount rate used is from the hedge asset. For liabilities that are independent, we use a term structure of rate as discount rate. PBGC essentially gives a corporation a put option on value of the defined benefit (DB) pension plan. This implies the DB pension plan should be invested in all equities however investors are taxed higher on bonds (debt) than equity (stock). Corporations maximizes their tax deductibility by contributing more to DB pension plan which implies that DB pension plan should all be invested in debt.

(b)

Treynor's augmented balance sheet

includes asset in DB pension plan in the balance sheet and is treated as a subsidiary. Shareholder would be responsible for any deficiency or excess, and any excess of assets over liabilities would ultimately get to the company through lower future contribution. The company provides the annuity themselves instead of asking the outside annuity company and buys each year accrued benefit for the pension plan by making contribution to it.

(c)

(i)

Market-to-market cost

$$= \left(L_t + P_t - L_{t-1}\right) - \left(A_t + P_t - C_t - A_{t-1}\right)$$
$$= \left(1122 + 122.40 - 1020\right) - \left(901.85 + 122.40 - 15.30 - 850\right)$$
$$= 193.80 - 158.95$$
$$= 34.85$$

$$224,40 - 158,95 = 65,45$$

(ii)

Investment return on assets

$$A_t + P_t - C_t - A_{t-1} = eA_{t-1}$$
$$e = \frac{850}{158.95}$$
$$= 0.187$$
$$= 18.7\%$$

4. (c) continued

(iii)
Return on Liabilities

$$L_t + P_t - SC_t - L_{t-1} = rL_{t-1}$$

$$r = \frac{193.80}{1020}$$

$$= 0.19$$

$$= 19\%$$

(iv)
Annuity company gain (loss)

$$= (L_t + P_t - SC_t - L_{t-1}) - (A_t + P_t - C_t - A_{t-1})$$

$$= 193.80 - 158.95$$

$$= 34.85$$

(d)

1 A

- In the long run equities are not as risky as they appear to be in the short run
- Equity returns are not as volatile in the long term. This is mean-reverting model and using bonds will mean we need larger contributions.

C

- It ignores arbitrage theory and supports perpetual money machine.

2 A

- Even though equities are risky in the short run, the actuarial process is self-correcting and does not get far off course when mkt setbacks occur. The S-T effects on plan assets are troubling but the impact is deferred and we usually catch up sooner.
- This is a combo of the L-T argument and a reliance on the enabling actuarial technology

C

- This combo can be no stronger than the L-T argument alone and the "pension crisis," also described as "the perfect storm" challenges the robustness of the actuarial process in the fact of prolonged economic recession.

4. **(d) continued**

3 A

- We take our fiduciary responsibility seriously. We understand that the pension scheme serves many stakeholders and prudent application of portfolio selection theory tells us to diversify across asset classes as well as across indiv securities

C

- This misrepresents the interests of plan participants and misinterprets fiduciary responsibility in most venues. It is clear that a liability-matching bond portfolio meets fiduciary responsibility.

(e)

Either (i) or (ii)

(i)

Choose Peter and Juan's proposal

Zoolander has experience with fixed income assets but less with investment therefore their investment expertise can be used. The external fees can be reduced from 150bp to 120bps. Save management fee paid to Evergreen Asset Management, FAS 87 accounting may change to reflect fair-value treatment. They could move to a duration matched portfolio with bonds for better cash flow matching. They can take advantage of tax deduction and improve the risk profile in the company. If they shift to investing 100% in bonds then this will help capture benefits of Tepper Black arbitrage and improve the risk profile on the plan.

(ii)

Maintaining status quo

Zoolander has no expertise in transitioning an equity portfolio to a fixed income one. Pension expense is recognized under SFAS87 but pension assets & liabilities are merely disclosed in the footnotes – the lesson is that the presentation of info can be as or more important than its content. It is hard to get Board of Directors to agree to invest in all fixed income.

5.

Learning Objectives:

This question tests the basic structure of a securitization of life/annuity liabilities, as well as credit enhancements available to such transactions (last part). It is basically a list question with very little application.

2 – Capital Funding and Structure
2 – h. Describe the process, methods and uses of insurance securitizations and recommend a structure that is appropriate for a given set of circumstances.

Source: SN FE-C118-07, pp. 193-216

Grader Comments:

(a) Most passing candidates defined securitization as repackaging, few mentioned isolation of pool.

Most candidates listed 4 or less reasons for economic rationale. Fewer listed downsides (mainly cost).

(b) Most passing candidates listed several examples, mainly VIF and reserve funding. Should give more detail on descriptions.

(c) Almost all candidates omitted, or mis-stated, discussion of what is securitized –difference of actual and expected annuity payments.

Most passing candidates answered by drawing a diagram, listing Luxor Re, SPV and investors. Better answers gave more detail on the cash flows between the parties.

(d) Most passing candidates mentioned credit enhancement protects from market value risk, fewer mentioned protection of originator default.

Candidate typically listed examples of over-collateralization and credit insurance. Many candidates named collateralization (not appropriate, since protection given by over-collateralization, more assets than necessary).

Most candidates failed to distinguish between internal and external, nor listed enough examples.

5. continued

Solution:

(a)

At the general level, i.e., not specific to Luxor Re's situation, provide a brief description of what securitization is, including the economic rationale for securitizations and the downside of securitizations.

Isolation of a pool of assets or cash flows, repackaged into securities for trade in the capital markets.

- Economic Rationale
  - Creation of new classes of securities
  - Facilitates risk management
  - Add liquidity to financial market
  - Improve market efficiency and capital utilization
  - Unlock embedded profits in a block of business
  - Reduce cost of capital, increase ROE, improve other operating measures

- Downsides
  - Complex transactions
  - Costly to analyze and structure
  - Must release sensitive information

(b)

List and describe the primary categories of securitization for life insurance assets and liabilities.

- Future cashflows of a block (VIF) – open and closed blocks for demutualization
- Reserve funding – ease regulatory reserve requirements (XXX or AXXX)
- Life Insurance risk transfer – mortality, longevity, lapse
- Pure asset – package assets and sell cash flows (commercial mortgages)
- Viatical and life settlements

(c)

Outline a structure that would enable Luxor Re to securitize the future cash flows of the inforce business in order to realize some of the block's future profits immediately. Identify the parties to the transaction and describe the cash flows and role for each party.

5. (c) continued

Luxor Re securitizes the expected margin – the difference between the expected payments and the actual payments.

Parties and cash flows

- Luxor Re
  - Reinsures the longevity risk from the direct writer (receives expected, pays actual).
  - Assigns longevity risk cash flows to SPV.
  - Receives cash from SPV.
  - Purchases credit enhancement from 3rd party guarantor.

- Special Purpose Vehicle
  - Assigned longevity risk cash flows from Luxor Re.
  - Pays cash to Luxor Re as compensation for future longevity risk cash flows.
  - Repackages future longevity risk cash flows as securities, issues securities to capital markets.

- Investors
  - Receives payments from securities issued by SPV.
  - Pays cash for securities to SPV.
  - Receives payment from 3rd party guarantor in event of default.

- 3rd Party Guarantor
  - Receives premium from Luxor Re for providing guarantee.
  - Makes payment to investors in event of default.

(d)

(i)

Explain the purpose of credit enhancement in securitization.

Protects investors from

- risk originator will default on obligations to investors of securitized assets.
- risk market value of original assets backing securitizations will decrease.

5. (d) continued

(ii)

Describe how the following types of credit enhancement could be utilized in the Luxor Re transaction you described in (c), and give examples of each type of enhancement:

- Internal credit enhancement

- Overcollateralization – value of assets backing securitization is larger than amount securitized.

- Subordination – multiple classes / tranches in securitization, with lower classes absorbing extra risk (for higher return).

- External credit enhancement

    - Credit Insurance
    - Surety Bonds
    - Letters of Credit

- Issued by 3rd party financial institution (insurance company or bank) to guarantee the securities issued.

6.

Learning Objectives:

7 – f. Describe operational risks and governance issues including market conduct, audit, and legal risk.

8 – e. Define credit risk as related to derivatives. Define credit risk as related to reinsurance ceded counter party risk. Describe the use of comprehensive due diligence and aggregate counter-party exposure limits.

Solution:

(a)

Most candidates were able to give the main points

Operational risk

- Need expert workers
  - find employees with derivatives expertise
  - training program
- Systems
  - need adequate systems in place
  - must be able to mark-to-market and measure all material sources of risk
- Authorities
  - need management with knowledge and authorities
  - controls and guidelines in place

Credit risk

- Aggregate credit measurement
  - use netting with each counter party
- Use master agreements that track all positions with each counterparty
- Credit enhancement
  - use instruments like letter of credit and swaps to minimize counterparty risk
  - credit default swaps, total return swaps, etc.
  - structural credit enhancement via special-purpose vehicles to conduct derivatives business
- Measuring credit exposure
  - current and potential exposure
  - replacement cost

6. (a) continued

Other risk

- practices by end-users
- promoting enforceability
- Accounting practices
- Disclosures
- Recognizing netting

(b)

Most candidates were able to give 3 out of 5

Board of Directors should

- have finance and investment committees
- understand investment approach of management
- determine the aggregate risk tolerance
- review the policies and procedures used by senior management
- monitor whether the policies are carried out
- approve major investment decisions and investment policy changes
- But management should handle day-to-day investment decisions

(c)

Not very well answered, answers were all over the place, most had the steps taken but not the rest

Steps:
Static replication of GMIB

- Replicate annuity payments with readily available traded options
- Usually involves a swaption
- Swap variable rate annuity for fixed annuity based on guaranteed annuity rate
- Ex: swap bond paying LIBOR for fixed-rate bond

Complications:

- Payment is level as opposed to principal and interest payments
- Payment is life contingent
- Payment depend on separate account value at maturity
- Counterparty risk (risk that option provider may default) is substantial for long-term options

6. continued

(d)

Most candidates did well on this part.

Traditional way: collateral insurance, third party guarantee, mark-to-market
Credit derivative: total return swap, credit options
Master agreement and netting
Limit and control policy, concentration risk management
Enhance sharing of information between counterparties
Integrate analytical framework to evaluate effects of leveraging on market risk
Factor in liquidation costs
Enhance qualify of info to senior management
Improve standards industry documents and internal controls for documentation

(e)

The candidates that attempted this part got all the points, but most did not try it.

	Counterparty A	Counterparty B
Add-on amount:	Option: 6% x 500 = 30 Swap: 0.5% x 1000 = 5	Option: 6% x 800 = 48 Swap: 0.5% x 500 = 2.5

Risk-weighted amount without netting

	Counterparty A	Counterparty B
Total add-on amount	30 + 5 =35	48 + 2.5 = 50.5
Gross replacement cost	0 + 300 = 300	200 + 0 = 200
	335	250.5

Risk-weighted amount = (total add-on + gross value) x risk capital weight

	335 x 30% = 100.5	250.5 x 40% = 100.2

Risk-weighted amount with netting

	Counterparty A	Counterparty B
Net liquidation value	-100 + 300 = 200	200 – 250 = -50 (min 0)

Net replacement ratio = net liquidation value cost over gross replacement

	200 over 300 = .67	0 over 200 = 0
Total add-on amount	35 x (40% + 60% x .67) = 35 x 0.8 = 28	50.5 x (40% + 60% x 0) 50.5 x 40% = 20.2
Risk weighted amount	(200 + 28) x 30% = 68.4	(0 + 20.2) x 40% = 8.08

7.

Learning Objectives:

This question tests how an individual's behavioral characteristics can influence their investment decisions and a firm's management decisions. It is basically a list question straight from the study note with minimal application.

2 – Capital Funding and Structure
2 – f. Describe how behavioral characteristics and biases of users and providers of capital affect the capital structure.

Source: SN: 8FE-C114-07, pp. 6-11, 18-22

Grader Comments:

Candidates did well on part A with most being able to list at least 3 reasons and a supporting sub-point about that reason.

For part B, many candidates did not answer this from a behavioral finance perspective. They made many statements about dividends in general but few answers had a focus from the behavioral finance perspective.

Candidates did very well on part C-iii) with most picking up the points for this section. Responses for C-i) and C-ii) were less complete with most candidates only getting points for 1 or 2 of the bullet points.

Solution:

(a)

Overconfidence

- People overestimate their abilities
- Mutual fund managers are overconfident in their investment abilities

Non-Bayesian Forecasting

- People appear to make probability judgments using "similarity" or what they call the "representative heuristic"
- Leads to giving too much weight to recent evidence and too little weight to the base rate or prior odds

Loss Aversion, Framing and Mental Accounting

- Loss Aversion – Losses are weighted more than gains
- Framing – Decision Making is sensitive to the description of the action choices
- Mental Accounting – Individuals create their own frames

7. **(a) continued**

Also accept: Fashions / Fads or Regret / Responsibility / Prudence with definitions in lieu of any of the above

(b)

(i)

Dividends are paid because investors want them more than capital gains even though dividends are taxed at higher rate than capital gains

- Mental accounting - savored as a separate gain when stock prices rise and mitigate stock price decline
- Avoids anticipated regret of selling a stock that has risen in value
- Subsequent elimination of "special" dividends is not experienced as a loss

(ii)

- Stock dividends create image of an actual dividend without a dollar payout
- Dividend smoothing helps to minimize adverse stockholder reactions

(c)

(i)

Management compensation is related to firm size

Hubris (overconfidence) – management feels they can run target firm better than target firm's management

Job security

(ii)

Struggling firm – perhaps caused by information problems, agency costs and mindset of managers

Even when managers do acknowledge the requirement for exit, it is difficult for them to accept and to initiate the shutdown decision

(iii)

Target firm shareholders typically do well when their firm is acquired

Acquiring firm shareholders do not appear to make any money, and may in fact lose wealth

8.

Learning Objectives:

6c – Describe various regulatory/industry frameworks: Basle II, Sarbanes-Oxley Act, OSFI Supervisory Framework, OSFI Standard of Sound Financial and Business Practices, UK FSA guidelines, and COSO.

6d – Understand the perspectives of regulators, rating agencies, stock analysts, and company stakeholders and describe how they evaluate the risks and the risk management of an organization.

Source

Crouhy, Risk Management, Ch. 2 for Basle
The Financial Reporter, Dec. 2004, "Actuarial Aspects of SOX 404"
The FinReporter, 12/04, "Responsibilities of the Actuary for Communicating Sarbanes-Oxley Controls"
FE-C133-07 (formerly 8E-700-04), Internal Control – Guidance for Directors on the Combined Code
ERM Specialty Guide
FE-C129-07 (formerly 8E-707-04), Basle Committee – Principles for the Mgmt of Interest Rate Risk
FE-C135-07 (formerly 8FE-408-03), Financial Oversight of Enron
FE-C137-07 (formerly 8E-705-04), Moody's looks at Risk Management and New Life Insurance Risks

Grader Comments

The idea behind the first half of the question (Sections a-c) was for a candidate to be able to analyze the differences between internal controls regulation in Canada and the US. In this case however, the rules are so universal that the question was requesting the details of each and then a realization by the student that the rules are nearly identical.

However, the results on this part were poor. Section c was not answered by the majority of the candidates because they could not draw distinctions or similarities between a and b. Students did better on part b and were able to get most of the points.

Part d then addressed measuring the effectiveness of your control system once it is implemented. Candidates did not demonstrate much knowledge of this part of COSO.

8. (Learning Objectives) continued

Part e and f. Addressed what can go wrong with internal control and why stakeholders would want ERM. Section e was answered by virtually everyone but most contributed a lot of facts without getting to the meat of the question. Section f was a lot of rambling but most candidates concluded that shareholders were better off; only few commented on benefits to policyholders. Many candidates talked about dampening volatility of earnings, for which some credit was given.

Overall, on this question most candidates did poorly and only showed cursory understanding of the basics and not much depth or applicable knowledge.

Solution:

(a)

Internal controls on interest rate risk include evaluation of the system's effectiveness, compliance with policies and procedures, reporting review to senior management or board of directors and having an independent review. The review should consider vulnerability to yield curve, basis risk and optionality.

(b)

Key steps for evaluating controls in actuarial processes are:

- Determine which actuarial processes are material to financial statements
- Identify risks, including those in the data, the actuarial systems, the compilation process and management review
- Document controls, e.g. peer review, trending, password protection
- Evaluate controls
- Identify and correct deficiencies
- Report on internal control
- Conduct an independent audit

(c)

The controls for banks and insurance companies are nearly identical.

(d)

The components of COSO that apply to evaluating effective internal controls are: setting up a controlled internal environment; objective setting; event identification; risk assessment; risk response; control activities; information and communication; and monitoring.

8. continued

(e)

Errors made by General American include: selling a highly credit and market sensitive product; dependence on a weak reinsurer; and inadequate liquidity. Errors made by Enron include fraud by management, questionable accounting practices and failure by auditors and rating agencies to recognize problems. These problems can be resolved by setting up internal controls consistent with SOX requirements.

(f)

Shareholders benefit from ERM because active risk management can increase shareholder value, the cost of capital is lower, uncertainty is reduced, and agency costs are lower. Policyholders benefit from ERM because they are more confident in the company's ability to meet its obligations.

9.

Learning Objectives:

This question attempts to illustrate how GAAP ROE can be a misleading performance measure relative to earned rates on embedded value. Specifically, it's shown how a financial shock affects all future years' earnings under GAAP, but only the year of the shock under EV. It basically follows the example set forth in the source, but with numbers changed.

2 – Capital Funding and Structure
2 – b. Evaluate various profitability measures including IRR, NPV, and ROE, etc.

Source

Michelle D. Smith, "Investor & Management Expectations of the 'Return on Equity' versus Some Basic Truths of Financial Accounting", 03 The Financial Reporter, 9/03, pp. 34-38

Grader Comments:

Overall, most students were able to state the definition for Distributable Earnings and ROE. Very few students calculated the DE at issue. Several students used GAAP Equity at end of period instead of GAAP Equity at end of period.

For Part A, students who answered the question were able to state the 2 main points; very few students provided further details on the subpoints.
For Part B, most students were able to state the EV definition. Very few students calculated EV for each year; Very few students showed work for the Earned Rate Calculation.
For Part C, most students calculated DE and ROE. Very few students calculated EV and the EV earned rate. Most students were able to state how the shock lapse affected ROE and EV earned rates.

Solution:

(a)

(i)

Distributable Earnings = Statutory Earnings – Increase in Target Surplus

	At issue	1	2	3	4
Distributable Earnings	– 1000	250	400	350	330
	0–(1000–0)	0–(750–1000)	150–(500–750)	199–(250–500)	80–(0–250)

9. (a) continued

(ii)

ROE = GAAP Income / GAAP Equity at beginning of income period

	1	2	3	4
ROE	15.0%	11.1%	6.7%	13.8%
	150 / 1000	100 / 900	40 / 600	40 / 290

(b)

(i)

ROE varies from IRR from year to year. In years where ROE > IRR (ROE < IRR), management may think product is performing better (worse) than target. Variation could be due to good or poor actual experience.

(ii)

Different policies will contribute different ROE's depending upon which policy year they are currently in. Thus, the calendar year ROE is a weighted average of the policy year ROE's of the inforce distribution.

(c)

(i)

Embedded Value = NPV (IRR, Distributable Earnings)

	At issue	1	2	3	4
Embedded Value	1,000	870	575	295	0
	$NPV(12\%, DE_1 : DE_4)$	$NPV(12\%, DE_2 : DE_4)$	$NPV(12\%, DE_3 : DE_4)$	$NPV(12\%, DE_4 : DE_4)$	

(ii)

Earned Rate = discount rate = IRR in all years = 12.0%

(d)

(i)

	At issue	1	2	3	4
Distributable Earnings	– 1000	250	600	210	198
	0 – (1000 – 0)	0 – (750 – 1000)	150 – (300 – 750)	60 – (150 – 500)	48 – (0 – 150)

	1	2	3	4
ROE for each year	15.0%	11.1%	0.0%	4.2%
	150 / 1000	100 / 900	0 / 400	8 / 190

9. (d) continued

(ii)

	At issue	1	2	3	4
Embedded Value	1,000	870	345	177	0
	$\text{NPV}(12\%, \text{DE}_1 : \text{DE}_4)$	$\text{NPV}(12\%, \text{DE}_2 : \text{DE}_4)$	$\text{NPV}(12\%, \text{DE}_3 : \text{DE}_4)$	$\text{NPV}(12\%, \text{DE}_4 : \text{DE}_4)$	

Embedded Value earned rate for each year

	At issue	1	2	3	4
$= \frac{(\text{DE}_t + \text{EV}_t)}{\text{EV}_{(t-1)}} - 1$		12.0%	8.6%	12.0%	12.0%
		$\frac{(250+870)}{1000} - 1$	$\frac{(600+345)}{870} - 1$	$\frac{(210+177)}{345} - 1$	$\frac{(198+0)}{177} - 1$

(iii)

ROE drops after shock for all years,

GAAP equity is only partially affected by shock lapse. DAC part of equity not affected.

GAAP income is entirely affected by shock lapse.

Embedded Value earned rate drops only at the point of the shock lapse (at the end of year 3), Future years' earned rates are unaffected.

10.

Learning Objectives:

The idea behind this question was to create a different underlying distribution in order to challenge the candidates to apply the CTE in a new environment.

7 – d. Explain how risk metrics can be incorporated into the risk monitoring function as part of an ERM framework
7 – e. Describe means for managing risks and measures for evaluating their effectiveness.

Source:

Hardy, Investment Guarantees – ch. 4, 6, 9, 12
Doherty, FE-115-, Ch. 8: Duality and Globality

Grader Comments:

Part (a) (i), most students understood this part fairly well. The most common error was forgetting to divide by 35 or 10.
Part (a) (ii), most students understood this part fairly well. The most common new error was limits of integration
Part (a) (iii), students were challenged by this part but once the idea was grasped they seemed to understand the next steps
Part (a) (iv), most students did not comment on adequacy
Part (b) (i), many students were able to obtain these values
Part (b) (ii), many students were able to obtain these values. Often an integral method was used for determining the mean
Part (c), some students who proceeded to this part were able to make one or two relevant comments
Part (d), few students proceeded to this part. Some were able to complete the work, many did not grasp the ideas.

Solution:

(a)

(i)

Reserve and Capital of Product A

$$\left(\int_{65}^{90} 2160 - 24x = 2160x - 12x^2 \Big|_{65}^{90}\right) + \left(\int_{90}^{100} 24300 - 3x^2 = 24300x - x^3 \Big|_{90}^{100}\right)$$

$$= 7,500 - 28,000 = -20,500$$

$$\text{CTE 65 reserve} = \frac{20,500}{35} = 585.71$$

$$\text{CTE 90 – Capital} = \frac{28,000}{10} = 2,800.00$$

10. (a) continued

(ii)

Reserve and Capital for Product B

Note the worst 10% is from 0 to 10.

CTE 65 – Reserve

$$\left(\int_0^{35} 20x - 400 = 10x^2 - 400x \Big|_0^{35} \right) = -1750$$

$$\text{CTE 65 Reserve } = \frac{1750}{35} = 50$$

$$\left(\int_0^{10} 20x - 400 = 10x^2 - 400x \Big|_0^{10} \right) = -3000$$

$$\text{CTE 90 – Capital } = \frac{3,000}{10} = 300$$

(iii)

Capital Requirement is 2,800 + 300 = 3100

Positive results except in the tail when $x > 90$ and $x <= 100$. Results descending as x increases

$$24,300 - 3x^2 + 20x - 400 = -3,100$$

$$3x^2 - 20x - 27,000 = 0$$

using quadratic roots

$$x = 98.2602057726736$$

Approximately 1.75% of the time it is inadequate

(iv)

Normally you would expect capital to cover over 99% of the scenarios thus total capital is inadequate.

10. continued

(b)

(i)

VAR can be defined as mean – variance $= \text{mean} - 2.33 \times 1,405$

Expected Value

$$\left(.01 \times \int_0^{90} 2160 - 24x = 2160x - 12x^2 \Big|_0^{90} \right) + \left(.01 \times \int_{90}^{100} 24300 - 3x^2 = 24300x - x^3 \Big|_{90}^{100} \right)$$

$$= \frac{(97,200 + 28,000)}{100} \quad \text{mean} \quad 692.00$$

VAR $692 - 3,274 = (2,582)$ suggest capital of 2,582

Monte Carlo VAR for Product A

$24,300 - 3 \times 99^2 = (5,103)$ Suggests capital of 5,103

(ii)

Calculate a 99% VAR for Product B

Mean is $20 \times 50 - 400 = 600$

Parametric Var $= 600 - 1,344 = -744$ suggest Capital of 744

Monte Carlo method

Value for the 99th percentile occurs at $x = 1$

$20 \times 1 - 400$ suggests capital of 380

(c)

(i)

	90 CTE	Parametric Var	Monte Carlo Var
Product A	2,800	2,582	5,103

The VaR and the CTE produce very similar results.
The Monte Carlo Var however suggests a much larger tail.
VaR is not a good metric for something with large tail risk because it is only based on standard deviation.
90 CTE not adequate in this situation.

(ii)

	90 CTE	Parametric Var	Monte Carlo Var
Product B	300	744	380

The 90 CTE produced a smaller requirement than either VaR
Parametric VAR is conservative metric for this since there is not a large tail risk.
The 90 CTE would not be adequate for this a stand alone product. Only enough 95% of the time.

10. **continued**

(d)

(i)
Shareholders

$$.01\times\int_0^{100}\max\left(20x-400-300,0\right)dx=10x^2-700x\Big|_{35}^{100}$$

(ii)
Bondholders

$$.01\times\int_0^{100}\max\left(0,\min\left(300,20x-400\right)\right)dx=0\Big|_0^{20}\quad 10x^2-400x\Big|_{20}^{35}+300\Big|_{35}^{100}$$

(iii)
Govt Guarantee on Bankruptcy

$$-0.9\times.01\times\int_0^{100}\min\left(20x-400,0\right)dx=10x^2-400x\Big|_0^{20}$$

(i) Shareholders	422.5
(ii) Bondholders	207.5
(iii) Govt. Guarantee on Bankruptcy	36
(iv) Pholder Losses on Bankruptcy	4

11.

Learning Objectives:

This question tests the students' ability to apply fair value valuation to simple insurance liabilities and assets, as well as to recognize the insensitivity of book values to changing market conditions. It also illustrates the distortion that book value accounting can have in changing market conditions.

4 – Measuring Value
4 – a. Compare and contrast different approaches to the fair value of insurance liabilities
4 – b. Apply an appropriate fair value methodology in a given situation

Source

SN 8FE-320-01, pp. 154-167

Grader Comments:

In general, this was a great question as it distinguished pretty clearly the students who knew the material versus others. Students did well on parts (a) and (b) and struggled in part (c) (ii). Most got only few partial points on (d).

Most students did well on part (a). Almost all students got the constant graphs. Graphs for part (iii) and (iv) were not always perfect, but partial marks were given if the slope and convexity were correct.

For part (b), most students got part (i) and struggled on part (ii).

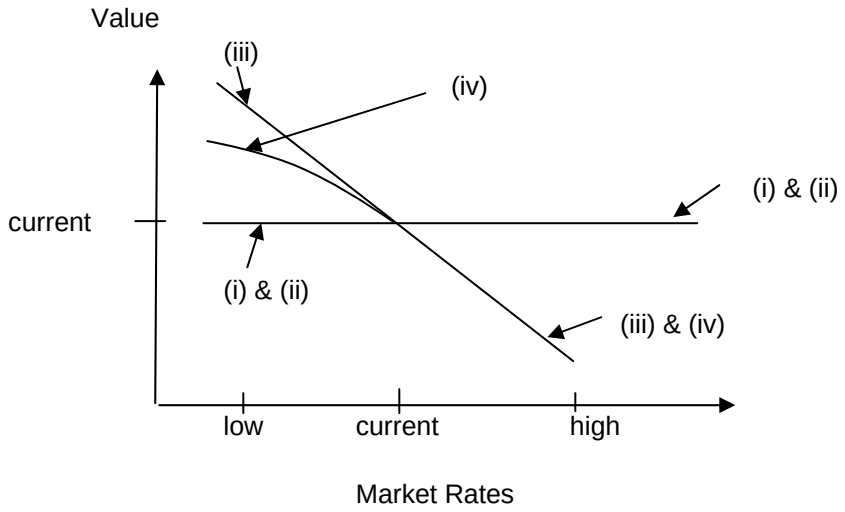
For part (c), most students got part (ii). A few received full marks on part (i), still many got partial marks for writing down correct comments.

For part (d), surprisingly very few got the total return definition correct. They seem to have confused this with another part of the material but most recognized that liabilities have no measures for realized and unrealized gains and losses.

11. continued

Solution:

(a)



(i)
Not a function of market rates, so constant.

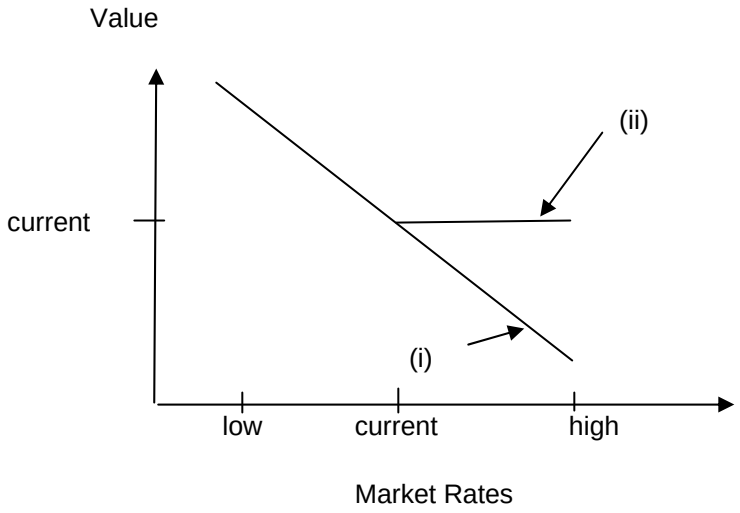
(ii)
Not a function of market rates, so constant

(iii)
Decreasing market value for fixed rate bonds in increasing market rate environment

(iv)
Call feature depresses market values at lower market rates; traditional bond behavior at lower rates (increasing value)

11. **continued**

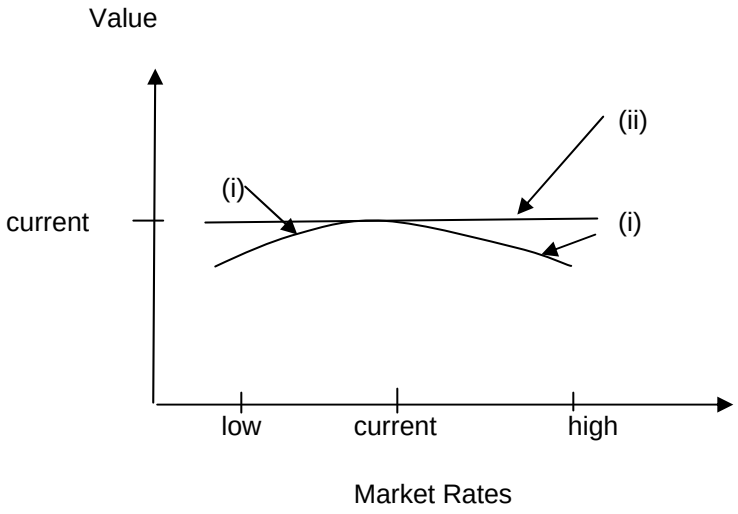
(b)



(i)
Fixed rate GIC value decreases with increasing market rates

(ii)
Surrender feature floors GIC value at higher market rates, since investors can essentially "put" the GIC back to the issuer when market rates increase

(c)



11. (c) continued

(i)

- Asset market values depressed at low market rates due to call features on corporate bonds
- Liability market values increased at higher market rates due to surrender feature on the GIC's which allow surrenders

(ii)

Book surplus values are flat since both book asset and liabilities values are flat

(d)

- Income + Realized Gains + Unrealized Gains
- No measures for realized and unrealized gains for the liabilities
- Encourages management to focus primarily on short-term income instead of on total returns for assets and liabilities
- Encourages management to take additional risks

12.

Learning Objectives:

This question tests capital management via the assumption reinsurance transaction. Financial statement implications of this transaction were tested too.

5 – Risk Management
5 – a. Identify and describe means for transferring risk to a third party, and to identify the costs and benefits of doing so.

Source: Ch. 16, Reinsurance by Tiller, pp. 437-450

Grader Comments:

For Part A, a few candidates were able to give the main points

For Part B, policyholder behavior was not described adequately by majority of candidates.

For Part C, a few candidates provide the majority of the reasons why the transaction can be favorable for Bally Life.

For Part D, most of candidates were able to provide changes on company balance sheet.

For Part E, the free capital calculation was not done properly by a majority of candidates.

For Part F, a few candidates were able to give the main points

Solution:

(a)

- Relationship to the policyholder shifts to the assumption insurer
- Under indemnity reinsurance, the customer relationship remains with the ceding company
- Policyholders approval of transfer
- A sale of a block of business to another company. Not so for indemnity reinsurance.
- Free up cash and capital to reinvest in life business
- Able to exit the annuity line of business

(b)

- Agents can get clients to change to companies they represent
- Usually shock lapse

12. continued

(c)

- Bally may have excess surplus
- Able to buy market share

(d)

Balance Sheet after transaction:

Assets	
General Account (GA):	$50000 - 2000 + 1000 \times (1 - \text{tax rate}) = 48650m$
Separate Account (SA):	0
Liabilities (GA):	$40000 - 2000 = 38000m$
Liabilities (SA):	0
Equity:	$10000 + 650 = 10650m$

(e)

(i) & (ii)

Required Capital (RC) Life $= 6\% \times 38000 = 2280$
Required Capital (RC) SPVA $= 8\% \times 12000 = 960$

Total RC = 3240

Target Total Capital $= 300\% \times 3240 = 9720$
Free Capital = $280m$

(f)

- VA business has higher required capital than life business
- Payment of \$5 billion represents monetarization of expected future profits of the SPVA business

13.

Learning Objectives:

This question tests the application of real options in an insurance environment, including the options for abandonment and contraction. The answer closely follows the example set forth in the text.

2 – Capital Funding and Structure
2 – a. Calculate the cost of capital for a venture using the most appropriate method for given circumstances and justify the choice of method

Source:

Chapter 9 – Financial Theory and Corporate Policy, pp. 313-314, 322-324

Grader Comments:

- Most candidates didn't bother writing the equations that got them to the final answer.
- We gave full credit for a correct final number and partial credit if equation given makes sense but wrong final number.
- Most candidates skipped item (a) which was a short list question and went straight to the numerical parts (b), (c), (d).

Solution:

(a)

- Marketed Asset Disclaimer (MAD)
  - The underlying asset for the real options is present value of project without flexibility

- No arbitrage
  - Law of one price

- Samuelson's assertion that regardless of pattern of expected cash flows, we can use recombining binomial trees to model evolution of the value of the project through time

(b)

Objective probability

Consider time 1 to time 2

$$V_0 = \frac{\left[puV_0 + (1-p)dV_0 \right]}{1+k}$$

$$100 = \frac{\left[p \times 125 + (1-p) \times 80 \right]}{1+0.12}$$

$p = 0.711$ for upward

$1-p = 0.289$ for downward

13. (b) continued

Risk-neutral probability

Risk-free rate = 4%

$$V_0 = \frac{\left[quV_0 + (1-q)\,dV_0 \right]}{1+rf}$$

$$100 = \frac{\left[q \times 125 + (1-q) \times 80 \right]}{1+0.04}$$

$q = 0.533$ for upward

$1-q = 0.467$ for downward

(c)

Decision tree for the value of underlying block

$t = 1$

up $100 \times 1.25 = 125$

down $100 \times 0.8 = 80$

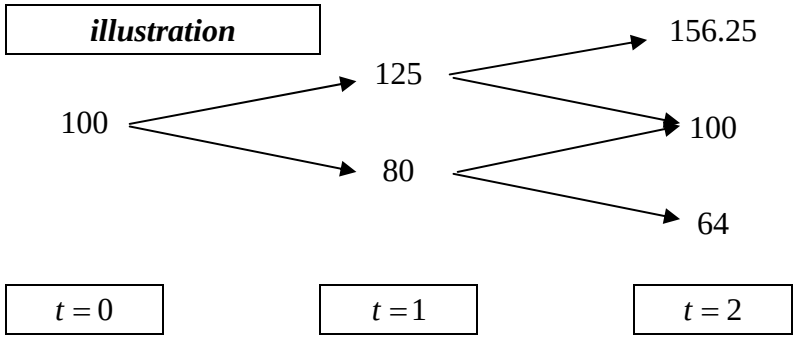
$t = 2$

up – up $100 \times 1.25 \times 1.25 = 156.25$

up – down $100 \times 1.25 \times 0.80 = 100$

down – up $100 \times 0.80 \times 1.25 = 100$

down - down $100 \times 0.80 \times 0.80 = 64$



13. (c) continued

Decision tree for the business with the option to sell the block

$t = 0$ $\max\left(\dfrac{\left(0.533\times 125+\left(1-0.533\right)\times 83.6\right)}{1+0.04}=101.6, 100, 80\right)=101.6$ don't sell

$t = 1$ up $\max\left(\dfrac{\left(0.533\times 156.25+\left(1-0.533\right)\times 100\right)}{1+0.04}=125, 76\right)=125$ don't sell

down $\max\left(\dfrac{\left(0.533\times 100+\left(1-0.533\right)\times 72\right)}{1+0.04}=83.6, 76\right)=83.6$ don't sell

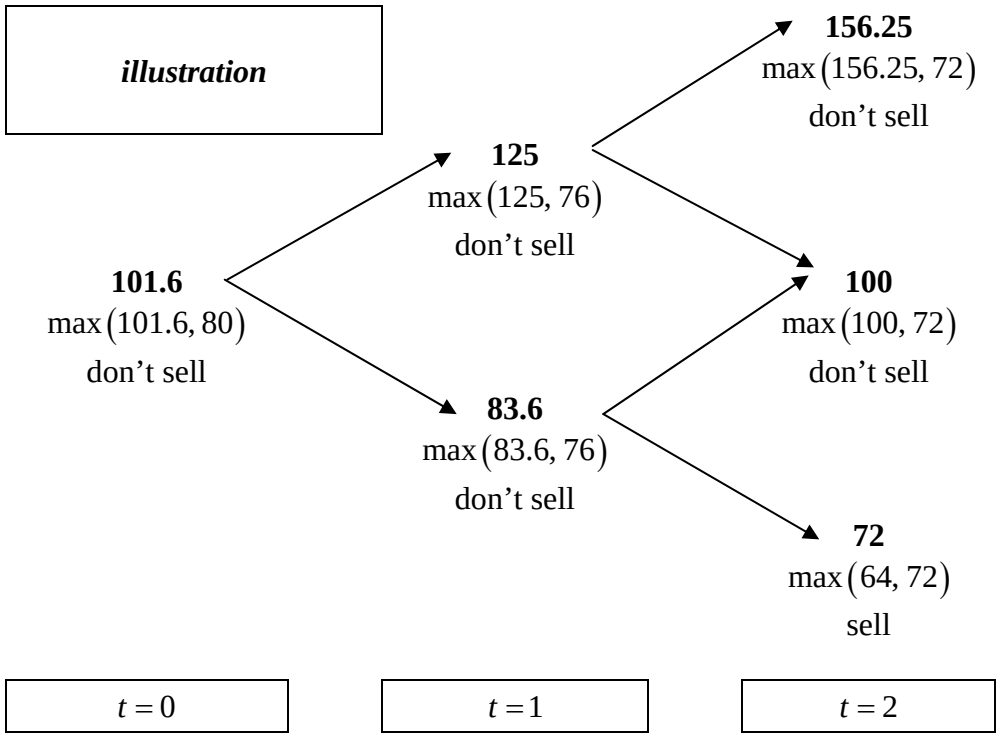
$t = 2$ up-up $\max\left(100\times 1.25\times 1.25=156.25, 72\right)=156.25$ don't sell

up-down $\max\left(100\times 1.25\times 0.8=100, 72\right)=100$ don't sell

down-up $\max\left(100\times 0.8\times 1.25=100, 72\right)=100$ don't sell

down-down $\max\left(100\times 0.8\times 0.8=64, 72\right)=72$ sell

Value of option $101.6-100=1.61$ million don't sell

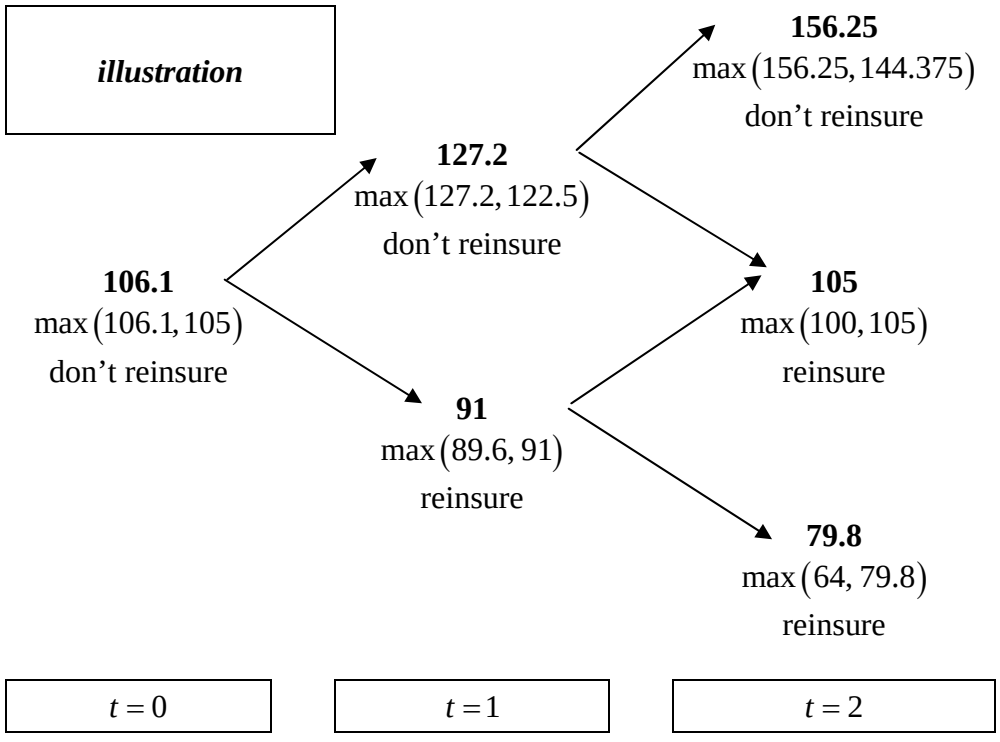


13. continued

(d)

$t=0$		$\max((0.533\times 127.2+(1-0.533)\times 91.0)/(1+0.04)$ $=106.1, 100, 100\times 0.7+35=105)=106.1$	don't reinsure
$t=1$	up	$\max((0.533\times 156.25+(1-0.533)\times 105)/(1+0.04)=$ $127.2, 125\times 0.7+35=122.5)=127.2$	don't reinsure
	down	$\max((0.533\times 105+(1-0.533)\times 79.8)/(1+0.04)=$ $89.6, 80\times 0.7+35=91.0)=91.0$	reinsure
$t=2$	up-up	$\max(100\times 1.25\times 1.25=156.25, 156.25\times 0.7+35=144.375)=156.25$	don't reinsure
	up-down	$\max(100\times 1.25\times 0.80=100, 100\times 0.7+35=105)=105$	reinsure
	down-up	$\max(100\times 0.80\times 1.25=100, 100\times 0.7+35=105)=105$	reinsure
	down-down	$\max(100\times 0.80\times 0.80=64, 64\times 0.7+35=79.8)=79.8$	reinsure

Value of option $106.1-100=6.1$ million; don't reinsure



14.

Learning Objectives:

This question tests the student's ability to recognize how specified work tasks and responsibilities fit into the ERM framework, specifically the ERM risk control process and risk management culture process. It is basically a list question, with some application in recognizing real-life work activities as ERM related.

6 – Enterprise Risk Management Framework
6 – e. Describe how an organization can create a risk management culture including: risk consciousness, accountabilities, discipline, collaboration, and communication.
6 – f. Articulate risk objectives and a risk philosophy.

Source:

ERM Specialty Guide, pp. 24-28

Grader Comments:

a – most of the individuals were able to list some of the ERM objective but not all

b – i. usually attempted the definition
b. – ii. only half of the risk control process steps were listed
b. – iii. most of the individuals got Derivative, Reinsurance and Securitization right

c. – all – very little right answers on all the sections. They missed outright or were quite wrong in most of the cases.

Solution:

(a)

- Competitive advantage
  - Holistic approach
  - Actively pursue risk optimizations
- Strategic Goals
  - Identifying potential opportunities
- Shareholder value
  - Support growth by lowering cost of capital

14. (a) continued

- Transparency of Management
  - Compensation structure aligned with success of the firm reduce agency costs

Also accept Decision-making and Policyholder as Stakeholder, along with applicable explanations

(b)

(i)

- Risk Control is the process of identifying, monitoring, limiting and avoiding risks.
- The objective of risk control is to maintain the risk retained by the company within the risk appetite.

(ii)

- Identifying Risk
- Risk Evaluation
- Monitor the Risk
- Risk Limits
- Risk avoidance
- Offsetting Risk
- Transferring risks
- New Product Review

(iii)

- Derivatives $\rightarrow$ Offsetting Risk
- Reinsurance $\rightarrow$ Transferring Risk
- Experience Studies $\rightarrow$ Risk Evaluation and Monitoring
- Securitization $\rightarrow$ Transferring Risk

(c)

(i)

General approach of the firm to dealing with its risks

(ii)

- Risk Assessment
- Best Practices
- Support
- Communications
- Reinforcement

14. (c) continued

(iii)

- Educate senior management $\rightarrow$ Risk Assessment and Support
- Quarterly Reports $\rightarrow$ Communication
- Training Managers $\rightarrow$ Reinforcement and Risk Assessment
- Funding $\rightarrow$ Support