

# GH SPC Model Solutions

## Fall 2017

### 1. Learning Objectives:

1. The candidate will understand pricing, risk management, and reserving for individual long duration health contracts such as Disability Income, Long Term Care, Critical Illness, and Medicare Supplement.

### Learning Outcomes:

- (1b) Understand utilize experience studies in setting assumptions for long-duration contracts.
- (1d) Apply applicable Actuarial Standards of Practice.

### Sources:

Combo Long-term Care Products: A Solution to Address Market Needs, The Actuary, October / November 2013

ASOP 18, Long-Term Care Insurance

### Commentary on Question:

*Commentary listed underneath question component.*

### Solution:

- (a) Explain the economic fundamentals which in the last few years have caused insurance companies to experience financial difficulties with their long-term care (LTC) business.

### Commentary on Question:

*Many candidates performed well in this section of the question, specifically identifying the three main drivers. Candidates that received full credit for this section detailed not only the impact to the financial performance of the LTC product, but also how the assumptions developed by actuaries in pricing the product contributed to the difficulties.*

1. Reduced investment earnings caused by historically low interest rates.
  - a. LTC policies have level premiums that are invested by the insurance company and then held in reserve to pay benefits down the road.
  - b. Interest rates are much lower than anticipated, resulting in insufficient funds to pay for future benefits.
2. Higher costs of providing LTC is consistent with the broader issue of rapidly rising costs in the United States

## 1. Continued

3. Strong persistency
  - a. Insurance companies typically estimate what proportion of policies will stick around long enough to be eligible for benefits.
  - b. These estimates were generally too low for LTC policies, and more policies than anticipated are eligible for benefits.
- (b) You are considering the need to design your plan as a State Partnership LTC plan.
  - (i) Define a typical structure for a State Partnership LTC plan.
  - (ii) Evaluate the successfulness of State Partnership LTC plans. Justify your answer.

### **Commentary on Question:**

*Many candidates received credit for answering the first part of this question, specifically mentioning dollar for dollar shielding for Medicaid purposes. The vast majority also accurately pointed out that partnerships have not been successful, while almost no one mentioned that most new plans qualify for Partnership status.*

- (i) A typical structure will allow an individual to shield \$1 of assets from the Medicare “impoverishment” rules for each \$1 of private insurance that they buy.
  - (ii) The majority of new policies automatically qualify for Partnership status. These programs have had a limited impact on increasing the market penetration for LTC policies.
- (c) Explain how the Pension Protection Act of 2006 (PPA) created more favorable conditions for LTC Combo Insurance.

### **Commentary on Question:**

*Most candidates identified tax changes. Beyond that, few candidates expanded on the PPA, while most expanded on LTC combo products in general, which was not what was asked.*

1. Under the PPA, funds in a life insurance or annuity policy can be used to pay for “qualified” LTC premiums without creating a taxable event to the policyholder. (Previously these funds would generate a 1099 for taxable income.)

## 1. Continued

2. An LTC product is “qualified” if it satisfies several benefit and consumer protection provisions created by HIPAA and codified in IRS code. In essence, this requires:
    - a. That an individual must be receiving care pursuant to a plan of care prescribed by a licensed health care practitioner, and
    - b. The individual be certified by a licensed health practitioner as being “chronically ill” by either:
      - i. Being unable to perform at least two activities of daily living (ADL) or
      - ii. Requiring substantial supervision due to severe cognitive impairment.
  3. Because of this regulatory requirement, these have become the standard benefit triggers.
- (d) Describe all considerations, as mentioned in ASOP #18 – Long Term Care Insurance, when setting assumptions for total claim costs.

### **Commentary on Question:**

*Many candidates successfully received full points on the #3 list below. Few candidates expanded their focus beyond those considerations into how product features impact morbidity, and where to obtain data.*

1. The actuary should determine morbidity assumptions consistent with all significant plan features including:
  - a. Types of LTC benefits being provided
  - b. Types of optional benefits being provided
  - c. The plan’s benefit eligibility criteria
  - d. The claim adjudication process
  - e. The benefit amounts
  - f. The benefit limits
  - g. Exclusions
2. In order to estimate total claim costs, the actuary, where appropriate, should establish:
  - a. Claim incidence rates
  - b. Claim termination rates
  - c. Costs of eligible benefits
3. The actuary should consider at least the following:
  - a. The fact that claim cost elements will vary by nursing home, assisted living facility, and home care.
  - b. The possible substitution effect among the various benefits in the instances where more than one type is available.
  - c. The effect of induced demand for LTC services due to the presence of LTC insurance.

## 1. Continued

- d. The availability of benefits from other public and private programs such as Medicare, Medicaid, and Medicare Supplement policies.
  - e. The availability of LTC services
  - f. The effect of selection and classification of applicants.
    - i. Intensity of application questions
    - ii. Marketing methods
    - iii. Number and types of underwriting requirements
    - iv. Number and definitions of underwriting classes
    - v. Effect of regulations on underwriting and claim process
    - vi. The experience of the underwriting and claim personnel
  - g. The financial benefit to the claimant of remaining eligible for benefits.
  - h. The effect of mortality on termination rates.
4. Data should be from the following sources:
- a. Specific data from the entity to which the actuary's calculations apply generally are preferable to data from other sources.
  - b. Where such data are not adequately credible, industry data should be considered next in setting assumptions.
  - c. As a last but sometimes necessary source, general population noninsured data may be utilized.

## 2. Learning Objectives:

2. The candidate will understand and evaluate the risk associated with health insurance and plan sponsorship and recommend strategies for mitigating the risk.

### Learning Outcomes:

- (2b) Complete a capital needs assessment.
  - Calculate capital needs for a given insurer.
  - Determine actions needed to address issues identified by assessment.
  - Describe components of an Economic Capital model.
- (2c) Integrate reinsurance arrangements within an overall risk management strategy of company plan / sponsor.
- (2e) Apply applicable Actuarial Standards of Practice.

### Sources:

Financial Enterprise Risk Management, Sweeting, 2011; Chapter 18, Economic capital

GHS-117-16 – Life & Health and Annuity Reinsurance, 4th Edition, Chapter 18

ASOP 46: Risk Evaluation in Enterprise Risk Management, ASB Final

### Commentary on Question:

*Question 2 asks the candidate to understand risk evaluation in the Economic Capital Model and to apply provided and derived information to recommend business decisions from different perspectives. Leniency was granted as appropriate when wording could be considered ambiguous based on candidate responses and feedback.*

### Solution:

- (a)
  - (i) List the considerations relating to an Economic Capital Model while performing actuarial tasks relating to the design, development, and review of the model.
  - (ii) List the assumptions to consider when reviewing an Economic Capital Model.

### Commentary on Question:

*For part (i), most candidates provided the same list of considerations as in the model solution. Some provided different lists with similar overlapping considerations which also earned credit. The intention of the question in part (ii) was to focus on considerations during review of the model assumptions rather than the assumptions themselves. However, candidates providing lists of assumptions such as discount rate, expenses, et cetera were also given credit.*

## 2. Continued

- (i) List the considerations relating to an Economic Capital Model while performing actuarial tasks relating to the design, development, and review of the model.
- the appropriateness of the selected time frame, basis for measuring loss and risk metric underlying the organization's definition of economic capital relative to how it is used to support strategic decisions
  - the degree to which the economic capital model reflects the significant risks of the organization and the interdependencies of those risks in a consistent and comprehensive manner
  - the appropriateness of the method used to model each risk (some are more appropriate to be modeled stochastically while others may be modeled using stress tests)
- (ii) List the assumptions to consider when reviewing an Economic Capital Model.
- historical data available
  - prices in the marketplace
  - opinions of other experts
  - the fit of the assumed distribution to available data
  - the ability of the assumed distribution to reflect possible extreme value
  - internal consistency of the assumptions
  - consistency in the application of assumptions
- (b) Calculate the additional capital your company needs to allocate from surplus in excess of their premium to satisfy their internal ERM economic capital policy. Show your work.

### **Commentary on Question:**

*Calculation of additional capital needed to be allocated from surplus was fairly straightforward and most candidates did well on (b). Candidates that interpreted TVaR<sub>95</sub> as including expenses and used the formula additional capital needed = TVaR<sub>95</sub> – premium = \$43M also received credit.*

Premium = Margin + Expenses + Expected Losses or TVaR<sub>0</sub> = \$4M + 6M + 67M = \$77M.

Additional capital needed = TVaR<sub>95</sub>, the average of the highest modeled losses, plus expenses minus premium = \$120M + 6M – 77M = \$49M.

## 2. Continued

- (c) Recommend, for each of the following, a business decision for your company to enter or not enter this market:
- (i) Your company's capital model
  - (ii) Your company's ERM policy
  - (iii) ASOP 46
  - (iv) Reinsurance strategy

Justify your recommendations.

### **Commentary on Question:**

*Part (c) challenged candidates to synthesize provided information about the company with results from (b) as well as knowledge of risk mitigation and ASOP 46. The model solution presents a complete answer based on finding the additional capital requirement in (b) to be \$49M and surplus to be inadequate; however, a candidate finding the additional capital requirement to be \$43M would reach different conclusions. Grading evaluated logical flow of points made in responses and consistency with prior results. Most candidates had difficulty evaluating the decision in light of model results, company policy and strategic priorities. Some candidates did not use information provided or came to illogical conclusions.*

- (i)
  - Capital model displays heavy tail risk
  - Unallocated surplus is insufficient to satisfy ERM
  - Model appears inconsistent with competitor premiums; new line should consider other models and prices observable
  - Will not have flexibility to pursue other areas of expansion if entering based on capital model
  - May recommend not to enter or to enter depending on bullets above that support conclusion
- (ii)
  - ERM policy is not satisfied as Unallocated Surplus is < Economic Capital
  - ERM allows for the appropriate safeguard for risk but should not be the sole reason for pursuing a line of business
  - Market consistent pricing and internal capital model appear to be at odds, with the market based pricing identifying a lower level of risk

## 2. Continued

- Adjustments to internal model for mark to market or blend of internal model and external pricing may be appropriate
- Available funds withheld reinsurance products have the ability to further lower the economic capital required under the policy
- Recommend not entering based on ERM policy; unallocated surplus would not be sufficient for worst modeled losses

(iii)

- Consider against the organization's strategic goals for the level of volatility of profits both short term and long term
- The extent to which the organization's exposure to risks may differ from the exposures of its competitors
- Risk mitigation alternatives and mechanisms to utilize those alternatives may or may not be present or fully effective
- Recommend alternatives to the internal capital model: adjusting the model to mark to market OR combining reinsurance to lower the economic capital requirement
- Management identified flexibility as a key component; entering into the line without modification to the internal model or reinsurance would restrict flexibility
- No experience in line; potentially an opportunity to partner with reinsurance to leverage their experience

(iv)

- Reinsurance arrangement for modified coinsurance ensures the ceding company has assets to support reserves
- Reinsurance arrangement for funds withheld coinsurance may be more expediate if assets from reinsurer are not a concern.
- Determine qualitatively if value of additional safety worth 500k premium difference
- Allows company to reduce economic capital below \$49M by reducing the highest average of 5% of losses from \$120M to 24M
- New premium at zero margin = \$30M Reinsurance + \$13.4M Expected Losses + \$6M Admin = \$49.4M
- This allows for up to \$8.6M margin while matching competitor's lowest price (\$58M - \$49.4M)
- Recommend funds withheld or modified coinsurance reinsurance arrangement based on qualitative value of additional safety vs premium difference. This allows company to enter market with a competitive premium while reducing economic capital requirements and tied up surplus.

### 3. Learning Objectives:

3. The candidate will understand an actuarial appraisal.

#### Learning Outcomes:

- (3a) Differentiate the components of an actuarial appraisal versus an embedded value.
- (3b) Describe an approach for preparing and actuarial appraisal.
- (3c) Describe risks associated with interpreting an actuarial appraisal and an embedded value.
- (3d) Describe principles of applicable Actuarial Standards of Practice.

#### Sources:

GHS-111-14 Components of Insurance Firm Value and the Present Value Liabilities

#### Commentary on Question:

*Students did well on A, B and D but poorly on C.*

*C came directly from the GHS-111-14 but the study note didn't have it in obvious list form. The best candidates most likely read and thought about the source material.*

#### Solution:

- (a) Verify the accuracy of the following four statements with respect to the major components of Market Value of Insurance Equity. Justify your answers.
  - (i) Franchise value includes renewal business.
  - (ii) Franchise value is the present value of the “rents” that an insurer is expected to garner because it has scarce resources, scarce capital, reputation, and so forth.
  - (iii) Market Value of Tangible Assets can be netted with the put option value to produce the “net tangible value”.
  - (iv) Put option value arises from the limited liability enjoyed by equity holders when their firm repurchases shares in the marketplace.

#### Commentary on Question:

*Student did well on this question.*

- 1. Franchise Value includes renewal business.  
This is a true statement.
- 2. This statement is true about Franchise value.
- 3. This statement is false as the statement should say the Market Value of Tangible Assets can be netted with the present value of liabilities (not the put option value) to produce the “net tangible value”.

### 3. Continued

4. This statement is false as the Put Option Value arises from the limited liability enjoyed by equity holders when their firm issues debt (not repurchases shares) in the marketplace.
- (b) Describe how the equity value changes as the firm decreases in insolvency risk, when analyzing the market value of:
- (i) each of the four components separately
- (ii) the four components on a combined basis

#### **Commentary on Question:**

*This question rewarded candidates who thought about the material as they studied. People who understood the graph in GHS-111-14, pages 3 & 4 did a good job on part (ii). Successful candidates explained the equity value versus solvency risk curve.*

- (i) Discussed separately
1. Franchise Value – FV
    - Increases as insolvency risk decreases
  2. Market Value of Tangible Assets – MV(TA)
    - Does not increase or decrease as insolvency risk decreases because MV(TA) is completely independent of insolvency risk
  3. Present Value of Liabilities – PV(L)
    - Does not increase or decrease as insolvency risk decreases because PV(L) is completely independent of insolvency risk
  4. Put Option Value – PO
    - Decreases as insolvency risk decreases
- (ii) Equity value movements (answer should be similar to the following)
- With low insolvency risk, Market Value of Equity is high, driven mostly by Franchise Value.
  - As insolvency risk increases, Market Value of Equity decreases as Franchise Value decreases.
  - The Net Tangible Value, which is the market value of tangible assets – pv of liabilities, is not affected by changes in the firm's insolvency risk.
  - The equity value includes a premium over the net tangible value which stems either from the franchise value or the put option value, or some combination of the two.
  - As insolvency risk continues to increase, MV of Equity will begin to increase as Put Option Value increases and will continue to increase as the Put Option increases.

### 3. Continued

- (c)
- (i) List four disadvantages of an indirect method of valuing liabilities.
  - (ii) List four advantages of a direct method of valuing liabilities.

**Commentary on Question:**

*The answer to this question came directly from GHS-111-14, pages 5 & 6 but it was not in obvious list form. Candidates should read the source material as well as the study guides.*

- Disadvantages
  - Inefficient in valuating liabilities
  - Equity value embraces the net value of default put options, franchise value, spin-off values, and perhaps other options, as well as the net tangible value; yet the market value of tangible assets omits one or more of these
  - Understates the present value of liabilities by the amount of the franchise value (FV) and the default put option (PO).
  - Adding these two values (FV and PO) back in invokes subjective judgment resulting in an unreliable liability calculation
- Advantages
  - The present value of liabilities tells us the amount of tangible assets needed to satisfy our liabilities
  - Treasury rates or Treasury security prices are used to account for interest rate sensitivities
  - Mortality and morbidity are factored in only on an expected basis
  - Interest rate sensitivities can be included to cover surrenders, lapses, and adverse selection
  - Reserves and surpluses are not included in the present valuation of liabilities
  - Resulting present value estimates mitigate C-1 risk and C-3 risk
  - C-2 risk and C-4 risk remain and are accounted for at their expected present values

- (d) Calculate the market value of the insurer's
- (i) Assets
  - (ii) Equity

Show your work.

### 3. Continued

**Commentary on Question:**

*The math was easy, but candidates had to know how all the values fit together.*

Equation 1: Market Value of Equity = Market Value of Assets – Market Value of Liabilities

$$MV(E) = MV(A) - MV(L)$$

Equation 2: Market Value of Equity = Franchise Value + Market Value of Tangible Assets – Present Value of Liabilities + Put Options

$$MV(E) = FV + MV(TA) - PV(L) + PO$$

(i) Assets

- $MV(TA) = \$210M$
- $PV(L) = \$200M$
- $PO + FV = \$4M$
- $MV(L) = \$194M$
- $MV(A) - \$194M = \$210M - \$200M + \$4M$
- $MV(A) = \$208M$

(ii) Equity

- $MV(E) = MV(A) - MV(L)$
- $MV(E) = \$208M - \$194M$
- $MV(E) = \$14M$

#### **4. Learning Objectives:**

4. The candidate will understand and apply risk adjustment in the context of predictive modeling.

#### **Learning Outcomes:**

- (4a) Develop and evaluate risk adjustments based on commonly used clinical data and grouping methods.
- (4b) Apply risk adjustment to underwriting, pricing, claims, and care management situations.
- (4c) Describe typical predictive modeling techniques.
- (4d) Evaluate the appropriateness of each technique.
- (4e) Apply applicable Actuarial Standards of Practice.

#### **Sources:**

Duncan Chapter 13 – Medicaid Risk Adjustment

ASOP 12 – Risk Classification (excluding appendices)

#### **Commentary on Question:**

*Commentary listed underneath question component.*

#### **Solution:**

- (a) Describe the goals of risk adjustment in Arizona’s Medicaid program.

#### **Commentary on Question:**

*Nearly everyone got full credit for this.*

1. the purpose of the program is to align payment with the relative health risk of members
  2. Accuracy: high correlation between projected and the actual cost
  3. Unbiased: not over compensate for some risk factors at the expense of others
  4. Be as simple as possible
  5. Minimize administrative burden of implementing
  6. Be budget neutral in total
- (b) Describe situations where a claims based risk adjustment model will not be applied in developing their rates.

#### **Commentary on Question:**

*This question includes a lot of detail on who doesn’t get a risk score, and there are a lot of fine points that were in the text explaining this.*

## 4. Continued

1. Reconciled risk groups for which actual claims are used to determine reimbursement.
2. Delivery Supplementary case rates paid for maternity deliveries.
3. Option 1 and 2 transplant members: case rates paid
4. SOBRA Family Planning Rates for women who are eligible for family planning services but not for other Medicaid benefits.

(c) Describe how risk adjustment is calculated for new members.

### **Commentary on Question:**

*A lot of exam takers didn't bother to mention that 6 months was the cutoff between short duration and long duration which lowered a lot of scores.*

- (a) For those with at least 6 months, they will be given a claims-based risk adjustment factor (average ERG risk score)
  - (b) For those with less than 6 months of enrollment during the experience period
    - (i) Given a risk factor that is equal to 50% of their pure age/gender factor plus 50% of an adjusted plan factor.
    - (ii) Adjusted plan factor is calculated by taking the average ERG risk score of the long cohort and dividing by the pure age/gender factor of the long cohort (relative health factor) and then multiplying by the pure age/gender factor of the short cohort.
- (d) Calculate the Total Average Risk Score for your plan. Show your work.

### **Commentary on Question:**

*Most candidates got full credit here.*

1. Relative Condition Factor = Long Cohort Condition (ERG) Factor divided by Long Cohort Age/Gender Factor

$$\Rightarrow 0.49/0.45 = 1.09$$

2. Imputed Condition Factor = Relative Condition Factor multiplied by Short Cohort Age/Gender Factor

$$\Rightarrow 1.09 * 0.55 = .60$$

3. Short Cohort Weighted Condition Factor = 50% multiplied by adjusted plan factor plus 50% multiplied by the Short Cohort Age/Gender Factor

$$\Rightarrow 50\% * 0.60 + 50\% * 0.55 = 0.575$$

## 4. Continued

4. Total Average Risk Score =  
Long Cohort Weight multiplied by Long Cohort Condition (ERG)  
Factor plus the  
Short Cohort Weight multiplied by the Short Cohort Weighted  
Condition Factor  
 $\Rightarrow 0.70 * 0.49 + 0.30 * 0.575 = .5155$

- (e)
- (i) Describe why the newborn population is an issue for risk adjustment.
  - (ii) Describe how Arizona has addressed the issue in (i).
  - (iii) Describe the Temporary Assistance to Needy Families (TANF) under age one risk adjustment methodology.

**Commentary on Question:**

*Most candidates received full credit here.*

- (i) Why: Newborns have no prior claims to project their cost

- (ii) AZ Method:

Retrospective (concurrent) method is used, taking advantage of risk factors that are identified for newborns during the risk-scoring period.

Thus the claims of the prior cohort of newborns in the experience period are used to project newborn experience in the rating period.

- (iii) TANF < age 1 risk adjustment methodology is based on identifying differences in health status during the experience period that result in material differences in cost.

- (f) Calculate

- (i) the average Arizona statewide risk score, and
- (ii) your plan's relative risk score.

Show your work.

**Commentary on Question:**

*Most candidates received full credit.*

## 4. Continued

Total Average Risk Score =  
Long Cohort Age/Gender Factor times Long Cohort Weight plus  
Short Cohort Risk Factor times Short Cohort Weight

$$\Rightarrow 0.422 * 0.84 + 0.435 * 0.16 = 0.424$$

Relative Plan Risk =  
Total Average Risk Score (from part C) divided by  
Total Average Risk Score (from i)

$$0.5155 / 0.424 = 1.22$$

- (g) List the Medicaid costs not reflected in the Arizona calibrated model.

**Commentary on Question:**

*Most candidates missed this one, or got it confused with other parts of the question.*

1. Prior Period Coverage (PPC)
2. Behavioral Health covered by AZ Department of Health Services (ADHS)
3. Costs above reinsurance thresholds
4. Children's Rehabilitative Services
5. Maternity costs covered by the delivery supplement

- (h) List and explain the considerations in the selection of risk characteristics according to ASOP 12.

**Commentary on Question:**

*Most got full credit here.*

- 1 Relationship of Risk Characteristics and Expected Outcomes
  - be related to expected outcomes
- 2 Causality
  - not necessary to establish a cause and effect relationship
- 3 Objectivity
  - be objectively determined
- 4 Practicality
  - reflect the tradeoffs between practical and other relevant considerations
- 5 Applicable Law
  - Consider whether compliance with applicable law creates significant limitations
- 6 Industry Practices
  - Consider usual and customary risk classification practices
- 7 Business Practices
  - Consider limitations created by business practices