Institute of Actuaries of India

Subject SA1– Health and Care

December 2022 Examination

INDICATIVE SOLUTION

Introduction

The indicative solution has been written by the Examiners with the aim of helping candidates. The solutions given are only indicative. It is realized that there could be other points as valid answers and examiner have given credit for any alternative approach or interpretation which they consider to be reasonable.

Solution 1:

i)

a) XS 70 crores:

LTCI will have the highest probability of making a recovery under this contract

For a symmetrical distribution the chance of exceeding the mean is 50%. For one skew to the right, the probability is somewhat under 50%.

However, for LTCI to exceed 95 cr, for example, the result would have to be more than two standard deviations above the mean.

The chance of this for the normal distribution is only about 2½%.

For other distributions the probability may be of a similar order (possibly a little larger).

IP or CI make a recovery when the result is 0.2 standard deviations above the mean. This is a little less likely than LTCI making a recovery.

However, 90 cr is only 1 s.d. above the mean, and 2 s.d. above is 115 cr. This shows that the chance of a large recovery is greater for IP or CI than for LTCI.

The premium for IP or CI seems likely to be bigger than that for LTCI (although this is not totally conclusive).

PMI makes a recovery when the result is 0.33 standard deviations above the mean. This is a little less likely than IP or CI making a recovery.

However, 90 cr is only 1 s.d. above the mean, and 2 s.d. above is 120 cr. This shows that the chance of a large recovery is somewhat greater for PMI than for IP or CI.

It seems clear that LTCI will have the smallest premium, because it is much less variable.

The overall result between PMI and IP/CI seems to us to be a close call and the result of the calculations may well depend on the assumed distribution of the loss ratio. [6]

b) XS 100 crores

PMI will have the greatest chance of any recovery and also the greatest chance of a large recovery.

LTCI will have the least chance of any recovery and also the least chance of a large recovery.

Hence PMI should have the largest premium, IP and CI the next and LTCI has the smallest. [6]

c) XS 90 crores capped at 25 crores

This time we have, in terms of standard deviations above the mean, the layer:

IP or CI : +1.0 to +2.0

LTCI : +1.6 to +3.6

PMI : +1.0 to +1.8

Whenever the upper limit of this layer is breached (likeliest for PMI) a full recovery of 25 cr is made.

So it is clear that the premium order must be the same as in (b), ie PMI should have the largest premium, IP and CI the next and LTCI has the smallest.

Using a statistical package we can get the pure premiums by fitting suitable distributions (logNormal, Gamma etc) with the same moments as the empirical distributions. [6]

ii) Burning cost

The burning costs pure premiums are just the average past recoveries, if the cover had been in place throughout. These are as follows:

(XS 70 cr) IP: 5.8 cr CI: 7.4cr LTCI: 4.4 cr PMI: 8 cr

(XS 100 cr) IP: 0 cr CI: 1.4 cr LTCI: 0 cr PMI: 0.8 cr

(XS 90 cr, capped at 25 cr) IP: 0 cr CI: 3.4cr LTCI: 0 cr PMI: 2.8 cr [0.25 each, total 3]

These are dramatically different from the results in part

(i). Now:

CI always has a much larger burning cost & hence should have higher premium than IP

PMI is not the largest for XS 100 cr or XS 90 cr (capped at 25 cr), but CI is.

IP and LTCI each have no burning cost at all for XS 100 cr and XS 90 cr (capped at 25 cr). [1 each]
[Max 6]

iii) Rating a stop loss treaty:
Clearly neither (ii) nor (iii), by itself, provides a suitable way to rate a stop loss treaty. [½]
In particular (i) penalises IP relative to CI, although past experience suggests that when CI makes a loss at all it makes a relatively big loss [1]
... which is exactly what unlimited or high layer stop loss cover is protecting against. [½]
In (ii) it seems inappropriate to have a zero pure premium for cover XS 100 cr or XS 90 cr, capped 25 cr to IP or LTCI, despite there (presumably) being some chance that a recovery would be made in the future. [1]
The ideal would be to decide, somehow, what the prospective distribution of the total claims for any LOB is. [½]
We could then calculate the pure premium for any layer of cover directly from that distribution. [½]
Whether it is an analytical or empirical one, we could do this given a suitable computer package or a very large envelope to write on the back of. [½]
So, then, we just need to decide what the distribution of next year's gross claim is. [½]
To make as good a job as possible of this, we would study all relevant historical information for the risk, and also all others that could shed some light on the distribution for this risk. [½]
We would need to be careful about the effects of changes in lots of factors, including the precise cover provided, if it's reducing then future claim amounts will not be as bad as past ones [1]
the effect of inflation and, in particular, the measure which correctly accounts for the mix of past claims and next year's prospective claims from this portfolio [1]
the business cycle, eg if a portfolio increases next year by 10% but other things are equal, then claim next year will increase by a factor close to that. [1]
The ideal practical approach would probably be to do as much as possible analytically. [½]
Then look at the result on various bases (including (i) and (ii)), then pass those results to a highly skilled health underwriter for them to estimate a suitable risk premium, taking the analytical results as part of their deliberations. [1]
[Max 8]

iv) Conditions:

a. Must be approved by the regulator
b. Long term predictable liabilities – No surrender is allowed
c. The ley liability risks are longevity & expense
d. Assets are ring fenced and no pre-mature redemption is allowed
e. The assets (bonds) are matched by nature, term & currency of the expected benefits

On 50% of the backing assets, 1.50% of additional yield is available. Excluding 0.50% for default risk, the overall additional yield 50%*(1,50% - 0.50%)= 0.50%. Assuming the term of the assets and liabilities are matched, the extent of the matching adjustment is 0.50% p.a. [5]

v) Method for EV calculation
Net assets
The net assets will be the total assets in excess of those covering the technical provisions plus SCR under Solvency II. [½]
As the business is 100% shareholder-owned, 100% of the market value of these net assets will be included in the embedded value (EV). [1]
PVIF
The PVIF is the present value of future shareholder cashflows projected to emerge from the assets backing the liabilities. [½]
Under Solvency II, the PVIF includes the release of the risk margin component of the technical provisions and the release of the SCR. [1]

These amounts may be reduced to allow for the cost of holding this required capital, [½]
ie frictional costs such as taxation and agency costs. [½]
The PVIF also represents the release of any margins if there are places where the assumptions underlying the best estimate liabilities are not in line with the company's best estimate assumptions [1]
for example, if the best estimate liabilities have been determined using a constrained discount rate [½]
or including premiums up to some restrictive contract boundary. [½]
To calculate the PVIF, a model would be used to project future cashflows on the business and the future supervisory reserves and capital requirements. [1]

In the case of the unit-linked LTCI business, both the unit and non-unit funds would be projected, as the non-unit cashflows depend on the size of the unit fund. [1]
A set of assumptions will be needed to project the future cashflows, including investment returns, mortality, expenses, withdrawals, inflation and so on. [1]
The current and likely future tax position of the company must also be considered. This will depend upon the company's mix of business. Tax should therefore be dealt with at a global level. [1]
These projections would enable the transfers to the shareholders in each future year to be determined. [½]
The in-force policies may be modelled individually, but this may not be practical due to IT limitations or limited access to the data of the target company. [1]
The in-force business could then be represented by a number of sample policies (model points). [½]
The contracts will be split by class, most notably unit-linked and without-profits contracts treated separately. They will then be split into smaller groups, eg by product type, policy term, sales method etc.[1]
The PVIF will be the present value of the shareholder transfer arising each year. [½]
The discount rate may allow for a risk margin. [½]
If the embedded value calculation is performed on a market-consistent basis, the investment return and discount rate assumptions will be based on risk-free rates, [1]
and separate allowance would need to be made to allow for non-hedgeable risks. [½]

[Max 10]

vi) Because the contracts have the provision of top-up premiums which act as recurrent single premium, it is difficult to judge what future premiums under the contracts are likely to be. [½]
There is scope for discussion as to whether the future premiums should be regarded as part of the in-force business. [½]
This is similar to the issue of establishing the contract boundary for these contracts for Solvency II purposes [½]
... although a different treatment may be adopted for this embedded value (where the treatment is unconstrained) than for Solvency II (which must comply with the regulations). [½]
This gives a number of possible approaches, for example:
1. Treat as new business and therefore ignore future contributions to in-force business. The purchaser might prefer this but you may not & it may be difficult to justify. [1]
However, if this is the treatment adopted by the company under Solvency II, this may strengthen the argument for adopting this approach. [½]
2. Allow for future premiums on some assumptions. These may be best estimate, although the purchaser may prefer prudent assumptions and so might assume high rates of withdrawal and of ceasing contributions. [1]

[Max 3]

[50 Marks]

Solution 2:

i) Typical features

- Provides insured with regular income during periods when the insured is unable to work due to illness or incapacity [1]
- The policy may have several exclusions such that not all illnesses/injuries may be covered eg. Mental illness [½]
- Policy term typically runs up to retirement e.g., age 60 but could be for a fixed term [½]
- Regular premiums paid by insured – e.g., yearly, half-yearly, quarterly or monthly [½]
- Premiums can be level or increasing in line with an index [½]
- Waiver of premium whilst claim in payment [½]
- There can be multiple periods of sickness benefits paid during policy term [½]
- Typically includes a Deferred period – e.g., a policy with a 4-week deferred period will commence income payments once the policyholder has been off work for a period of 4 weeks [½]
- Typically includes a linked claims period – After a claim has ended, if your client goes off work again for the same reason within, say, a 12-month period, a new deferred period will not apply [½]
- Benefits can be level or increasing in line with an index [½]
- Benefits could escalate differently in and out of claim [½]
- Benefits limited to prevent over insurance. Limit based on a percentage of salary (gross or net of tax) at date of incapacity [½]
- Benefits may reduce or cease after a specified period [½]
- Definitions of incapacity – occupation based e.g., unable to do 'own' occupation [½]
- Or activity based – e.g., unable to carry out 4 out 6 activities of daily living such as washing, bathing etc. [½]
- There may be rehabilitation/counselling services to facilitate earlier return to work [½]

[Max 5]

ii) Advantages and disadvantages of guaranteed premium rates

Advantages

- Increase in sales as the policyholders would like certainty in terms of the premium payable throughout the term of the policy [½]
- This is particularly the case if the competition is not offering guarantee and WTH pricing is not out of line with the market [½]
- No risk of bad publicity and hence reputations risks associated with reviewable rates [½]
- Likely lower level of regulatory scrutiny compared to reviewable rates [½]
- Less issue of selective lapsation since the premium rate is fixed there is no direct trigger for policyholders to be actively looking for better rates [½]
- More certainty with respect to lapse assumption compared to reviewable rate [½]
- System – administration is easier and less expensive compared to reviewable rates [½]

Disadvantages

- There will be heavy reliance on sufficiency of pricing data and credibility of experience at outset as the insurer does not have the option to fine tune the premium rates on written business in the future. [1]
- Profitability – may decrease as the company does not have the option to change premiums if the actual experience turns out to be worse than the original pricing assumptions [½]

- Reinsurance – it may be difficult to obtain reinsurance as some reinsurers in the market may not offer guaranteed terms. [½]
- Reserving – reserving requirements for guaranteed business are likely to be higher than those for reviewable business as there is no option to change premium rates. [½]
- Capital requirements – for the same reason as above, capital requirements for guaranteed business are likely to be higher than those for reviewable business. [½]
- Decrease in sales – if the premium is higher due to higher reserving/capital requirements [½]
- This is particularly the case if the competition is offering significantly lower rates with reviewable structure [½]

[Max 7]

iii) Accidently only Income Protection (IP) – possible reasons and risks

Possible reasons

- Differentiated product offering from competition [½]
- Better alignment to need for certain categories of target market – eg. Young lives at blue collar industries etc. [½]
- Significant claim adjudication challenges with respect to sickness disabilities [½]
- Bad publicity/Repudiation risk due to claim declinature for sickness claims leading to disgruntled policyholders [½]
- Insurance ombudsman/court rulings against the insurer for most of the sickness IP claims [½]
- Claim adjudication more objective/easier for injuries than sickness [½]
- Simplify underwriting which is a main hurdle for sales [½]
- Long-term guarantee is less risky with 'accident only' vs 'accident plus sickness' [½]
- Less exposure to epidemics and pandemics [½]

[Max 3]

Risks

- Accident/sickness gets blurred for certain disabilities [½]
- e.g., falling due to sickness and getting hurt, road accidents caused by fatigue due to sickness etc. [½]
- So, the risk of having to end up paying claims not envisaged at pricing [½]
- Risk of bad publicity/repudiation if claims are denied in such instances [½]
- …root cause is sickness, but disability is caused by accident [½]
- Anti-selection – those that have greater exposure to accidents picking up the cover [½]
- …underwriting might help to an extent but would defeat the objective of simplified issue [½]
- Risk of pricing mis-estimation in the absence of incidence and termination data that clearly split out cause of disability, occupation, industry, age, gender etc. [½]
- Risk of decreased profitability due to actual target segment different from expected [½]
- Selective lapsation from the current product and entry into this product – causing profitability challenges for other products [½]
- Distribution churning from existing product into the new product since first year commission tends to be higher than renewal commission [½]

[Max 3]

[6]

iv) Factors to Consider

Demand

- Would there be sufficient demand to sell volumes?
- No state provision & no IP insurance and so this green field and potential for sufficient volume of sales

- Are there personal tax incentives that might make the product more attractive?
- How aware the customers of the need for IP?
- How are they currently addressing the need?
- Would the product be affordable?
- Would carry out a survey to assess these
- New company in the market – consumer confidence
- …in the company/brand and in the product

Competition
- any previous attempts from outside companies - if so, why did they not enter?
- Generally, how profitable the health insurance market in the Country B
- … if the existing insurers (though different product) are not making money, why should you?

Data
- Availability of relevant and sufficient data to price
- … disability incidence, termination split by risk factors such as age, gender, occupation, income etc.

Capital/regulatory/legal
- Licensing requirements
- Capital/solvency requirements
- expense overruns/new business strains
- Reserving/financial reporting requirements
- Restrictions on product design/investments
- Regulations of distributors (eg. Commission levels)/sales process
- Contract low/employment law
- How evolved are the insurance ombudsman/insurance legal systems?

Distribution channels
- Availability of qualified salespeople /training required
- potential channels and how evolved they are
- …own sales force, bancassurance, independent advice, direct to customer

Talent/resources
- Availability/hiring of key staff
- administrative and claims systems
- availability of service partners (eg. disability rehabilitation/counselling)
- possibilities for outsourcing

Profitability
- demographics/demand projections
- profitability levels and projected growth
- investment returns
- regulatory limitations on profitability
- cultural impacts on propensity to claim/lapse
- Repatriation of profits
- Corporate tax

Others

- willingness of reinsurers to support business
- health care infrastructure medical infrastructure - hospitals and doctors (referrals, reports)
- …. how does this product underwriting and claim processing fit with that infrastructure?
- Potential for fraud
- modelling and profit testing
- would buying fully/partially an existing insurer in the Country a better alternative?

[½ per point, **Max 12]**

v) Difference is rating factors

- 'A' is more matured/developed and so will have adequate data/experience for segmented pricing [½]
- … therefore, will tend to have higher number of rating factors than B [½]
- Typical rating factors for IP include
    - Age
    - Gender
    - Occupation
    - Location
    - Income level
    - Type of disability definition
    - Length of deferred period
    - Level of replacement ratio [¼ per point; max 1½]
- Given 'B' is new to IP the following will likely inhibit segmented pricing
    - Data limitations – availability and quality
    - Need to keep the rating structure simple to make it easier for distribution to sell
    - Need to keep the rating structure simple for to make it easier for customers to understand

  [½ per point; max 1]
- Also, given the riskiness with any new product with no locally relevant experience, WTH will be reluctant to offer certain features and hence premium rating factors [½]
- ..for example, higher replacement ratio / 'own occupation' disability definition [½]
- In both countries, regulations may limit the rating factors that can be applied [½]
- for example,
    - no gender discrimination
    - no discrimination due to place of residence of the policyholder within the country

  [½ per point; max 1]

[Max 5]

vi) Possible reasons for reviewable rates

- Market research shown that there is viable market opportunity [½]
- Higher internet adaptability for buying health insurance online and so website distribution [½]
- Decided to target younger lives and so internet distribution [½]
- …due to lower risk and like more incentive to return to work [½]
- Other types of distribution not making economic sense due to higher costs [½]
- …and lack of available qualified resources [½]
- Onerous capital requirements for guarantees and so reviewable rates [½]
- Lack of relevant data makes reviewable proposition is less risky way to start [½]
- Market is used to reviewable health insurance and so the approach is aligned [½]
- Research/survey shown some initial period of guarantee is important to gain traction for the product [½]
- '5-years' initial guarantee period allows enough data to be gathered before premium review [½]

- Regulations require at least 5-years guarantee [½]
- The initial guarantee likely encourages good early duration persistency when asset share is negative [½]

[Max 5]

vii) Premium review process

- Morbidity experience data should be collected since the last pricing or premium review date, whichever is the latest. [½]
- Incidence rates & termination rates will be looked at for each homogeneous group and split into
  - age
  - gender
  - occupation (if known)
  - location/area of residence
  - income level
  - duration from entry
  - underwriting method
  - Income replacement ratio
  - Type of disability definition
  - Length of waiting period [½ per point, max 2]
- Mortality experience is also an important component of the investigation [½]
- Analysis type of claim (accident or sickness)
- …and ideally subdivided into causes - type of accident / sickness that led to disability [½]
- Exposure calculation – important to ensure that only lives insured in the investigation period under consideration are included in the figures [½]
- …equally important to ensure that claims are grouped so that the exposure and claims correspond [½]

Adjustments to "exposed to risk" will need to be made for withdrawals (lapse/freelook cancellation) [½]

- The adjustments should be made on a life-by-life basis using the date of entry and/or exit from the investigation [½]
- A vs E - the insurer needs to monitor the actual claims experience against the expected level [½]
- … by issue year (to reflect underwriting implications) & by calendar year (to reflect to general claim environment) [½]
- Expense analysis - needs to monitor the actual expenses incurred against the expected level [½]
  - Split by initial, renewal and claims expenses [½]
  - Allowing for inflation since the last analysis [½]
  - Excluding any one-off expenses [½]
- Lapse investigation – actual to expected lapses [½]
- …by duration given the long-term nature of the product [½]
- Investment income - actual to expected [½]
- With regular premium, the significance of investment income is likely to be low [½]
- The best estimate assumptions will need to be revised based on the results of the experience investigations mentioned above [½]
- Allowing for sufficiency and credibility of own data [½]
- Make appropriate allowance for expectations of future trends in incidence & termination rates [½]
- The risk discount rate will be based on the insurer's required profit margin at the original pricing date [½]

- but the risk-free rate should be consistent with current economic conditions and other financial assumptions [½]
- Investment return will need be consistent with risk discount rate and expense inflation [½]
- For each policy/model point, cashflows will be projected forward from the premium review date to the end of the policy term [½]
- The net projected cashflows will then be discounted at a rate of interest, the risk discount rate [½]
- The profitability criterion based on the latest assumptions should be compared with that used in the last review [½]
- This will allow WTH to decide if the rates should be adjusted to maintain the level of profitability of the policies concerned when they were priced [½]
- Consider if there is scope to reduce rates based on the outcome of the analysis if excess profits are expected [½]
- Consider how the results of any review are communicated to policyholders [½]
- Ensure the policyholders are given sufficient time to make any decisions about whether to continue with cover particularly when rates are increased [½]
- Weight the risk of selective withdrawal, potential impact volume to cover overheads etc. if rates are increased [½]
- Consider impact of any changes that could be made to the underwriting/claims/other processes before deciding on the rate increase [½]
- So, rate increase is the last resort if nothing else can be tweaked to improve the experience [½]

[Max 10]

[50 Marks]

****