INSTITUTE OF ACTUARIES OF INDIA

SUBJECT ST3 –GENERAL INSURANCE

MAY 2009 EXAMINATION

INDICATIVE SOLUTION

1.

i)

- The underlying assumptions may be incorrect.
- There may be bias in the source data.
- Errors or distortions in past data will distort the projections
- For example, large claims may distort the link ratios
- The older years may not be fully run-off
- The underlying claims handling processes may have changed, making the past link ratios inappropriate for future claims development

ii)

- Insufficient or incomplete data
- Distortions from individual large or catastrophe claims
- Incorrect inflation assumptions
- Changes in :
    - Product mix
    - Policy conditions
    - Reporting delays e.g. procedure changes
    - Settlement pattern
- Further outstanding claims reserves from earlier origin years
- Inappropriate projection of economic or social trends
- Random fluctuations in claims settled most recently from the first and last origin years are magnified by the methods
- Changes in the average cost of claim or definition of a claim will invalidate the average cost per claim method
- BF method will be invalidated due to :
- Inappropriate assumption regarding run off pattern
- Inappropriate assumption regarding choice of prior loss ratios

iii)

Assumptions
- The historical pattern of claims development will continue in the future
- All claims have been settled at the end of the 4th year.

The annual run off pattern is:

	1	2	3	4
2005	154	250	281	302
2006	139	230	259	
2007	168	274		
2008	174			

Development ratios
     1.6356 1.125   1.0747
  1

Ultimate loss

=259x1.0747	278.3
=274x1.125x1.0747	331.3
=174x1.6356x1.125x1.0747	344.1

1

Outstanding claims reserves

278.3 - 259	=	19.3
331.3 - 274	=	57.3
344.1 - 174	=	170.1

Estimate of total outstanding claims reserves = 246.7   1

iv)   Reserves not included:
- UPR
- AURR
- Catastrophe reserves
- Equalisation reserves

Possibly only partially included:
- O/s & IBNR & reopened claims (may be more payments after 4th year)
- Claim handling expense reserve (not covered if the claim amounts do not include suitable allowance for handling expenses).
- As figures are gross of reinsurance, future reinsurance recoveries need to be estimated before setting up actual net reserves.

v)

Advantages of the basic chain ladder
The method is simpler and easier to apply
If the claims development is stable and assumptions hold true, the basic chain ladder will work well, without the need to estimate a prior loss ratio.

The results with BHF will be distorted if the prior loss ratio is inaccurate
Advantages of Bornhuetter-Ferguson
The results are more stable from year to year.
This is particularly useful if the claims data is immature or there are significant changes from year to year.
The results are less sensitive to the tails of the BCL triangle.
Full data is not required, so this is useful for quick approximate valuations, or for frequent valuations.

Allows independent view of expected loss ratio from underwriters who priced the portfolio

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2.
i)
Reinsurance is purchased to reduce the volatility of claims experience outcomes
and to protect the company's solvency position
Both aims will be important factors for this company since it has minimal capital.
Quota Share – provide solvency support
Could include reciprocal arrangement to allow diversification of portfolio
Individual risk excess of loss – to protect against large losses on individual risks (e.g. serious bodily injury)

Catastrophe Excess of Loss – protection against events that give rise to large aggregate loss (e.g. flood, hail, earthquakes)
Stop Loss – to protect the company's earnings
However required cover may not be available or may come at a significant cost
Surplus – protection against single risk large losses, e.g. office buildings
Largest risks will be placed under facultative covers
Aggregate excess of Loss – Stop Loss – to protect the company's earnings
Financial reinsurance to protect balance sheet

ii)
For a well established company with significant excess capital, the desire for reinsurance cover may be lower
However this would depend on the risk appetite of the company
Higher retention levels are more likely as the company will be in a position to accept larger risks given its stronger capital base.
The Stop Loss covers is less desirable, particularly if it is expensive to purchase.
The company may still purchase reinsurance if it is perceived to be good value for money ½

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3.
i)
Possible intervention from the supervisory authority before the statutory minimum is breached.
A loss of confidence in the market and subsequent loss of new and existing business
Restrictions placed on volumes of new business to prevent intervention by the authority
May stop writing certain classes of business if they require more capital than others
Greater use of reinsurance to protect solvency
Investment in more secure assets
Company may need to consider raising additional capital from shareholders

ii)
Size of free reserves depends on strength of valuation bases for assets and liabilities
Solvency margin requirement depends on
- tail length,
- any mismatch of assets and liabilities by amount/term/currency
- the type, nature and security of reinsurance may differ between companies

For financial strength assessment , need to consider
- Expected future profitability, not just at one point in time.
- Riskiness of the classes— i.e. accumulations, latent claims etc need to be considered
- Riskiness of assets portfolio-- quality of assets, stability of market values and diversification
- Hidden margins /deficiencies in outstanding claims reserves
- for example, one company's reserve may be discounted
- Future exposures
- Quality of management
- Premium rate bases
- One off events will cause distortions If only looking at one year

[9]

4.

<u>Investment related risks</u>

There is a risk that the actual investment income is lower than expected.
This may be due to :

- Market conditions for securities invested in may worsen
- A larger than expected portion of the assets may not be available for investment
- Claims may have to be paid sooner than expected
- Assets may need to be realised in unfavourable conditions
- Poor investment management

Further investment risks may arise in situations where :

- there is insufficient liquidity in the portfolio
- the company deviates from a matched investment position (to maximize return)
- similarly the portfolio is invested in less secure instruments (perhaps to attain higher returns)
- Investment related expenses may be higher than expected
- Regulations relating to investment income may change that affects the return
- Legislative changes (e.g. tax rate) may change, reducing investment return

Movements in asset values can impair solvency if there is :

- A fall in certain sectors of the market in which investments are held
- A failure or adverse performance of individual assets or investments

There may also be some expectation about the level of premium income to meet current liabilities. The actual premium income may be lower than expected.

Pricing takes into account return on investment held to meet liabilities and assumptions may not be borne out

Expenses related risks

- Commission levels for different intermediaries may vary
- Change in the mix of the source of business could result in actual commission payable being different to that projected even though overall business volumes are in line with expectations.
- Change in staff and accommodation costs as the business increases / decreases.
- Particularly relevant for small company -decision about when to change premises can increase costs.
- Changes in legal and professional costs.
- There is no control as these costs are affected by supply and demand.
- Expense inflation rate may increase
- Changes in medical costs, salaries. May lead to anti selection if expense allocation is not appropriate
- Business volumes (new business/renewals) different to expected
- Contribution to fixed expenses will change-especially in a competitive market (soft premium)
- Changes in mix of risks within personal line motor business
  - E.g. mix of proportion of motorcycle and private car different than expected --(risk structure is different)

- For a small company fixed expenses will be a high proportion of total expenses
- Higher than expected claims expenses
  - where claim frequency is high
- Business risks which affect expenses   **[14]**

5.

Let $X \sim Exp(\ )$ be the gross claim random variable, Y be the net insurer's claim random variable and Z be the reinsurer's claim random variable.

Let the net premium rate be c*.

Then the equation for insurer's net account is is $+c^*R = M_Y(R)$, where

$c^* = (1+\ )\ m_1-(1+\ )\ E(Z)$

Now, to derive E(Z),

$$E(Z) = \int_M^\infty (x - M)\mu e^{-\mu x} dx$$

$$= \int_M^\infty \mu x e^{-\mu x} dx - M e^{-\mu M}$$

Let $\mu x = y \Rightarrow \mu dx = dy$

$$\frac{1}{\mu}\int_{\mu M}^\infty y e^{-y} dy - M e^{-\mu M}$$

Using integral by parts

$$= \frac{1}{\mu}[\mu M e^{-\mu M} + e^{-\mu M}] - M e^{-\mu M}$$

$$= \frac{1}{\mu} e^{-\mu M} = 1000 e^{-1}$$

So, $c^* = 1.5^*5^*1000 - 1.25^*5^*1000^*e^{-1} = 5000^*(1.5-1.25^*.368) = 1.04^*5000 = 5200$

$M_Y(R) = E(e^{RY})$

$$= \int_0^M \mu e^{Rx} e^{-\mu x} dx + \int_M^\infty \mu e^{RM} e^{-\mu x} dx$$

$$= \mu \int_0^M e^{(R-\mu)x} dx + e^{RM} e^{-\mu M}$$

$$= \frac{\mu}{(R-\mu)}[e^{(R-\mu)M} - 1] + e^{(R-\mu)M}$$

$$= \frac{\mu}{(\mu - R)} - \frac{R}{(\mu - R)} e^{-(\mu - R)N}$$

$$= \frac{1}{(1 - 1000R)} - \frac{1000R}{(1 - 1000R)} e^{-(1 - 1000R)}$$

So, the equation is

$$1 + 1040R = \frac{1}{(1 - 1000R)} - \frac{1000R}{(1 - 1000R)} e^{-(1 - 1000R)}$$

[7]

6.

i)

This insurance indemnifies the insured against legal liability for the death of or bodily injury to a third party that results from a product fault
or from damage to property belonging to a third party that results from a product fault.

ii)

The main risk and rating factors for product liability insurance are :
- Trade/occupation of the policyholder
- Nature/type of product
- How the product is used
- Potentially dangerous components in the product
- Territory where product is sold
- Previous claim history
- Instructions to use the product

iii)

Inadequate pricing (risk premium lower than expected claims) due to lack of data

Risk of anti-selection due to incorrect risk grouping

Past data may be irrelevant for future due to new product types or changes in technology

It may be difficult to set assumptions / loadings for pricing

Claim size variability versus the need for reinsurance to smooth results

Latent claims: new products and technologies may give rise to unexpected claims

Policy holders attitude to claim: One claim can give rise to a series of similar claims once policyholders become aware (i.e. class actions)

Potential accumulation of risk due to wide coverage of the product

Judicial decisions

Legislation/regulation changes

Interpretation of wording: ambiguous wordings can result into long court cases

Ability to make reinsurance recoveries

Failure to comprehend true coverage/limits of a reinsurance arrangement

Availability and cost of the desired reinsurance

Claim related inflation: may be higher than expected

Moral Hazard

Adequacy of expense loading in premiums

Change in expense inflation

Changes in legal and other professional expenses

Investment return lower than expected

Worse than expected market conditions

Claim payments sooner than expected

Liquidity risk

Competitors' behaviour

Operational risks

Inadequate IT systems to cope with new product

Poor underwriting criteria

Poor claim management

Insurance cycle

Interaction of these risks

iv)
As this is a new class of business for the company, it will be appropriate to work with a
reinsurance company which has experience in product liability business.

The reinsurer can also provide relevant reinsurance cover

Reinsurer can also be used to advise on systems designs

and support underwriting criteria, terms and conditions

As no internal data exists, market data may exist to support product pricing.

Considerations should be given to the issues of applicability of market statistics compared to the product the company intends to sell

Accurate database designs should be carried out to capture relevant pricing data so as to analyse the experience in future for repricing

Premium rates should be revised at regular and appropriate interval so that prices can be corrected to reflect experience

Policy wording should be made very clear to avoid any misinterpretation at the time of claims

Exclusions should be used properly in the policy wording to minimize moral hazard

High deductibles could be used to minimize moral hazard

Claims handling processes should be robust to check for fraudulent claims

Tight controls on underwriting acceptance, terms and conditions

Within the product liability portfolio, the business should be diversified to a variety of sectors, products and geographical areas to reduce accumulation of risk

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7.

i)

- Policy database (ideally transactional data)
- Policy number/Client ID
- Transaction date/time/number
- Inception/cover start date
- Transaction type
- Operative/Expiry dates for transaction
- Location (address, postcode)
- Cover/Product type (Only fire, Machinery cover, Business interruption, etc.)
- Gross written premium
- Commission
- Rating factors :
  - Trade/Occupation of business
  - Sum insured (Buildings /Contents/Stock/ Business Interruption)
  - EML
  - Business Interruption indemnity period
  - Construction type
  - Policy excesses
  - Age of building
  - Type of building
  - Fire protection equipment
  - Surveyor's report
  - Previous claims
  - Length of trading

- Claims database (ideally transactional data)
  - Claim number
  - Policy number/Client ID
  - Date of Loss
  - Reported date
  - Settled date
  - Event number/ID (to capture the event in case of catastrophe)
  - Claim status
  - Peril and Cause data
  - Payment type
  - Payment amount
  - Payment date
  - Gross and net of recoveries outstanding reserves
  - Fees for handling claims

ii)

Improper database management exposes a firm to various risks:

- Inaccurate pricing
- Which may lead to reduced volumes of business
- Resulting in higher expense ratio due to fixed expenses
- Could lead to higher than expected volumes of business
- Resulting in inadequate staff available to cope with administration
- Potential undetected accumulations of risk
- Inaccurate reserving
- which may increase risk of insolvency if under-reserved
- Or missed opportunity cost of tying up capital if over-reserved
- Possible downgrading by credit rating agencies
- Loss of reputation
- Lack of control in claims costs / claims management process
- Lack of underwriting controls due to incorrect decision making
- Loss of control of recoveries from other insurers and reinsurers
- Incorrect information sent to policyholder at renewal
- Higher risk capital requirements imposed by regulatory authority

iii)

There should be regular monitoring of various data reports by management to ensure that proper data is being captured

Department heads (underwriting, claims, operations etc.) should monitor their area specific data to ensure quality checks are in place

Relevant department should be established to deal solely with Business MI (including robustness checks)

Summary level data, extreme or outliers, blanks etc should be checked to identify potential errors

There should be In-built data integrity checks in the data systems

This can be done by using dropdown options rather than free texts for input

Dropdowns can be intelligent for faster navigation though the system

All stakeholders in the data should be involved at the time of database design

This will ensure that all important fields are recognised

All the staff who enter data in the system should be fully trained on using the system

There should be regular refresher courses and tests to ensure that there is continued awareness of the systems

Senior management should be made aware of the importance of proper database management and adequate budget should be set aside for this purpose.

iv)

Exposure report (number of policies – new business, renewals)

Exposure report (premium income, major new clients by premium volume)

Claim frequency per unit exposure

Average claim size or claim amount distribution

Retention rate / Lapse rate

Gross and net claims (to understand the extent of reinsurance recoveries)

Average premium size

Risk profile (distribution of number and premium into various Sum insured / PML bands)

Actual vs Expected (as per the quarter-end calculations) IBNR / IBNER reserves

Proportion of claim from LOBs (Pie chart)

Large Claims report

New claims during the period

Claims closed without payment during the period

Claim payment delay reports

Settled claims during the period

Total outstanding claim at the beginning and end of the period

[23]
[Total 100 Marks]

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