

EXAMINERS' REPORT

June 2014 examinations

Subject F103 — *General Insurance* Fellowship Principles

INTRODUCTION

The attached report has been prepared by the subject's Principle Examiner. General comments are provided on the performance of candidates on each question. The solutions provided are an indication of the points sought by the examiners, and should not be taken as model solutions.

QUESTION 1

- i. The solvency margin is the excess of the value of an insurer's assets over its technical reserves and current liabilities
- ii. An insurer's solvency position is improved if its solvency margin increases relative to its solvency requirement. Reinsurance can assist by:

Increasing the value of the assets:

- Financing can be obtained through the reinsurance commission associated with proportional reinsurance.
- Financial reinsurance can be sought.
 - Such arrangements can effectively be loans repaid from the future profits of the underlying business.
 - As the "repayments" of the "loan" are contingent on profits they do not appear as a liability on the balance sheet, which would have been the case with a bank loan.

Decreasing the value of the liabilities:

- By reinsuring the insurer is reducing the value of its liabilities as some of its liabilities are ceded to the reinsurer.
- Reinsurance allows the insurer to get a better spread of risks which may result in more certainty in aggregate results and therefore less need for margins in reserves.
- Reciprocal arrangements can also assist with this.
- Non-proportional cover can assist in dealing with:
 - large claims; and
 - accumulations of risk.
- All of the above allow the insurer to hold lower reserves.
- However, the assets are reduced by the amount of the reinsurance premium paid.

Decreasing the regulatory minimum solvency requirement:

- The required solvency level is often calculated with reference to the proportion of business reinsured, i.e. more reinsurance means a lower solvency requirement, and therefore a stronger solvency position.
- However, this reduction may be subject to a limit, since there may be a legal requirement for an insurance company's free reserves to exceed a Required Minimum Margin (e.g. to protect against reinsurer failure).

iii. Adverse development cover:

- A reinsurance arrangement whereby a reinsurer agrees, in return for a premium, to cover the ultimate settled amount of a specified block of business above a certain pre-agreed amount.
- It protects the cedant from significant reserve deterioration on run-off business.
- The premium that is payable for the cover will depend on the risk appetite of the market.
- Usually it is only possible to reinsure a layer above a specified amount, i.e. there is usually an upper limit to the cover.
- The reinsurer may also insist that the insurer has a small participation in the layer.
- Claims are usually still handled by the insurer and hence there are the associated expenses.
- Reserves are maintained by the insurer (as opposed to being transferred to the reinsurer) and it receives all investment income generated from the investments backing these reserves.
- The insurer is exposed to the credit risk of the reinsurer, since the insurer remains liable to the insured parties for all claims within the block reinsured.

Loss portfolio transfers:

- An arrangement whereby the liability for a specified book of business is passed in its entirety from one insurer to another.
- Policyholders will be informed of this “novation” (the transfer of rights and obligations under a contract from one party to another) and the deal may need to be approved by a court.
- Novation is not strictly reinsurance since the new insurer is responsible for the liabilities in total from the date of the transfer.
- The original insurer will transfer the reserves and the remaining exposure to the new insurer.
- It is likely that there will be a premium in addition to the existing reserves (to compensate the accepting insurer for taking on the risk and for the cost of the transfer).
- This would normally include a claims handling service.
- Assets may need to be realised to pass across the value of the reserves to the accepting insurer (which is particularly important if there is mismatching or if tax gains / losses would be crystallised).
- If the new insurer defaults, this could damage the reputation of the original insurer.
- The transfer may require the buy-in of reinsurers where there are existing reinsurance arrangements covering the portfolio.

This was a fairly straightforward bookwork question. It was disappointing to see the number of candidates who could not even reproduce the definition of a solvency margin required in part (i). Several candidates defined the solvency ratio, while others defined solvency margin in terms of other (undefined) terms, e.g. free assets. Some others defined it as the margin

required by the regulators. Candidates that do not bother to learn definitions of fundamental terms are going to find it very difficult to answer questions based on those definitions.

The better prepared candidates did reasonably well in part (ii). Some candidates forgot that reinsurance comes at a cost as the reinsurers will price to make a profit. Some candidates listed general advantages of reinsurance, which did not answer the question.

Part (iii) was straight bookwork, which was answered fairly well by most candidates. Some, however, demonstrated that they did not know this part of the course material.

QUESTION 2

i. Liquidity risk may increase because:

- Brokers often collect premiums on behalf of the insurance company.
- This money will accrue as income to the insurer, but is not available as cash until the broker has paid it through to the insurer.
- This may affect the insurer's ability to meet its obligations.
 - This is particularly so if the money is paid later than expected.

ii. Relative advantages of moving to direct selling:

- The company has greater control over the remuneration of sales staff. (Brokers to an extent dictate the remuneration rates particularly in markets where broker business is dominant.) This may allow cost savings or better alignment of incentives.
- Sales-staff are selling only your products. Brokers may have a number of products from other companies that compete with yours and will sell the most appealing (to them) first.
- The company retains control of the target market by selling direct. There is no guarantee that brokers are selling to the desired target market.
- It can give the company greater control over its sales volumes, e.g. the ability to stop selling business to a certain category of policyholders by simply instructing call centre agents, rather than having to communicate to all brokers.
- The company may increase its potential reach and hence sales volumes. This is particularly important as direct selling is an expanding market and if the company does not start selling direct, competitors may gain a first-mover advantage.
- It can be an efficient way of selling business (e.g. can run one training session for all sales staff rather than visiting brokers separately), and result in some long-term cost savings.
- Management information should be able to be accessed more quickly as it will be directly loaded onto the company's systems – no need to collect data from brokers.

- Premium rates do not need to be as competitive as is required when selling via independent intermediaries as potential policyholders cannot compare quotes as simply as when buying through brokers. This could allow greater profit to be made.
- There will be a reduced liquidity risk in that brokers are not holding premiums for the company.
- Selling directly allows active cross-selling of products as the company has direct contact with customers.

Relative disadvantages of moving to direct selling:

- The company will incur the costs of setting up and maintaining an internal sales force.
- Furthermore, this will be a fixed cost (including salaries) compared to broker commission which is only paid when brokers bring in business. This increases fixed costs and the associated risk of not selling enough policies to cover costs.
- Brokers have an existing client base to which they can sell. They therefore can provide the company with more exposure to the market than they may be able to do directly – at least initially.
- Some product features may be complex, and such products could be difficult to sell directly to the public compared to brokers where they are able to explain product features to potential policyholders.
- It will take time to build up expertise in selling directly. This may make direct selling less effective initially.
- Extra costs will be incurred in establishing brand awareness with the public (through marketing etc.) because in the past policyholders would have known brokers brands, but not the insurer's brand.
- The policyholders attracted (target market) will likely be different, resulting in pricing assumptions being invalid (if there were cross-subsidies in existing rates based on a certain mix of business).
- Renewal rates may decline (lapses increase) on existing policies if broker business is done away with as policyholders are likely to have some degree of loyalty to their broker, rather than to the insurer. This will reduce policy volumes and reduce the insurer's ability to recover expenses.
- Renewal rates may decline and lapses increase, impacting on expense recoupment.
- The mix and volume of business attracted will not be known, which could make pricing difficult initially.

iii. Problem with expense cross-subsidies:

- Motor insurance premiums will be higher than they would be if they were only covering the costs of the motor insurance book as they are also covering some expenses from the property book.
- This increases the risk that the insurer's motor policies are overpriced relative to competitors' policies hence competitors attract business away from this insurer.

iv. Steps in investigation:

Goal of exercise:

- The goal of this exercise is to determine which expenses are as a result of writing each of the products, so that the cost of writing each product can be determined.
- This cost will then be compared to the current expense loading for each product to see if there is indeed an expense cross-subsidy.
- The expense loading can be calculated by taking the gross premium and subtracting the expected claims cost and other loadings (e.g. capital loading and a negative loading for investment income).

Collect data:

- Data on all expenses must be collected.
- This is to ensure that the expense allocation to each product sums to the total expenses of the company.
- Data items to be collected include number of policies, premium volumes, etc.

Allocate company expenses between products:

- The first step is to split expenses between direct and indirect expenses.
 - Direct expenses can be directly attributed to each product book
 - e.g. the salary of an actuary that sets premium rates for the motor product only can be directly allocated to the motor product.
 - There may be certain expenses that can't be directly allocated because they are shared between products
 - e.g. central call centre that sells both motor and property business or actuaries working on both policies.
- It may be helpful to split expenses between fixed and variable expenses because variable expenses are always direct and can be allocated easily to the product they relate to
 - e.g. commission is charged as a percentage of premium on each policy, so it is easy to sum the commission on each of the products to get the total commission per product.
- Fixed expenses can be direct or indirect.
- Direct fixed expenses, will be easily allocated to the product they relate to, e.g. salaries of staff dedicated to a particular product.
- However there needs to be a pragmatic allocation of indirect fixed expenses that can't easily be allocated to a particular product.

For example:

- Management salaries or admin staff salaries for staff that work on more than one product. Allocation may be in proportion to premium volumes or using staff timesheets.
- Property costs can be allocated by charging each department a notional rent according to floor space occupied and then allocating this rent to products in the same proportions as salaries of staff in each department.

- Computer costs. Spread cost over its useful lifetime and split according to how the salary of the staff member who uses the computer is split.
- Investment costs. Split based on the contribution of each product to the level of investible assets.
- Once-off capital costs. Allocate over useful lifetime and split according to their use. Similar to computer costs.
- Claims handling costs. If claims assessment is a fixed cost per claim, then the total claims assessment cost can be split between products based on the number of claims experienced on each product or, if only claims above a certain limit are assessed then claims assessment cost will be split based on number of claims above that level. If the claims assessment cost is proportional to the size of the claim, then the total claims assessment cost may be split between products based on total claims.
- Commission expenses are likely to be excluded from this analysis (since it is usually a straight forward percentage of premium per policy).

Part (i) was well answered by most candidates. Some candidates failed to mention that there may be uncertainty in the timing of the receipt of premiums from brokers. If timing was certain, planning could reduce the liquidity risk.

In part (ii) the better students split the relative advantages and disadvantages and made it clear why each point was a relative advantage or disadvantage.

In part (iii) many students wrote about the problem of mix of business changing and resulting in expenses not being recovered, but this was not the problem alluded to in the question, which was that premiums are too high relative to competitors on the motor book due to the expense loading being too high.

Part (iv) only required expenses to be split between direct and indirect and then indirect expenses allocated to each product. Many candidates scored poorly because they simply regurgitated material recited from the expenses section of the notes without actually answering the question.

QUESTION 3

- i. The burning cost premium is defined as the actual cost of claims during a past period of years expressed as an annual rate per unit of exposure such that:

$$\text{BCP} = (\text{Total Claims}) / (\text{Total Exposed to Risk}).$$

The effective burning cost premium (EBCP) is the burning cost premium using unadjusted data.

$$\text{Hence EBCP} = \text{R } 157\,961\,655 / 41\,228 = \text{R } 3\,831.42$$

The indexed BCP (IBCP) adjusts the claims for past inflation and also includes IBNR.

As a result, if we price using the EBCP (unadjusted approach), we will often end up with loss ratios higher than expected.

Firstly need to adjust claims to 1/1/2014 assuming inflation has been 6% over the last 5 years and that claims occurred uniformly over the period (this implies that on average claims occurred half way through the period).

In addition, assuming that the new exposure period runs from 1/5/2014 to 31/4/2015, we need to adjust claims to 1/11/2014.

Start Date	Mid period of exposure	Months to 1/11/2014 from mid period of exposure	Claim Amounts	Inflation-adjustment factor	Inflation-adjusted claims
1/5/09	1/11/09	60	R 27 066 562	$1.06^5 = 1.338226$	R 36 221 166
1/5/10	1/11/10	48	R 25 846 461	$1.06^4 = 1.262477$	R 32 630 562
1/5/11	1/11/11	36	R 59 766 377	$1.06^3 = 1.191016$	R 71 182 711
1/5/12	1/11/12	24	R 31 683 226	$1.06^2 = 1.123600$	R 35 599 273
1/5/13	1/9/13	14	R 13 599 029	$1.06^{14/12} = 1.070344$	R 14 555 643
Total			R 157 961 655		R 190 189 355

The IBCP = $(R190\ 189\ 355 + R10\ 879\ 223) / 41\ 228 = R4\ 876.99$

Alternative solution:

Allow the exposure measure to be sum insured rather than policy numbers i.e. premium rate per unit sum insured:

EBCP = $R157\ 961\ 655 / R57\ 737\ 610\ 746 = R2.73585$ per R1000 Sum Assured

IBCP = $(R190\ 189\ 355 + R10\ 879\ 223) / R57\ 737\ 610\ 746 = R3.482454$ per R1000 SI

ii. Advantages of the burning cost approach include:

- Simplicity.
- Needs relatively little data.
- Quicker than other methods to perform.
- Allows for experience of individual risks or portfolios.

Disadvantages of the burning cost approach include:

- Harder to spot trends so it provides less understanding of changes impacting the individual risks.
- Adjusting past data is difficult.
- Adjusting for changes in cover, deductibles and so on may be difficult as we often lack individual claims data.
- It can be a very crude approach.

iii. The gross premium would be calculated as:

$$\frac{(\text{Exposure in 2014} \times \text{burning cost premium} + \text{expected claims costs} + \text{policy expenses} + \text{vehicle expenses})}{(1 - \text{commission rate} - \text{profit and contingency loadings})}$$

iv. Before the final premium is determined, we need to determine whether there are any potential large losses in the historical data distorting the calculations:

If we consider the experience and look at the average claim amounts:

Start Date	Months	No.	Amounts	Average Claim amount
1/5/2009	12	1 984	R 27 066 562	R 13 642.42
1/5/2010	12	2 112	R 25 846 461	R 12 237.91
1/5/2011	12	2 439	R 59 766 377	R 24 504.46
1/5/2012	12	2 240	R 31 683 226	R 14 144.30
1/5/2013	9	924	R 13 599 029	R 14 717.56

There is a clear indication of a massive jump in the average claim in 2011. This could be due to some potentially large claims in 2011 or a data error.

As a result, one should first double check the data and then possibly apply some sort of smoothing to the claims or cap any of the extremely large claims.

Other factors to consider include:

- May involve business decisions such as offering preferential rates (taking lower profit) on this business as ABC Car Rental may have other insurance contracts with the company that are highly profitable.
- It may be inappropriate to rely solely on the experience of ABC Car Rental, especially if it is not credible and therefore, some combination between book rates and experience rates should be considered.
- No information has been provided on the type of cover in each year within the experience. It is important to identify whether the cover in 2014 will differ from previous years
- Need to determine whether there has been any change in the car rental market e.g. types of drivers and types of cars driven
- If company doesn't have the business already, one would also need to consider different policy wordings / restrictions expected to reduce claims costs / numbers.
- Need to consider any expected future external events such as changes in legislation that may impact claims costs, expenses, commission or profit allowances.
- Determining whether the policy will be reinsured and whether reinsurance loadings should be included.
- Competitors' quotes and assumptions made by competitors.

In part (i) a number of candidates did not know the difference between the effective burning cost premium (where there are no adjustments to past claims and exposure) and the indexed burning cost where adjustments are included. As such, candidates who included IBNR in the

effective burning cost premium calculations lost marks. A number of candidates who did adjust claims for inflation did not state their assumption or alternatively did not justify why they accumulated claims to the end or mid period in 2014. Some candidates used the premiums as a measure of exposure. Whilst this may be appropriate in reinsurance pricing, given that there were two clearly more appropriate measures of exposure in the question, candidates were given no credit for this.

Part (ii) was bookwork and was generally well answered. Many candidates, however, did not provide enough information or focused on the frequency-severity advantages and disadvantages.

In part (iii) the burning cost premium (BCP) is defined as the actual cost of claims during a past period of years expressed as an annual rate per unit of exposure. Candidates lost marks if they did not multiply BCP by an exposure measure or left out the exposure and loadings plus commission. Some credit was given where candidates demonstrated a basic understanding of obtaining OP from BCP.

Part (iv) was bookwork and was fairly well answered. However, many candidates did not provide enough points.

QUESTION 4

- i. Funded accounting is a method of accounting whereby premiums, claims and associated expenses are related to the underwriting year in which the policies start. The recognition of any underwriting profit is deferred until a subsequent accounting period, but provision is made for losses as soon as they are foreseen.

It is used where the underwriting year is of fundamental importance, e.g.

- at Lloyd's (determines who is on risk);
- for reinsurance contracts that operate on a policies incepting basis because for some classes considerably more information is available after three years compared with after only the first year regarding premium payment, claims settlement and making reinsurance recoveries;
- marine and aviation insurance and non-proportional reinsurance.

- ii. Assumptions:

- Risk is spread evenly over the policy period
- UPR is calculated on 365th method i.e. based on date of inception
- Commission expense is incurred evenly over the policy term

Calculations:

$$\text{UPR cf Yr1} = [5/6 + 4/6 + 3/6 + 2/6 + 1/6] \times 120 / 12 = \text{R25m}$$

$$\text{UPR cf Yr2} = [5/6 + 4/6 + 3/6 + 2/6 + 1/6] \times 144 / 12 = \text{R30m}$$

$$\text{UPR cf Yr3} = [5/6 + 4/6 + 3/6 + 2/6 + 1/6] \times 192 / 12 = \text{R40m}$$

DAC cf = 5% of UPR cf for each year

Earned premiums = Written premiums + UPR bf – UPR cf

Commission incurred = Commission paid + DAC bf – DAC cf

Claims incurred = Claims paid + Claim reserves cf – Claim reserves bf

Insurance profit = Earned premiums – Claims incurred – Expenses (incl. commission)
+ DAC increase + Investment income

	Year 1	Year 2	Year 3
	R mill	R mill	R mill
Written premiums	120	144	192
UPR bf	0	25	30
UPR cf	25	30	40
Earned premiums	95	139	182
Claims paid	62	82	103
Claims bf	0	18	29
Claims cf	18	29	37
Claims incurred	80	93	111
Commission paid	6	7.2	9.6
DAC bf	0	1.25	1.50
DAC cf	1.25	1.50	2.0
Increase in DAC	1.25	0.25	0.50
Other expenses paid	5	8	12
Investment income	2	6	10
Insurance profit	7.25	37.05	59.90

iii. The UPR at the end of the year for a policy written in month m of the year is:

- For $m \leq 6$, UPR = 0, and
- For $m \geq 7$, UPR = $(2m - 13)/12 \times \text{Premium}$

Alternatively one can assume in this case that premiums are written half-way through the year on average, and that $\frac{1}{4}$ of premiums remain unearned by the end of the year.

Calculations:

$$\text{UPR cf Yr1} = [11/12 + 9/12 + 7/12 + 5/12 + 3/12 + 1/12] \times 120 / 12 = \text{R30m}$$

$$\text{UPR cf Yr2} = [11/12 + 9/12 + 7/12 + 5/12 + 3/12 + 1/12] \times 144 / 12 = \text{R36m}$$

$$\text{UPR cf Yr3} = [11/12 + 9/12 + 7/12 + 5/12 + 3/12 + 1/12] \times 192 / 12 = \text{R48m}$$

Or alternatively:

$$\text{UPR cf Yr1} = \frac{1}{4} \times 120 = \text{R30m}$$

$$\text{UPR cf Yr2} = \frac{1}{4} \times 144 = \text{R36m}$$

$$\text{UPR cf Yr3} = \frac{1}{4} \times 192 = \text{R48m}$$

DAC cf will also be affected:

$$\text{DAC cf Yr1} = 5\% \text{ of UPR cf Yr1} = 5\% \text{ of R30m} = \text{R1.5m}$$

$$\text{DAC cf Yr2} = 5\% \text{ of UPR cf Yr2} = 5\% \text{ of R36m} = \text{R1.8m}$$

$$\text{DAC cf Yr3} = 5\% \text{ of UPR cf Yr3} = 5\% \text{ of R48m} = \text{R2.4m}$$

All other items remain unchanged, hence the new profits are:

$$\text{Profit Yr1} = \text{R2.5m}$$

$$\text{Profit Yr2} = \text{R36.1m}$$

$$\text{Profit Yr3} = \text{R58m}$$

iv. The proposed method would not be suitable.

If all premiums are received at the start of the month, as is stated, the impact of calculating UPR on the proposed method is that it would mis-state the financials by:

- overstating the UPR, and hence
- understating the earned premiums and profits.

Very few candidates did well on this question.

Part (i) was bookwork that has been tested previously, yet candidates generally produced poor answers. Stating that funded accounting is “based on the underwriting year” without any further explanation, and without explaining the relevance of the underwriting year, got no credit. Candidates had to specify that the method tracks premiums and outgo relating to policies written in a particular underwriting year.

Common errors in part (ii) included:

- *Assuming that premiums are written evenly over the month despite the question specifying that premiums are received at the beginning of the month;*
- *Ignoring DAC and the increase in DAC;*
- *Not specifying assumptions.*

For part (iii), full credit was given for the correct method for deriving UPR even though the formula given was not produced. The most common methods used by candidates entailed a manual method of showing all the months and calculating the UPR per month, or assuming that the premium is written half-way through the year, thus implying that $\frac{1}{4}$ of the premium is unearned by the end of the year.

For part (iv), a number of candidates claimed that the student actuary’s suggestion is better and more realistic since premiums will in reality be written evenly over the month. However candidates were expected to use the information given in the question, and not make comments based on their own assumptions.

QUESTION 5

i. Best-estimate reserves:

- The best-estimate reserve is a point estimate reserve commonly defined as the mean or expected value of the outstanding liabilities after allowing for areas of uncertainty.
- It may also be defined as the median of reserves i.e. equally likely that the true claims value will be above or below this value.
- The best-estimate is the Actuary's subjective derivation of the outstanding liabilities. It takes into account all available information to date and is based on the Actuary's selected reserving model and assumptions.
- Best-estimate should not be inherently optimistic or pessimistic.
- Not meant to contain margins.
- The best-estimate should be based on sound and appropriate actuarial or statistical techniques and on current and credible information.
- Different actuaries may calculate different best-estimate reserves based on the same information i.e. it is the actuary's subjective view.
- Best-estimate reserves do not provide any information on the variance.
- A range of best-estimate reserves may be provided instead of a single best-estimate reserve.
- The actuary should specify what is included in the best-estimate e.g. expenses, salvages, etc.

ii. Let X be the random variable representing the best estimate claim reserves at the year end. From Assumption $X \sim \text{Normal}$ (mean = R1 billion, variance = R1.5 billion).

Let X_p be the p^{th} percentile of the distribution of X .

i.e. Probability $\{X < X_p\} = p$

$X_{40\%} = \text{R } 0.69 \text{ billion}$

$X_{60\%} = \text{R } 1.31 \text{ billion}$

The best-estimate claim reserves are expected to lie in the range (R0.69 billion, R1.31 billion) at the year end.

iii. Types of uncertainty and potential errors:

- Process uncertainty:
This is the randomness of the underlying process.
The occurrence, severity and reporting delays of claims is an inherently random process and there will always be some randomness.
- Parameter uncertainty:
Uncertainty in selecting the parameters within the reserving process.
Incorrect chain ladder development factors possibly for the liability class where a large number of development factors have been excluded.

- **Model error:**
Uncertainty arising from the fact that an inappropriate model may be selected.
Selecting the claim reserves based on the chain ladder using paid claims data instead of incurred claims data could be a cause of model error.
Selecting the basic chain ladder instead of using the loss ratio could be a model error.
- **Errors due to incorrect data:**
Incorrect data could lead to incorrect parameters, e.g. development factors, or could lead to the selection of the wrong model.
- **Systemic error:**
Uncertainty arising from unforeseen trends or shifts away from the current claims environment.
Changing weather patterns and the resulting hail claims could represent systemic error.

iv. Issues to consider:

- You should quantify the level of uncertainty by providing a range of outcomes i.e. as calculated in part (ii).
- You should state that the range of outcomes is also itself subject to uncertainty to avoid the illusion of certainty implied by the use of ranges.
- You should also consider giving a qualitative description of the uncertainty in outcome e.g. there is a good chance that if the court awards compensation for workplace stress current claim reserves are insufficient.
- You should emphasise that the best estimate is just an estimate; there are many different best estimate reserves depending on the underlying models selected and assumptions made. The actual ultimate claims will most certainly differ from the selected best estimate reserve.
- You should highlight key assumptions and methodologies underlying the best estimate reserves. Specifically highlight critical key assumptions that the best estimate is most sensitive too and how appropriate you believe these assumptions to be.
- You should comment on the main restrictions in deriving the selected best estimate reserve and the range of best estimate reserves. These could include :
 - Incomplete or inadequate data.
 - Suitability of the normal distribution for calculating the range of best estimate reserves.
 - Exclusion of certain events e.g. catastrophes, etc.
- You should emphasise any unusual issues, e.g. :
 - Latent claims.
 - Increase in weather-related claims.
- Consider the limitations of the methods used to determine the best estimate.
- Consider model limitations which may increase the uncertainty within the best estimate reserves.

- Consider areas where actuarial judgement is used, including the reasoning underlying this judgement together with possible alternative judgement calls.
- State what is included and excluded from the best estimate reserves i.e. this will ensure the audience appreciates the scope of the best estimate reserves.
- Carry out scenario testing to better understand the level of uncertainty and potential impact of specific scenarios.
- Make specific reference to the strengths and weaknesses of the normal distribution versus other possible distributions.
- Consider the audience when drafting presentations.
- Consider actual versus expected to understand variability.
- Cover all areas of uncertainty parameter, model, process & systemic.
- Consider the effect of reinsurance on the level of uncertainty.

Part (i) was a book work question and was generally well answered. A (surprisingly) common error was confusing the mean and median of a distribution (which are not the same for a skewed distribution).

A surprising number of candidates did not attempt part (ii), which was a fairly straightforward application of statistical principles. Candidates studying subject F103 should ensure that their statistical knowledge is sound. Marks were lost by some candidates for failing to state assumptions, e.g. stating the assumption of normality for the underlying reserve distribution.

In part (iii) few candidates understood the concept of process error which is essentially the error arising since the claims process is inherently a random process, and would exhibit variation even if the parameters of the underlying distribution were known with certainty. This was confused with other types of error e.g. parameter error. Other errors, e.g. human error or errors due to inappropriate data, were given credit.

Part (iv) was generally not well answered. Some answers were too narrow and focused on one particular area. In order to score well candidates needed to cover a wide range of issues.

QUESTION 6

i. Advantages:

- Simple to understand, which could increase the number of policies sold.
- Higher premium for those that travel further.
 - This is sensible because these drivers are at risk for longer periods and so claims are more likely.

Disadvantages:

- Creates cross-subsidies in premiums between drivers who travel the same distance, but pose more or less risk in other ways.
 - In particular the size of the vehicle is not taken into account.

- Premium will be based on average driver (car size, age, etc.).
- If more of high risk drivers purchase policy, the average premium will not be enough.
- Could be difficult (and costly) to determine distance travelled.

Examples of how premium may be inaccurate:

- Larger vehicles of greater value and therefore property claims likely to be for greater amounts.
- Larger vehicles are at greater risk of passenger liability claims as they may have more passengers.
- Driving ability (e.g. as measured by past claims experience) is ignored, so poor drivers will be undercharged.

ii. Possible methods of distribution include:

- Affinity groups that have access to taxi-drivers e.g. a taxi association:
 - The association will likely have regular communication and/or contact with the taxi drivers allowing them to explain the insurance policy.
 - Policies can be sold and claims can be settled through this group, which will keep administration costs low.
- Direct marketing:
 - It should be possible to get contact details for the taxi owners/drivers to target marketing.
 - This should be able to be done efficiently as the product is fairly simple.
- Brokers already in the market:
 - The brokers would already have presence in the market and thus could sell to policyholders quickly without the need to establish the brand, advertise, etc.
 - This could have lower start-up costs as it works off existing broker networks and infrastructure

iii. Risks of increase in claim frequency:

- Deteriorating driving conditions leading to more accidents
 - e.g. potholes on roads.
 - weather related e.g. above average rainfall resulting in more accidents.
- Moral hazard risk. Drivers may be more reckless in an attempt to get more revenue, knowing that they are insured if they have an accident.
- Fraudulent claims are possible where taxi drivers fabricate claims.

Risks of increase in average claim cost:

- More larger vehicles than expected and priced for in “average” premium and hence larger claims.
- Repair costs going up in country e.g. due to lack of supply of parts.
- Exchange rate of South American country getting stronger relative to the rand, hence claims cost more in rand terms.

Risks of accumulations of risk:

- Fire at taxi depot resulting in many claims from the same event.

iv. Advantages:

- After one year the company will be able to analyse experience so that it can:
 - price more accurately;
 - refine the product design to be more applicable to the target market,
 - especially if the take-up is slow this may indicate that the product is not attractive.
- If claims are higher than expected, the limit of one year and 1000 policies will limit losses.
- If policy volumes increase extremely quickly, this may indicate anti-selection.
- The limit of 1000 policies will allow the insurer time to observe claims experience to see if it has under-priced.
- The company gains experience in the environment, including regulation, so can make a more informed decision of whether to offer the product.

Disadvantages:

- If the company fails to renew policies after 1 year, it will have to start from scratch in terms of marketing, distribution, etc. if/when it decides to re-enter the market.
- Some drivers will be disgruntled and may not re-purchase the insurance.
- If the company stops selling policies when it reaches 1000, it will lose momentum and ground to competitors.
- A limit of 1000 taxi drivers may not be a sufficiently large sample for decisions especially if the sales process hits some subset of the available market with unknown characteristics.
- The effect of the underwriting cycle would not be appreciated with only one year of experience.

v. Possible reasons:

- There should be sufficient time to sell enough policies to get a fair idea of experience (reducing the distortion in experience due to randomness).
- The period should be short enough so that the insurer does not overcommit and risk large losses due to poor product design and/or mis-pricing.
- There will be sufficient time to collect data on other features that were not included in the premium rate calculation for the trial product so more accurate rates can be charged when re-entering the market e.g. age of drivers, etc.
- To assess experience in all seasons of the year e.g. claims may be higher around certain festivals specific to the South American country.
- The insurer already has experience in this type of business, so they may feel that a year is enough time to give them an indication of how this country differs to what they know.

vi. Importance:

- The premium calculation in its current form is overly simplified and will result in cross-subsidies.
- This opens the insurer up to risk.
 - anti-selection if the premium is too low for riskier policyholders; and
 - loss of business if premiums are too high.
- It is desirable to be able to charge a premium that more accurately reflects risk.
- By collecting information on other factors the insurer will be able to use this information together with claims information to calculate more accurate premiums.
- The data can also be used for other exercises e.g. marketing campaigns.

vii. Exposure measure: sum-insured year or sum-insured kilometres.

Both give a measure of the size and duration of the risk, i.e. exposure to risk.

Additional data:

- Driver's age or years as a driver: Less experienced drivers likely to be more accident prone.
- Sex of driver: Male or female driver may be riskier (drive faster or have more accidents).
- Number of seats in taxi: More seats increases claims cost of passenger liability.
- Vehicle brand: Certain vehicles may be more prone to accident e.g. related to engine capacity.
- Colour of vehicle. Certain colours are less visible and hence more likely to be involved in collisions.
- Safety features. Will reduce number of accidents (e.g. ABS braking) and potential damage to passengers given an accident (e.g. airbags).

This question was well-answered by most candidates. A key point that was missed by some candidates in part (i) was the risk of anti-selection. In part (ii) candidates were awarded marks if they were able to give valid reasons for the distribution channels that they suggested. Part (iii) required some creative suggestions of claims risks, although these would have been similar to motor claim risks, making the idea generation easier. Parts (iv) and (v) were the most difficult parts of the question, requiring students to think about the reasons for the design of the trial. The better candidates were able to generate good reasons. Part (vii) was relatively straightforward. Some candidates gave reasons for the suggested rating factors, although this was not asked for in the question and so no extra credit was given.

END OF EXAMINERS' REPORT