

EXAMINATION

September 2007

Subject ST3 — General Insurance Specialist Technical

EXAMINERS' REPORT

Introduction

The attached subject report has been written by the Principal Examiner with the aim of helping candidates. The questions and comments are based around Core Reading as the interpretation of the syllabus to which the examiners are working. They have however given credit for any alternative approach or interpretation which they consider to be reasonable.

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Chairman of the Board of Examiners

December 2007

Comments

Individual comments are shown after each part-question or question.

1 (i)

- Probability of ruin $\Psi(U) \leq e^{-RU}$ (Lundberg's inequality)
- where U = initial capital = 10
- R = adjustment coefficient = $a\theta/(1 + \theta)$
- where a is the exponential parameter i.e. = $1/0.5 = 2$
- and θ = is the premium loading factor
- so $1/(1 + \theta) = x$, where x is the loss ratio
- Set $0.005 = e^{-RU}$ and solve for x to find the required loss ratio
- $R = 2(1 - x)$
- $0.005 = e^{-20(1-x)}$
- $x = 1 + \ln(0.005)/20$
- $x = 73.5\%$

Comments on Q1(i). Some students showed that 73.5% loss ratio implies a ruin probability of less than 0.5%. This approach gained equal credit. Many candidates got full marks on this part.

(ii)

- 90% LR implies a probability of ruin much higher than 0.5%, so this may be a problem if the insurance company requires a 0.5% or lower probability of ruin...
- ... for regulatory solvency/capital requirements, for example
- ... or if this would adversely affect insurer's credit rating
- Lundberg's inequality gives probability of ruin $< 13.5\%$
- Being a small company, parameter uncertainty surrounding the predicted 90% LR is likely to be greater as it is being estimated on less data
- Lundberg's inequality is probability of ultimate ruin so concern will depend to an extent on whether the 90% LR is expected to persist; the current position within the insurance cycle may mean that market is currently soft but expected to harden in the next few years
- The extent to which this is a problem also depends on the level of expenses and commissions
- as well as the investment return expected on the assets held to back the reserves

Possible actions:

- Investigate why the predicted loss ratio is 90%
- Consider why insurer requires a probability of ruin of 0.5%. If competitors live with a higher probability of ruin then at a competitive disadvantage
- Consider reinsurance: might be able to reduce probability of ruin by using reinsurance to reduce variability but will be passing on profit to the reinsurer
- Reduce expense/commission ratio to compensate for higher LR
- Tighten claims handling/settlement procedures to reduce payouts
- Consider diversification into other lines (currently writing specialised book)
- Enforce tighter underwriting criteria to exclude bad risks

- Reduce coverage using lower limits and/tighter policy wording/higher excess or deductible
- Increase premium rates
- Do nothing; if 90% LR is thought to be the soft part of insurance cycle, management may make a strategic decision to write across the cycle

Comments on Q1(ii). Most students were able to list the various actions to bring the loss ratio down. Not so many mentioned the insurance cycle and virtually none pointed out that probability of ruin is to ultimate, not just over the next year.

2 (i) **Household contents insurance:**

Claim event is usually sudden and easily determinable (e.g. burglary, fire)
 Notification is normally prompt
 Settlement is usually quick
 Often just consists of a single payment although total losses (e.g. from fire) may take longer to settle and be settled in parts
 Claim amount can normally be estimated accurately
 Claims tend to be fairly consistent in size and distribution
 Claim amount tends to be low relative to buildings cover
 Frequency tends to be high relative to buildings cover
 As a class, can be exposed to accumulation/cat risk
 As a class, very exposed to the risk of moral hazard
 Frequencies closely linked to the economic cycle, e.g. theft claims frequencies rise when unemployment rises
 Claims costs tend to rise in line with price inflation
 May have nil claims as an excess often applies

Comments on Q2(i). Bookwork on which most candidates scored reasonably well.

(ii) **Assumptions:**

Even risk profile over the year
 Identical policies
 No cancellations
 Claims occur on average mid-month
 (In each case, alternative assumptions are valid if correctly applied.)

Calculation:

(1)	(2)	(3)	(4)
Month	Policies written	Earned exposure = policies on risk	$(\text{Month} - 0.5) \times \text{earned exposure}$
9	1,000	1,000	8,500
10	1,500	2,500	23,750
11	2,000	4,500	47,250
12	2,500	7,000	80,500
	7,000	15,000	160,000

If a non-constant earnings assumption is used then column (3) needs to be adjusted appropriately.

Average accident date = $\text{sum}(4)/\text{sum}(3) = 10.667$, i.e. two-thirds of the way through November 2006

Comments on Q2(ii). *Some silly mistakes such as giving average accident date in 2007 by ignoring the statement “occurring during 2006”. Various approaches are possible, all given equal credit if correctly reasoned and applied.*

- (iii) Long-established => writing business for many years. The benchmark companies' portfolios are likely to be quite stable without the rapid growth in volumes that we have experienced. In particular, their pre-September exposure is unlikely to be zero like ours.

Their aggregate earnings patterns are therefore likely to be much more even across a year, so their average accident date is likely to be around mid-year and our 2006 accident year will develop later than the benchmark accident year

Therefore applying the benchmark development factors is likely to underestimate the true 2006 accident year ultimate

So the benchmark is not appropriate for use unless first adjusted for this lag effect.

General remarks on why benchmarks development factors may not be appropriate:

- benchmarks may have faster/slower claims handling procedures;
- may have different reinsurance arrangements (if considering net);
- policies though similar won't be identical;
- business mixes though similar won't be identical;
- benchmarks could contain large claims/cats which could distort development pattern;
- benchmarks may use different inflation assumptions;
- benchmarks might/might not include ALAE
- may not expect future claims to develop in same way as past.

Comments on Q2(iii). *Virtually all students were able to recall the standard points for/against benchmarks. Only a few linked the answer back to (ii) and discussed why the unadjusted benchmark would probably under-project in this case.*

- 3** (i) Facultative reinsurance is a reinsurance arrangement covering a single risk, commonly used for very large risks or portions of risk written by a single insurer

Treaty reinsurance is a reinsurance arrangement that a reinsurer is obliged to accept, subject to conditions set out in a treaty

- (ii) *Advantages of using facultative reinsurance*
- The insurer can choose the risks that it believes are most advantageous to cede or retain from the point of view of maximising profit and subject to acceptable retention of risk

- under an obligatory/obligatory treaty, the insurer is required to cede all risks that meet the criteria of the contract
- under a facultative/obligatory treaty, the insurer can choose which risks it wishes to cede
- Facultative reinsurance can cover risks that
 - fall outside treaties
 - fall inside treaties but outside the contract limits
- Easier for insurers to shop around for best rate/terms in market.

Disadvantages of using facultative reinsurance

- It is a time-consuming and costly exercise to place each and every risk separately
- The insurer may not be able to accept and provide cover immediately until it has had the opportunity to find appropriate facultative reinsurance cover; under the treaty all risks covered by the contract are ceded automatically
- This may impact the company's stance in the market with distributors and customers
- There is no certainty that the cover required will be available when needed; under the treaty the cover is predetermined in the contract
- Even if cover is available, the price and terms may not be acceptable; under the treaty, the price and terms are all predetermined at the start of the contract

(iii) **Discussion of Factors:**

- Look at the reinsurance profit and loss accounts (or suitable ratios, e.g. recovery ratios) historically by year to understand the level of profit or losses ceded
- Analyse separately for each treaty to understand the impact of each arrangement on the overall result
- Analyse different levels of facultative arrangement (e.g. by size of risk) to determine profitability by amounts ceded
- Check to see if the period has been atypical in terms of claims experience and adjust accordingly
- Compare cost of other forms or levels of reinsurance that could have been used.
- For example, would a Property per risk treaty with a higher or lower retention have proved more profitable for the insurer (*or other appropriate example*)
- What are the current reinsurers' credit ratings? Is there a need to move cover to more secure companies?
- What level of financial assistance are the current reinsurers providing? Do these adequately cover acquisition and administration costs?
- What level of technical assistance is provided by the reinsurers?
- Can the insurer find more tailor-made solutions elsewhere?
- Any reciprocal arrangements in operation need to be assessed to determine the profitability of these arrangements and their effectiveness in reducing risk concentration
- Look at how the reinsurance programme reduces capital requirement

- Check extent to which reinsurance programme covers accumulations of risk in book
- Analyse the profit smoothing achieved by the reinsurance programme
- Consider any regulatory constraints or relaxations that the reinsurance programme has caused
- Has the reinsurer imposed any conditions, e.g. minimum retention, certain policy conditions?

Comments on Q3. Bookwork which was generally well answered. A few students were confused between facultative reinsurance and fac/oblig treaties and some mistakenly answered part (iii) as reasons for purchasing reinsurance.

4 (i) Claims

Claims data needs to be collated into homogeneous groups and triangulated. Analyse claim numbers and average claim cost separately to identify source of poor experience. This may be a result of increased frequency, increased severity or both.

Analyse claims paid, outstanding reported claims reserves and IBNR separately in case one has developed unusually

Analyse historic claims inflation to see if claims costs increasing faster than expected

Investigate large claims experience. Poor profitability may be explained by a few large claims in the last couple of years.

Where there is sufficient data, claims may be analysed by claim type to isolate the claim type(s) developing poorly

Where possible, also analyse claims on quarterly/monthly basis to see if any clearer trends emerge

Review the company's historic reserving (are their methods appropriate?)

There may be errors in their calculations leading to overstatement of reserves

Review strength of reserving basis. Are assumptions too conservative?

Alternatively, an historically weak basis may have resulted in the need to increase prior year reserves

Investigate changes in claims handling procedures. Claims adjusters setting case estimates may have become more cautious over time.

Claim settlement controls may have slipped resulting in higher payouts (e.g. due to new claims handling staff being inadequately trained or increased claims volumes and not enough staff to handle workload efficiently or other valid examples)

Compare company claims development with external/industry benchmarks. Were there any accumulations of risk in the book which have now caused losses?

Investigate claims for signs of fraud

Compare rate- and inflation-adjusted historic loss ratios to identify trends in underlying risk

Could analyse loss ratios for new business and renewals separately to see if experience of one group is worse than the other

(ii) **Premiums**

Analyse claims together with exposure to determine adequacy of risk premium rates

Split by rating factor (age/sex/vehicle type, etc.) into rating cells

For each rating cell, compare total cost of claims against theoretical risk premium predicted by company's rating structure

Identify particular factor levels where inadequate premiums are being charged which may indicate anti-selection.

Where sufficient exposure to perform credible analysis, split by claim type (AD, TPPD, TPBI, etc.) to identify more accurately the inadequacy in the rating structure

But company is small so credibility of data may be an issue

Consider changes in cover that may have led to increased claims

Analyse adequacy of each loading:

Expense loading may no longer cover costs (office space, staff costs) arising from increased written volumes

Commission loading may be too low, e.g. because commission rates boosted in order to attract more broker business

Profit and/or contingency loadings may have been cut to make premiums more competitive

Use historic company and market data to investigate position in insurance cycle. Falling profitability may be a feature of the market as a whole

Look at historic changes in market share. Changes in share can indicate premiums out of line with market.

(iii) **Mix of business**

Investigate change over time of:

Mix of policyholders: proportion of higher risk policies may be increasing, e.g. young male drivers, high performance cars, more policies in high theft areas?

Mix of policy type, i.e. comp/non-comp, as these typically experience different loss ratios.

New business/renewal ratio as acquisition costs are higher than renewal costs but usually spread across all policies. Therefore higher than expected volume of new business will mean lower contribution to expenses than expected

Source of business: broker/direct as broker business more costly to acquire due to commissions. May have seen broker business increase and direct sales fall.

Analyse profitability and persistency by source. Identify sources (phone/internet) or particular brokers where the experience is poor.

Analysing lapse rates may indicate rating cells where we have lost profitable business to competitors

(iv) **Reinsurance**

Analyse historic recovery ratio (RI recoveries/RI premium earned). Has it fallen in the last two years?

The company may be failing to structure its RI programme appropriately for the increased business, e.g. aggregate XL limit too low so vertical exhaustion more likely

Insufficient reinstatements on treaties causing horizontal exhaustion

The price of reinsurance may have risen disproportionately

RI recoveries may have fallen due to:

new exclusions, tighter policy wording imposed by reinsurers

increased deductibles

higher attachment points

Check for reinsurer failures and disputes. Bad debt provisions may have impacted results.

Comments on Q4. Most candidates did not get many of the points available for this question. Better answers covered a broad range of points and also clearly explained why and how the proposed analyses would be useful in investigating declining profitability. Poorer answers tended just to list the various analyses possible without linking these to the specific details of the question. This was especially the case in (iv).

5

(i) **Assume that :**

- Employee count definition remains constant
- No change in structure of company e.g. disposals/acquisitions
- No change in safety procedures/substances handled
- No unusual losses in the data
- No change in the terms and conditions of the policy e.g. limits, deductible
- Underwriting pattern provided by underwriter is reasonable
- Future risk profile is same as historic risk profile

Calculation:

<i>Underwriting year</i>	<i>CL Ultimate</i>	<i>Inflation index</i>	<i>Inflated Ultimate</i>	<i>Inflated ultimate per employee</i>
2003	1,333,333	146.41	1,952,133	929.6
2004	1,750,000	133.10	2,329,250	895.9
2005	2,000,000	121.00	2,420,000	1,008.3
2006	2,200,000	110.00	2,420,000	968.0

average 950.5

weighted average 950.1

average excl. 2006 944.6

weighted average excl. 2006 943.9

- Make a reasonable selection: average or weighted average
- Taking e.g. weighted average, risk premium for 2007 is: $950.1 \times 2800 = \text{£}2.66\text{m}$

(ii) **Explanation:**

- Frequency-severity approach would provide more information on the risk and might improve accuracy of answer
- Number of employees may not be the ideal exposure measure. Wage-roll might be better (number of employees okay for frequency)
- Insufficient data to give full credibility to answer
- Unlikely to be sufficient large losses in the data to give reasonable allowance for future large losses

- Or may be heavy experience in the data e.g. unusual large losses
- Need to investigate trends in the data
- Any of the assumptions identified in (i) may be incorrect
- Exposed to latent claims so may need to include a loading

Comments on Q5(i) & (ii). There were some strange calculations where students tried to triangulate claims using the development pattern in order to apply the inflation adjustment. Very few discussed alternative methods or exposure measures in (ii). Otherwise the question was generally well answered.

(iii) **Further information:**

- commission rate
- expense loading
- contingency loading
- return on capital required/profit requirement/ target loss ratio
- tax rate
- cost/structure of reinsurance
- investment return

Comments on Q5(iii). Bookwork. Almost all candidates scored full or near full marks.

(iv) **Situations:**

- Could be a hard/soft market at present so we may be able to charge more/less than the theoretical office premium under present conditions (adjustment for insurance cycle)
- May make a decision to price over/under the competition (regardless of insurance cycle)
- Regulations may restrict the premium we can charge
- We may wish to sell the cover as a loss leader or as part of a combined package
- Underwriter may have “soft” information giving him additional information about the risk that enables him to adjust the premium
- The broker may apply pressure to accept a lower premium

Concerns:

- Need to consider the premium charged for the risk in previous year as customer would compare to this
- There will be less concern if a higher than theoretical premium is charged in a hard market
- Although if actual rates are too high this might be an indication that we are losing out to competitors on other profitable business and this may result in volumes insufficient to cover fixed expenses
- The concern in a soft market will be how low rates will have to go and how long the soft market will persist
- Charging less than the theoretical premiums may eventually lead to losses and to capital/solvency issues

Comments on Q5(iv). Generally well answered.

6 (i) Reasons:

Future claims inflation is not a weighted average of past inflation
Payment pattern may extend beyond development year 7 (i.e. a tail factor is needed in the projection)
Payment pattern may have changed across accident years due to:
 Change in incidence pattern of claims during each year, e.g. harsher than normal winter causes more claims
 Change in reporting delay, e.g. postal strike, bad weather
 New claims handling procedures/systems
 New legislation, e.g. TPBI settlements change from lump sum to periodical payments
Large claims (or the absence of such) may invalidate payment pattern as they usually have a different development pattern to non-large claims
The reinsurance program may have varied between accident years
Reinsurance recoveries may have been disrupted by defaults/disputes
The mix of business may have changed during the period due to:
 change in balance of comp and non-comp business
 rapid growth or contraction of business
 change in mix of policyholders (e.g. age distribution, male/female split)
A change in any of these could influence reporting and settlement patterns
Random variation
The selected development factors may not be appropriate. There is uncertainty surrounding the selected development factors:
 At later developments they are calculated on relatively little data (one or two years)
 At early developments they are generally large so a small percentage error in the factor can lead to a large numerical difference in the estimated ultimate
 Any sensible comment on the development factors given
The data may contain errors

Comments on Q6(i). Answers were reasonable but students could have gained more marks by systematically going through the possible factors which might invalidate the constant development pattern assumption.

- (ii) If possible, a better starting point is to project gross claims and then net down as a separate step. This avoids distortions to net patterns caused by changes in RI programme over time.
Fit a tail to the net paid projection.
Use more historical data if available
If not, could try fitting a curve to the development pattern or consult industry/external benchmarks
Also project on a monthly or quarterly basis to compare
Project gross/net notified claims as a check on the gross/net paid BCL
Notified claims includes case estimates so factor to ultimate is smaller. May consider notified claims projection to be more reliable than paid projection
Split claims into homogeneous groups and project separately, e.g. by claim type (AD, TPPD, TPBI, etc.), by comp/non-comp, by geographical location

Advantages: this gives more homogeneous groups of data which are more likely to develop in the same way.

Avoids distortions caused if mix of claim types changes in future

Disadvantages: each projection is on a smaller volume of data so less credible, more volatile

Large insurer: may write business across several countries, currency may be an issue:

conversion of payments at historic exchange rates will distort the development pattern

better to compile triangle using constant exchange rate across whole triangle

or project currencies separately if enough data for credible projection

Large claims (say > £250k) in private motor are usually TPBI.

These are likely to be longer-tailed than other claims and have a different development pattern

Therefore sensible to remove large claims from triangles and project large and non-large separately.

Definition of large should vary (by large claim inflation) between accident years, otherwise you would effectively be removing more claims in earlier accident years

Due to low frequency/high severity nature, claims development will be lumpy and irregular so any statistical projection methods for large claims will be problematic.

Individual case estimates probably best for outstanding reported large claims reserve.

Large claims IBNR: could apply a simple loading to large outstanding if historical data supports this or frequency-severity approach: project numbers of notified large claims to get an IBNR number. Estimate an average cost of large IBNR claims by comparing historic IBNR with reported sizes and allowing for any trends, known changes

You need to be consistent in how you treat claims which are “large” at some point but eventually settle for an amount less than “large”

For 2005 (and 2004) accident years:

The chain ladder method is very unstable (factor to ultimate is high for the immature years)

The Bornhuetter-Ferguson provides a more stable estimate whilst taking some account of actual development

Alternatively could use the Expected Loss Ratio method for these years

Other projection methods:

Inflation adjusted CL if historic claims inflation has varied considerably over time and/or future inflation is likely to be different to the past

ACPC (and/or inflation adjusted version) to study development of frequency and severity separately

Need to allow correctly for nil claims here

Stochastic methods (e.g. bootstrapping), to get an idea of the reserve uncertainty or if a specified percentile is required

The methods and assumptions used will be influenced by the purpose of the reserving exercise

Comments on Q6(ii). *Generally reasonably good answers.. Most students were aware of the different claim types in private motor and why they need to be studied separately. Some answers simply listed different projection methods without any discussion of why they might be used. Unfortunately, quite a few students seem to think that projected accident year paid amounts do not include IBNR.*

(iii) (a) **Arguments for discounting:**

In the case of long-tail business investment income can be significant
It gives a more realistic position of the financial condition of the insurance company

This is particularly relevant for management accounts
and for estimating claim costs for rating purposes
and allows easier comparison between different classes

Arguments against discounting:

For short-tail classes discounting makes negligible difference

Not discounting provides an automatic margin for uncertainty

For long-tail classes, the greater uncertainty justifies the margin provided by not discounting

May be seen as a sign of weakness if market practice is not to discount
(where regulations allow) not discounting increases reserves and defers the emergence of profit and therefore, tax

Where regulations don't specify it, discount rate is a subjective choice requiring extra calculations/time

Regulations may prohibit discounting

(b) **Factors to consider in choosing discount rate:**

The purpose of the accounts. Management accounts would probably use a more realistic rate than solvency/published company accounts

Regulations might dictate or limit the discount rate to use

The expected returns from the assets held to back the technical reserves for this class

Proportion of non-investible assets held

Delay before receiving premiums

Investment expenses/tax

Consistency with inflation assumptions used for projections

Discount rate used last year

Any margin to reflect riskiness of class

Comments on Q6(iii). *An easy question with most students scoring highly.*

(iv) Use selected idf's and assume no tail (or else select a tail and apply correctly in calculations)

Assume payments occur on average mid-way through the year

Development yr	2	3	4	5	6	7
Selected idf	1.200	1.100	1.050	1.040	1.030	1.000
1. Selected cdf	1.485	1.237	1.125	1.071	1.030	1.000
2. Cum % dev	67.4%	80.8%	88.9%	93.4%	97.1%	100.0%
3. Increm % dev		13.5%	8.1%	4.4%	3.7%	2.9%
4. Increm % paid for 2004 acc yr reserve		41.3%	24.8%	13.6%	11.4%	8.9%
Time t in years		1.00	2.00	3.00	4.00	5.00
5. Discount factors $(1+i)^{-(t-1/2)}$		95.8%	87.9%	80.6%	74.0%	67.9%
6. Payment * discount factor		39.5%	21.8%	11.0%	8.5%	6.1%
7. Discount factor = sum of row 6			86.8%			

Comments on Q6(iv). Surprisingly few candidates were able to calculate a discount factor correctly. This may be partly explained by a lack of time. Some scripts did show evidence of time pressure towards the end of the exam.

END OF EXAMINERS' REPORT