Instituto Superior de Economia e Gestão
UNIVERSIDADE TÉCNICA DE LISBOA
DESDE 1911

Master in Actuarial Science
Loss Reserving
02-07-2018
Time allowed: 2 hours

Instructions:

1. This paper contains **6** questions and comprises **3** pages including the title page.
2. Enter all requested details on the cover sheet.
3. You must not start writing your answers until instructed to do so.
4. Number the pages of the paper where you are going to write your answers.
5. Attempt all questions.
6. Begin your answer to each question on a new page.
7. Marks are shown in brackets. Total marks: 200.
8. Show calculations where appropriate.
9. An approved calculator may be used.
10. Mobile phones and smartphones may not be used during the examination.

You are the actuary of a general insurance company and have received the following data showing paid claims on 31.12.2008.

Incremental	Payment delay				
Accident year	0	1	2	3	4
2004	0	13	75	555	1142
2005	4	23	894	4734	
2006	3	14	195		
2007	1	11			
2008	0				

Cumulative	Payment delay				
Accident year	0	1	2	3	4
2004	0	13	88	643	1785
2005	4	27	921	5655	
2006	3	17	212		
2007	1	12			
2008	0				

The exposure is shown in the next table.

Accident year	Exposure
2004	17050
2005	17250
2006	17200
2007	17500
2008	17200

You may assume that no claims will be paid with a delay of more than four years.

1. <u>Bornhuetter-Ferguson method</u>
   a. Estimate the delay-specific claim rates. By claim rate we mean claim payments per unit of exposure. [10 marks]
   b. Estimate the overall claim rate per accident year. [10 marks]
   c. Estimate the payment pattern. [10 marks]
   d. Estimate the outstanding claim payments for each accident year. [10 marks]
   e. Fill the missing cells in the run-off triangle with predictions. [10 marks]

2. <u>Chain ladder method</u>
   a. Estimate the development factors. [10 marks]
   b. Estimate the payment pattern. [10 marks]
   c. Estimate the overall claim rate per accident year. [10 marks]
   d. Estimate the outstanding claim payments for each accident year. [10 marks]
   e. Fill the missing cells in the run-off triangle with predictions. [10 marks]

3. <u>Benktander's method</u>
   With claim rates and payment pattern from question 1, apply Benktander's method to estimate the outstanding claim payments for each accident year. [10 marks]

4. Choice of method
   a. Explain the properties of the Bornhuetter-Ferguson method and the chain ladder method (robustness, sensitivity). [10 marks]
   b. Which method would you choose for the portfolio shown here, and why? [10 marks]

5. Discounting

   For the Bornhuetter-Ferguson method and using the predictions in 1.e:
   a. Calculate the total predicted payments per future payment year. [10 marks]
   b. Calculate the discounted value of future payments using 3% interest. [10 marks]

   You may assume that payments are made at the end of each year.

6. Stages in the life of a claim

   a. Explain the meaning of the acronyms RNBS, IBNR and CBNI. Please do not just translate the abbreviations, but explain what it means for a claim to be "RBNS", "IBNR" or "CBNI" on a specific valuation date. [10 marks]

   b. Suggest a few pieces of information that could be useful in modeling the development and estimating the ultimate cost of claims that are RBNS. [10 marks]

   c. Suggest what information could be used to model the arrival and estimate the ultimate cost of claims that are (still) IBNR. [10 marks]

   d. Explain the meaning of this assertion:
   "Statistically, CBNI claims behave in the same way as IBNR claims." [10 marks]

   e. Explain the meaning of this assertion:
   "Know your RBNS, then IBNR/CBNI come by themselves (well, almost)." [10 marks]