Chapter 1 - Key Concepts

Introduction to Ratemaking and Reserving

Outline

1. Basic Insurance Terms

2. Data

3. Exposures

4. Premium

Basic Insurance Terms

- Exposure - Basic risk unit that underlies the premium
- Premium - Amount the insured pays for the coverage
- Claim - A demand to the insurer for indemnification under the policy
- Claimant - Individual who makes the claim
- Accident date - Loss date, date of the event that caused the loss
- Report date - Date when the claimant reports the claim to insurer

Basic Insurance Terms (Cont.)

- IBNR Claim - Incurred But Not Reported claim, loss that has occured but not yet reported to insurer
- Reported Claim - After the report date, the claim is known to insurer and is classified as reported claim
- Reported Claim = Paid Claims + Case Reserve
- Ultimate Claim - Amount required to close and settle all claims for a defined group of policies
- Estimated Ultimate Claims = Reported Claims + IBNR Reserve + IBNER Reserve

Basic Insurance Terms (Cont.)

- LAE - Loss Adjustment Expense, expenses incurred in settling claims. Can be seperated to ALAE (Allocated LAE) and ULAE (Unallocated LAE)
- ALAE - Claim-related expenses that can be allocated to a specific claim, e.g. fees paid to loss adjuster
- ULAE - Claim-related expenses that can not be directly allocated to a specific claim, e.g. salaries of claims department personnel
- Underwriting Expenses - Expenses incurred in acquisition and servicing of policies. Four common categories of underwriting expenses:
  1. Commissions and brokerage
  2. Other acquisition
  3. General
  4. Taxes, licenses, and fees

Ratemaking Data

- There are two types of data: internal data and external data
- Examples of internal data used:

    1. Risk Data - Policy Database, Claims Database
    2. Accounting Information

- Examples of external data used:

    1. Competitor Rate Filings
    2. Industry Data
    3. Other Third Party Data - Economic data, Geo-demographic data, etc

Risk Data - Policy Database

- Policy database - Defined according to records and fields
- Records - Individual policies or subdivision of policy and it depends on exposure measure and the way premium is calculated
- Field - Explanatory information about the records
- Examples - Personal Auto Insurance:

Policy	Eff. Date	Term. Date	Trans. Date	Ded	Terr	W. Exposure	W. Premium
A	01/01/10	12/31/10	01/01/10	250	1	1.00	1,100
B	04/01/10	03/31/10	04/01/10	250	2	1.00	600
B	04/01/10	03/31/10	12/31/10	250	2	-0.25	-150
C	07/01/10	06/30/10	07/01/10	500	3	1.00	1,000
C	07/01/10	06/30/10	01/01/11	500	3	-0.50	-500
C	07/01/10	06/30/10	01/01/11	250	3	0.50	600

Risk Data - Claims Database

- Each record tied to a specific claim, e.g. payments or change in reserve
- Some typical fields in claims database:
  1. Policy number
  2. Risk identifier
  3. Claim identifier
  4. Claimant identifier
  5. Relevant loss dates - Accident, report, and transaction date
  6. Claim status - Open/Close
  7. Claim count - Number of claims associated with an occurence
  8. Paid claim - Payment made
  9. Event identifier - Identify any event involving claim
  10. Case reserve
  11. ALAE - Allocated Loss Adjustment Expense
  12. Salvage - Recoveries from the sale of damaged property or from third party
  13. Claim characteristics - type of injury, etc

Accounting Information

- Data needed to set rates that isn't specific to one policy
- Examples:
  1. May not be specific to any line of business: Salary of CEO
  2. Underwriting Expenses (Commission, Acquisition, etc) , LAE

Data Aggregation

- Three general objectives apply during aggregation of data for ratemaking purposes:
  1. Accurately match claims and premium for the policy
  2. Use the most recent data available
  3. Minimize the cost of data collection and retrieval

- Four common method of data aggregation:
  1. Calender year
  2. Accident year
  3. Policy year
  4. Report year

- Each method differs in how well it achieves the objectives above

Remark: With exception of calendar year aggregation, the period doesn't need to be a calender year (Jan 1 to Dec 31) but could also be a fiscal year (e.g. Jul 1 to Jun 30)

Data Aggregation - Calender Year

- Transactions that occur in that twelve months period
- Earned premium/exposure = All premium/exposure earned during that twelve months period
- Paid Claims = All claims paid during the calender year
- Reported Claims = Paid Claim + Change in Case Reserve

Data Aggregation - Accident Year

- Aggregate losses that occur in that twelve months period
- Accident year is not closed (fixed) at the end of the year
- Earned premium/exposure = Same as Calender Year method
- Paid Claims = All claim payments for losses that occur in that year
- Reported Claims = Paid claims + case reserve (for losses occur in that year)

Data Aggregation - Policy Year

- Premium, exposure and losses on policies in that were underwritten in that year
- Earned premium/exposure = All premium/exposure earned for policies written in that year
- Exposures may take up to 24 months to be fully earned (e.g. a policy written 12/31/2016 may have claim at 12/30/2017 and this is included in policy year 2016)
- Paid Claims = All claim payments for policies written in that year
- Reported Claims = Paid claims + case reserve (for policies written in that year)

Data Aggregation - Report Year

- Losses that are reported in that twelve months period
- Earned premium/exposure = Same as calender year
- Paid Claims = All claim payments for losses reported year
- Reported Claims = Paid claims + case reserve (for losses reported in that year)

Data Aggregation - Comparison of Different Methods

		Calender Year	Accident Year	Policy Year	Report Year
Advantages	1.	Available quickly once calender year ends;	Better match of premium and losses	Exact match between claims and exposures	No. of claims is fixed at close of the year
	2.	All premium, exposures and claims value are fixed.			
Disadvantages	1.	Mismatch between premium and claims	Must estimate future development of claims	Data takes longer to develop	

Data Aggregation - Example

An insurance company started writing annual policies in 2005.
Given the following information for claims associated with policies
written in 2005:

Accident Year	Calender Year	Payments	End of Year Reserve
2005	2005	1,000,000	500,000
	2006	300,000	300,000
	2007	250,000	100,000
	2008	50,000	
2006	2005		
	2006	1,500,000	1,000,000
	2007	700,000	200,000
	2008	100,000	50,000

Accidents in 2005 & 2006

Data Aggregation - Example (cont.)

a. Calculate the calender year reported claims for 2006

b. Calculate the accident year reported claims for 2006 evaluated as of Dec 31, 2007

Data Aggregation - Example (cont.)

c. Calculate the policy year reported claims for 2005 evaluated as of Dec 31, 2008

d. Provide one advantage and one disadvantage associated using calender year reported claims rather than accident year reported claims for ratemaking

Exposure

- Exposure - Basic unit of risk that underlies the premium
- Examples:
  1. Homeowners insurance - Earned house year
  2. Workers compensation - Annual payroll
  3. Personal Automobile - Earned Car year
- It can be seen that the exposure varies according to line of business (LOB)
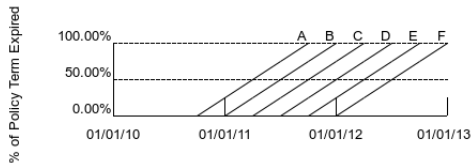
Aggregation of Exposures - Annual Term

- Only two ways are applicable - Calender Year (also known as Calender-Accident Year) and Policy Year aggregation
- Instead of wordy explanation, we use the following example to demonstrate these concepts

Aggregation of Exposures - Annual Term, Example

- Given the data below:

Policy	Effective Date	Expiration Date	Exposure
A	10/01/10	09/30/11	1.0
B	01/01/11	12/31/11	1.0
C	04/01/11	03/31/12	1.0
D	07/01/11	06/30/12	1.0
E	10/01/11	09/30/11	1.0
F	01/01/12	12/31/12	1.0

- All policies can be represented pictorially

Aggregation of Exposures - Annual Term, Example (cont.)

- Calender Year aggregation considers all exposures within twelve months calender year and this can be represented by using square
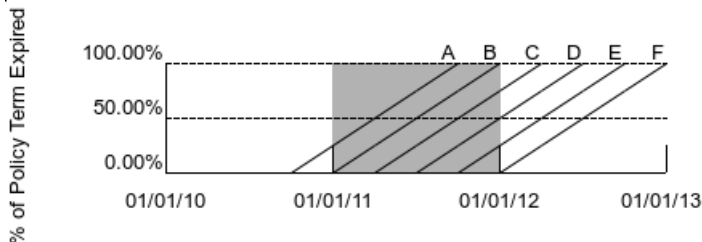
Aggregation of Exposures - Annual Term, Example (cont.)

- Policy Year aggregation considers all exposures with effective dates during the year and this can be represented by using parallelogram
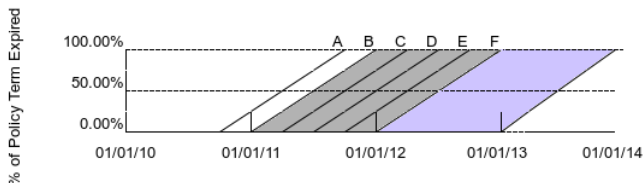
- As illustrated here, Policy Year aggregation takes longer to close

Ways To Measure Exposure

- Written exposures - total exposures arising from policies written during a specified period of time.
- Earned exposures - the portion of the written exposures for which coverage has already been provided as of a certain point in time.
- Unearned exposures - the portion of the written exposures for which coverage has not yet been provided as of that point in time.
- In-force exposures - the number of insured units that are exposed to loss at a given point in time.

Example - Written Exposures, CY

Based on the information in previous example, calculate the

1. Written exposures for calender year 2010, 2011 and 2012.

Example - Written Exposures, PY

2. Written exposures for policy year 2010, 2011 and 2012.

Example - Written Exposures, PY (cont.)

- It seems that using CY or PY gives the same written exposures, but this is not true in general
- If Policy D is cancelled on Mar 31, 2012, then for Calender Year aggregation, Policy D will contribute 1 exposure to Calender Year 2011 and -0.25 exposure to Calender Year 2012
- While for Policy Year aggregation, both original written exposure and the written exposure due to cancellation are booked in same policy year (same as policy effective date)

Example - Earned Exposures, CY

3. Earned exposures for calender year 2010, 2011 and 2012.

Example - Earned Exposures, PY

4. Earned exposures for policy year 2010, 2011 and 2012.

- For Policy Year aggregation, earned and written exposures are the same if the policy year is complete

Example - Unearned Exposures

- Unearned Exposures = Written Exposures - Earned Exposures
- For Policy Year aggregation, formula above follows immediately
- For Calender Year aggregation, we need to consider the unearned exposures at the beginning of the calender year
  CY Unearned Exposures = CY Written Exposures - CY Earned Exposures + Unearned Exposures as of beginning of CY
- Compute the unearned exposures of calender year 2011.

Example - In-force Exposures

- Number of insured unit that are exposed to having a claim at a given point in time.
- Calculate the in-force exposures on June 15, 2011
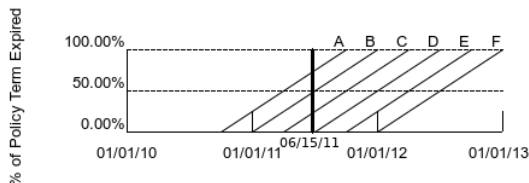
Calculation of Block Exposures

- Previous sections illustrated how to deal with individual policies
- Sometimes data are summarized in monthly basis and thus we do not know the exact effective dates of each policy
- It is common to assume that all policies are written on 15th of the month
- This is referred to as the "15th of the month" rule or the "24^{th}s" method.

Calculation of Block Exposures - Example

- Assume that a company write annual policies in 2010 and write 240 exposures in each month. Find the in-force exposures using "24^{th}s" method.

Written Month	Exposure	Assumed Effective Date	In-force Exposures a/o 7/1/2010	1/1/2011	7/1/2011
10-Jan	240	1/15/2010	240	240	0
10-Feb	240	2/15/2010	240	240	0
10-Mar	240	3/15/2010	240	240	0
10-Apr	240	4/15/2010	240	240	0
10-May	240	5/15/2010	240	240	0
10-Jun	240	6/15/2010	240	240	0
10-Jul	240	7/15/2010	0	240	240
10-Aug	240	8/15/2010	0	240	240
10-Sep	240	9/15/2010	0	240	240
10-Oct	240	10/15/2010	0	240	240
10-Nov	240	11/15/2010	0	240	240
10-Dec	240	12/15/2010	0	240	240
Total	2,880		1,440	2,880	1,440

Calculation of Block Exposures - Example (cont.)

- Now compute the earned exposure using "24^{th}s" method.

Written Month	Exposures Written	Assumed Effective Date	Earning Percentage 2010	2011	Earned Exposures 2010	2011
10-Jan	240	1/15/2010	23/24	1/24	230	10
10-Feb	240	2/15/2010	21/24	3/24	210	30
10-Mar	240	3/15/2010	19/24	5/24	190	50
10-Apr	240	4/15/2010	17/24	7/24	170	70
10-May	240	5/15/2010	15/24	9/24	150	90
10-Jun	240	6/15/2010	13/24	11/24	130	110
10-Jul	240	7/15/2010	11/24	13/24	110	130
10-Aug	240	8/15/2010	9/24	15/24	90	150
10-Sep	240	9/15/2010	7/24	17/24	70	170
10-Oct	240	10/15/2010	5/24	19/24	50	190
10-Nov	240	11/15/2010	3/24	21/24	30	210
10-Dec	240	12/15/2010	1/24	23/24	10	230
Total	2880				1,440	1,440

Fundamental Insurance Equation

- Price = Cost + Profit
- Relating this to insurance pricing, we have
- Premium = Losses + LAE + UW Expenses + UW Profit
- Recall that ratemaking is prospective
- So, we need to project the various component to current level when we are using historical information to estimate future cost

Premium

- Calculation of written, earned, unearned and in-force premium are the same as exposures
- Use "24ths" method for block policies also
- Refer to tutorial for more examples

Adjustments to Premium

- Consider a simplified scenario, imagine if I bought a pen with RM2 last year and I buy another one this year with the price of RM4. How many pens do I have?

- Obviously, 2. But If we were to look at the total cost, which is RM6. Then we might conclude that I have 3 pens (with price of pen, RM2) or 1.5 pens (with price of RM4), which is totally unreasonable

- Similarly, for insurance premium, one dollar collected last year might not be not comparable with one dollor collected today, as the rate might have changed during the past one year

- We have to bring all the premium to current level in order to use these historical information for estimating future premium
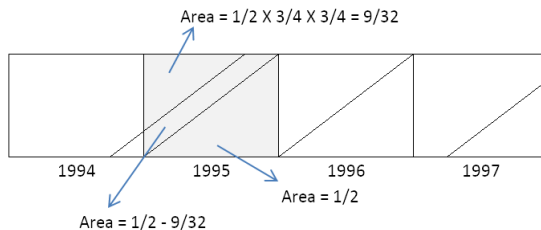
Adjustments to Premium - Example

You are given that 1995 Earned Premium is RM5,000 and the following information:

Overall Rate Change	Effective Date
+5.0%	10/01/1994
+10.0%	01/01/1995
-5.0%	01/01/1996
+15.0%	04/01/1997

Compute the CY 1995 earned premium at present rate. All policies are annual.

Adjustments to Premium - Example (Solution)

- This method is known as parallelogram method, as we can represent the rate change using a parallelogram

Area = 1/2 X 3/4 X 3/4 = 9/32

1994   1995   1996   1997

Area = 1/2

Area = 1/2 - 9/32

Adjustments to Premium - Example (Solution cont.)

- Then we need to compute the on-level factor for 1995, on-level factor is defined as $\frac{\text{current relative rate level}}{\text{average relative rate level}}$.

- Then compute the on-level earned premium for 1995