Lecture 2: Introduction to P&C Insurance and Terminology II

AS 8360: Insurance Ratemaking

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Overview

- The lifetime of a claim
- Losses vs claims
- Loss adjustment expenses (LAE)
- Extraordinary and catastrophe losses
- Deductibles and policy limits
- Internal data
- Data aggregation
  - Calendar year
  - Accident year
  - Policy year
  - Report year
- External data

Assume accident took place in December 2008, then AY08

The lifetime of a claim

Assume policy was issued in June 2008, PY08

	Date	Transaction	Reported Value of Claim to Date	Cumulative Paid to Date
CY09	February 20, 2009	Case O/S of $15,000 established for claim only	$15,000	$0
CY09	April 1, 2009	Claim payment of $1,500 – case O/S reduced to $13,500 (case O/S change of -$1,500)	$15,000	$1,500
CY09	May 1, 2009	Expense payment to IA of $500 – no change in case O/S	$15,500	$2,000
CY09	September 1, 2009	Case O/S for claim increased to $30,000 (case O/S change of +$16,500)	$32,000	$2,000
CY10	March 1, 2010	Claim thought to be settled with additional payment of $24,000 – case O/S reduced to $0 and claim closed (case O/S change of -$30,000)	$26,000	$26,000
CY11	January 25, 2011	Claim reopened with case O/S of $10,000 for claim and $10,000 for defense costs	$46,000	$26,000
CY11	April 15, 2011	Partial payment of $5,000 for defense litigation and case O/S for defense costs reduced to $5,000 – no change in case O/S for claim	$46,000	$31,000
CY11	September 1, 2011	Final claim payment for an additional $12,000 – case O/S for claim reduced to $0 (case O/S change of -$10,000)	$48,000	$43,000
CY12	March 1, 2012	Final defense cost payment for an additional $6,000 – case O/S for defense costs reduced to $0 and claim closed (case O/S change of -$5,000)	$49,000	$49,000

RY09

Losses vs claims

Terminology can vary depending on the reference or company or person. The following dictionary will be useful.

- *Claims* (= losses)
- *Claim counts*: of paid claims or closed claims
- *Paid claims* (= paid losses)
- *Case outstanding* or *unpaid case* (= case reserves)
- *Reported claims* (= reported or incurred losses)
- *IBNR*: includes not reported (*pure IBNR*), not enough reported (*IBNER*), or reported but not recorded
- *Ultimate claims* (= ultimate losses)

Loss adjustment expenses

As we have discussed earlier, we have:

- Allocated loss adjustment expenses (ALAE)
- Unallocated loss adjustment expenses (ULAE)

For ratemaking purposes, ALAE are included with losses, and ULAE are considered as the factor that is applied to reported loss + ALAE.

6.23 ULAE Ratio

Calendar Year	(1) Paid Loss and ALAE	(2) Paid ULAE	(3) ULAE Ratio
2008	$ 913,467	$ 144,026	15.8%
2009	$ 1,068,918	$ 154,170	14.4%
2010	$ 1,234,240	$ 185,968	15.1%
Total	$ 3,216,625	$ 484,164	15.1%
		(4) ULAE Factor	1.151

Extraordinary and catastrophe losses

Losses need to be projected to the cost level expected when the rates will be in effect. This is typically done using historical losses with a series of adjustments.

The first step is to remove *extraordinary events* (e.g., individual shock losses and catastrophe losses).

1. One approach is to exclude these losses in their entirety or, more typically, may just exclude the portion above some predetermined threshold.

2. Another one is to examine the size of loss distribution and set the threshold at a given percentile, such as the 99th percentile.

The example below illustrates the excess loss procedure.

6.3 Excess Loss Procedure

Accident Year	(1) Reported Losses	(2) Number of Excess Claims	(3) Ground-Up Excess Losses	(4) Losses Excess of $1,000,000	(5) Non-Excess Losses	(6) Excess Ratio
1996	$ 118,369,707	5	$ 6,232,939	$ 1,232,939	$ 117,136,768	1.1%
1997	$ 117,938,146	1	$ 1,300,000	$ 300,000	$ 117,638,146	0.3%
1998	$ 119,887,865	3	$ 3,923,023	$ 923,023	$ 118,964,842	0.8%
1999	$ 118,488,983	0	$ -	$ -	$ 118,488,983	0.0%
2000	$ 122,329,298	7	$ 12,938,382	$ 5,938,382	$ 116,390,916	5.1%
2001	$ 120,157,205	3	$ 3,824,311	$ 824,311	$ 119,332,894	0.7%
2002	$ 123,633,881	0	$ -	$ -	$ 123,633,881	0.0%
2003	$ 124,854,827	1	$ 3,000,000	$ 2,000,000	$ 122,854,827	1.6%
2004	$ 125,492,840	0	$ -	$ -	$ 125,492,840	0.0%
2005	$ 127,430,355	6	$ 13,466,986	$ 7,466,986	$ 119,963,369	6.2%
2006	$ 123,245,269	3	$ 4,642,423	$ 1,642,423	$ 121,602,846	1.4%
2007	$ 123,466,498	0	$ -	$ -	$ 123,466,498	0.0%
2008	$ 129,241,078	10	$ 17,038,332	$ 7,038,332	$ 122,202,746	5.8%
2009	$ 123,302,570	0	$ -	$ -	$ 123,302,570	0.0%
2010	$ 123,408,837	3	$ 4,351,805	$ 1,351,805	$ 122,057,032	1.1%
Total	$ 1,841,247,359	42	$ 70,718,201	$ 28,718,201	$ 1,812,529,158	1.6%
			(7) Excess Loss Factor			1.016

A common occurrence is modifications of the coverage/benefits associated to a book of policies, which affect the severity of the claims.

6.4 Limit Change

Claim number	(1) Losses Capped @$5,000	(2) Losses Capped @$3,000	(3) Effect of Change
1	$ 1,100	$ 1,100	0.0%
2	$ 2,350	$ 2,350	0.0%
3	$ 3,700	$ 3,000	-18.9%
4	$ 4,100	$ 3,000	-26.8%
5	$ 5,000	$ 3,000	-40.0%
6	$ 5,000	$ 3,000	-40.0%
Total	$ 21,250	$ 15,450	-27.3%

Deductibles & policy limits

You have already encountered deductibles and policy limits in earlier courses. There can be:

- Fixed dollar deductibles
- Fixed percentage deductibles
- Disappearing deductibles
- Franchise deductibles

if $X < d$, insurer pays 0

X = loss if $X > d$, insurer pays X

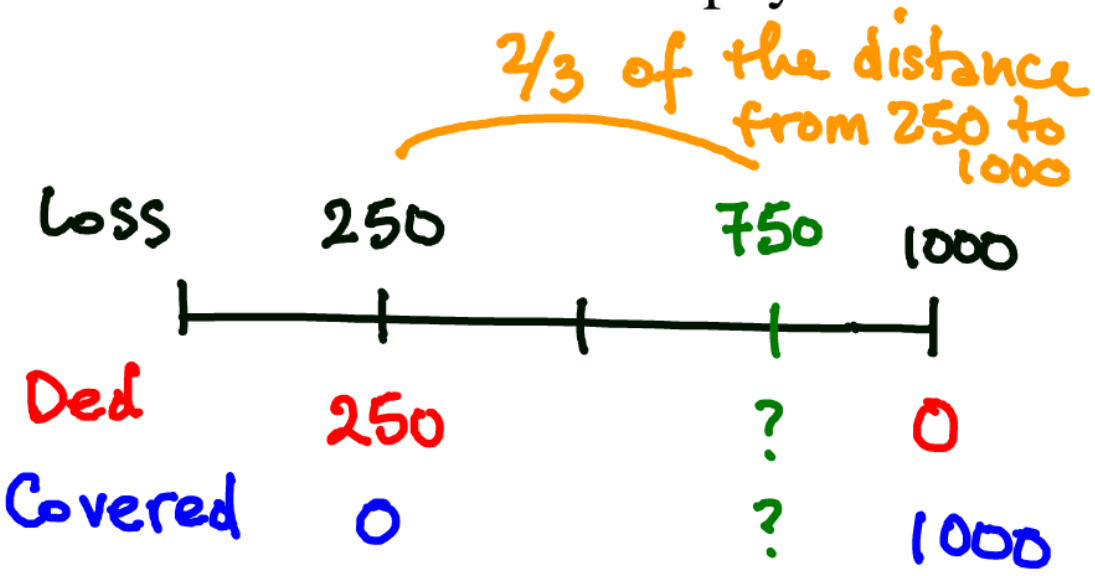
d = Franchise ded

Individual coverages can have their own policy limit.

Deductibles and policy limits result in reduced expenses, risk, and moral hazard. They allow flexibility in terms of the premium, though they are sometimes not fully understood by the insured.

Example

Assume you purchased coverage with a linearly disappearing deductible. Up to \$250 of claim, the insurer pays nothing. Beyond \$1000, the insurer pays all. What does the insurer pays on a claim of \$750?



Deductible for loss of 750 $= \frac{1}{3}\,250$

Covered amount for loss of 750 $= 750 - \frac{1}{3}\,250 = 667$

$= \frac{2}{3}\,1000$

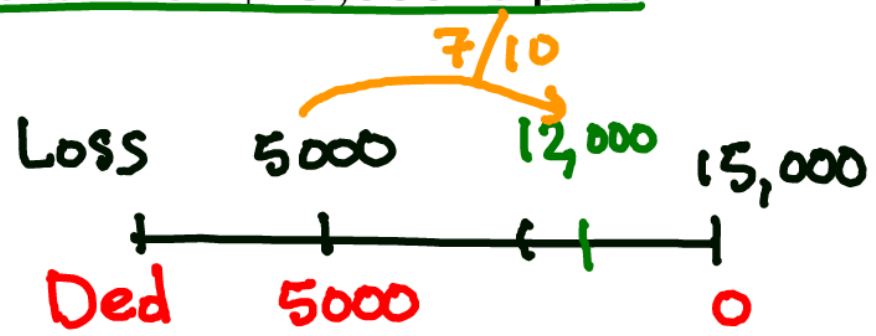
Example

In each of the following cases, what will the insurer pay on a claim of $12,000?

- A 20% deductible and a policy limit of $12.500.
- A straight deductible of $1000 and a policy limit of $10,000.
- A linearly disappearing deductible such that a claim of $5000 has no loss payment, but a claim of $15,000 is paid in full.

80% 12,000 = 9600

10,000



Deductible for 12,000 loss = 3/10 · 5000 = 1500

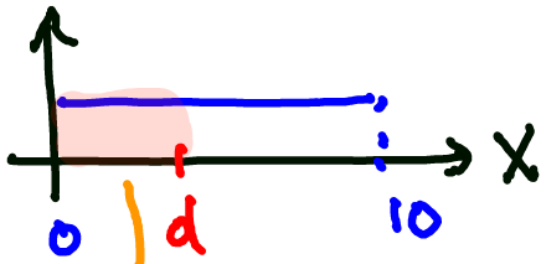
Covered loss for 12,000 loss = 12,000 − 1500 = 10,500

= 7/10 · 15,000

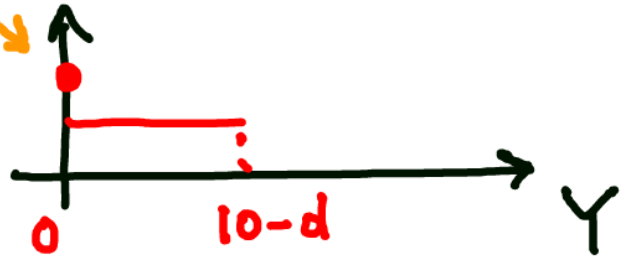
Example

A decision maker is faced with a random loss that has a uniform distribution over the interval $0 < X < 10$. If she wishes to pay a premium of \$2, then the optimal coverage requires a deductible of d. Assuming no expenses, find d.

$X \sim \mathcal{U}(0,10)$



$Y = \max\{X-d, 0\}$



$$E(Y) = E(\max\{X-d,0\})$$

$$= \int_0^{10} \max\{x-d,0\} \cdot \frac{1}{10}\, dx$$

$$= \int_0^{d} 0 \cdot \frac{1}{10} \cdot dx + \int_d^{10} (x-d)\frac{1}{10}\, dx$$

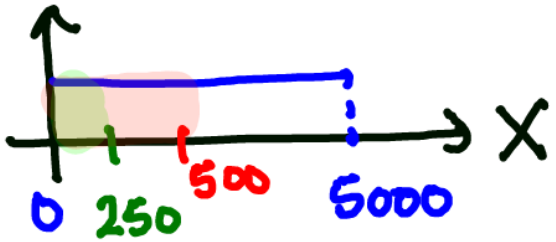
$$= \frac{1}{10}\left[\frac{x^2}{2} - xd\right]_d^{10} = \frac{1}{10}\left(50 - 10d + \frac{d^2}{2}\right) = 2$$

Example

$\Rightarrow \quad d = 3.675$

A company provides a coverage whose loss distribution is uniform over the interval $0 < X < 5000$. If the company moves from a deductible of \$250 to a deductible of \$500, how much will the expected loss payment be reduced?

$X \sim U(0, 5000)$



$Y = \max\{X-250, 0\}$

$Z = \max\{X-500, 0\}$

$$E(Y) = \int_{250}^{5000} (x-250)\frac{1}{5000}\,dx$$

$$= 2256.25$$

$$E(Z) = \int_{500}^{5000} (x-500)\frac{1}{5000}\,dx$$

$$= 2025.00$$

Reduction in loss payment = 231.25

Internal data

There are generally two types of internal data involved in a ratemaking analysis:

- The first is risk information, such as exposures, premium, claim counts, losses, and explanatory characteristics about the policy or the claim.
- The second type is accounting information, such as underwriting expenses and ULAE, which are typically available only at an aggregate level.

Some actuaries have access to a data mart specifically designed for ratemaking analyses. Other actuaries must access general company databases and manipulate the data to make it appropriate for ratemaking analysis.

Policy database: Defined according to records.

- In homeowners insurance, a record may be a home for an annual policy period.
- In U.S. workers compensation insurance, records are maintained at the classification level.
- In personal auto insurance, separate records are typically created for each coverage, car, and driver.

In addition, if a policy is amended during the policy term, then separate records are created for the partial policy periods before and after the change.

Typical fields on the policy database include: policy id; risk id; relevant dates; premium; exposure; characteristics.

Claims database: Each record generally represents a transaction tied to a specific claim (e.g. a payment or a change in reserve).

Typical fields on the policy database include: policy id, risk id, claim id, claimant id, relevant loss dates, claim status, claim count, paid loss, event id, case reserve, ALAE, salvage/subrogation, claim characteristics.

Accounting data: Data required for ratemaking that is not specific to any one policy or product.

Typical items from accounting data include: underwriting expenses, ULAE.

Data aggregation

The aforementioned policy, claim, and accounting databases must be aggregated for use in the ratemaking analysis.

When aggregating data for ratemaking purposes, three general objectives apply:

1. Accurately match losses and premium for the policy.
2. Use the most recent data available.
3. Minimize the cost of data collection and retrieval.

Four common methods of data aggregation are *calendar year*, *accident year*, *policy year*, and *report year*. Each method differs in how well it achieves the objectives outlined above.

Calendar year aggregation: All premium and loss transactions that occur during the twelve-month calendar year without regard to the date of policy issuance, the accident date, or the report date of the claim.

Accident year aggregation: Losses for accidents that have occurred during a twelve-month period, regardless of when the policy was issued or the claim was reported.

Policy year aggregation: All premium and loss transactions on policies that were written during a twelve-month period, regardless of when the claim occurred or when it was reported, reserved, or paid.

Report year aggregation: Losses are aggregated according to when the claim was reported, as opposed to when the claim occurred.

External data

When pricing a new line of business, it may be necessary to use external data. Even when pricing an existing line of business, it is often helpful to supplement internal data with external data.

The most commonly used sources of external information include:

- Data calls or statistical plan data.
- Other aggregated insurance industry data.
- Competitors' rate filings.
- Third-party data unrelated to insurance.