2020 INTRODUCTION TO INSURANCE

Bruin Actuarial Society
A Brief Overview

- This series of workshops builds on last year’s Introduction to Insurance workshop by adding the following components:
  - Introduction to Reserving
  - Introduction to Pricing
  - Applications of Pricing and Reserving
- Although many concepts are presented through a property and casualty (P&C) perspective, they can easily be extended to health insurance
Agenda

- What is insurance?
- Fundamental Insurance Equation:
  \[ \text{Premium} = \text{Losses} + \text{Loss Adjustment Expenses} + \text{Underwriting Expenses} + \text{Underwriting Profit} \]
- We will define and explore each of these components.
What is insurance?

- **Insurance** is a means of protection from financial loss.
- It is used to manage the risk of uncertain losses.
- When insurance companies purchase insurance, we call this **reinsurance**.
- If a company assumes the financial risk by itself, we say the company is **self-insured**.
How is insurance different from other products?

- With most other products in the economy, the cost is known up front, when the good/service is purchased.
- The true cost of insurance is not known until years (even decades) after purchase.
- The actuary's job, in both pricing and reserving, is to estimate this cost to:
  - Determine how much the insureds should be charged for coverage.
  - Ensure that the insurance company is able to pay unpaid claims.
Exposures and Premium

- **Exposures** are the basic units of risk that underlie insurance premium.
- The *exposure base* selected should be proportional to expected loss, practical (i.e. objective, easy to verify), and ideally have some industry precedent.
- For example:
  - One house insured for one year, for homeowners insurance.
  - Annual payroll (in hundreds), for workers' compensation insurance.
  - Number of vehicles, for auto insurance.
Exposures and Premium

- An **insurance policy** involves the insured paying money (i.e., **premium** ) to an insurer in exchange for a promise to indemnify the insured for the financial consequences of an event covered by the policy.

- Insureds are divided into groups, with each group charged a different premium based on its expected cost.

- **Rating variables** define what characteristics premium varies by, and by how much.
  - For example, a 65-year old may be charged 3 times as much for health insurance as an 18-year old.
Exposures (and premium) can be measured in the following ways:

- **Written exposures** are the total exposures arising from policies written during a specified period of time (e.g. calendar year).
- **Earned exposures** represent the portion of the written exposures for which coverage has already been provided as of a certain point in time.
- **Unearned exposures** represent the portion of the written exposures for which coverage has not yet been provided as of that point in time.
- **In-force exposures** are the total number of exposures of active policies (in-force policies) at a given point in time.
Exposures and Premium: Example

- Suppose two annual homeowners policies are written, one on 1/1/2019, another on 4/1/2019.
  - How many policies were written between 1/1/2019 and 12/31/2019 (CY 2019)? 2 (both policies)
  - How many policies were earned as of 12/31/2019? 1.75 (all of the first policy, 75% of the second)
  - How many policies were unearned as of 12/31/2019? 0.25
  - How many policies were in-force on:
    - 2/1/2019? 1 (the first policy)
    - 4/1/2019? 2 (both policies)
    - 1/1/2020? 1 (the second policy)
Ratemaking, or pricing, refers to the process of setting insurance prices (i.e. how much premium to charge).

The goal of ratemaking is to balance the fundamental insurance equation (both in aggregate and at the individual level) to ensure sufficient premium.
If an event is covered under a policy, the insured makes a demand to the insurer for indemnification under the policy.

- The demand for payment is called a **claim**
- The individual making the demand is called the **claimant**

The date of the event that caused the loss is called the **date of loss**, **accident date**, or **occurrence date**.
Claims and Losses

- Until the claimant reports the claim to the insurer (i.e. the **report date**), the insurer is not aware of the claim.
- Claims not known by the insurer are called **unreported claims** or **incurred but not reported (IBNR)** claims.
Claims and Losses

- **Loss** is the amount of compensation paid (or payable) to the claimant
  - *Loss* and *claim* are often used interchangeably in industry

- Losses on reported claims are split into the following categories:
  - **Paid losses** are amounts that have already been paid to claimants
  - Once a claim is reported and the insurer expects to make a payment, it establishes a case reserve, an estimate of the remaining money required to ultimately settle that claim
    - This excludes amounts already paid
  - The sum of paid losses and current case reserve is referred to as *reported loss*, *case incurred loss*, or, erroneously, *"incurred loss"*
Claims and Losses: Example

On 2/3/2020, an insured reports a medical malpractice lawsuit, scheduled to take place on 5/2/2020. The insurer estimates that it will pay $12,000 in legal fees and other costs, as well as an estimated $88,000 in settlements or judgments.

- What is the report date? **2/3/2020**
- How much is paid as of the report date? **$0 (no payments were made)**
- How much is in case reserves on the report date? **$100,000 ($12,000 + $88,000)**
Throughout the month of April, the insurance company incurs and pays legal fees of $10,000. Its estimate of total legal fees is unchanged.

- As of 4/30/2020, how much losses were paid in total? $10,000
- How much money is in case reserves on 4/30/2020? $90,000, since the estimated total is unchanged.

<table>
<thead>
<tr>
<th>Date</th>
<th>Paid Losses</th>
<th>Case Reserve</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/3/2020</td>
<td>$0</td>
<td>$100,000</td>
</tr>
<tr>
<td>4/30/2020</td>
<td>$10,000</td>
<td>$90,000</td>
</tr>
</tbody>
</table>
On 5/1/2020, the insurer incurs, but does not pay, $5,000 of legal fees. It expects that no additional expenses are remaining, but still expects to pay $88,000 in settlements.

- As of 5/1/2020, how much losses were paid in total? $10,000
- How much money is in case reserves on 5/1/2020? $93,000 ($5,000 estimated expenses + $88,000 estimated settlements)
On 5/9/2020, the insured is ordered to pay $200,000, which is covered by the company. Additionally, the company pays the $5,000 of expenses. The claim is then closed.

- As of 5/9/2020, how much losses were paid in total? $215,000 ($10,000 + $5,000 + $200,000)
- How much money is in case reserves on 5/9/2020? $0 (the claim is closed)

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</tr>
<tr>
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<td>$10,000</td>
<td>$93,000</td>
</tr>
<tr>
<td>5/9/2020</td>
<td>$215,000</td>
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## Claims and Losses: Example

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<td>$93,000</td>
</tr>
<tr>
<td>5/9/2020</td>
<td>$215,000</td>
<td>$0</td>
</tr>
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Claims and Losses

- **Ultimate loss** (or, for financial reporting purposes, "incurred loss") is the amount of money required to close and settle all claims for a defined group of policies.

- The difference between ultimate losses and reported losses is referred to as **(broad) IBNR**.

- *Estimated* Ultimate Losses = Reported Losses + IBNR
Claims and Losses

- Broad IBNR is comprised of:
  - Unreported claims, for which we establish an incurred but not yet reported (IBNYR) reserve (also called pure IBNR)
    - This includes a provision for claims in transit (that is, claims reported but not recorded)
  - Changes in case reserve on known claims, for which we establish an incurred but not enough reported (IBNER) reserve
    - This includes a provision for previously closed claims reopening
### Claims and Losses: Previous Example

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<thead>
<tr>
<th>Date</th>
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<th>Case Reserve</th>
<th>Reported Losses (Paid + Case)</th>
<th>Actual IBNR (Actual Ult. - Reported)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/3/2020</td>
<td>$0</td>
<td>$100,000</td>
<td>$100,000</td>
<td>$115,000</td>
</tr>
<tr>
<td>4/30/2020</td>
<td>$10,000</td>
<td>$90,000</td>
<td>$100,000</td>
<td>$115,000</td>
</tr>
<tr>
<td>5/1/2020</td>
<td>$10,000</td>
<td>$93,000</td>
<td>$103,000</td>
<td>$112,000</td>
</tr>
<tr>
<td>5/9/2020</td>
<td>$215,000</td>
<td>$0</td>
<td>$215,000</td>
<td>$0</td>
</tr>
</tbody>
</table>

**Question:** Is this column IBNER or IBNYR?

Assuming the claim doesn’t reopen, this is the ultimate cost of the claim.

Actual IBNR is unknown, so it must be estimated by the actuary.
# Claims and Losses: Previous Example

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**Question:** Is this column IBNER or IBNYR?

**Answer:** IBNER, since it's associated with the development on a known claim.
The goal of **reserving** is to estimate unpaid claims

- Case reserve is often set by claims departments, so actuaries are more concerned with IBNR
- This affects the ratemaking process as well, as the unpaid portions of claims are part of the cost of the insurance product
Claims and Losses: Fundamental Ratios

- **Frequency** = Number of claims / Number of exposures
  - i.e. *how many* claims do we expect for each vehicle?
- **Severity** = Losses / Number of claims
  - i.e. *how much* do we expect each claim to be?
- **Pure premium** = Frequency x Severity = Losses / Number of exposures
  - i.e. *how much* do we expect to pay out in claims for each vehicle?
- **Loss ratio** = Losses / Premium
  - i.e. what portion of premium is paid to claimants?
Loss Adjustment Expenses (LAE)

- **Loss adjustment expenses (LAE)** are expenses the insured incurs in the process of settling claims.

- Some of these expenses can be allocated to a specific claim: we call these **allocated loss adjustment expenses (ALAE)**
  - For example, fees associated with outside legal counsel hired to defend a specific claim.

- The expenses that cannot be attributable to a specific claim are called **unallocated loss adjustment expenses (ULAE)**
  - For example, salaries of claims department personnel.
Loss Adjustment Expenses (LAE)

- Statutory financial reporting separates LAE into different (but similar) categories, which are uniformly defined across insurers:
  - **Defense and cost containment (DCC)** includes all defense litigation and medical cost containment expenses
  - **Adjusting and other (A&O)** includes all loss adjusting expenses
  - DCC and ALAE are roughly similar; A&O and ULAE are roughly similar
Underwriting Expenses

- Companies also incur other expenses in the acquisition and servicing of policies, called **underwriting expenses** or **operational and administrative expenses**

- These are broken into two components:
  - **Variable U/W expenses** vary with the amount of premium (e.g. commissions, taxes)
  - **Fixed U/W expenses** do not vary with premium, but do vary with the amount of exposures/policies (e.g. general expenses, marketing, licenses)
Underwriting Profit

- Since the ultimate cost of insurance is not known at the time of sale, the insurance company is assuming the risk that premium may not cover losses and expenses.
- Since insurance companies must maintain capital to support this risk, they are entitled to a reasonable expected return (profit) on the capital.
Profit comes from two main sources:

- **Underwriting profit**, or **operating income**, is the sum of profits generated from individual policies (i.e. premium minus losses and expenses)

- **Investment income** is the income generated by investing funds held by the company (e.g. investing equity or investing case reserves / unearned premium)

- Investment income is *not* part of the fundamental insurance equation.
Ratemaking actuaries determine the level of premium such that the fundamental insurance equation is balanced, both in aggregate and at the individual level.

- If the equation is imbalanced in aggregate, the company could either become uncompetitive or not be able to pay out claims.
- If the equation is imbalanced at the individual level, the company could be subject to adverse selection.

In insurance, **adverse selection** refers to situations where insurance companies provide coverage for a risk substantially riskier than initially assumed.
Adverse Selection: Example

- Suppose the true cost of Territory 1 is $100 and the true cost of Territory 2 is $150.

<table>
<thead>
<tr>
<th>Company</th>
<th>Terr. 1 Exposures</th>
<th>Terr. 1 Rate</th>
<th>Terr. 2 Exposures</th>
<th>Terr. 2 Rate</th>
<th>Excess Profit/(Loss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1,000</td>
<td>$100</td>
<td>1,000</td>
<td>$150</td>
<td>$0</td>
</tr>
<tr>
<td>B</td>
<td>1,000</td>
<td>$125</td>
<td>1,000</td>
<td>$125</td>
<td>$0</td>
</tr>
</tbody>
</table>

- Company A reflects these differences. Company B prices correctly in aggregate, but not at the individual level.
Adverse Selection: Example

- If 25% of insureds shop around at the end of each period, and insureds select the cheapest policy, Company B will gain Territory 2 exposures and lose Territory 1 exposures:

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</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1,250</td>
<td>$100</td>
<td>750</td>
<td>$150</td>
<td>$0</td>
</tr>
<tr>
<td>B</td>
<td>750</td>
<td>$125</td>
<td>1,250</td>
<td>$125</td>
<td>($12,500)</td>
</tr>
</tbody>
</table>

- Thus Company B will have to increase its rates.
Adverse Selection: Example

- This process will continue until Company B adjusts its rates, goes bankrupt, or only writes Territory 2 exposures.

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1,438</td>
<td>$100</td>
<td>562</td>
<td>$150</td>
<td>$0</td>
</tr>
<tr>
<td>B</td>
<td>562</td>
<td>$131</td>
<td>1,438</td>
<td>$131</td>
<td>($9,900)</td>
</tr>
</tbody>
</table>

- This is an example of adverse selection, and demonstrates why rates must be balanced at the individual level.
When working with large commercial policies, the process is somewhat different:
- E.g. medical malpractice, workers’ compensation, general liability, …

Commercial policies are hard to group into similar risks, so may be priced individually.

Instead of following a rating manual (used for individuals), actuaries may employ other techniques to deal with large policies using their experience and other metrics.
Conclusion

- We have introduced a lot of terminology used throughout the insurance industry.
- We will use this terminology when discussing reserving (workshop II) and pricing (workshop III).
- The concepts underlying the examples will be useful, both in actual applications and in interviews!