2019 INTRODUCTION TO INSURANCE

Bruin Actuarial Society

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Agenda

- What is insurance?
- Fundamental Insurance Equation:

  Premium = Losses + Loss Adjustment Expenses

  + Underwriting Expenses + Underwriting Profit
- We will define and explore each of these components.

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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**

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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

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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
- In order for premium to reflect the expected cost, we vary premium by groups of insured
- **Rating variables** define what characteristics premium varies by, and by how much

Exposures and Premium

- 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)?
  - How many policies were earned as of 12/31/2019?
  - How many policies were unearned as of 12/31/2019?
  - How many policies were in-force on:
    - 2/1/2019?
    - 4/1/2019?
    - 1/1/2020?

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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)

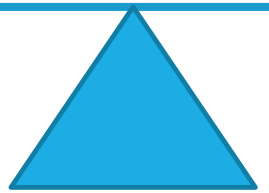
Exposures and Premium

- **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)

Premium

Losses + LAE

+ U/W Expenses + U/W Profit



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Claims and Losses

- 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**"

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Claims and Losses: Example

- On 2/3/2019, an insured reports a medical malpractice lawsuit, scheduled to take place on 5/2/2019. 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**?
  - How much is paid as of the report date?
  - How much is in case reserves on the report date?

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Claims and Losses: Example

- On 2/3/2019, an insured reports a medical malpractice lawsuit, scheduled to take place on 5/2/2019. 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**? 2/3/2019
  - 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)

Claims and Losses: Example

- 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 4/30/2019, how much losses were paid in total?
  - How much money is in case reserves on 4/30/2019?

Date	Paid Losses	Case Reserve
2/3/2019	$0	$100,000

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Claims and Losses: Example

- 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 4/30/2019, how much losses were paid in total? $10,000
  - How much money is in case reserves on 4/30/2019? $90,000, since the estimated total is unchanged

Date	Paid Losses	Case Reserve
2/3/2019	$0	$100,000

Claims and Losses: Example

- On 5/1/2019, the insurer incurs, but does not pay, $5,000 of court expenses and additional legal fees. It expects that no additional expenses are remaining.
  - As of 5/1/2019, how much losses were paid in total?
  - How much monev is in case reserves on 5/1/2019?

Date	Paid Losses	Case Reserve
2/3/2019	$0	$100,000
4/31/2019	$10,000	$90,000

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Claims and Losses: Example

- On 5/1/2019, the insurer incurs, but does not pay, $5,000 of court expenses and additional legal fees. It expects that no additional expenses are remaining.
  - As of 5/1/2019, how much losses were paid in total? $10,000
  - How much money is in case reserves on 5/1/2019? $93,000 ($5,000 estimated expenses + $88,000)

Date	Paid Losses	Case Reserve
2/3/2019	$0	$100,000
4/31/2019	$10,000	$90,000

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Claims and Losses: Example

- On 5/9/2019, 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 5/9/2019, how much losses were paid in total?
  - How much money is in case reserves on 5/9/2019?

Date	Paid Losses	Case Reserve
2/3/2019	$0	$100,000
4/31/2019	$10,000	$90,000
5/1/2019	$10,000	$93,000

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Claims and Losses: Example

- On 5/9/2019, 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 5/9/2019, how much losses were paid in total? $215,000 ($10,000 + $5,000 + $200,000)
  - How much money is in case reserves on 5/9/2019? $0 (the claim is closed)

Date	Paid Losses	Case Reserve
2/3/2019	$0	$100,000
4/31/2019	$10,000	$90,000
5/1/2019	$10,000	$93,000

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Claims and Losses: Example

Date	Paid Losses	Case Reserve
2/3/2019	$0	$100,000
4/31/2019	$10,000	$90,000
5/1/2019	$10,000	$93,000
5/9/2019	$215,000	$0

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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

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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

Question: Is this column IBNER or IBNYR?

Date	Paid Losses	Case Reserve	Reported Losses (Paid + Case)	Actual IBNR (Actual Ult. - Reported)
2/3/2019	$0	$100,000	$100,000	$115,000
4/31/2019	$10,000	$90,000	$100,000	$115,000
5/1/2019	$10,000	$93,000	$103,000	$112,000
5/9/2019	$215,000	$0	$215,000	$0

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.

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Claims and Losses: Previous Example

Question: Is this column IBNER or IBNYR?

Date	Paid Losses	Case Reserve	Reported Losses (Paid + Case)	Actual IBNR (Actual Ult. - Reported)
2/3/2019	$0	$100,000	$100,000	$115,000
4/31/2019	$10,000	$90,000	$100,000	$115,000
5/1/2019	$10,000	$93,000	$103,000	$112,000
5/9/2019	$215,000	$0	$215,000	$0

Answer: IBNER, since it's associated with the development on a known claim.

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Claims and Losses

- 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?

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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

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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

Underwriting Profit

- 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.

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Balancing 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 provides 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.

Company	Terr. 1 Exposures	Terr. 1 Rate	Terr. 2 Exposures	Terr. 2 Rate	Excess Profit/(Loss)
A	1,000	$100	1,000	$150	$0
B	1,000	$125	1,000	$125	$0

- 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:

Company	Terr. 1 Exposures	Terr. 1 Rate	Terr. 2 Exposures	Terr. 2 Rate	Excess Profit/(Loss)
A	1,250	$100	750	$150	$0
B	750	$125	1,250	$125	($12,500)

- Thus Company B will have to increase its rates.

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Adverse Selection: Example

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

Company	Terr. 1 Exposures	Terr. 1 Rate	Terr. 2 Exposures	Terr. 2 Rate	Excess Profit/(Loss)
A	1,438	$100	562	$150	$0
B	562	$131	1,438	$131	($9,900)

- This is an example of **adverse selection**, and demonstrates why rates must be balanced by classification.

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Large-Scale Commercial Policies

- 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

Questions?

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