Introduction to Insurance

Bruin Actuarial Society

04/05/2022
Agenda

- Introduction
- Pricing & Reserving
- Adverse Selection
- Common Insurance Products
What is Insurance?

- Insurance is a means of protection from financial loss
  - A way to manage the risk of uncertain losses
  - Started as far back as 3rd and 2nd century BCE for sea trading
- Reinsurance: “insurance for insurance”
- Self-insured: when company assumes the financial risk by itself
How is insurance different than other products?

- Cost for most products on market is known upfront, when the good/service is purchased
- True cost of insurance is not known until years after purchase
- One of the main duties of an actuary 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
Pricing and Reserving
Some Terminologies

- **Insured**: person/item receiving insurance
- **Exposures**: Basic unit of risks that underlie insurance premium
  - **Homeowners**: house per year
  - **Auto**: mileage driven per year
  - **Health**: Per Member Per Month (PMPM)
- **Premium**: Money paid by the insured to insurer for the insurance policy
- **Underwriting**: Process of taking on financial risk
Exposures and Premium

Exposures (and premium) can be measured in the following ways:

- **Written**: total exposures arising from policies written during a specified period of time
- **Earned**: portion of written exposures for which coverage has been provided as of a certain point in time
- **Unearned**: portion of written exposures for which coverage has not been provided as of a certain point in time
- **In-force**: total number of exposures of active policies at a given point in time
Fundamental Insurance Equation

- Premium = Losses + Loss Adjustment Expense + Underwriting Expenses + Underwriting Profit
Fundamental Insurance Equation

- Pricing and reserving thus stem from the equation

- **Ratemaking**, or **pricing**, is the process of setting insurance prices (i.e. how much premium to charge)

- **Reserving** is the process of estimating unpaid loss
  - Affects ratemaking as loss is part of premium
Claim 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 is called **claim**
  - The individual making the demand is called the **claimant**
- The date of the event that caused the loss is called **date of loss, accident date, or occurrence date**
Claim 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 to the claimant
  - Loss and claims are often used interchangeably in the industry

- Losses on reported claims are split:
  - **Paid losses**
  - **Case Reserve**: estimate of the remaining money to ultimately settle the claim, can change

- **Reported Loss = Paid Loss + Current Case Reserve**

- **Ultimate loss** (or “incurred loss” for financial reporting purposes) is the amount required to settle all claims for a defined group of policies
  - **Estimated Ultimate Losses = Reported Loss + IBNR**
On 2/3/2022, an insured reports a medical malpractice lawsuit, scheduled to take place on 5/3/2022. The insurer estimates that it will pay $12,000 in legal fees and other costs, as well as an estimated $88,000 in settlements.

- What is the report date?
- How much is paid as of the report date?
- How much is in case reserves on the report date?
Claims and Losses: Example

- On 2/3/2022, an insured reports a medical malpractice lawsuit, scheduled to take place on 5/3/2022. The insurer estimates that it will pay $12,000 in legal fees and other costs, as well as an estimated $88,000 in settlements.
  - What is the report date? 2/3/2022
  - How much is paid as of the report date? $0
  - 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. The estimate of total legal fees is unchanged.

As of 4/30/2022, how much losses were paid in total?

How much money is in case reserves on 4/30/2022?
Claims & Losses: Example

Throughout the month of April, the insurance company incurs and pays legal fees of $10,000. The estimate of total legal fees is unchanged.

- As of 4/30/2022, how much losses were paid in total? $10,000
- How much money is in case reserves on 4/30/2022? $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>2/3/2022</td>
<td>$0</td>
<td>$100,000</td>
</tr>
<tr>
<td>4/30/2022</td>
<td>$10,000</td>
<td>$90,000</td>
</tr>
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</table>
On 5/1/2022, the insurer incurs, but does not pay, $5,000 of court expenses and legal fees. It expected that no additional expense are remaining, but still expects to pay $88,000 in settlements.

As of 5/1/2022, how much losses were paid in total?

How much money is in case reserves on 5/1/2022?

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On 5/1/2022, the insurer incurs, but does not pay, $5,000 of court expenses and legal fees. It is expected that no additional expenses are remaining, but still expects to pay $88,000 in settlements.

As of 5/1/2022, how much losses were paid in total? $10,000

How much money is in case reserves on 5/1/2022? $93,000 ($5,000 estimated expense + $88,000)
On 5/9/2022, 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 5/9/2022, how much losses were paid in total?
- How much money is in case reserves on 5/9/2022?

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**Claims & Losses: Example**

On 5/9/2022, the insurer 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 5/9/2022, how much losses were paid in total? $215,000 ($10,000 + $5,000 + $200,000)
- How much money is in case reserves on 5/9/2022? $0 (Claim closed)

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<td>$90,000</td>
</tr>
<tr>
<td>5/1/2022</td>
<td>$10,000</td>
<td>$93,000</td>
</tr>
<tr>
<td>5/9/2022</td>
<td>$215,000</td>
<td>$0</td>
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## Claims & Losses: Example

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Loss Adjustment Expense

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

- Some are claim-specific. These are called **allocated loss adjustment expenses (ALAE)**
  - e.g. fees for outside legal counsel hired to defend a specific claim

- Some are not claim-specific. These are **unallocated loss adjustment expenses (ULAE)**
  - e.g. salaries for claim department personnel
Loss Adjustment Expense

- Statutory financial reporting separated LAE into the following categories
  - **Defenses and cost containment (DCC)** includes all defense litigation and medical cost containment expenses
  - **Adjusting and other (A&O)** includes all loss adjusting expenses
  - **TLDR:** DCC are ALAE are roughly similar; A&O and ULAE are roughly similar
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 UW expenses** vary with the amount of premium (e.g. commissions, taxes)
- **Fixed UW expenses** do not vary with the 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.
- As 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.
Adverse Selection
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 provide coverage for a risk substantially riskier than initially assumed.
Adverse Selection: Example

- Suppose there are two companies, A and B, that offer coverage in two territories.
- Suppose the true cost of Territory 1 is $200 and the true cost of Territory 2 is $250.

<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>100</td>
<td>$200</td>
<td>100</td>
<td>$250</td>
<td>$0 + $0 = $0</td>
</tr>
<tr>
<td>B</td>
<td>100</td>
<td>$225</td>
<td>100</td>
<td>$225</td>
<td>$2,500 + ($2,500) = $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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<th>Excess Profit/(Loss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>125</td>
<td>$200</td>
<td>75</td>
<td>$250</td>
<td>$0 + $0 = $0</td>
</tr>
<tr>
<td>B</td>
<td>75</td>
<td>$225</td>
<td>125</td>
<td>$225</td>
<td>$1,875 + ($3,125) = ($1,250)</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.

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<th>Terr 2 Exposures</th>
<th>Terr 2 Rate</th>
<th>Excess Profit/(Loss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>144</td>
<td>$200</td>
<td>56</td>
<td>$250</td>
<td>$0 + $0 = $0</td>
</tr>
<tr>
<td>B</td>
<td>56</td>
<td>$231</td>
<td>144</td>
<td>$231</td>
<td>$1,736 + ($2,736) = ($1,000)</td>
</tr>
</tbody>
</table>

This is an example of adverse selection and demonstrates why rates must be balanced at the individual level.
Common Insurance Products
Life Insurance

How do they work?

- You pay premium, usually monthly for a fixed amount of time, and the beneficiary receives a death benefit (i.e. $$) when you pass away.

- **Term life insurance**: the beneficiary receives a death benefit if you pass away within a fixed time period.

  - E.g. If the term life insurance only cover you for 20 years, and you pass at year 21, then your beneficiary receives no benefit.

- **Permanent life insurance**: life insurance that provides coverage for life.
Retirement

There are two main products in retirement, which are often run through an employer:

- **Defined Benefit** plans provide a specified payment amount in retirement (e.g. pensions)
- **Defined Contribution** plans allow an individual (and/or their employer) to make contributions that will be invested, with the amount paid dependent on the contributions and their growth (e.g. 401k)

There has been a shift from defined benefit to defined contribution plans, with the risk being shifted from the employer to the employee.
Health Insurance

- Similar to P&C insurance
  - Different types: medical, dental, vision
  - Structure: deductible, coinsurance
- Key Feature in U.S. – Network Design
  - Health Maintenance Organization (HMO): coverage to a fixed number of physicians and hospitals, known as the network. No out of network coverage in most cases.
  - Preferred Provider Organization (PPO): access to network like HMO, but out of network care is also covered.
Property and Casualty

- This type of insurance provides coverage to protect physical property and cover liability.

- **Homeowners insurance** protects a home and its belonging against perils such as fire, weather-related events, and theft. It can also include liability coverage.
  - Also **condo insurance**, protecting the interior of a home, and **renters insurance**.

- **Car Insurance** protects a vehicle and its occupants from damage and liability, depending on the types of coverage chosen.
  - **Powersports insurance** is for other vehicles (e.g. boats, ATVs, snowmobiles).

- Other types include **business** and **umbrella insurance**, which raises liability coverage.