INTRODUCTION TO INSURANCE
AGENDA

01 Introduction
02 Pricing and Reserving
03 Adverse Selection
04 Common Insurance Products
Introduction
WHAT IS INSURANCE?

• Insurance is a way to protect against financial loss
  • A means 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
INSURANCE VS OTHER PRODUCTS

• The cost of most products on the market is known upfront, when the good/service is purchased.
• The true cost of insurance is unknown 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 (Pricing)
  • Ensure that the insurance company can pay unpaid claims (Reserving)
Pricing and Reserving
SOME TERMINOLOGY...

- Insured: person or item receiving insurance
- Exposures: Basic units of risks that underlie insurance premium
- Examples:
  - Homeowners: house per year
  - Auto: Car Year
  - Health: Per Member Per Month (PMPM)
- Premium: Money paid by the insured(You) to insurer for the insurance policy
- Underwriting: Process of taking on financial risk
EXPOSURES AND PREMIUMS

• Exposures and premium can be measured in the following ways:
  • Written: total exposures arising from policies written during a specified period
  • 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
- LAE (Loss Adjustment Expense)
- UW Profit
- Losses

- UW Expense

2023-2024 Bruin Actuarial Society
• 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
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 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
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 known as unreported claims or incurred but not reported (IBNR) claims
CLAIMS AND LOSSES

• Loss is amount of compensation paid to the claimant
  • Loss and claims are often used interchangeably throughout 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
CLAIMS AND LOSSES EXAMPLE

• On 2/3/2023, an insured reports a medical malpractice lawsuit, scheduled to take place on 5/3/2023. 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?
CLAIM AND LOSSES EXAMPLE

- On 2/3/2023, an insured reports a medical malpractice lawsuit, scheduled to take place on 5/3/2023. 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? 2/3/2023
  - 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)
CLAIM AND 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 4/30/2023, how much losses were paid in total?

• How much money is in case reserves on 4/30/2023?

<table>
<thead>
<tr>
<th>Date</th>
<th>Paid Loss</th>
<th>Case Reserve</th>
</tr>
</thead>
<tbody>
<tr>
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CLAIM AND 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 4/30/2023, how much losses were paid in total? $10,000

• How much money is in case reserves on 4/30/2023? $90,000

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CLAIM AND LOSSES EXAMPLE

• On 5/1/2023, the insured 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 5/1/2023, how much losses were paid in total? How much money is in case reserves on 5/1/2023?

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As of 5/1/2023, how much losses were paid in total? $10,000

How much money is in case reserves on 5/1/2023? $93,000 ($5,000 estimated expense + $88,000)

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<td>$90,000</td>
</tr>
<tr>
<td>5/1/2023</td>
<td>$10,000</td>
<td>$93,000</td>
</tr>
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CLAIM AND LOSSES EXAMPLE

• On 5/9/2023, 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 5/9/2023, how much losses were paid in total?
• How much money is in case reserves on 5/9/2023?

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CLAIM AND LOSSES EXAMPLE

• On 5/9/2023, 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 5/9/2023, how much losses were paid in total? $215,000 ($10,000 + $5,000 + $200,000)

• How much money is in case reserves on 5/9/2023? $0 (Claim closed)

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<td>$90,000</td>
</tr>
<tr>
<td>5/1/2023</td>
<td>$10,000</td>
<td>$93,000</td>
</tr>
<tr>
<td>5/9/2023</td>
<td>$215,000</td>
<td>$0</td>
</tr>
</tbody>
</table>
• Loss adjustment expenses are incurred by insured 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 known as 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
UNDERWRITING EXPENSE

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

• These are broken in two components:

• Variable UW expenses vary with the amount of premium (e.g. agent 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.
• Profit comes from two main sources:
  • Underwriting profit, or operating income, is the sum of profits generated from individual policies (premium minus losses and expenses)
  • Investment income is 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
• 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 cities: San Francisco (SF) and Los Angeles (LA).
- Suppose the true cost of San Francisco is $200 and the true cost of Los Angeles is $250.

<table>
<thead>
<tr>
<th>Company</th>
<th>SF Exposures</th>
<th>SF Rate (True Rate $200)</th>
<th>LA Exposures</th>
<th>LA Rate (True Rate $250)</th>
<th>Excess Profit/(Loss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>100</td>
<td>$200</td>
<td>100</td>
<td>$250</td>
<td>0 + 0 = 0</td>
</tr>
<tr>
<td>Company B</td>
<td>100</td>
<td>$225</td>
<td>100</td>
<td>$225</td>
<td>$2500 + ($2500) = 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 LA exposures and lose SF exposures:

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<th>Excess Profit/(Loss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>125</td>
<td>$200</td>
<td>75</td>
<td>$250</td>
<td>$0 + $0 = 0</td>
</tr>
<tr>
<td>Company B</td>
<td>75</td>
<td>$225</td>
<td>125</td>
<td>$225</td>
<td>$1875 + ($3125) = ($1250)</td>
</tr>
</tbody>
</table>

• Thus, Company B will have to increase its rates in order to stay solvent.
• Should company B decide to continue using average rate, it would be $231.25
ADVERSE SELECTION EXAMPLE

• This process will continue until Company B adjusts its rates, goes bankrupt, or only writes LA exposures.

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<tbody>
<tr>
<td>Company A</td>
<td>144</td>
<td>$200</td>
<td>56</td>
<td>$250</td>
<td>$0 + $0 = 0</td>
</tr>
<tr>
<td>Company B</td>
<td>56</td>
<td>$231.25</td>
<td>144</td>
<td>$231.25</td>
<td>$1750 + ($2700) = ($950)</td>
</tr>
</tbody>
</table>

• This is an example of adverse selection and demonstrates why rates must be balanced at the individual level.
Common Insurance product
LIFE INSURANCE

• How do they work?
• You pay a 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
• 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
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.
- Auto 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.
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.
KEY TAKEAWAYS

• Pricing actuaries – avoid adverse selection
• Reserving actuaries – estimate unpaid claims

ANNOUNCEMENTS

[INSERT WORKSHOP]

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Thank you

Any questions?