Bruin Actuarial Society

Introduction to Insurance

BRUIN ACTUARIAL SOCIETY

Agenda

- Introduction
- Pricing & Reserving
- Adverse Selection
- Common Insurance Products

01.

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
  - Ensure that the insurance company can pay unpaid claims

02.

Pricing and Reserving

Terminology

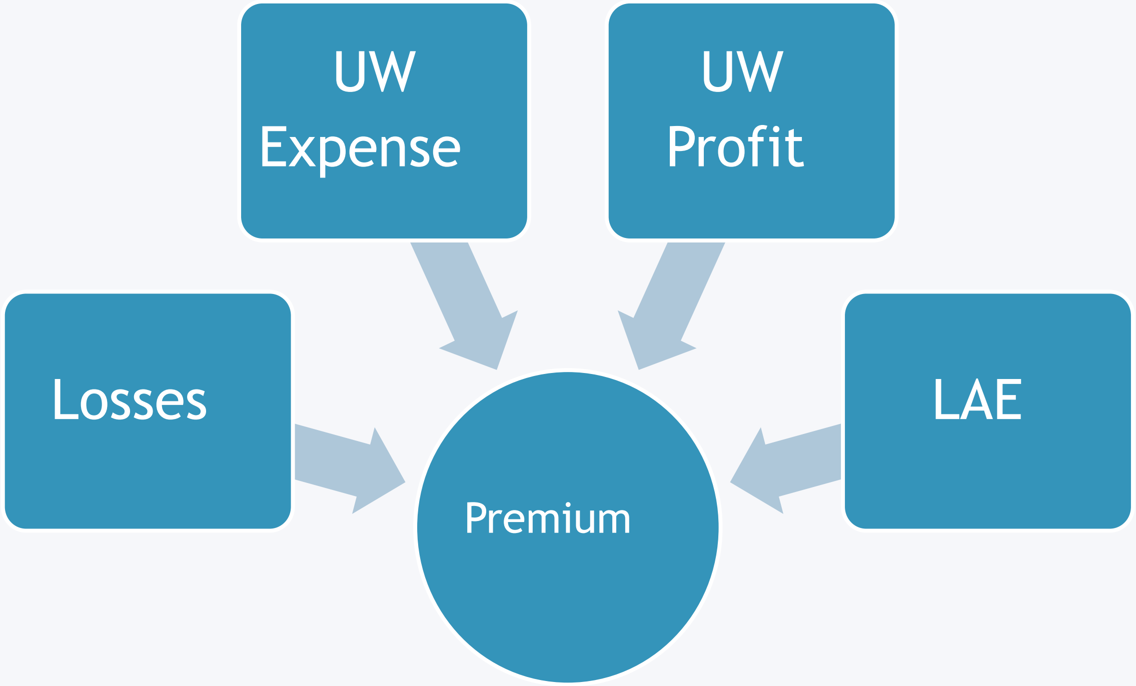
- Insured: person or item receiving insurance
- Exposures: Basic units of risks that underlie insurance premium
  - Homeowners: house per year
  - Auto: mileage driven per year
  - Health: Per Member Per Month (PMPM)
- Premium: Money paid by the insured to insurer for the insurance policy
- Underwriting: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

Exposures and 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 = 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

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?

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? 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)

Claims 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?

Date	Paid Losses	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	???	???

Claims 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, since the estimated total is unchanged

Date	Paid Losses	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	$10,000	$90,000

Claims 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?

Date	Paid Losses	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	$10,000	$90,000

Claims 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 the insured is still expected to pay $88,000 in settlements.
  - 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)

Date	Paid Losses	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	$10,000	$90,000

Claims 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?

Date	Paid Losses	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	$10,000	$90,000
5/1/2023	$10,000	$93,000

Claims 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)

Date	Paid Losses	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	$10,000	$90,000
5/1/2023	$10,000	$93,000
5/9/2023	$215,000	$0

Claims and Losses Example

Date	Paid Losses	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	$10,000	$90,000
5/1/2023	$10,000	$93,000
5/9/2023	$215,000	$0

Loss Adjustment Expense

- 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 Expenses

- 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. 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 (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.

03.

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 on 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

Company	Terr 1 Exposures	Terr 1 Rate	Terr 2 Exposures	Terr 2 Rate	Excess Profit/(Loss)
A	100	$200	100	$250	$0 + $0 = $0
B	100	$225	100	$225	$2500 + ($2500) = $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	125	$200	75	$250	$0 + $0 = $0
B	75	$225	125	$225	$1875 + ($3125) = ($1250)

- 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.

Company	Terr 1 Exposures	Terr 1 Rate	Terr 2 Exposures	Terr 2 Rate	Excess Profit/(Loss)
A	144	$200	56	$250	$0 + $0 = $0
B	56	$231	144	$231	$1736 + ($2736) = ($1000)

- This is an example of adverse selection and demonstrates why rates must be balanced at the individual level.

04.

Common Insurance Products

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

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

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 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

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.

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Questions?