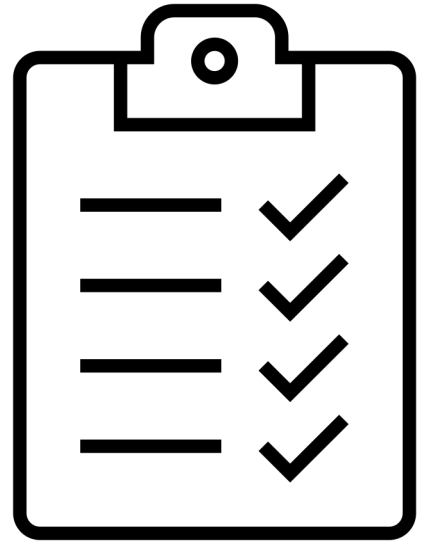
INTRODUCTION TO INSURANCE

October 29, 2026



AGENDA

- Why Insurance?
- Pricing & Reserving
- Adverse Selection
- Common Insurance Products



BRUIN ACTUARIAL SOCIETY

01

WHY INSURANCE?

BAS.00
BRUIN ACTUARIAL SOCIETY

CENTRAL IDEA

Would you pay **$200** to avoid a 1% chance of losing **$10,000**?

CENTRAL IDEA

Would you pay **$200** to avoid a 1% chance of losing **$10,000**?

- Expected cost of paying: **$200**
- Expected cost of NOT paying: $10,000 * 0.01 = **$100**

BAS.00
BRUIN ACTUARIAL SOCIETY

CENTRAL IDEA

Would you pay **$200** to avoid a 1% chance of losing **$10,000**?

- Expected cost of paying: **$200**
- Expected cost of NOT paying: $10,000 * 0.01 = **$100**

According to statistics, you should not pay.
However, what if that 1% scenario does occur?

BAS.00
BRUIN ACTUARIAL SOCIETY

WHY INSURANCE?

- **Myth**: Insurance companies make huge profits
  - Payouts aren't proportional to what they collect in premiums, so policyholders must be losing money
- **Reality**: Insurance is about transferring and pooling risk
  - Policyholders exchange a small, predictable cost (premium) for protection against potentially catastrophic losses
  - Even insurance companies themselves buy insurance (reinsurance) to protect against large, unpredictable losses

BAS.00
BRUIN ACTUARIAL SOCIETY

WHY INSURANCE?

- **Key Idea**: Insurance allows individuals and businesses to use their money more efficiently
  - By paying a relatively small premium, policyholders don't need to keep large emergency funds for potential losses
  - Frees up money for investments, savings, and business growth
  - Enhances financial flexibility while maintaining security

BAS.00
BRUIN ACTUARIAL SOCIETY

WHY INSURANCE?

- Especially in life insurance, modern products now include **investment-linked** features
- A portion of the premium is invested, allowing policyholders to earn returns over time
- These maturity benefits help hedge against inflation and build long-term wealth
- Examples
  - Universal Life Insurance
  - Variable Life or Unit-Linked Insurance Plans (ULIP)

CASE STUDY 1: THE TITANIC

- The Titanic was insured for £1 million by Lloyd's of London and other marine insurers
  - Huge amount in comparing to total marine insured losses for the year 1912 (only ~ £6.75 million)
- **Interesting Points**
  - *Notable car insurance claim*: passenger William Carter claimed $5000 for his Renault that sank with the ship
  - *Biggest life insurance pay-out of its time*: John B. Thayer, a prominent Philadelphian businessman, drowned in the Titanic and his wife received a $50,000 payout
  - *Refusal to insure*: One insurer, British Dominions Marine Insurance, declined to underwrite the Titanic, citing concerns about the ship's low profile in the water

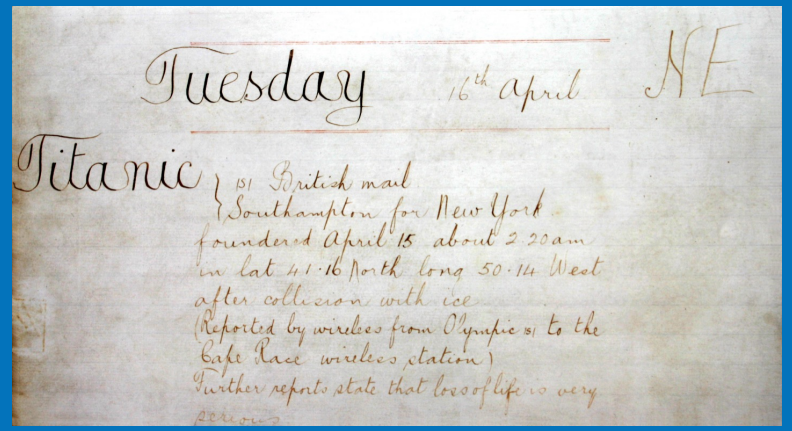

Tuesday 16th April NE
Titanic (S) British mail
Southampton for New York
foundered April 15 about 2.20 am
in lat 41.16 North long 50.14 West
after collision with ice
Reported by wireless from Olympic (S) to the
Cape Race wireless station
Further reports state that loss of life is very
serious

Figure 1: Famous entry of Titanic's collision in Lloyd's loss books

CASE STUDY 2: CELEBRITIES

- In industries where physical attributes are tied directly to income/brand, special insurance covers the risk of injury or disability affecting those attributes
- **Notable Examples**
  - David Beckham: The soccer star reportedly insured his legs for $195 million, given the essential role they play in his career
  - Taylor Swift: Insured her legs for an estimated $40 million – this insurance was reportedly taken out before a major concert tour
  - Miley Cyrus: Insured her vocal cords for an undisclosed amount to protect her primary asset as a singer
- **Why this matters**: these policies combine liability with protection of an intangible asset (brand, performance ability)

BAS.00
BRUIN ACTUARIAL SOCIETY

CASE STUDY 3: HURRICANE ISAIAS (Oct. 2026)

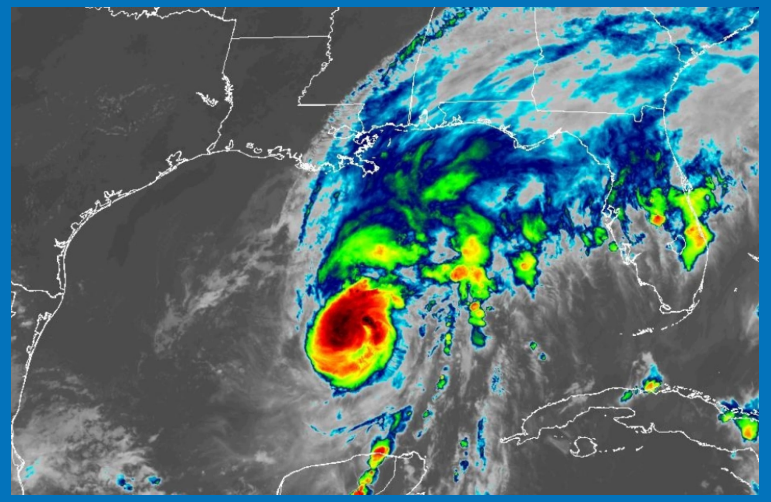


Figure 2: Storm map of Hurricane Isaias (October 9, 2026)

- Hurricane Isaias struck near Destin, Florida, on October 9 as a Category 2 hurricane
- Cotality estimates **$2–3 billion** in insured wind and storm-surge losses
- A single storm can generate many claims at once, challenging insurers' geographic diversification
- Insurers must estimate the final cost before every claim is reported or settled

BAS.00
BRUIN ACTUARIAL SOCIETY

02

PRICING & RESERVING

GENERAL TERMINOLOGY

- **Insured**: The person or entity that receives insurance coverage
  - Only protected from risks and entitled to benefits as outlined in the policy
- **Exposure**: Basic unit of risk that the insurer covers
  - Measurable item or time-period over which the company assumes potential loss
  - For instance, homeowners – claims per house-year, auto – claims per car-year, health – claims per member-month
- **Premium**: The regular payment (monthly, quarterly, or annually) made by the insured to the insurer to maintain active coverage

BAS.00
BRUIN ACTUARIAL SOCIETY

GENERAL TERMINOLOGY

- **Underwriting**: The process by which insurers evaluate the risk associated with a prospective policyholder and determine the terms, coverage limits, and premiums based on that risk assessment
- **Lapse Rate**: The rate at which insurance policies are terminated or expire due to non-payment of premiums or other reasons
- **Grace Period**: The additional time after a premium due date during which the policyholder can pay without the policy lapsing
  - Coverage remains active during grace period

BAS.00
BRUIN ACTUARIAL SOCIETY

COST SHARING TERMINOLOGY

- **Deductible**: The amount which the policyholder must pay before the insurer begins coinsurance/full coverage for rest of losses
- **Coinsurance**: The percentage of losses covered by the insurer
- **Out-of-Pocket Limit**: The maximum amount of losses the policyholder is responsible paying for before the insurer covers all losses remaining

BAS.00
BRUIN ACTUARIAL SOCIETY

COST SHARING TERMINOLOGY

Example:

- Deductible: $2,000
- Coinsurance: 60%
- Out-of-pocket limit: $5,000

https://www.desmos.com/calculator/9tjzjifsbw

BAS.00
BRUIN ACTUARIAL SOCIETY

EXPOSURES AND PREMIUMS

Exposures and premium can be measured in the following ways:

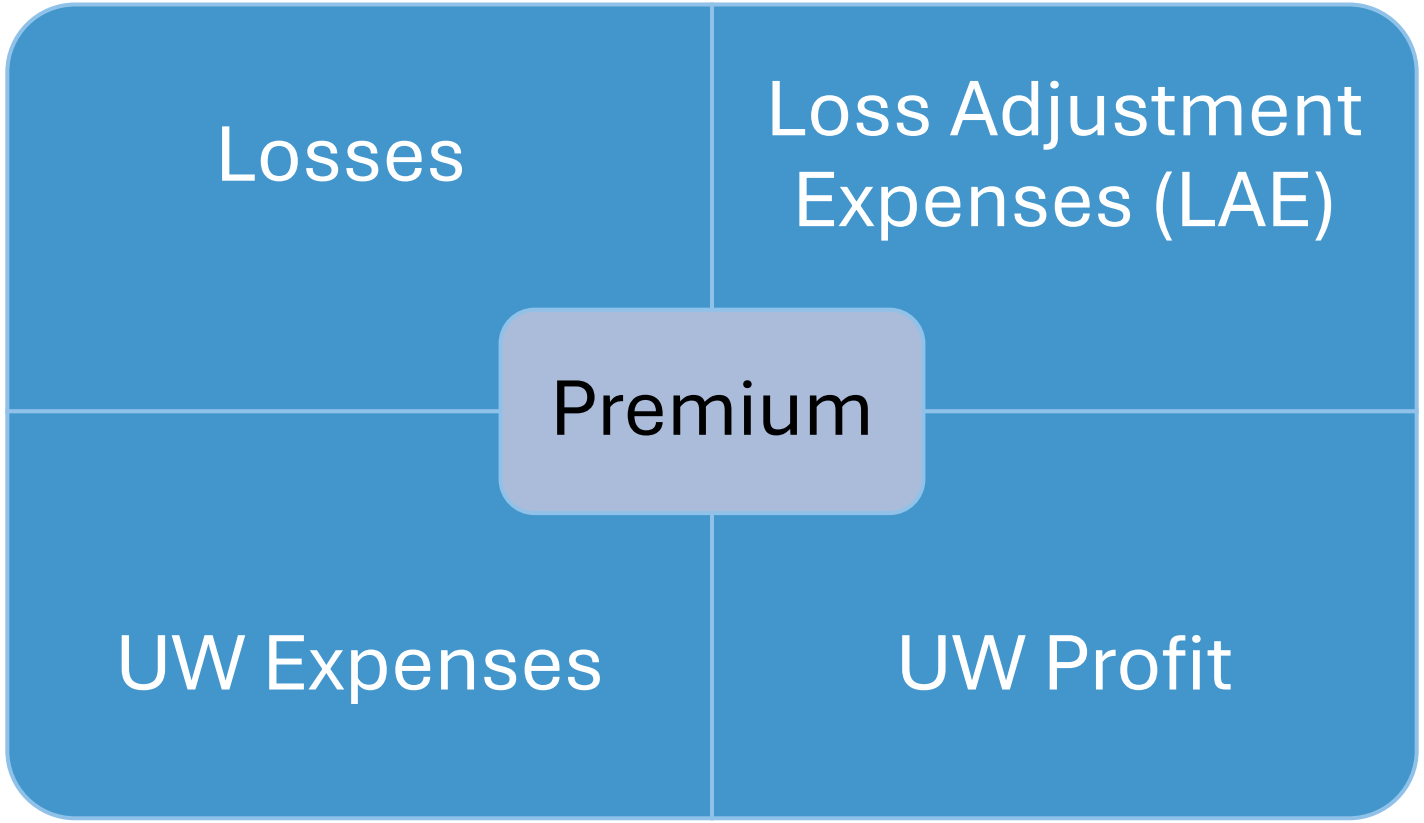
- **Written**: total exposures arising from policies written during a specific period
- **Earned**: portion of written exposures for which coverage has been provided as of a certain point in time
- **Unearned**: portion of written exposures for which coverage has not been provided as of a certain point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

BAS.00
BRUIN ACTUARIAL SOCIETY

IBNR CLAIMS

- **IBNR** = Incurred But Not Reported
- 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 IBNR claims
- **Example**: A person might be injured in a car accident but delays reporting the claim due to hospitalization
    - Although the insurer has not yet received the claim, it should anticipate such events and have reserves set aside to handle these “hidden” liabilities

FUNDAMENTAL INSURANCE EQUATION



BAS.00
BRUIN ACTUARIAL SOCIETY

FUNDAMENTAL INSURANCE EQUATION

- Pricing and reserving stem from the equation
- **Ratemaking** (or pricing) is the process of setting insurance prices
  - How much premium to charge
- **Reserving** is the process of estimating unpaid claims to ensure the company has enough cash to pay out future claims
  - Estimating unpaid losses also affects ratemaking
  - Recall that loss is a part of premium

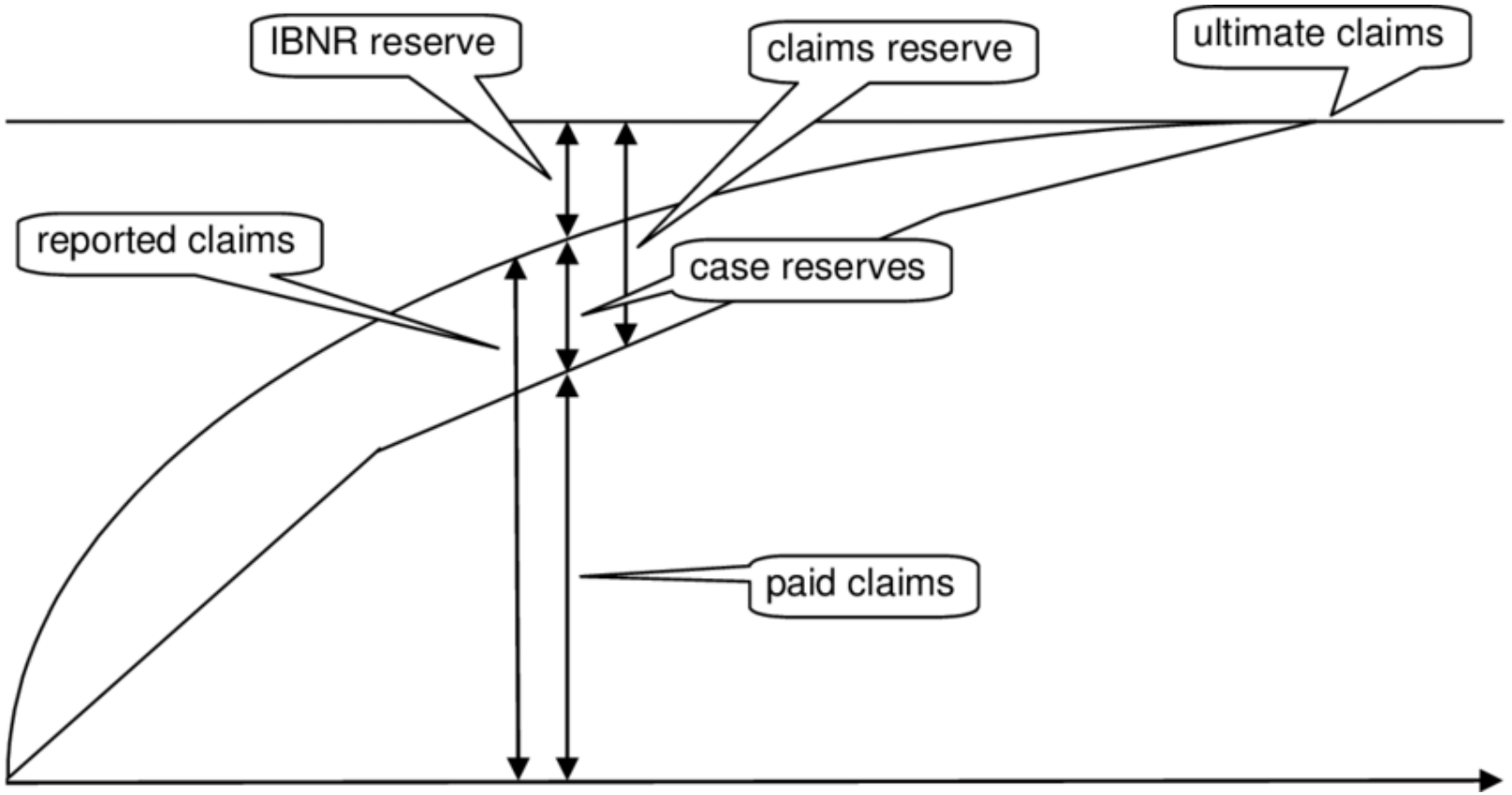
BAS.00
BRUIN ACTUARIAL SOCIETY

CLAIMS AND LOSSES

- Loss is a dollar amount of compensation paid to the claimant
- Reported Loss = Paid Loss + Current Case Reserve
- Case Reserve: estimate of the remaining money to ultimately settle the claim, can change
- 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

BAS.00
BRUIN ACTUARIAL SOCIETY

CLAIMS AND LOSSES



LOSS ADJUSTMENT EXPENSES

- Loss Adjustment Expenses (LAE) are incurred by the insured in the process of settling claims
- Some are claim-specific – called allocated loss adjustment expenses (ALAE)
  - Ex. fees for hiring a lawyer
- Some are NOT claim-specific – called unallocated loss adjustment expenses (ULAE)
  - Ex. salaries for claims analysts

WORK THROUGH AN EXAMPLE

Scenario: On March 10, 2026, a restaurant reports a customer's slip-and-fall claim to its liability insurer. The insurer estimates that it will pay $60,000 to settle the claim, as well as $15,000 in legal and claim-handling expenses. Assume the policy covers all amounts, with no deductible or coverage-limit issues.

1. What is the report date?
2. How much has the insurer paid as of that date?
3. What is the case reserve, including loss adjustment expenses?

WORK THROUGH AN EXAMPLE

Scenario: On March 10, 2026, a restaurant reports a customer's slip-and-fall claim to its liability insurer. The insurer estimates that it will pay $60,000 to settle the claim, as well as $15,000 in legal and claim-handling expenses. Assume the policy covers all amounts, with no deductible or coverage-limit issues.

1. What is the report date? March 10, 2026
2. How much has the insurer paid as of that date?
3. What is the case reserve, including loss adjustment expenses?

BAS.00
BRUIN ACTUARIAL SOCIETY

WORK THROUGH AN EXAMPLE

Scenario: On March 10, 2026, a restaurant reports a customer's slip-and-fall claim to its liability insurer. The insurer estimates that it will pay $60,000 to settle the claim, as well as $15,000 in legal and claim-handling expenses. Assume the policy covers all amounts, with no deductible or coverage-limit issues.

1. What is the report date? March 10, 2026
2. How much has the insurer paid as of that date? $0
3. What is the case reserve, including loss adjustment expenses?

BAS.00
BRUIN ACTUARIAL SOCIETY

WORK THROUGH AN EXAMPLE

Scenario: On March 10, 2026, a restaurant reports a customer's slip-and-fall claim to its liability insurer. The insurer estimates that it will pay $60,000 to settle the claim, as well as $15,000 in legal and claim-handling expenses. Assume the policy covers all amounts, with no deductible or coverage-limit issues.

1. What is the report date? March 10, 2026
2. How much has the insurer paid as of that date? $0
3. What is the case reserve, including loss adjustment expenses?

   $60,000 + $15,000 = $75,000

BAS.00
BRUIN ACTUARIAL SOCIETY

WORK THROUGH AN EXAMPLE

During April, the insurer pays $7,000 in legal expenses. Its estimated total legal and claim-handling expenses remain $15,000, and the estimated settlement remains $60,000. As of April 30, 2026:

1. How much has the insurer paid?
2. What is the remaining case reserve?

Date	Paid Loss	Case Reserves
March 10, 2026	$0	$75,000
April 30, 2026	?	?

BAS.00
BRUIN ACTUARIAL SOCIETY

WORK THROUGH AN EXAMPLE

During April, the insurer pays $7,000 in legal expenses. Its estimated total legal and claim-handling expenses remain $15,000, and the estimated settlement remains $60,000. As of April 30, 2026:

1. How much has the insurer paid?
2. What is the remaining case reserve?

Date	Paid Loss	Case Reserves
March 10, 2026	$0	$75,000
April 30, 2026	$7,000	$68,000

BAS.00
BRUIN ACTUARIAL SOCIETY

WORK THROUGH AN EXAMPLE

On May 5, new medical information leads the insurer to increase its estimated settlement from $60,000 to $85,000. Estimated total legal and claim-handling expenses remain $15,000. The insurer makes no additional payments.

Date	Paid Loss	Case Reserves
March 10, 2026	$0	$75,000
April 30, 2026	$7,000	$68,000
May 5, 2026	?	?

WORK THROUGH AN EXAMPLE

On May 5, new medical information leads the insurer to increase its estimated settlement from $60,000 to $85,000. Estimated total legal and claim-handling expenses remain $15,000. The insurer makes no additional payments.

Date	Paid Loss	Case Reserves
March 10, 2026	$0	$75,000
April 30, 2026	$7,000	$68,000
May 5, 2026	$7,000	$93,000

WORK THROUGH AN EXAMPLE

On June 12, the insurer settles the claim for $80,000 and pays that amount to the customer. It also pays the remaining $8,000 in legal and claim-handling expenses. No further payments are expected, and the claim closes.

Date	Paid Loss	Case Reserves
March 10, 2026	$0	$75,000
April 30, 2026	$7,000	$68,000
May 5, 2026	$7,000	$93,000
June 12, 2026	?	?

WORK THROUGH AN EXAMPLE

On June 12, the insurer settles the claim for $80,000 and pays that amount to the customer. It also pays the remaining $8,000 in legal and claim-handling expenses. No further payments are expected, and the claim closes.

Date	Paid Loss	Case Reserves
March 10, 2026	$0	$75,000
April 30, 2026	$7,000	$68,000
May 5, 2026	$7,000	$93,000
June 12, 2026	$95,000	$0

BAS.00
BRUIN ACTUARIAL SOCIETY

UNDERWRITING EXPENSE

- Companies incur other expenses in the process of acquiring and writing policies, these are called underwriting expenses / operational & administrative expenses
- These are broken down into:
  - **Variable UW expenses**: vary with the amount of premium (commissions, taxes, etc.)
  - **Fixed UW expenses**: do not vary with premium, but varies depending on exposures/policies (marketing, client meetings, licenses, etc.)

UNDERWRITING PROFIT

- The cost of each policy is not known at the time of sale
  - This means the insurance company is gambling on this policy not incurring any losses or expenses beyond the premiums earned
- Underwriting is essentially writing 10 accounts hoping only 1 would incur losses
  - There is no absolute way to guarantee this
- UW profit comes from two main sources
  1. Profits from individual policies (= premium - losses - expenses)
  2. Investment income is income generated by investing the funds held by the company (i.e. case reserves/unearned premium)

  Note: investment income is NOT part of the Fundamental Insurance Equation

BAS.00
BRUIN ACTUARIAL SOCIETY

03

ADVERSE SELECTION

ADVERSE SELECTION

- Ratemaking actuaries determine the level of premium such that the fundamental insurance equation is balance
- Both at a macro level and individual level
- If the equation is imbalanced at a macro level, the company becomes either uncompetitive or not having enough money for claim payouts
- If the equation is imbalanced at an individual level, the company could be subject to **adverse selection**
  - Refers to situations where insurance companies provide coverage for a risk substantially riskier than initially assumed

ADVERSE SELECTION

Scenario: Two insurers offer identical renters coverage for apartments with two levels of theft risk. Annual expected claim costs are $100 per lower-risk apartment and $200 per higher-risk apartment. Each insurer initially covers 100 apartments of each type. Insurer A charges each group its expected claim cost, whereas Insurer B charges everyone $150.

Insurer	Lower-risk apartments	Annual premium	Higher-risk apartments	Annual premium	Expected profit/loss
A	100	$100	100	$200	$0 + $0 = **$0**
B	100	$150	100	$150	$5000 + (-$5000) = **$0**

BAS.00
BRUIN ACTUARIAL SOCIETY

ADVERSE SELECTION

At renewal, half the customers who can save money switch insurers. Hence, 50 lower-risk customers move from B to A, and 50 higher-risk customers move from A to B. All other customers stay with their current insurer.

Insurer B now covers 50 lower-risk and 150 higher-risk apartments.

Insurer	Lower-risk apartments	Annual premium	Higher-risk apartments	Annual premium	Expected profit/loss
A	150	$100	50	$200	$0 + $0 = **$0**
B	50	$150	150	$150	$2500 + (-$7500) = **-$5000**

BAS.00
BRUIN ACTUARIAL SOCIETY

ADVERSE SELECTION

Insurer B's new break-even premium: [(50 × $100) + (150 × $200)] ÷ 200 = **$175**

Insurer B raises its uniform premium to $175. Insurer A keeps its premiums unchanged. At the next renewal, half the customers who can save money switch again. 25 remaining lower-risk customers move from B to A. 25 remaining higher-risk customers move from A to B.

Insurer	Lower-risk apartments	Annual premium	Higher-risk apartments	Annual premium	Expected profit/loss
A	175	$100	25	$200	$0 + $0 = **$0**
B	25	$175	175	$175	$1875 + (-$4375) = **-$2500**

BAS.00
BRUIN ACTUARIAL SOCIETY

04

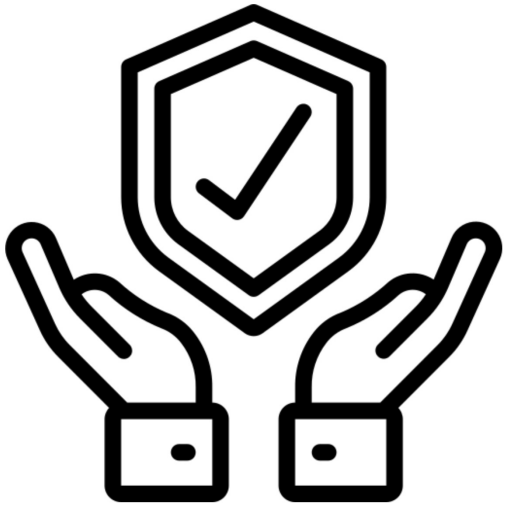
COMMON INSURANCE PRODUCTS

LINES OF BUSINESS

- Life Insurance
- Health Insurance
- Retirement
- Property & Casualty

LIFE INSURANCE

- Insureds pay a premium, usually monthly or a fixed amount of time, and the beneficiary receives a lump sum upon the death of the insured
- **Whole life** insurance: life insurance that provides coverage for life
- **Term Life** Insurance: the beneficiary receives a death benefit if you pass away within a fixed time
  - If the period is for 20 years and you pass away in year 21, there will be no benefit



BRUIN ACTUARIAL SOCIETY

HEALTH INSURANCE

- Individual & Family, Small Group (5-20 employees), Large Group (20+ employees)
- Different Types: medical, dental, vision, etc.
- Health Maintenance Organization (**HMO**): coverage to a fixed number of physicians and hospitals, known as the network
  - You cannot go out of your network under HMO
- Preferred Provider Organization (**PPO**): access to network like HMO, but also out of network care as well
  - Oftentimes more expensive



BRUIN ACTUARIAL SOCIETY

RETIREMENT

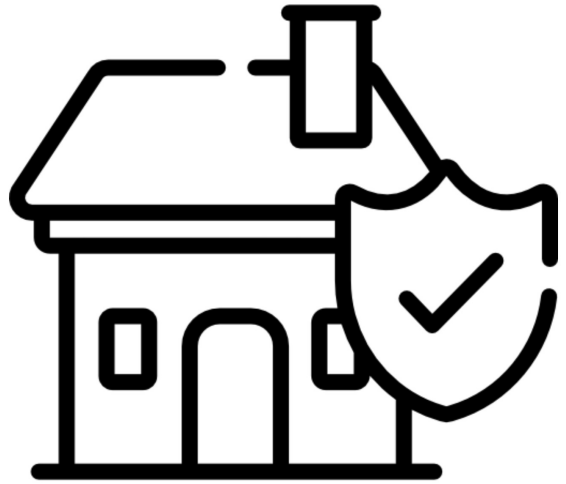
- Two main products
  - **Defined Benefit Plan**: provides specific payment amount in retirement (i.e. pensions)
  - **Defined Contribution Plan**: allows individuals (and/or their employer) to make contributions that will be invested (ex. 401K)
- Recently, there has been a shift from defined benefit to defined contribution plans, with the risk being shifted more onto the employee than the employer



BAS.00
BRUIN ACTUARIAL SOCIETY

PROPERTY & CASUALTY

- AKA "General Insurance"
- Coverage for physical property and liabilities
- Homeowner's insurance protects a home and its belongings against events such as wildfires, arson, tornadoes, and theft
- Auto insurance protects a vehicle and its occupants from damage and liability, depending on the type of coverage
- Boats, ATVs, snowmobiles, pets, etc. can also be insured
- Also includes commercial insurance, re-insurance, cyber insurance



BRUIN ACTUARIAL SOCIETY

KEY TAKEAWAYS

- Insurance protects individuals/businesses from large losses and promotes financial flexibility
- Pricing actuaries estimate the cost of future coverage, while reserving actuaries estimate remaining payments for claims that have already occurred
- Familiarize yourself with key insurance concepts and terminology to strengthen your conversations



www.math.ucla.edu/~actuary/



bruinactuaries@gmail.com



@bruinactuaries

ANNOUNCEMENTS

- Mentor Sign-Ups open tomorrow, Friday 10/30 @ 8 AM
- Intermediate Excel Workshop Thursday 11/5 @ MS 6627
- Mentorship Mixer Thursday 11/12 @ MS 3974

BAS.00
BRUIN ACTUARIAL SOCIETY

THANK YOU!

Any questions?