NLC NATIONAL LEAGUE OF CITIES

NLC-RISC RISK INFORMATION SHARING CONSORTIUM

Building Confidence in the Future: Actuarial Fundamentals for Trustees

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Building Confidence in the Future: Actuarial Fundamentals for Trustees

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NLC-RISC Trustees
Clearwater, FL

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Clearwater, FL

What do you need to know about actuarial work to fulfill your fiduciary duties as a Trustee?

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Questions an Insurance Pool is asking

- **Coverage:** Are our prices aligned with the coverages we are offering?
- **Claims:** What loss control measures can we recommend to reduce the chance of claims happening or the size of a claim once it's happened?
- **Investments:** Do we have the right mix of investments to support the business, create the income we need, and cover payment of future claims?
- **Regulation:** Are we aligned and compliant with all applicable state insurance regulations?
- **Capital:** Do we have sufficient capital to manage through the insurance cycle?

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What do Actuaries do?

We use mathematical and statistical methods

to answer all of those questions (and more)

to provide sound advice

to underwriting, finance, and management teams.

But what does that actually mean?

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What do Actuaries do?

Credit: Jake Likes Onions "the future: more of the present"

In simplest terms, an ACTUARY tries to predict the future.

We use what we know to guess what we don't know and set rates and reserves accordingly.

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What do Actuaries do?

ACTUARIES set the RATES and the RESERVES and review CAPITAL ADEQUACY.

- What is a RATE? A rate is a price.
  - We estimate how much money the Insurance Pool should charge for insurance.
- What is a RESERVE? A reserve is money set aside to pay future claims
  - We estimate how much money the Insurance Pool needs to keep to pay future losses
- What is CAPITAL ADEQUACY? Capital Adequacy measures the financial strength of the Pool by reviewing the level of surplus under various scenarios.
  - We estimate the sufficient level of surplus needed to support existing and future business and ensure financial stability, where Surplus = Assets - Liabilities

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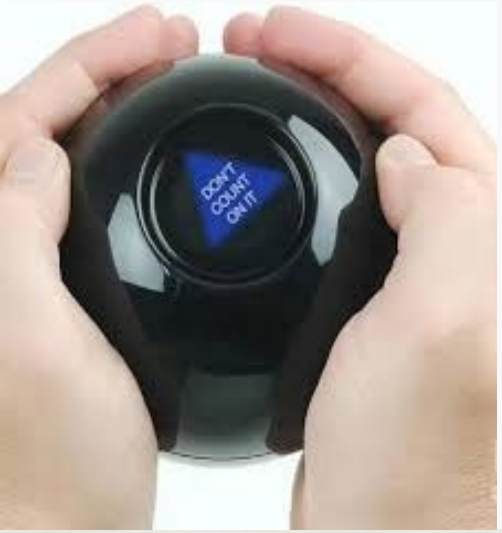
What do Actuaries do?

How do we do it?



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What do Actuaries do?

So, really, how do we do it?

- We know things that already happened.

  Yesterday, last week, last year, 10 years ago

- We don't know what will happen in the future.

  Tomorrow, next week, next year, in 10 years

- We use what we know to guess what we don't.

  We

  - Gather **DATA**
  - Look for **PATTERNS**
  - Make **PREDICTIONS**

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Actuarial Analysis – The Basics

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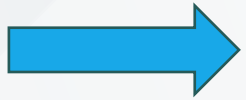
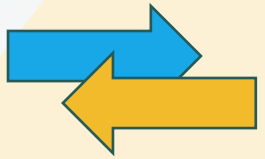
Actuarial Analysis - The Basics

Basic Idea for RATE MAKING: Prospective 
How much should be charged for contracts to be written in the year ahead?

Basic Idea for RESERVE REVIEW: Retrospective: 
How much do we need to set aside to pay claims for contracts already written?

Basic Idea for CAPITAL ADEQUACY: Combination 
Do we have sufficient surplus to support the volume and type of business written, given changes projected in the economic, claims and other environments, even under extreme scenarios?

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Actuarial Analysis - Some Helpful Definitions

- **Frequency** = Claim Count per Exposure
- **Severity** = Loss Dollars per Claim
- **Reserves** = Money set aside to pay future claims.
- **Case Reserves** or **Outstanding Reserves (OS)**
  = Reserves held for Known Reported Individual Claims at Current Estimates
- **IBNR Reserves** = "Incurred But Not Reported"

  = Reserves for Increases in Claim Dollars on Known Claims above Current Estimates
  + Reserves for Future Claim Payments on Unknown Claims
  (events that happened but the Pool or Member doesn't know about them yet)
- **Carried Reserves = Case Reserves + IBNR Reserves** shown on Balance Sheet

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Actuarial Analysis - Ratemaking Introduction

- **Purpose:** What rate should we charge for insurance coverage?
- **Methods:** Actuaries analyze the historical Premium, Exposure, & Claims Data along changes in Limit/Attachment, Rate Changes, Trends affecting Frequency and Severity of Claims
- **Final Result of Ratemaking Exercise:** A price for insurance coverage for each line of business that covers the members up to the desired limits for the desired coverages, usually phrased as a dollar charge per exposure.

Examples of Exposures

- ✓ Number of Vehicles
- ✓ Total Operating Expenses
- ✓ Population
- ✓ Number of Officers
- ✓ Number of Employees
- ✓ Total Insured Value

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Actuarial Analysis - Reserve Review Introduction

- **Purpose:** Is the Pool holding enough reserves to pay all of its claim liabilities?
- **Methods:** Actuaries analyze the historical Premium & Claims Data along with Changes in Loss Development Patterns and Loss Trends
- **Final Result of Reserve Review:** Total Estimated Reserves
- **Evaluate if Action is needed:**
  Compare Carried Reserves to Estimated Reserves

  If Carried Reserves < Total Estimated Reserves
  → Pool may need to set aside more Reserves to fulfill all claim obligations

  If Carried Reserves > Total Estimated Reserves
  → Pool may want to hold the Reserves or may want to take some down, depending on its assessment of financial environment, market, other factors.

Actuarial Analysis - Capital Adequacy Introduction

- **Purpose:** Does the Pool have sufficient capital to support the volume and type of business it has written, given a wide range of projected outcomes in the economic, claims, and other environments?
- **Methods:** Actuaries analyze the historical Premium & Claims Data and Investment Holdings. Involves both traditional actuarial analysis as well as financial analysis to ensure matched durations of assets and liabilities and to ensure surplus is maintained at acceptable levels under variety of scenarios. Like a Stress-Test for the balance sheet.
- **Final Result of Capital Adequacy Analysis:** A range of Surplus Projections under various loss and financial scenarios in expected and unexpected extreme cases.
- **Evaluate if Action is needed:**
  Is Surplus protected in extreme scenarios? If not, the Pool may need additional surplus.

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Super Simplified Example

Auto Insurance Problem

You be the ACTUARY

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Super Simplified Example

Auto Insurance Problem

You be the ACTUARY and Calculate the Rate

- Last year 1,000 municipal vehicles were insured by the Pool
- Last year 20 of those vehicles had accidents.
- The Pool paid $1,000 in repairs for each accident.
- How much did the Pool pay in all?

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Super Simplified Example

Auto Insurance Problem

You be the ACTUARY and Calculate the Rate

Next year we estimate there will be 2,000 insured vehicles and accidents will cost the same.

PREDICT THIS:

1) How many accidents will there be next year?

2) How much do you think we will pay in total losses next year?

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Super Simplified Example

Auto Insurance Problem

You be the ACTUARY and Calculate the Rate

What do we know?

LAST YEAR:

- 1,000 vehicles were insured
- 20 vehicles got into accidents
- Each accident cost $1,000
- We paid a total of $20,000 in losses

What do we estimate? What can we predict?

NEXT YEAR:

- 2,000 vehicles will be insured
- Each accident will cost $1,000

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Super Simplified Example

Auto Insurance Problem

You be the ACTUARY and Calculate the Rate

FINAL RESULT: How much to charge for each insured vehicle?

To Calculate Rates we start with Estimating Loss Per Exposure

Two Basic Methods to Estimate Loss Per Exposure :

- Loss Per Exposure = Total Expected Losses / Expected Number of Exposures
- Loss Per Exposure = Frequency of Claims per Exposure * Severity of Claims

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Super Simplified Example

Let's put the data in a chart!

(Actuaries like charts and graphs)

Year	Number of Insured Vehicles	Number of Accidents	Cost for each Accident	Total Amount Paid for all Accidents	FINAL RESULT: How much to charge for each Insured Vehicle?
2024	1,000	20	$1,000	$20,000	
2025	2,000	?	$1,000	?	?

Loss per Exposure

= Total Projected Losses / Total Number of Vehicles

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Super Simplified Example

Auto Insurance Problem

You be the ACTUARY and Calculate the Rate

Year	Number of Insured Vehicles	Number of Accidents	Cost for each Accident	Total Amount Paid for all Accidents	FINAL RESULT: How much to charge for each Insured Vehicle?
2024	1,000	20	$1,000	$20,000	
2025	2,000	40	$1,000	40 * $1,000 = $40,000	?

Loss per Exposure

= Total Projected Losses / Total Number of Vehicles

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Super Simplified Example

Auto Insurance Problem

You be the ACTUARY and Calculate the Rate

Year	Number of Insured Vehicles	Number of Accidents	Cost for each Accident	Total Amount Paid for all Accidents	FINAL RESULT: How much to charge for each Insured Vehicle?
2024	1,000	20	$1,000	$20,000	
2025	2,000	40	$1,000	40 * $1,000 = $40,000	

Loss per Exposure

= Total Projected Losses / Total Number of Vehicles

$40,000 / 2,000 = $20

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Super Simplified Example

Auto Insurance Problem

You be the ACTUARY and Calculate the Rate

Year	Number of Insured Vehicles	Number of Accidents	Cost for each Accident	Total Amount Paid for all Accidents	FINAL RESULT: How much to charge for each Insured Vehicle?
2024	1,000	20	$1,000	$20,000	
				Loss per Exposure = Frequency * Severity	
2025	2,000	?	$1,000	?	?

Frequency = Number of Accidents / Number of Vehicles

2%

Severity = Total Losses / Number of Accidents

$1,000

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Super Simplified Example

Auto Insurance Problem

You be the ACTUARY and Calculate the Rate

Year	Number of Insured Vehicles	Number of Accidents	Cost for each Accident	Total Amount Paid for all Accidents	FINAL RESULT: How much to charge for each Insured Vehicle?
2024	1,000	20	$1,000	$20,000	
					Loss per Exposure = Frequency * Severity
2025	2,000	?	$1,000	?	**2% * $1,000 = $20**

Frequency = Number of Accidents / Number of Vehicles

2%

Severity = Total Losses / Number of Accidents

$1,000

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Super Simplified Example

Auto Insurance Problem

You be the ACTUARY and Calculate the Rate

So, what is the Rate?

The Pool needs to charge $20 for each vehicle so they have enough money to pay for the expected losses. This is the LOSS COST.

$20

Another helpful definition:

Loss Cost = Loss per Exposure
= The component of the rate that will pay for future claims

But this is not the RATE.

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Super Simplified Example

Auto Insurance Problem

You be the ACTUARY and Calculate the Rate

So, what is the Rate?

There are expenses associated with running the Pool that must be covered by collected premiums.

Just like in everything, there are variable and fixed expenses.

Examples?

- ✓ Loss Control Expenses
- ✓ Staff Salaries
- ✓ Reinsurance placement cost
- ✓ And more

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Super Simplified Example

Auto Insurance Problem

You be the ACTUARY and Calculate the Rate

RATE is the sum of LOSS COST and the EXPENSES per Exposure

Another helpful definition:

Expense Ratio = Expenses / Premium

Let's say on average 25% of the Premium is allocated to pay Expenses

So the Expense Ratio = 25%

RATE = LOSS COST / (1 – Expense Ratio)

Trust me on this one…
Yay for algebra!

RATE = $20 / (1 - 0.25) = $26.67

So, the Pool would charge $26.67 per vehicle.

Super Simplified Example

Auto Insurance Problem

You be the ACTUARY and Calculate the Reserves

What about RESERVES?

RESERVES means money set aside to pay for future losses.

Typically held in cash, money market instrums, or bonds matched to duration of liabilities

How much should the Pool put aside over the next year to save for future losses?

Recall you estimated that they'll pay $40,000 for accidents for this next year's vehicles, so the RESERVE is $40,000 for losses associated with next year's insured vehicles.

$40,000

BUT this is not a Reserve Review. Reserve Reviews look back on all the business written in all prior years. The Final Result is a large Total Estimated Reserve amount that would cover the future claims to be paid for those prior years all together.

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The Not-So-Simple Real Life Complications

Real Life Complications:

Auto Physical Damage Complications

- ✓ Inflation
- ✓ Increasingly expensive technology in vehicles
- ✓ Increasing Timelines for Vehicle Repairs and Replacements especially Emergency Vehicles
- ✓ Tariffs on vehicle parts
- ✓ And more!

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The Not-So-Simple Real Life Complications

Real Life Complications:

Auto Liability Complications

- ✓ Tort Caps/Immunities affecting auto claims in each state
- ✓ Increasing Jury Awards
- ✓ Third Party Funding for Liability Cases
- ✓ Safety devices which reduce accident frequency and severity
- ✓ Fraud
- ✓ Large Losses distorting historical average losses
- ✓ Changes in claims handling processes/speed of resolution
- ✓ Regulatory changes
- ✓ And more!

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The Not-So-Simple Real Life Complications

Our Super Simplified Problem just got less simple!

Year	Number of Insured Vehicles	Number of Accidents	Cost for each Accident	Total Amount Paid for all Accidents	BONUS: How much should we charge for each Insured Vehicle?
2024	1,000	20	$1,000	$20,000	
			10% increase in costs		
2025	2,000	40	~~$1,000~~ $1,100		

40 * $1,100 = $44,000

$44,000 / 2,000 = $22

The Not-So-Simple Real Life Complications

Our Super Simplified Problem just got less simple!

Year	Number of Insured Vehicles	Number of Accidents	Cost for each Accident	Total Amount Paid for all Accidents	BONUS: How much should we charge for each Insured Vehicle?
2024	1,000	20	$1,000	$20,000	
		5% decrease in accidents	**10% increase in costs**		
2025	2,000	~~40~~ **38**	~~$1,000~~ **$1,100**		

38 * $1,100 = $41,800

$41,800 / 2,000 = $21

The Not-So-Simple Real Life Complications

Auto Insurance Problem

So, really, what are the Rates and Reserves?

Real Life Complications add **Uncertainty** to the Calculations

For Rates and Reserve Reviews often use the term Best Estimate to provide guidance amidst uncertainty. Additionally, the conclusion may be provided in the form of a Confidence Interval.

Another helpful definition

Confidence Interval = Range of Outcomes and Associated Probabilities

i.e., 95% Confidence Interval = 95% Probability that results are within the Range provided, or at or below the calculated value

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Super Simplified Example

Capital Adequacy

You be the ACTUARY

The Pool holds $20,000,000 in Assets, mostly bonds with durations of 3-5 years.

The $5M Annual Premium consists of approximately 25% Liability, 50% Property, and 25% Workers Compensation.

The loss ratios for each line are estimated at 70%.

Does the Pool have Sufficient Capital

to support the business it has written?

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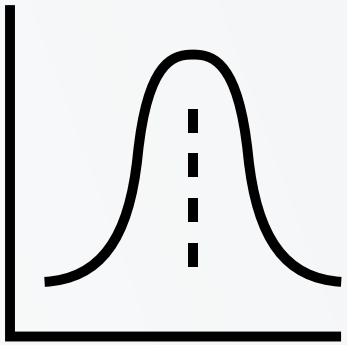
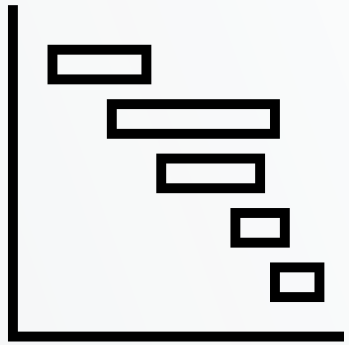
Super Simplified Example

Capital Adequacy

You be the ACTUARY



Just Kidding!!!!



We do not have nearly enough information,
tools or time to do this here.

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Super Simplified Example

Capital Adequacy

Capital Adequacy analysis is estimated by running thousands of simulations of scenarios, where the parameters are set based on:

- ✓ Pool's historical and prospective line of business and geographic mix
- ✓ Pool's loss experience
- ✓ Pool's investment mix
- ✓ Pool's projected payment patterns
- ✓ Prevailing economic trends
- ✓ Loss trend estimates
- ✓ And many more assumptions

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Super Simplified Example

Capital Adequacy

Output from the Capital Model would provide an estimate of assets under various extreme scenarios.

For Example:

What is the resulting surplus if there is an economic downturn AND losses come in twice as high as expected?

Often these extreme scenarios are phrased as

"1-in-100 year event" or "1-in-200 year event"

Capital Adequacy analyses are the Stress Tests that ensure the financial health of the Pool.

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More Actuarial Concepts and Analyses

(that we don't have time to explore today)

- Credibility
- Loss Development Factors (LDF)
- Catastrophe Modeling for Weather Events (CAT)
- Increased Limit Factors (ILF)
- Enterprise Risk Management (ERM)
- Predictive Analytics
- And much more!

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Q & A
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Appendix

Glossary of Helpful Definitions

Rate = price, usually expressed in terms of Total Cost per Exposure

Frequency = Claim Count per Exposure

Severity = Loss Dollars per Claim

Loss Cost = The component of the rate that will pay for future claims

Expense Ratio = Expenses / Total Premiums

Loss Ratio = Loss / Premium

Reserves = Money set aside to pay future claims

Case Reserves or **Outstanding Reserves (OS)**
= Reserves held for Known Reported Individual Claims at Current Estimates

IBNR Reserves = "Incurred But Not Reported"
= Reserves for Increases in Claim Dollars on Known Claims above Current Estimates
+ Reserves for Future Claim Payments on Unknown Claims
(events that happened but the Pool or Member doesn't know about them yet)

Carried Reserves = Case Reserves + IBNR Reserves on Balance Sheet

Capital Adequacy is the sufficient the level of Surplus that an Insurance Pool / Company holds to support existing and future business, where Surplus = Assets – Liabilities.

Confidence Interval = Range of Outcomes and Associated Probabilities

i.e., 95% Confidence Interval = 95% Probability that results are within the Range provided, or at or below the calculated value.

Susanlisa Kessler serves as Chief Actuary for the National League of Cities (NLC) Mutual Insurance Company.

She has over 25 years of experience in specialty, professional, and cyber lines pricing, reserving, and data governance at industry leaders AXIS and AIG. She most recently served as Head of Data Governance & Data Quality at AXIS, where she worked with executives across the organization to prioritize and implement solutions to improve consistency and reliability of data.

Susanlisa applies her passion for data and actuarial analysis to help NLC Mutual and its members improve their data-driven insights and decision-making.

Susanlisa earned her Bachelor of Arts degree in Mathematics from Rutgers University and is a Fellow of the Casualty Actuarial Society.

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