

Bruin Actuarial Society Case Competition 2025

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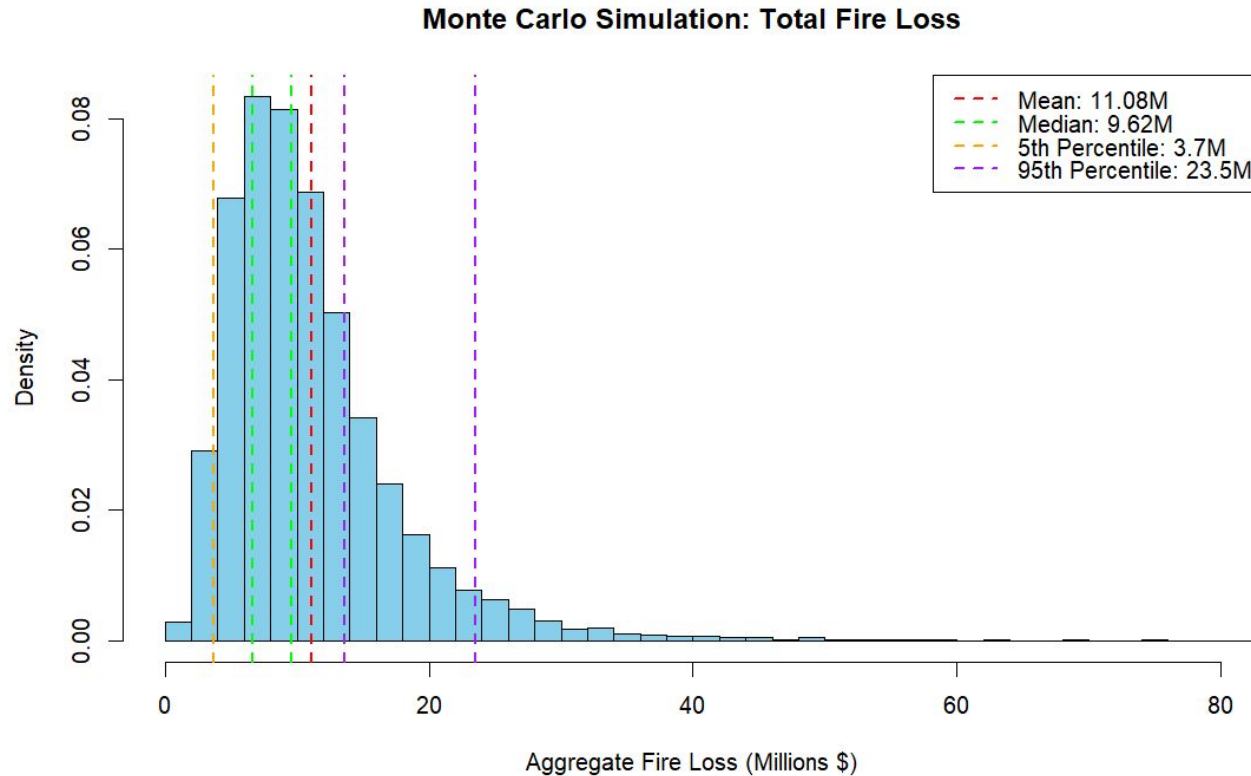
Comparing the Programs: We analyze each insurer's coverage, retentions, and premiums (via simulations) to see how well they handle Fire, NWS, and EQ losses, identifying the most cost-effective option.

Additional Metric (TVaR): We introduce Tail Value at Risk to capture worst-case losses beyond the 95th percentile, which median-based metrics can miss.

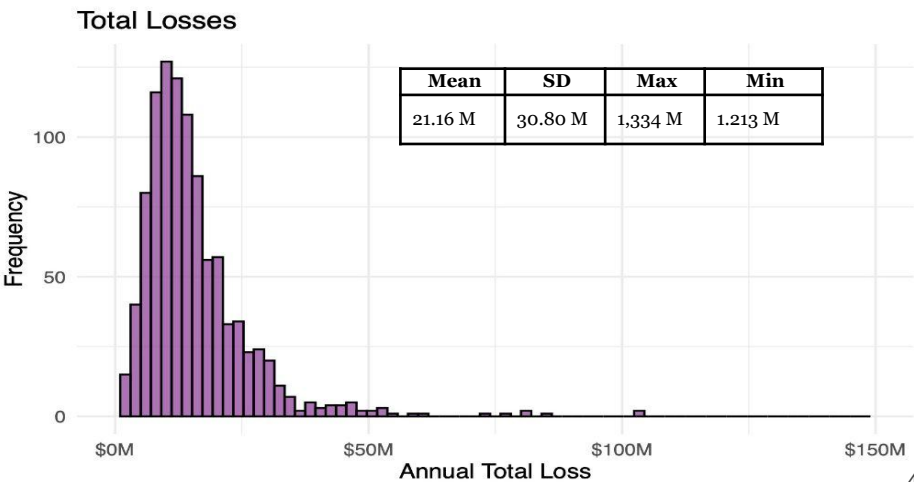
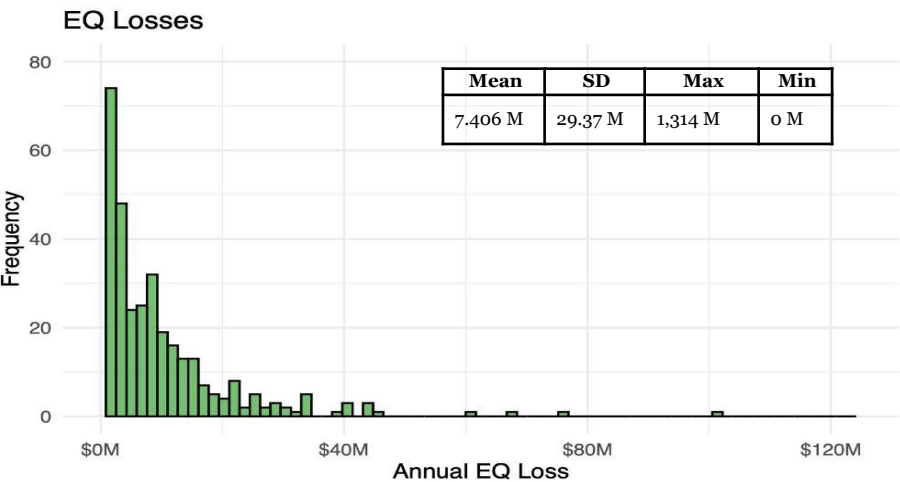
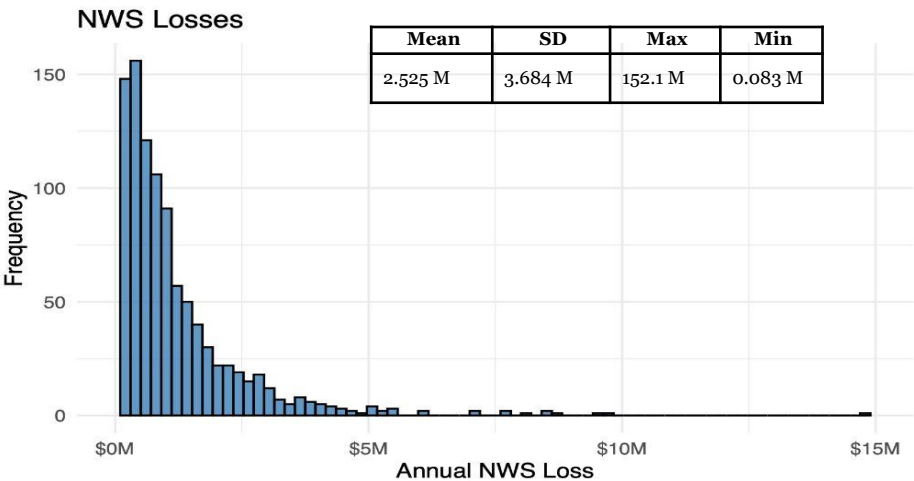
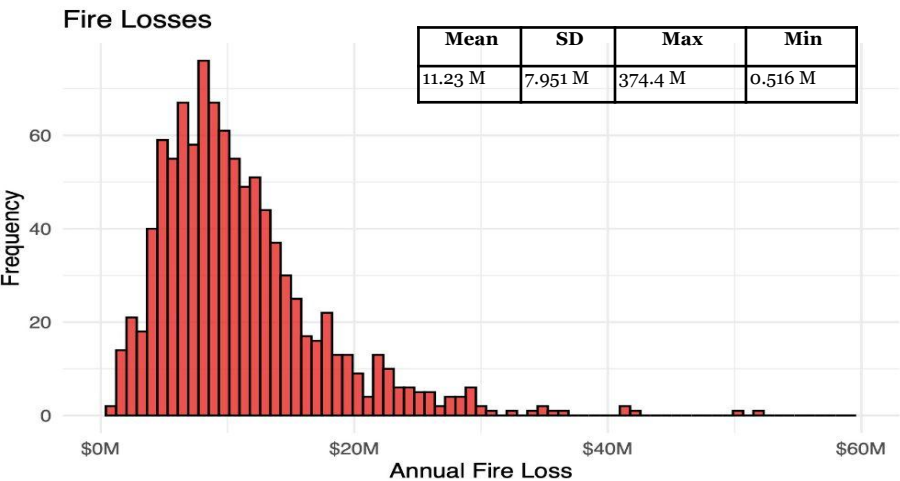
Recommending an Insurer: We weigh CFO's low-premium priority, the Risk Manager's preference for lower median retention, and the Broker's focus on overall TCOR, then select the best balance.

Removing the NWS Aggregate Limit: Because extreme NWS losses are very unlikely, we show that only a small premium increase (e.g., \$51.27M to \$51.3M) is warranted.

Volatility Exhibit



Distribution of Losses by Type





Insurance Program's

Category	Insurer 1	Insurer 2	Insurer 3
Fire Retention	\$10M per occurrence	\$10M per occurrence	\$1M per occurrence (lowest)
Fire Limits	\$1B per occurrence	\$1B per occurrence	\$1B per occurrence (30% co-insurance)
NWS Limits	\$100M per occurrence / \$100M per year total	\$100M per occurrence	\$100M per occurrence \$100M per year total
EQ Limits	\$500M per occurrence (lowest)	\$1B per occurrence	\$1B per occurrence
Premiums	\$51,270,000 (lowest)	\$54,095,800	\$59,411,000 (highest)



Overview of Client Objectives

- **CFO's choice:** select the lowest premium option to free up as much cash as possible
 - This choice will always pick the insurer that has the lowest price for insurance regardless of the coverage
- **Risk Manager's choice:** select the insurer that has the lowest total retained amount at the 50th percentile
 - The total retained amount at the 50th percentile means that 50% of the time Montgomery Realty will pay that amount or less in a given year under that insurer
 - This choice will pick the insurer that has the most coverage and leads to spending the least on losses that occur regardless of the premium amount
- **Broker's choice:** select the insurer with the lowest average Total Cost of Risk (TCOR)
 - The TCOR is the total retained plus the premium paid
 - This will lead to choosing the insurer that has the lowest expected total retained added to the premium paid



Additional Metric Proposal

- **Another metric to consider:** Tail Value at Risk (TVaR)
- **Goes beyond the median:** Rather than just focusing on losses at the 50th percentile, TVaR looks at the average of the worst losses (e.g., beyond the 95th percentile).
- **Addresses CEO's premium concern:** While TVaR may not point to the absolute cheapest plan, it helps prepare for rare but extreme situations, reducing major cash-flow disruptions.
- **Satisfies the Risk Manager:** By highlighting potential big surprises, TVaR shows how large losses could be if scenarios exceed typical outcomes.
- **Complements the Broker's TCOR view:** TCOR might miss severe, infrequent events; TVaR clarifies how a slightly higher premium can significantly reduce exposure to catastrophic losses.



Insurance Option Selection

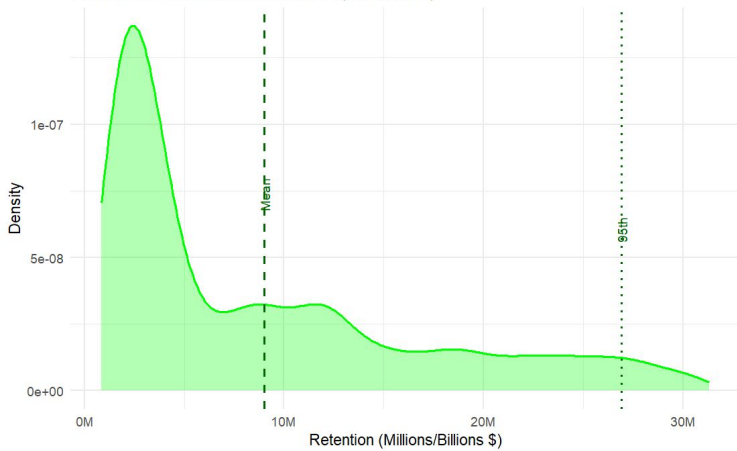
Insurer	Premium	Avg Retained	Median Retained	TVaR 95	TCOR
1	\$51,270,000	\$9,044,000	\$5,039,000	\$30,370,000	\$60,310,000
2	\$54,100,000	\$9,025,000	\$5,039,000	\$30,010,000	\$63,120,000
3	\$59,410,000	\$3,383,000	\$3,175,000	\$7,073,000	\$62,790,000

*Values rounded to the nearest 10,000

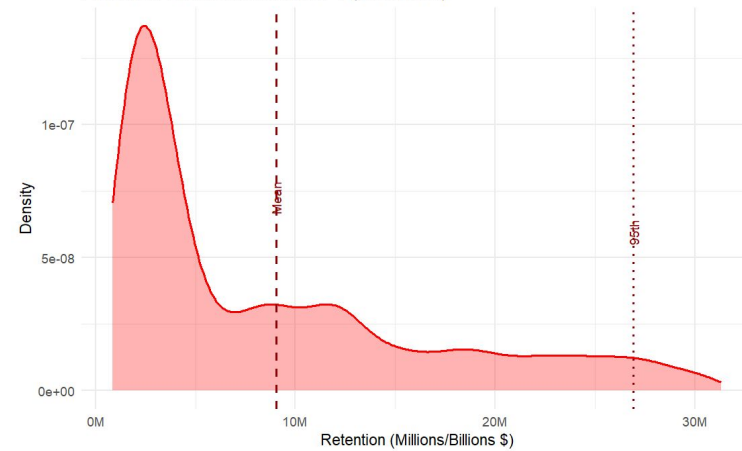
Key Findings:

- **Insurer 1:** Has the lowest average TCOR due to the \$100M aggregate limit on NWS, which caps exposure in extreme years, the \$10M retention, and it has the lowest EQ limit at \$500M per occurrence.
- **Insurer 2:** Highest TCOR due to the absence of the NWS aggregate limit but provides improved protection in catastrophic scenarios for hurricanes and earthquakes.
- **Insurer 3:** High TCOR, driven by the 30% coinsurance on fire losses and \$1M retention limit, results in smaller retained losses and a smaller TVaR at the 95% percentile.

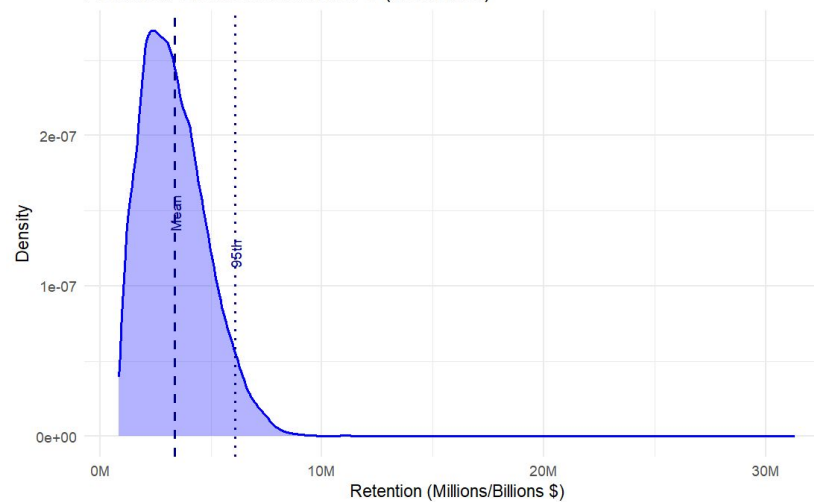
Retention Distribution: Insurer 2 (Truncated)



Retention Distribution: Insurer 1 (Truncated)



Retention Distribution: Insurer 3 (Truncated)





Client Objectives: Choices

- **CFO**
 - Choice: Insurer 1
 - While insurer 1 could be the best choice, we think the reasoning the CFO has could be flawed since it could lead to spending more money overall (TCOR) on losses that won't be covered by the insurance company
- **Risk Manager**
 - Choice: Insurer 3
 - This is a good way to think about what to choose because you are looking at the option that will save you the most money from losses that are incurred
 - However we think you should think about other metrics because even though it saves you the most compared to the other 3, overall you may still pay the most due to the premium
- **Broker**
 - Choice: Insurer 1
 - This is a great way to think because it looks at the cost of premium and how much is expected to be paid on losses



Recommendation

- Our recommended option: Insurer 3
- We are basing it off of the TVaR we calculated which is significantly smaller for Insurer 3
- This means that the expected amount under Insurer 3 that Montgomery would have to pay when a significant loss occurs is $\frac{1}{4}$ of the amount compared to Insurer 1 and 2
- The TCOR is greater for Insurer 3 than 1, but we think it is worth the extra premium for the added protection
- Alternatively we would recommend Insurer 1 since it has the lowest TCOR compared to the other two options



Recommended Price Change Negotiation

- The risk manager would like to remove the NWS aggregate limit from Insurer 1
- We could not find that the removal of the \$100M aggregate loss limit would make much of a difference
- The chance of NWS aggregate losses being greater than \$100M is improbable
 - 4.4×10^{-5} is the probability the aggregate for NWS damage to be over \$100M
- Average value of aggregate NWS losses exceeding \$100M is about \$170M
- Therefore we recommend the adjusted price be **\$51,300,000** and not change too much from the original price of \$51,270,000

Thank You!

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