Incorporating Reinsurance Considerations

Product design using an augmented price optimization framework

2013 CAS Reinsurance Seminar

by Yves Colomb and Brett Nunes

June 2013

TOWERS WATSON

Agenda

- Introduction
  - Reinsurance considerations in product design – current approaches
  - Limitations
- A Price Optimization Approach
  - Price Optimization 101
  - Adding reinsurance considerations - conceptual implications
- Practical Challenges
  - Data
  - Modeling
  - Bringing models together
  - Communication (Building management information systems and dashboards)

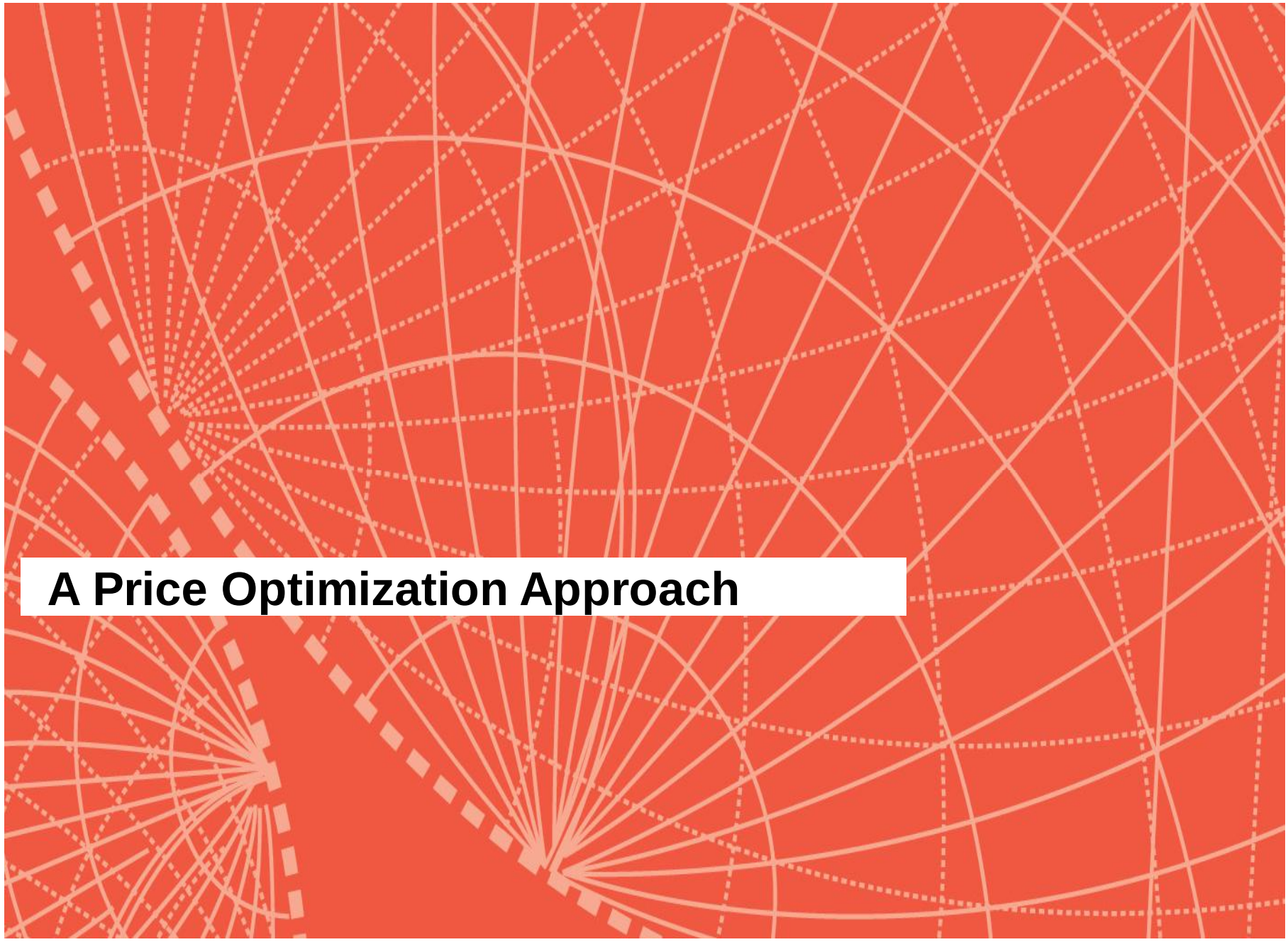
Introduction

Reinsurance considerations in primary product design – current approaches

- Let’s define product design
- Structure
- Underwriting
- Pricing

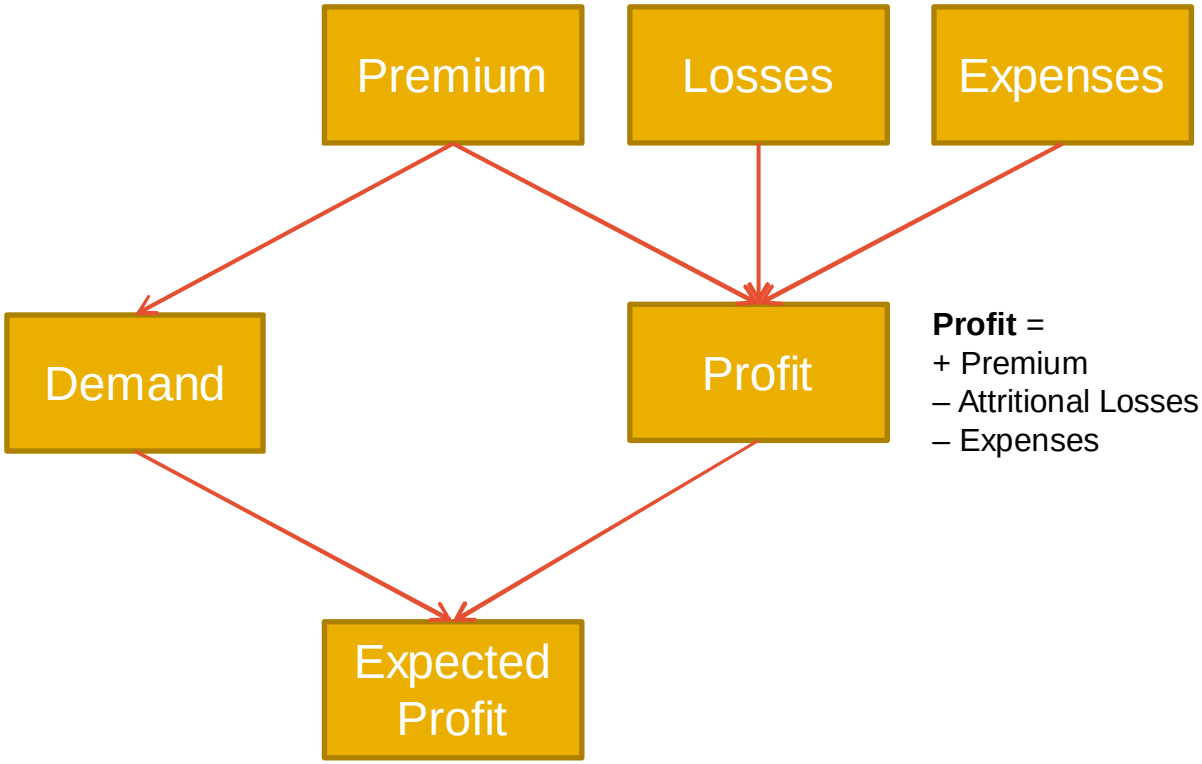
Reinsurance considerations in primary product design – limitations to current approaches

- A rough estimate of profitability
- A disjointed approach


A Price Optimization Approach

Price Optimization 101

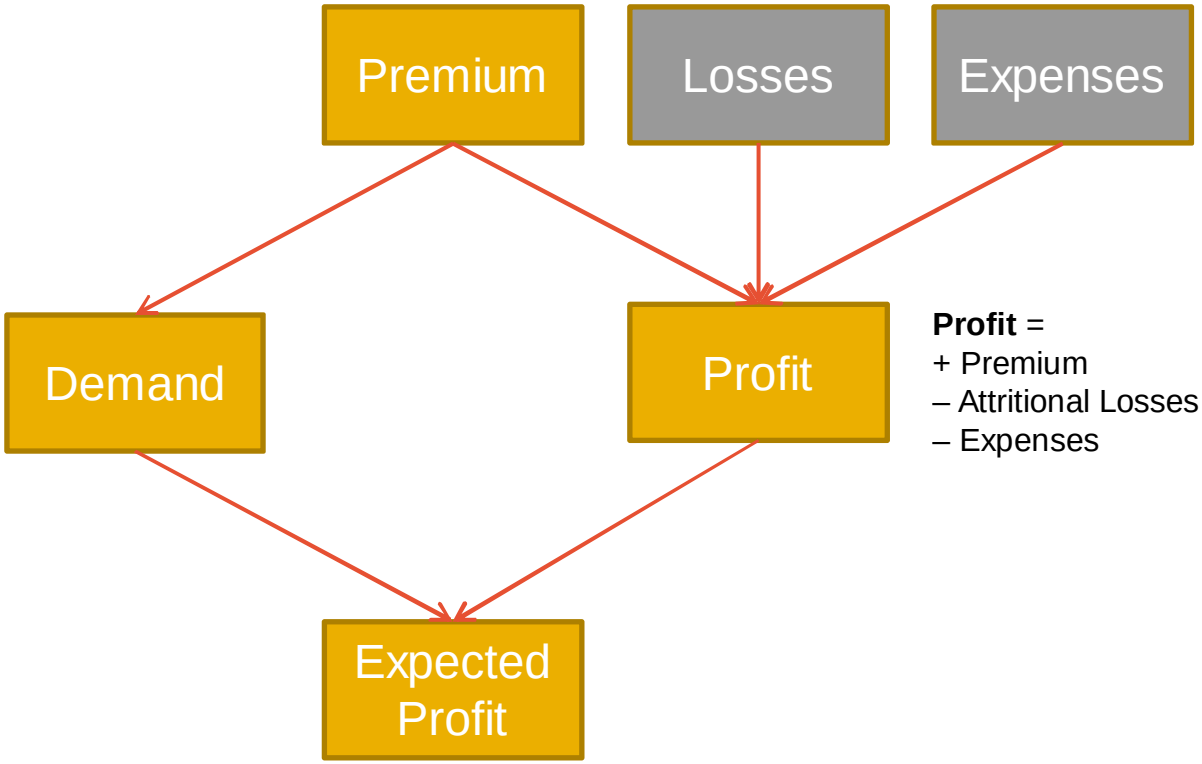
- Integration
  - Losses
  - Demand
  - Premiums
  - Expenses



Profit =
+ Premium
– Attritional Losses
– Expenses

Price Optimization 101

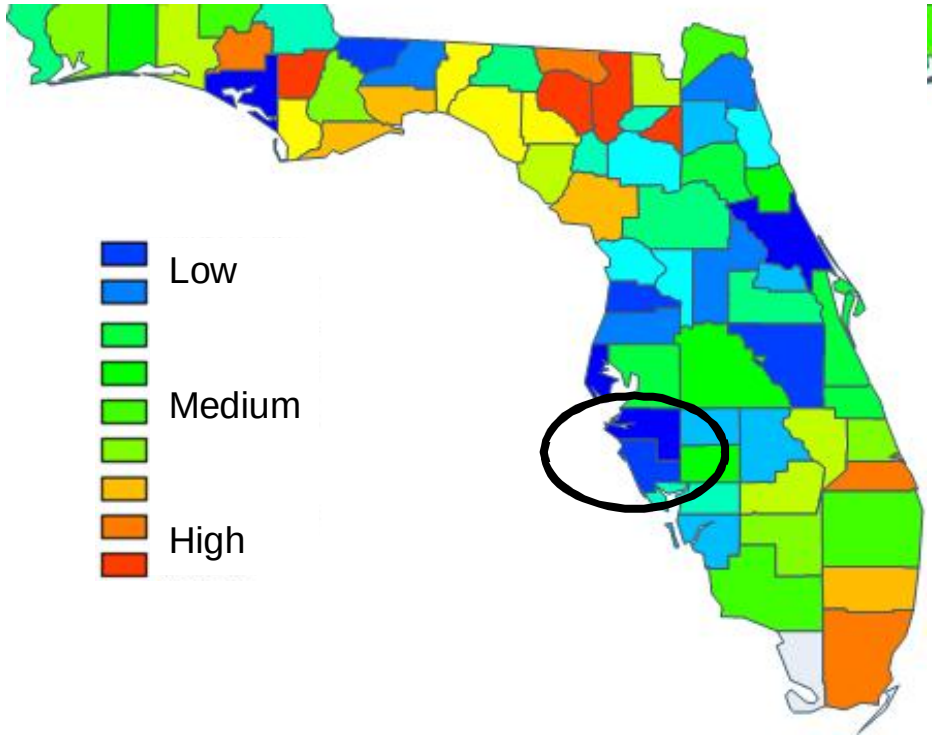
- Components are a function of premium
  - Assuming all else is fixed



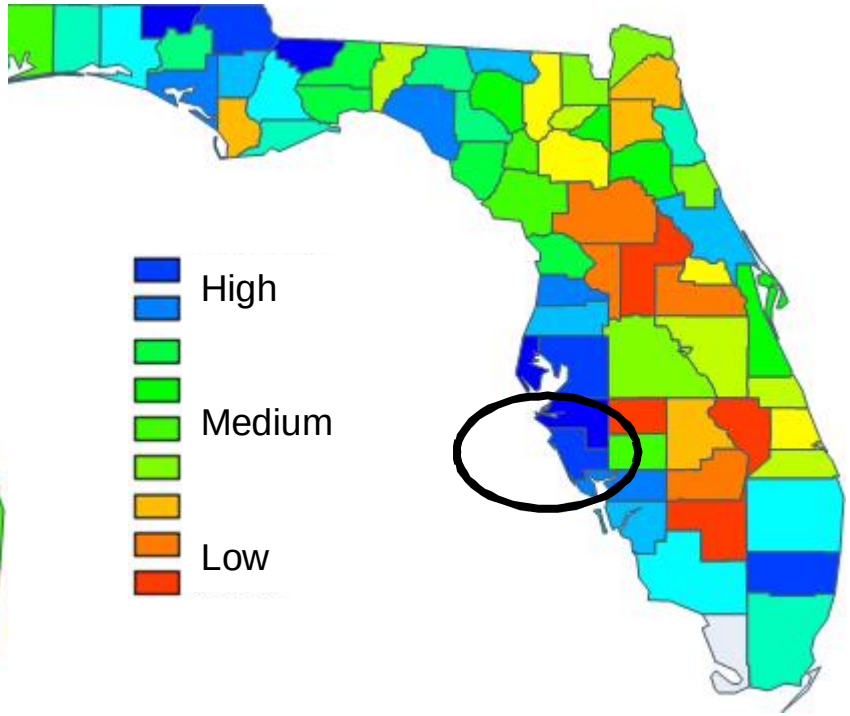
Price Optimization 101

- Overlay with competitive information

Underwriting profit

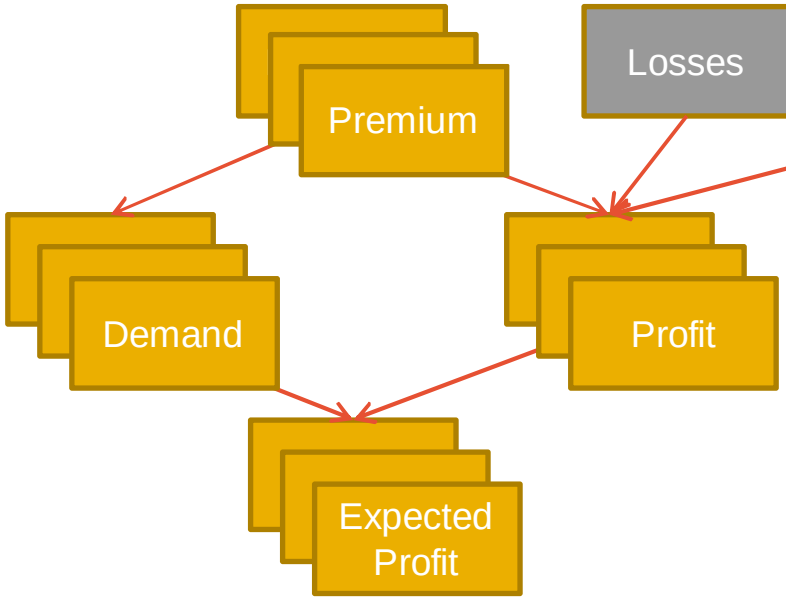


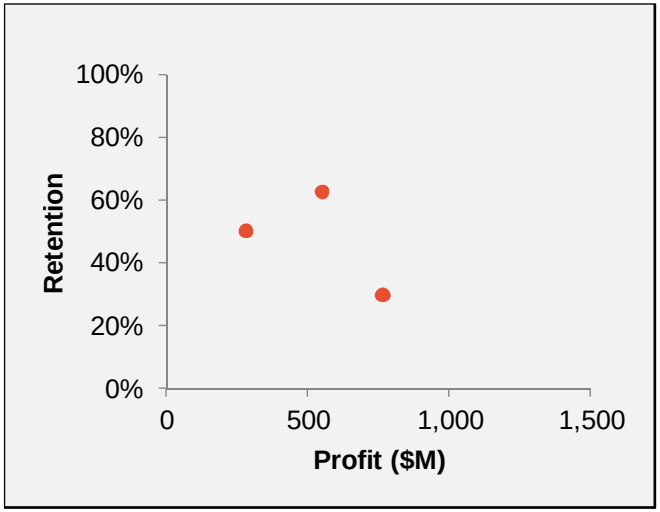
Competitiveness



Price Optimization 101

- Scenario-testing
  - Testing alternative premium propositions
  - A manual process
  - Add time and you have a Customer Lifetime Value framework



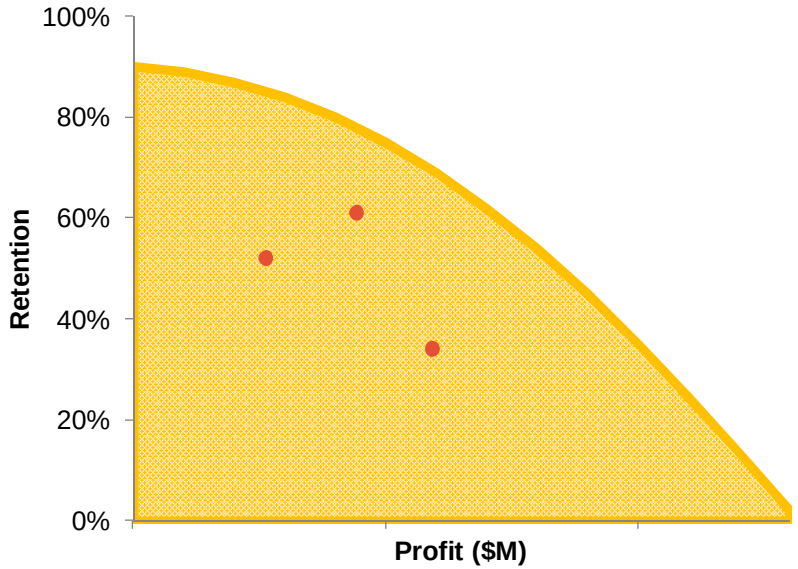


Price Optimization 101

- Simulations
  - To industrialize this scenario-testing
  - Consider range of possible premiums around current premium
  - We just created a universe to search through
    - Millions of possible combinations (at portfolio level)
  - Some will be inferior to others

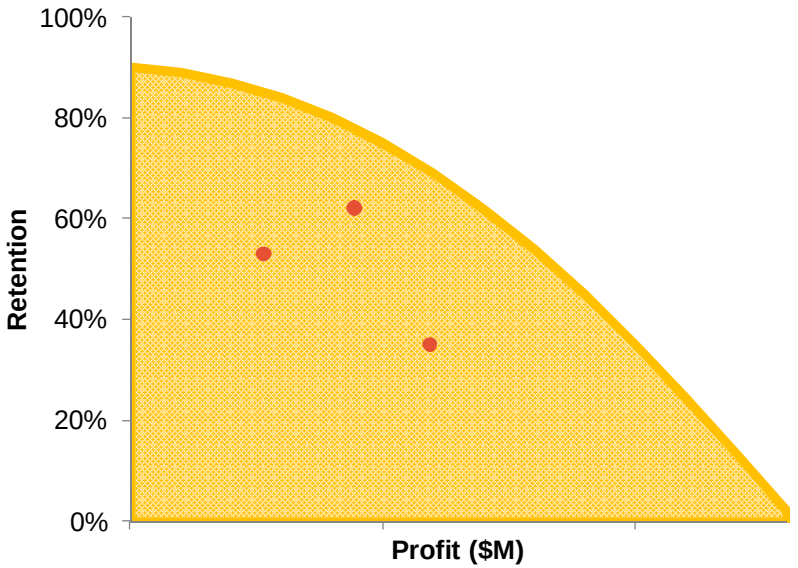
Price Optimization 101

- Optimization
  - At portfolio level
  - Searches the universe of portfolios
  - Identifies best outcome of one metric (e.g. profit) given value of another metric (e.g. volume)
  - Said differently: Identifies best trade-offs btw profit and volume



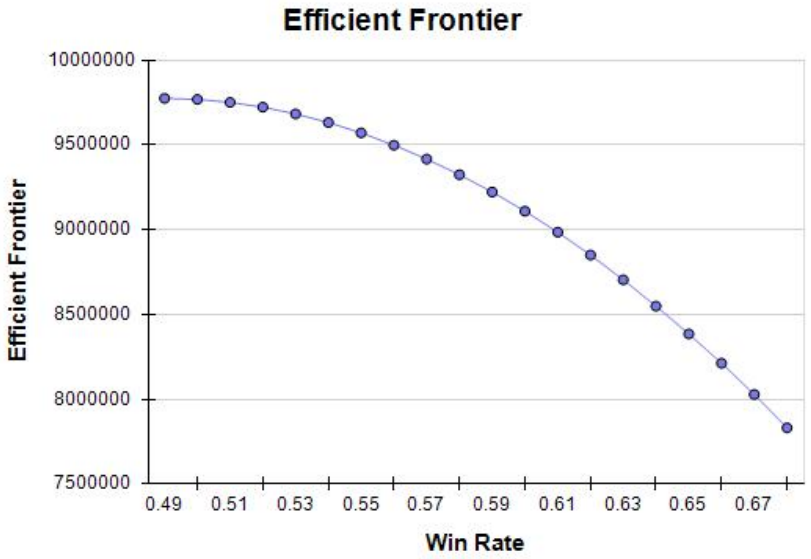
Price Optimization 101

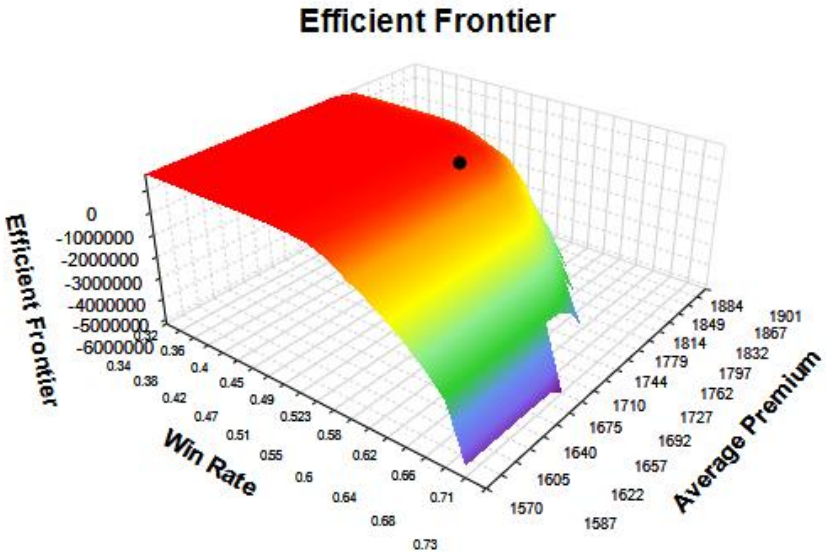
- The search space will contain scenarios you would like to test
  - So, you can situate your scenarios and see how close they are to the frontier
- Next phase is to
  - pick a point
  - adjust your rating algorithm
- Other comments
  - Alternative measures can be used (dislocation, cross-subsidies, etc.)
  - Time dimension
  - CLV



Price Optimization 101

- Example outputs
  - One dimension
  - Two dimension





Price Optimization 101 – Summary

- One lever: premium

- Steps
  - Integration
  - Scenario-testing
  - Simulations
  - Price Optimization

- Technically this is all “optimization”
  - With varying degrees of sophistication

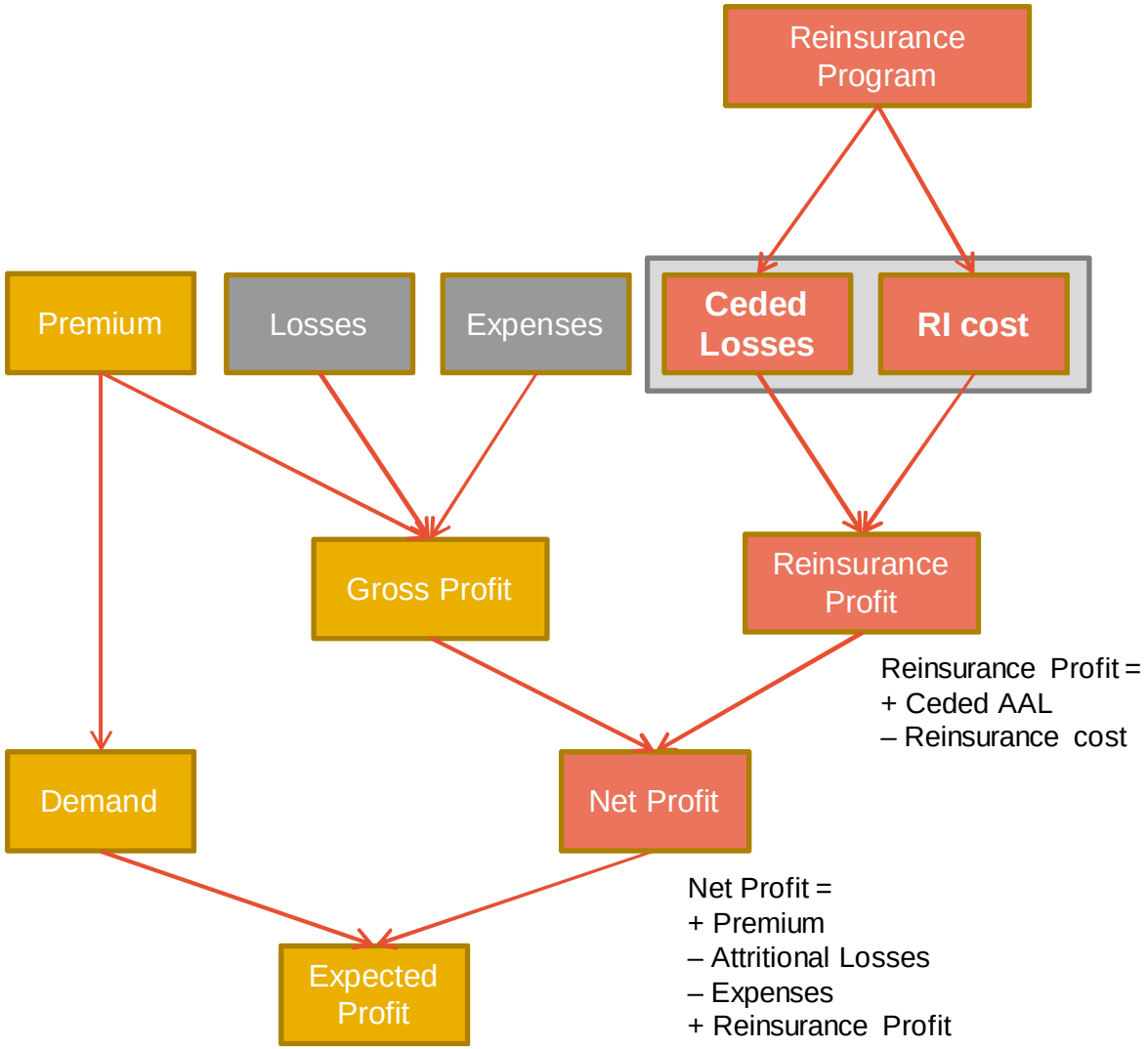
A Price Optimization Approach (with Reinsurance)

- Let us assume a non-simple reinsurance program

- Steps
  - Integration
  - Scenario-testing
  - Price Simulations
  - Price Optimization

Integration

- Components
  - Losses
  - Demand
  - Premiums
  - Expenses
  - **Ceded Losses**
  - **Reinsurance Cost**



Output

- Quantify impact of reinsurance on profitability

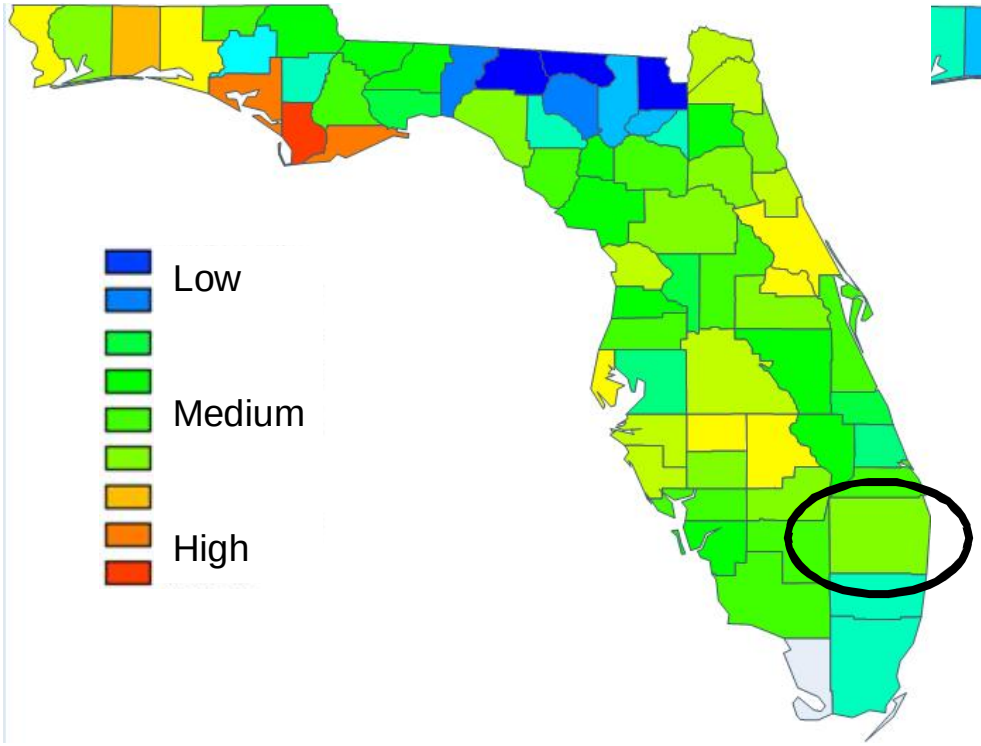
- Estimate of performance including reinsurance
  - Very useful where reinsurance is a large component of BS and P&L
    - Cat-exposed business (Florida, severe convective storms, etc.)
    - Low frequency / high severity risks
  - Identify those policies driving up reinsurance cost but not contributing to overall profit

- Circle back into underwriting at individual risk level
    - Underwriting
    - Price changes
    - Cross-subsidies

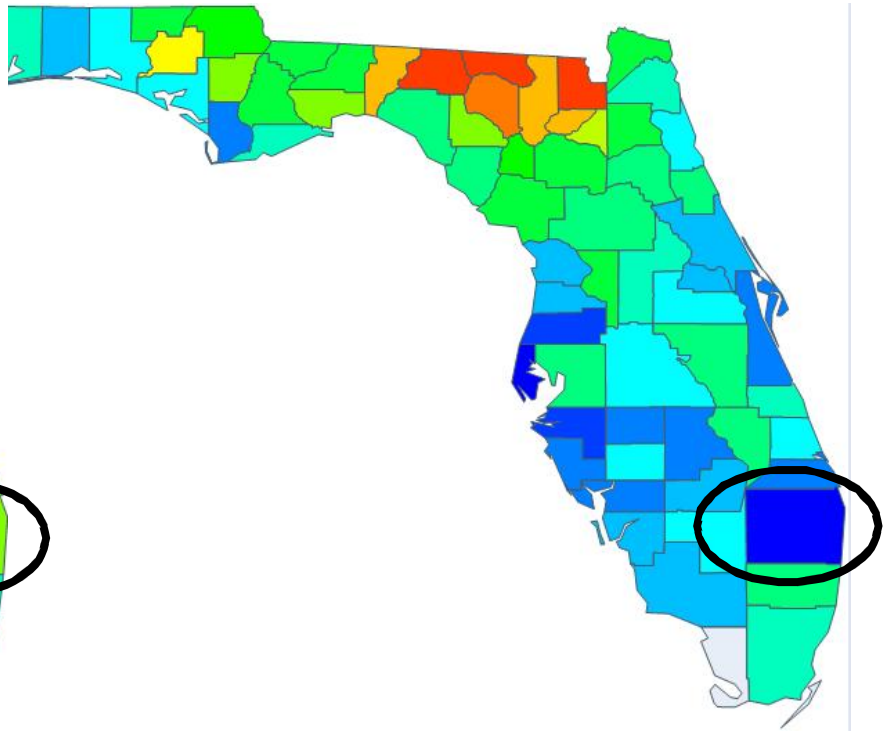
Output

- A finer estimate of profitability

Average Retained Annual Loss to Premium Ratio



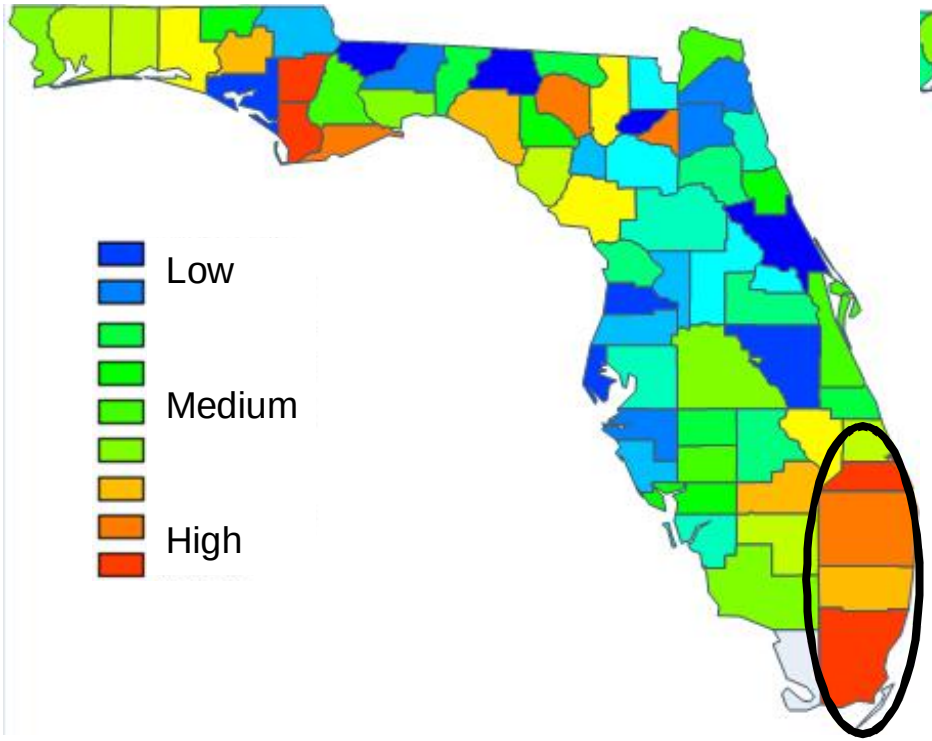
Underwriting Profit to Premium Ratio



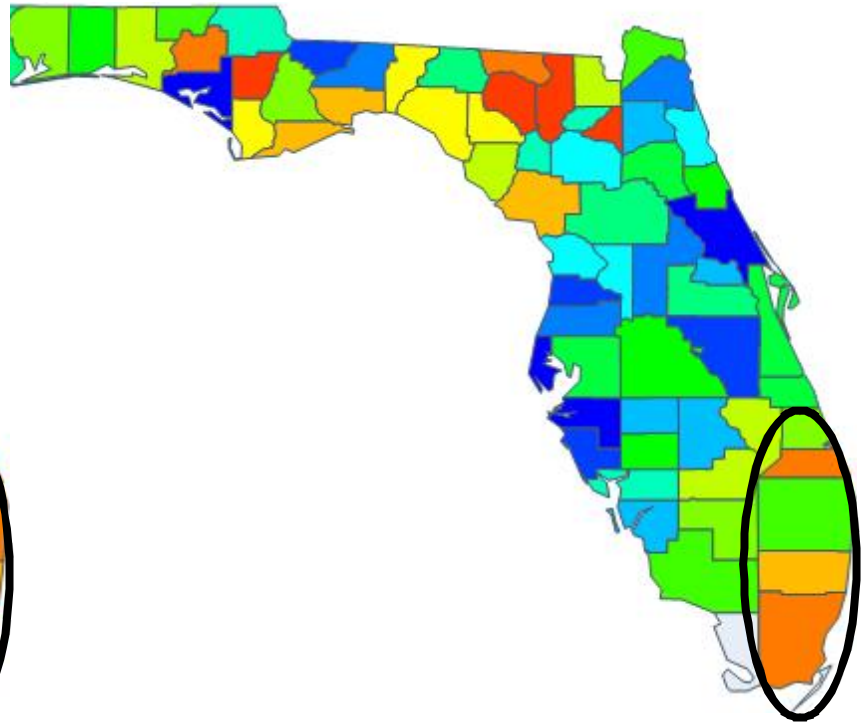
Output

- Impact of reinsurance

Gross Profit

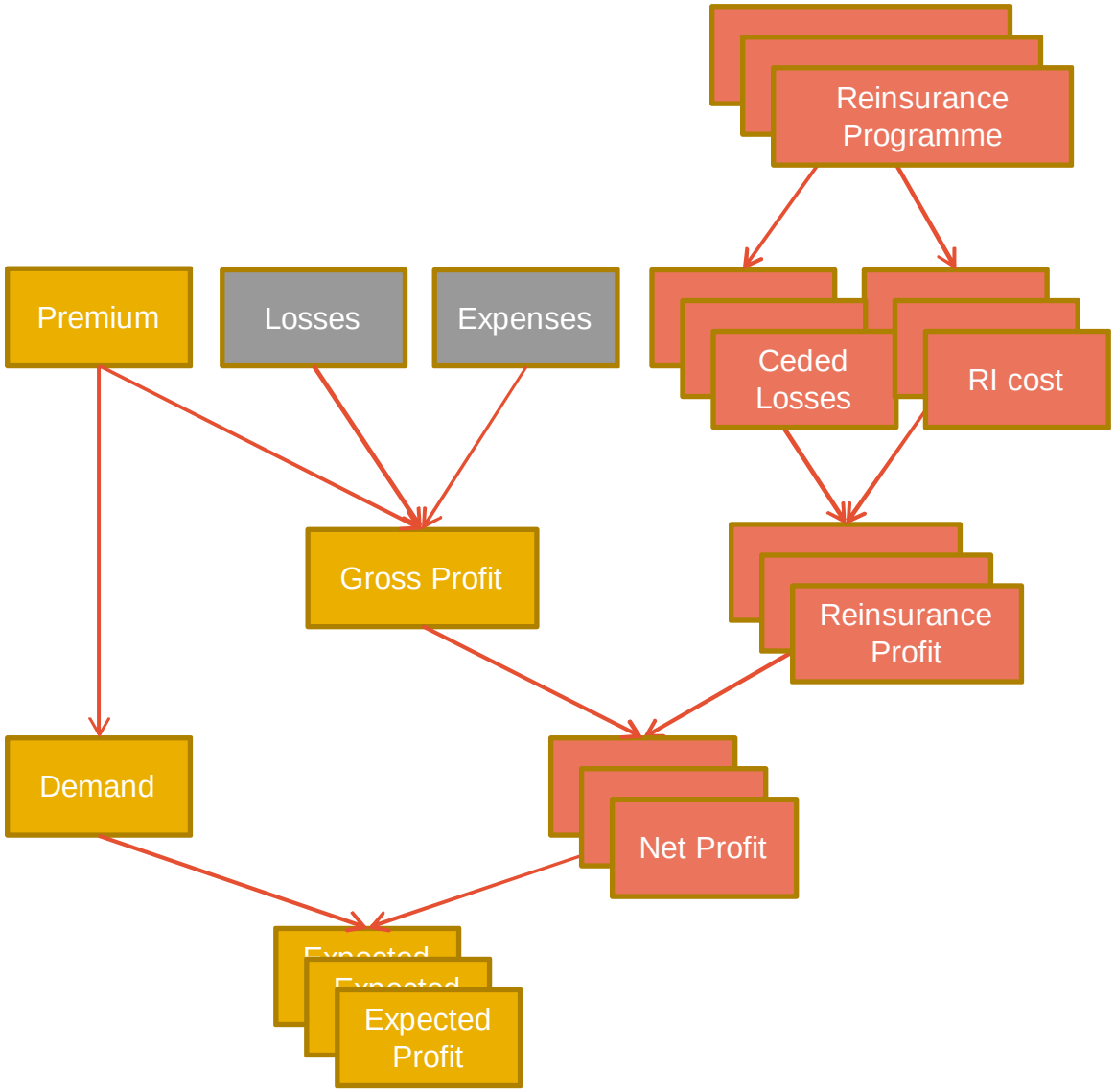


Net Profit



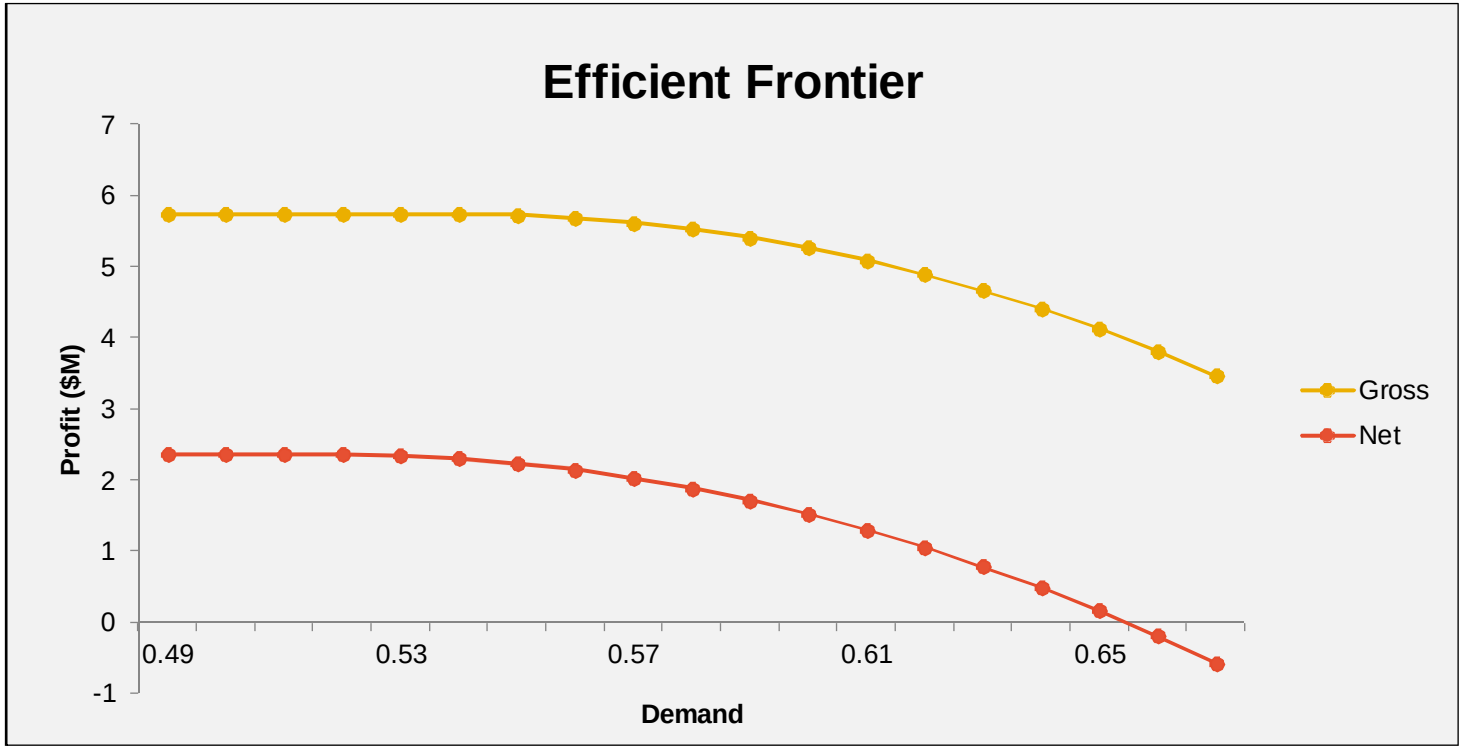
Scenario Testing

- Test alternative premium propositions
  - Assuming fixed reinsurance
- Test alternative reinsurance
  - Assuming fixed premiums
  - Or optimize premiums under each scenario



Scenario Testing

- How would the frontier change (conceptually)
  - Points on and under the efficient frontier will translate vertically
  - E.g. change in RoL, limits, etc.



Scenario Testing

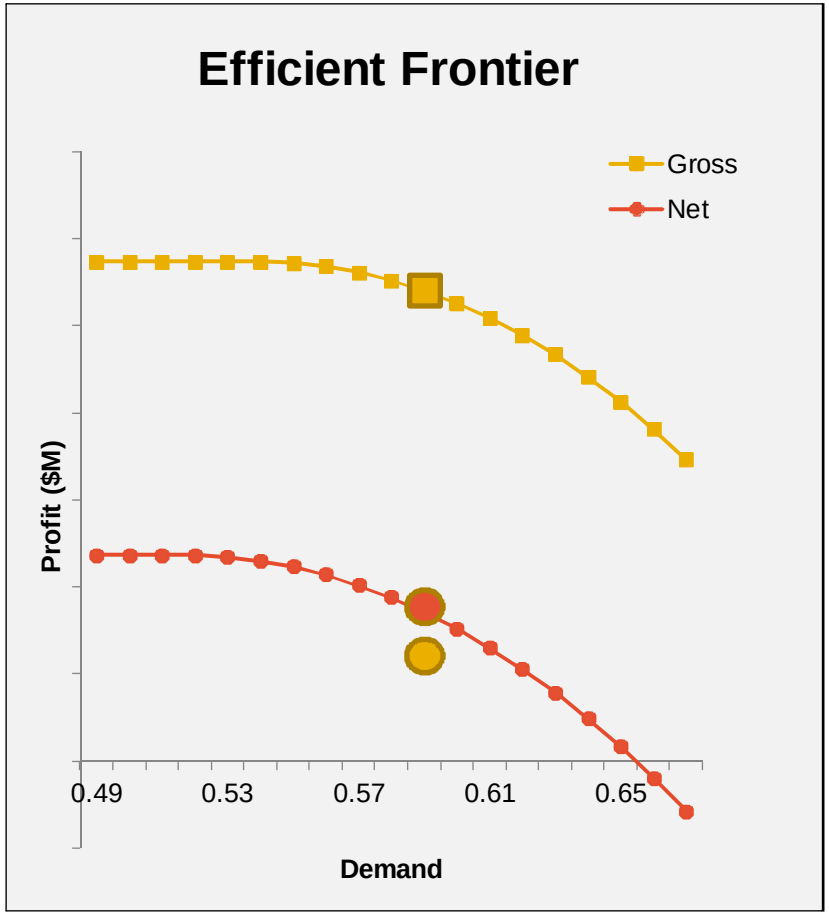
- How to design reinsurance program more efficiently
  - Increase the reinsurance profit
  - Sensitivity test layers
  - Compare RI cost with impact on PMLs and see if effective (cost/benefit analysis)
  - Cost changes across layers

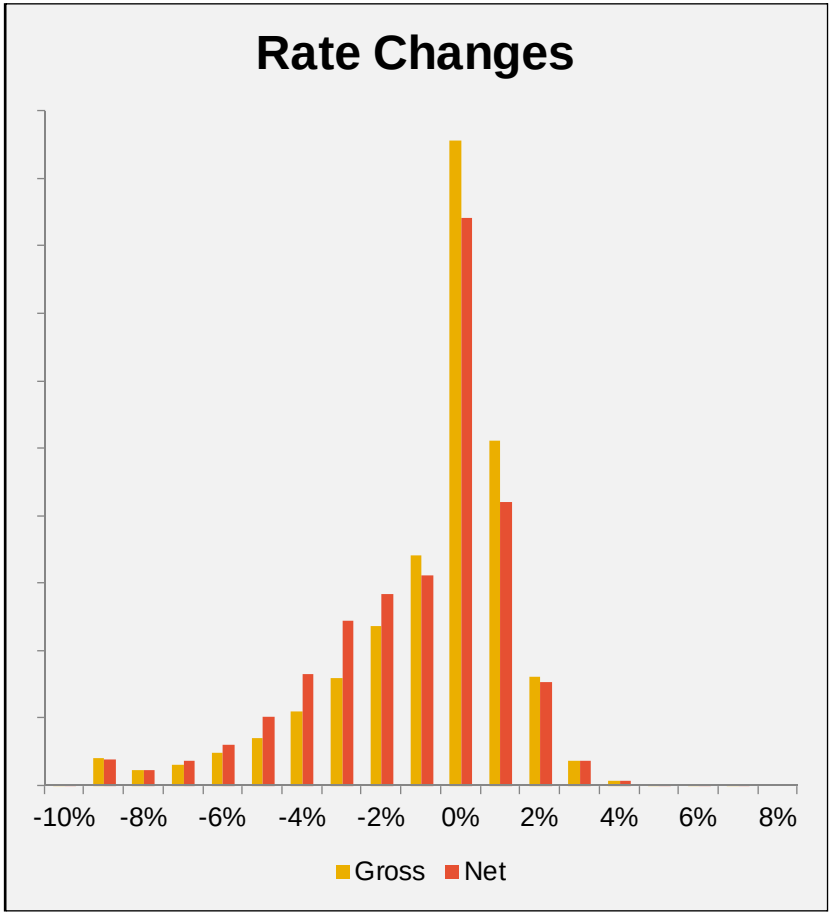
- Circle back into underwriting
  - Underwriting
  - Price changes
  - Cross-subsidies

- Overlay with competitor data
  - Simulate price change scenarios
  - Price sensitivity tells you who will react to rate increases/decreases (and how strongly)

Scenario Testing

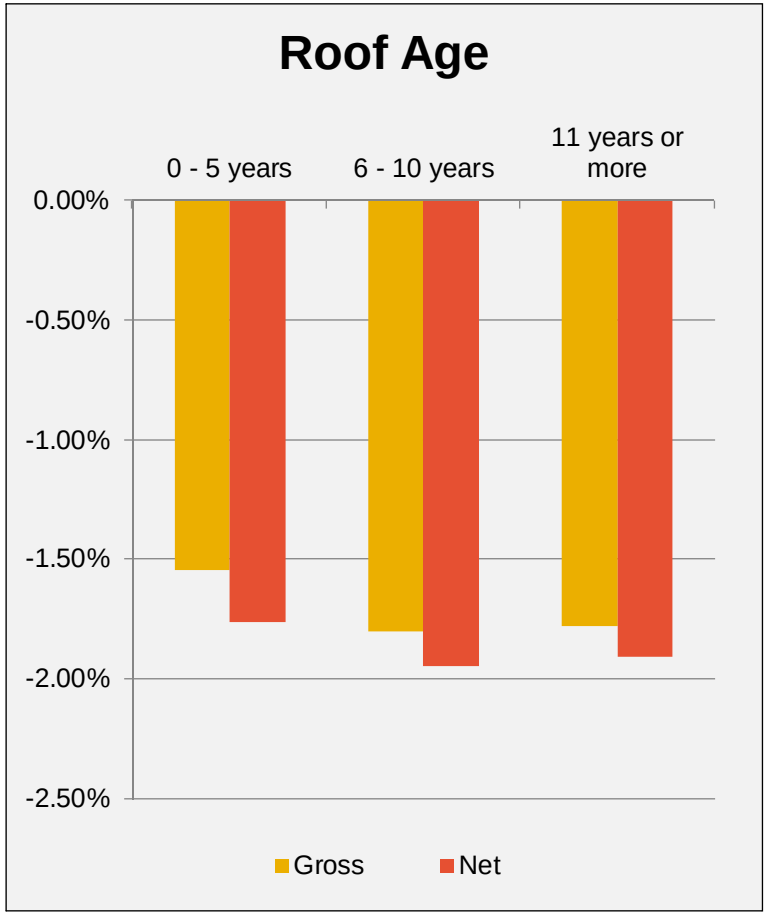
- Illustrative Analysis Output (same retention)

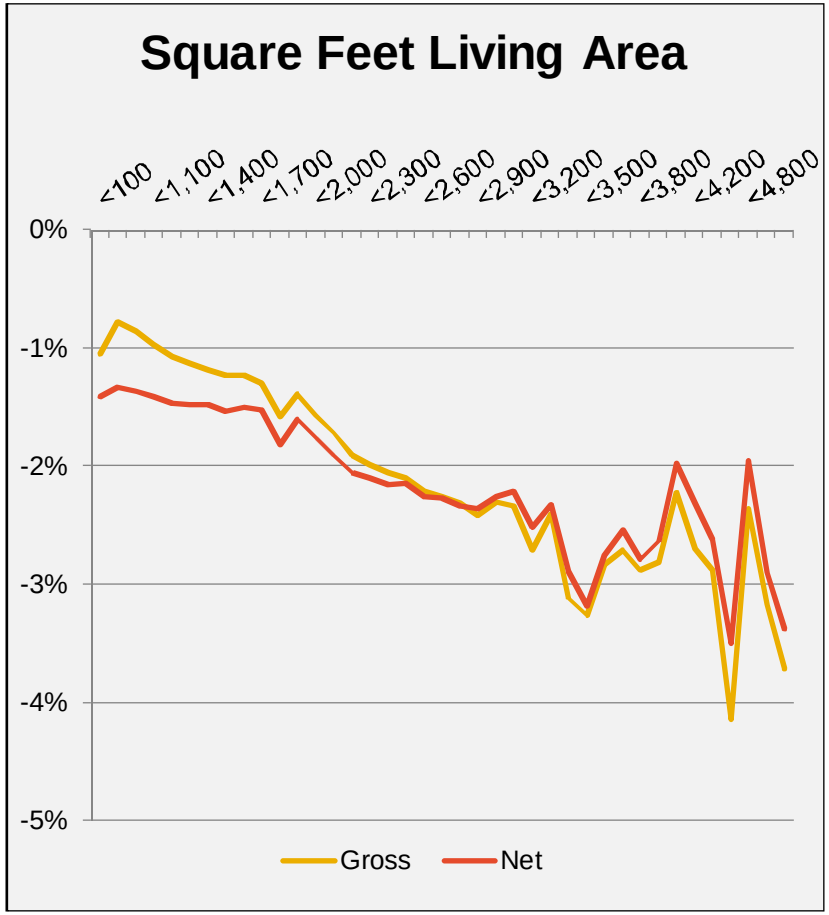




Scenario Testing

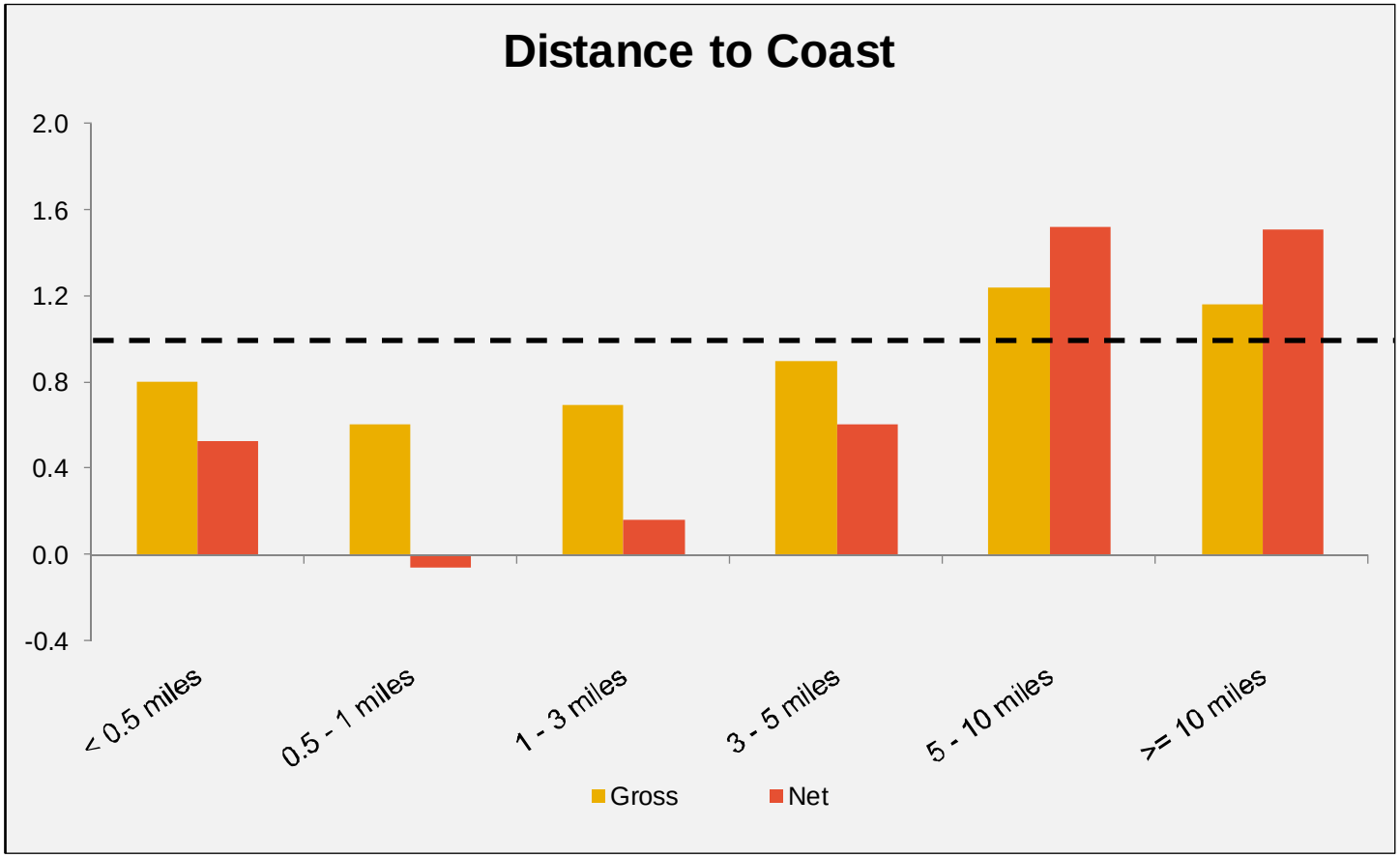
- Illustrative Analysis Output: Average Rate Change





Scenario Testing

- Illustrative Analysis Output: Profit Margin (ratio to average)

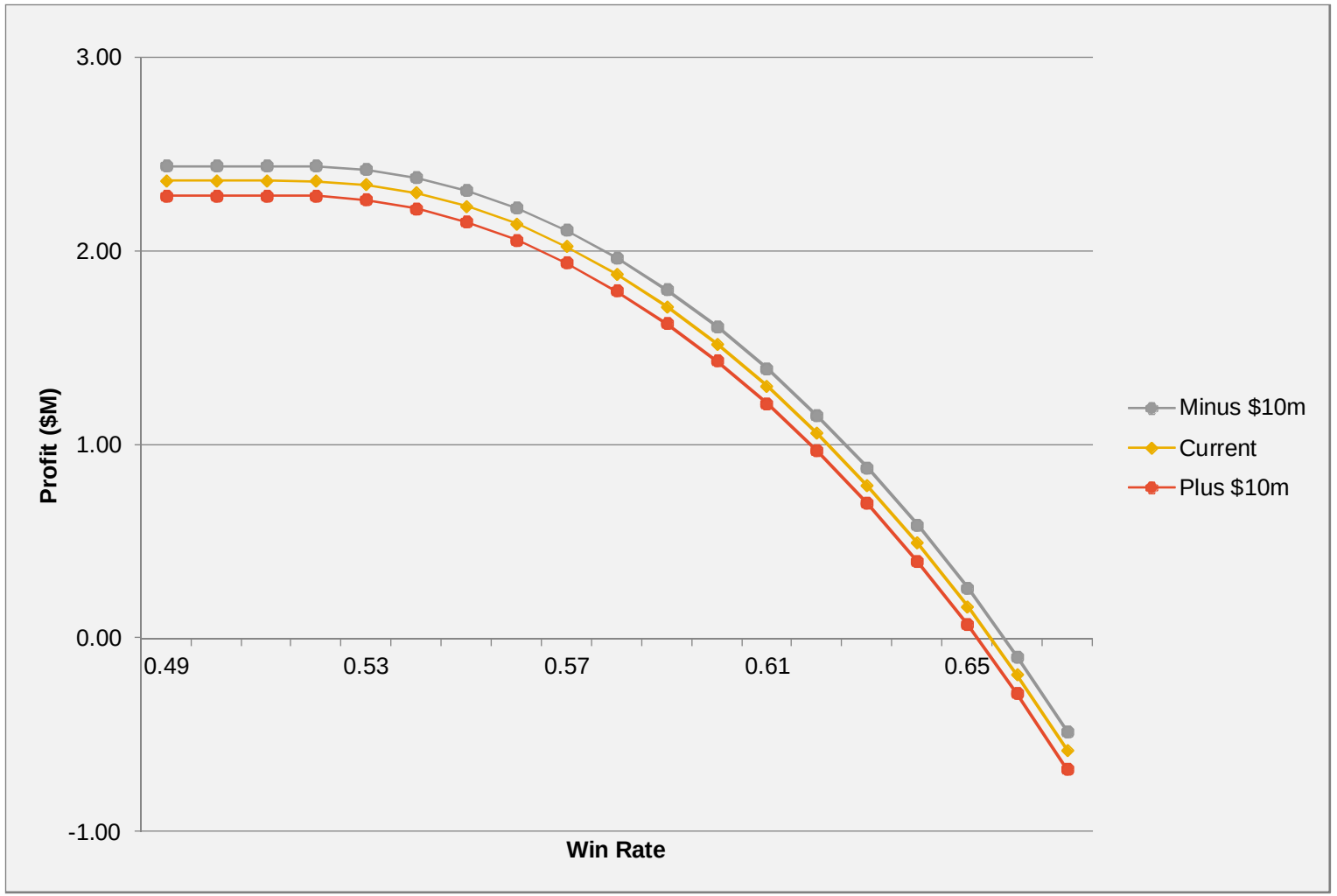


Simulations

- Is Reinsurance profit dynamic or static?
  - Ceded Losses
    - Depend on reinsurance terms
    - Depend on risk profile
  - Reinsurance Cost
    - Depends on premium (proportional RI)
    - Does not depend on premium (for XoL)

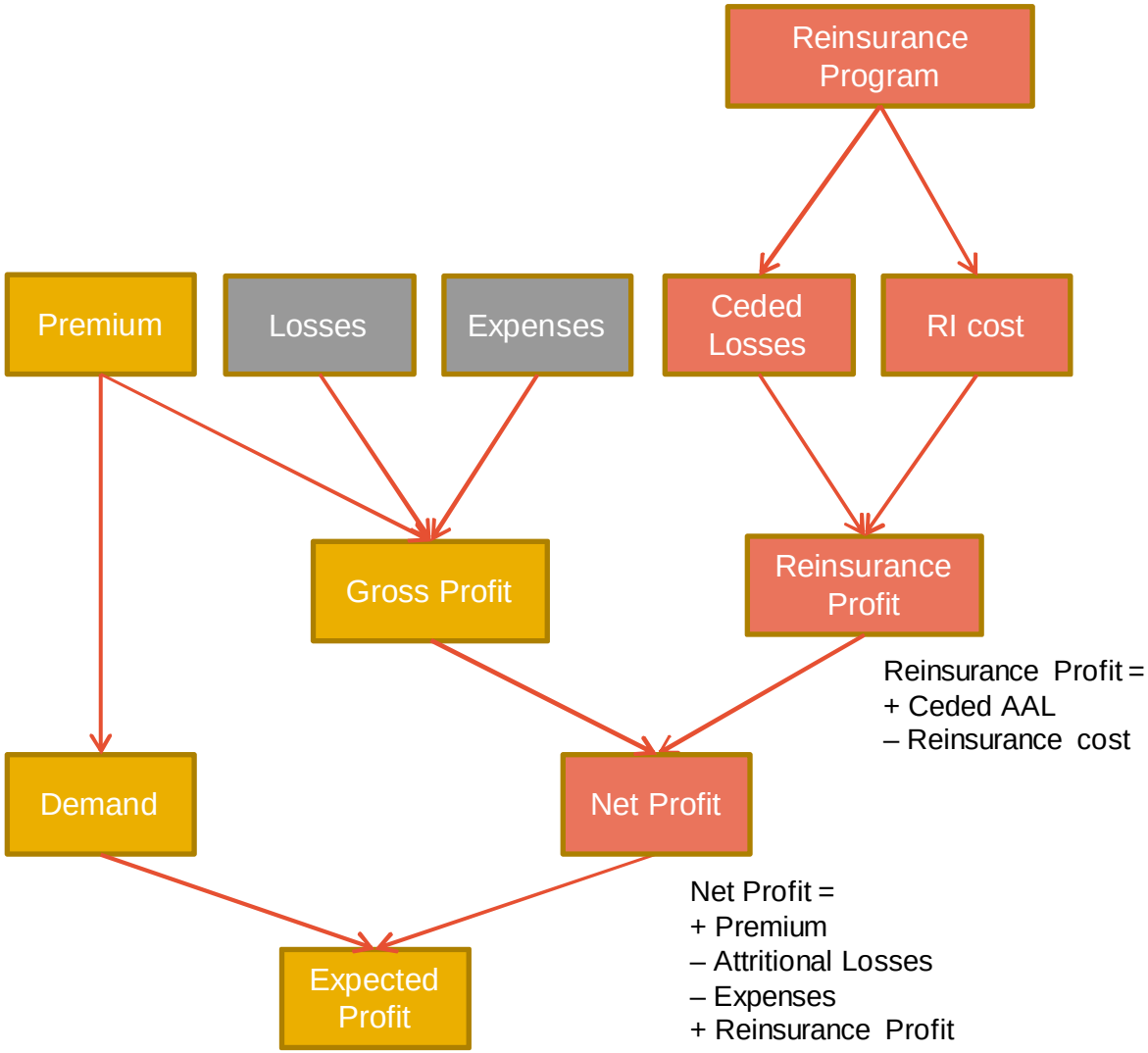
- Reinsurance terms is not a simple function of anything
  - Unlike premiums and gross expected profit
  - For XoL: use the highest layer limit?
    - This could be a two-dimensional optimization

Output



Learnings

- To do optimization you need
  - To identify what your levers are
  - Them to be at policy level
- Reinsurance
  - Book level
  - Scenario testing
- At individual level
  - Premiums
  - Additional services
- Policy allocation methodology will impact optimization results



Practical Challenges

Practical Challenges

- Typical challenges are
  - Data
  - Modeling
  - Resources
  - Integration
  - Communication

- They apply irrespective of complexity of existing Optimization

Practical Challenges - Data

- Manage multiple sources
  - Underwriting, Reinsurance, Actuarial information
- Needed:
  - Policy information (claims, policy characteristics)
  - Loss cost estimate
  - Competitive information
  - Detail of reinsurance conditions (program, RoLs)
  - If “predictive underwriting”: live integration to quotation systems
- At different points in time
  - Current
  - Next year
  - Future years

Practical Challenges – Modeling & Resources

- Models needed:
  - Loss cost models
  - Policyholder behavior models
  - Estimate of ceded claims
    - In aggregate – e.g. cat model output (risk location, TIVs)
    - Policy by policy and policy-level attribution of aggregate metrics
    - Reinsurance layer exhaustion

- Resources
  - Software
  - Knowledge
  - Cooperation / internal buy-in

Practical Challenges - Integration

- Data
- Systems/software
- Ideally as smooth as possible
- A process which is
  - Repeatable and easily updatable : Productivity gains
  - Adaptable: where individual components can be enhanced/replaced

- For optimization
  - Methodology
  - Tools supporting the methodology
  - Software

Practical Challenges - Communication

- Building management information systems and dashboards
- It’s a complex analysis – how quickly can you run it again?

Questions

TOWERS WATSON

Yves Colomb
Consultant

335 Madison Ave
New York NY 10017-4605

T 212-309-3642

yves.colomb@towerswatson.com

TOWERS WATSON

Brett Nunes
Senior Consultant

71 South Wacker
Chicago, IL 60606-3414

T 312-201-5288

brett.nunes@towerswatson.com

“In theory, theory and practice are the same.

In practice, they are not”

- Albert Einstein