Incorporating Reinsurance Considerations
Product design using an augmented price optimization framework

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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)

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

Price Optimization 101

- Integration
  - Losses
  - Demand
  - Premiums
  - Expenses
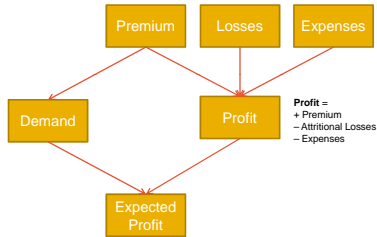
Profit =
+ Premium
− Attritional Losses
− Expenses

Price Optimization 101

- Components are a function of premium
  - Assuming all else is fixed
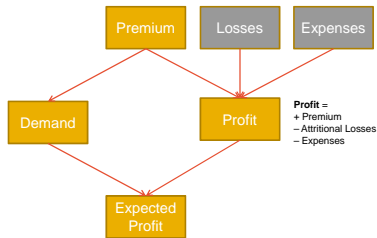
Profit =
+ Premium
− Attritional Losses
− Expenses

Price Optimization 101

- Overlay with competitive information

Underwriting profit   Competitiveness

Low
Medium
High

High
Medium
Low

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

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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**

Reinsurance Profit =
+ Ceded AAL
− Reinsurance cost

Net Profit =
+ Premium
− Attritional Losses
− Expenses
+ Reinsurance Profit

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

Low

Medium

High

Output

- Impact of reinsurance

Gross Profit

Net Profit

Low

Medium

High

Scenario Testing

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

Reinsurance Programme

Premium · Losses · Expenses · Ceded Losses · RI cost

Gross Profit · Reinsurance Profit

Demand · Net Profit

Expected Profit

Scenario Testing

- How would the frontier change (conceptually)
  - Change in RoL = Translation
  - Change in limit = Translation

Efficient Frontier — Profit ($M) vs Win Rate (0.32, 0.4, 0.49, 0.58, 0.66); Gross, Net

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)

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?
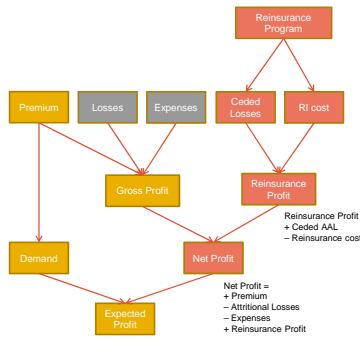   - This could be a two-dimensional optimization

Output
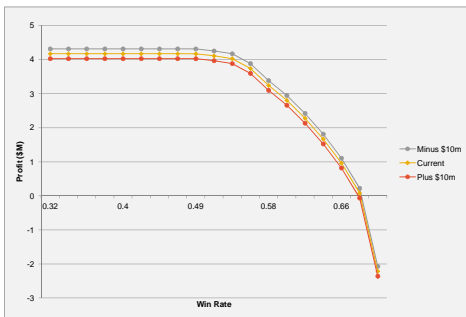
Learnings

- 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

Reinsurance Profit =
+ Ceded AAL
− Reinsurance cost

Net Profit =
+ Premium
− Attritional Losses
− Expenses
+ Reinsurance Profit

Practical challenges

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

- They apply irrespective of complexity of existing Optimization

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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 (programme, RoLs)
  - If "predictive underwriting": live integration to quotation systems

- At different points in time
  - Current
  - Next year
  - Future years

Practical challenges - Modeling

- 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?

Thank you

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> **"In theory, theory and
> practice are the same.
> In practice, they are not"**
> **- Albert Einstein**

Questions