CAS RPM SEMINAR

Getting started with price optimization – concepts, models & hurdles

by Yves Colomb (and courtesy of Simon Lee)

March 2015

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II-4

GETTING STARTED WITH PRICE OPTIMIZATION
– Concepts, Models, and Hurdles
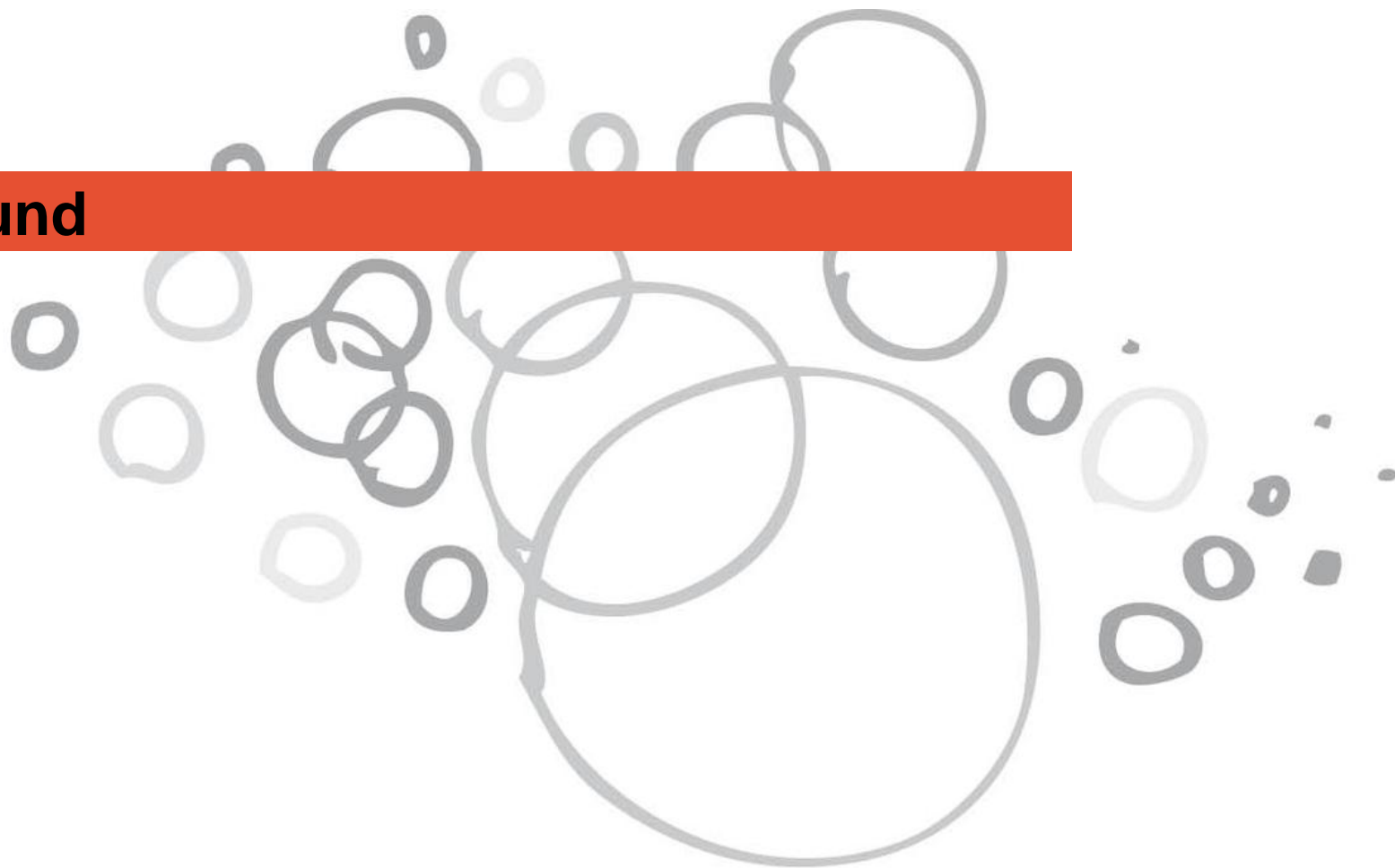
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Background

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Ratemaking vs. Pricing

- Actuarial Ratemaking
  - Actuarial Statement of Principles on Ratemaking
    - A rate is reasonable and not excessive, inadequate, or unfairly discriminatory if it is an actuarially sound estimate of the expected value of all future _costs_ associated with an individual risk transfer

- Pricing
  - Taking into account _all factors_, such as costs, regulatory constraints, business constraints (e.g. competitive constraints) and strategic constraints when setting actual price charged

- Traditionally, actuaries provide the _actuarial indication_ which was an input into the _pricing_ decision

- Today I'm talking about _pricing_ analytics

Price Optimization is…

"a process for adjusting prices away from a benchmark basis, ideally on an individual customer basis, to better achieve business objectives"

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Price Optimization

"A pricing scheme that optimizes business measure of success in a specific investment horizon"

- – Business goals can be achieved via also underwriting, marketing, claims handling strategies

- – Investment horizon is key as price optimization is usually served as Profit and Expense deferral mechanism
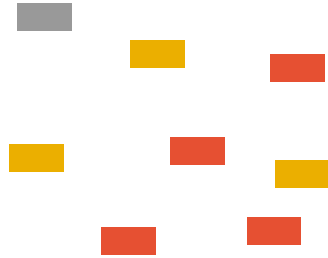
- – Price Optimization in very short: Cost + Demand

Why do insurers price-optimize?

- Market dynamics

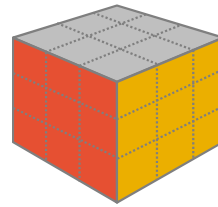- Competitive edge

- Investment
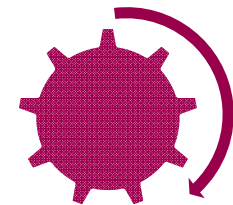
- Numerous useful by-products

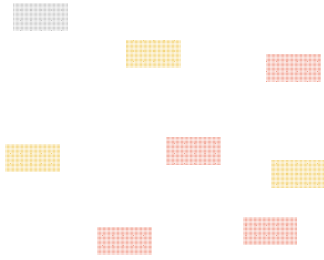# Concepts
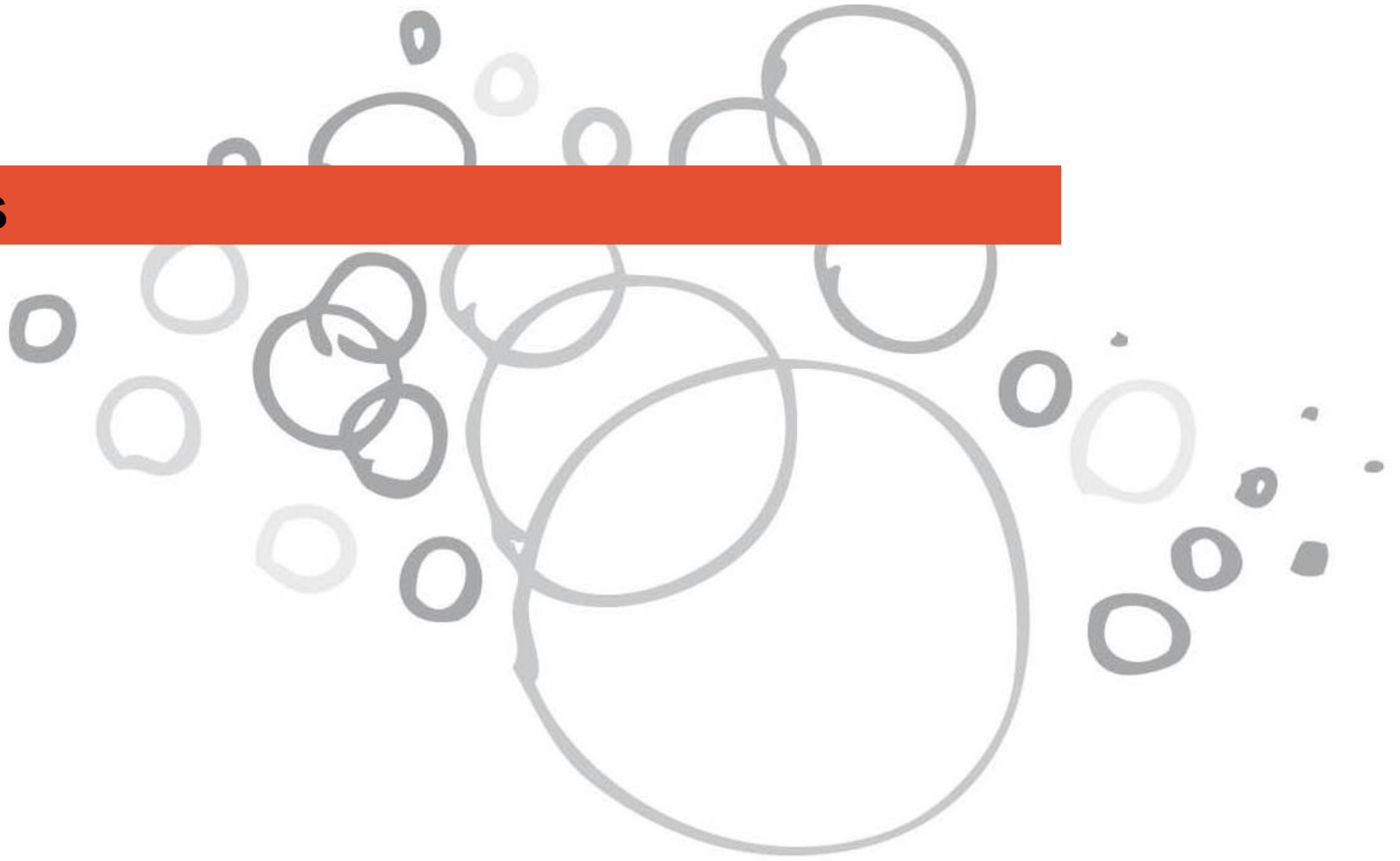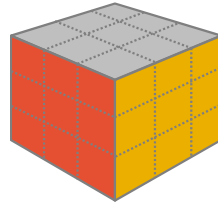
Three main stages

Develop components

Integrate components

Simulate and search

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Three main stages

Develop components

Integrate components

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Components

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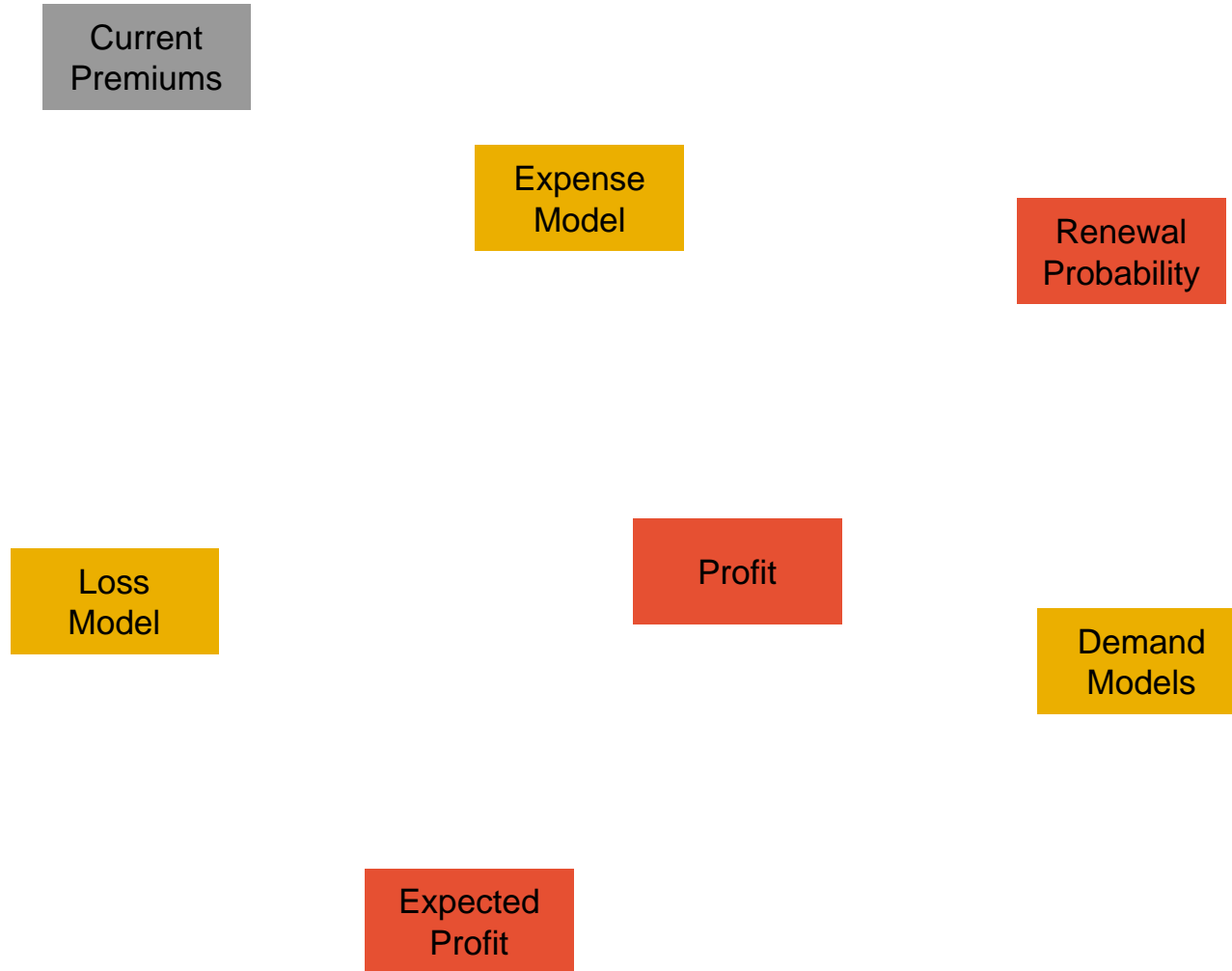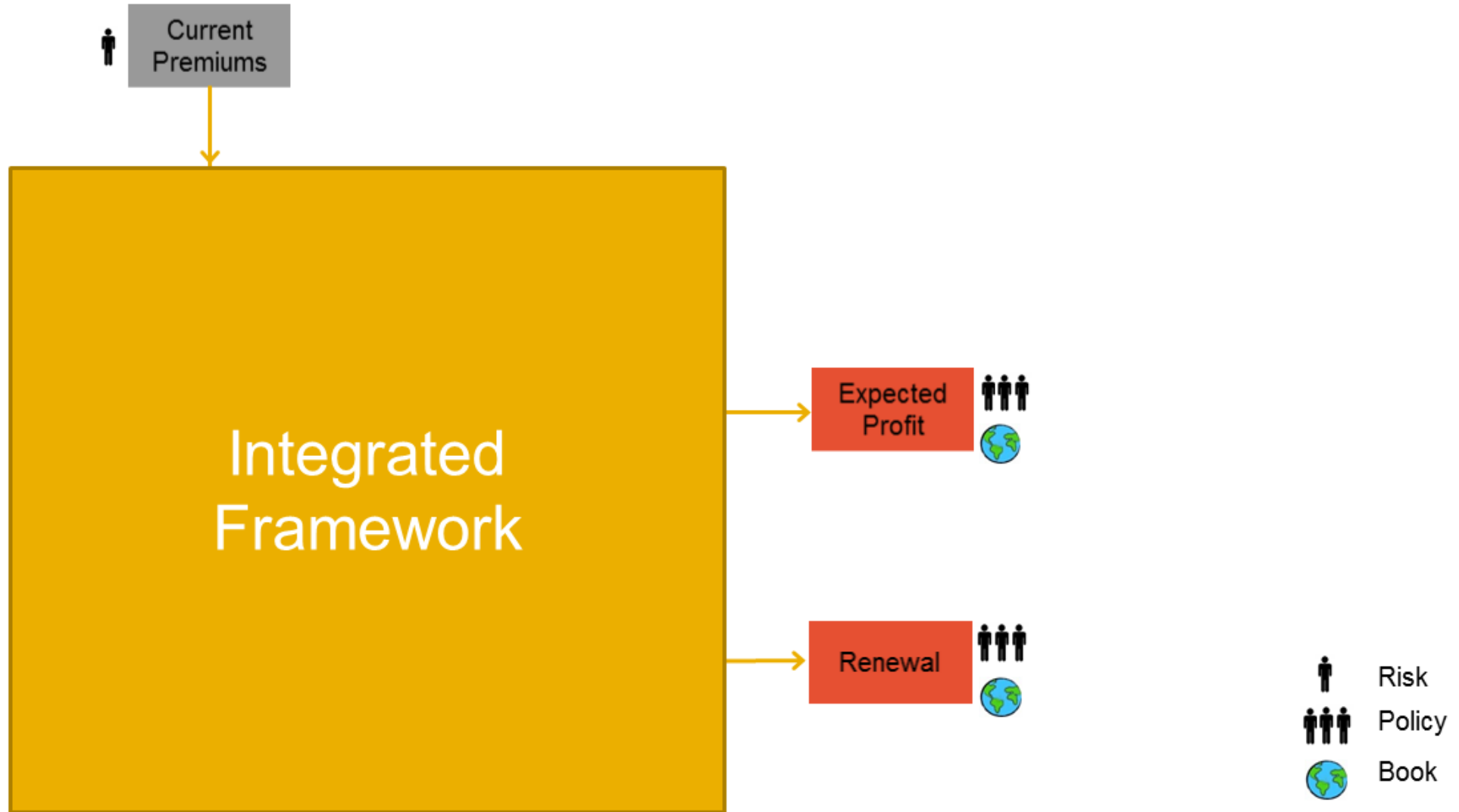
Integration

Additional ingredients for estimating LV

T=1 - - - Ageing Mask - - -> T=2

| T=1 Premiums | Distribution change | T=2 Premiums | - - -> | Pricing Strategy |

| Expected Profit (T=1) | | Expected Profit (T=2) | - - -> | **LV** |

| Renewal (T=1) | | Renewal (T=2) | - - -> | 2-year Cumulative Renewal |

Integration

Policy No	Risk No	Premium	Factor #1	Factor #2	Factor #3
PEL00979458	1	327	Red	A	…
PEL00979458	2	555	Red	Z	…
UQJ408808153	1	261	Blue	Z	…
UQJ408808153	2	349	Green	B	
UQJ408808153	3	334	Yellow	H	
KZH964999642	1	123	Yellow	H	
KZH964999642	2	389	Blue	K	

Pricing Strategy

(multi-year) Integrated Framework

Profit

Volume

How is integration used?

- 25% not currently using price integration but intend to build such framework in the future

- 25% in the process of building a price integration framework
  - Main challenges are data and demand modelling

- 17% currently using price integration framework for at least one product
  - 100% intend to expand it to other lines of business
  - 0% see no value in expanding price integration at this time

- 12% already beyond price integration
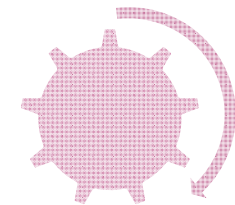
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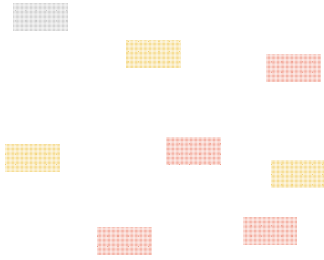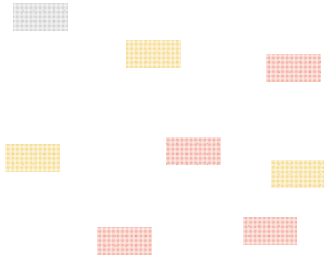
Three main stages

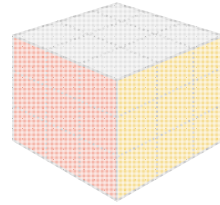Develop components
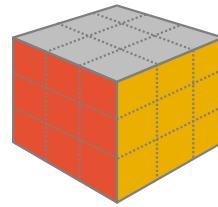
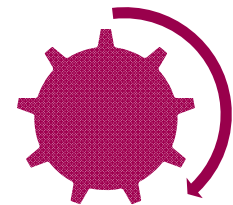Integrate components

Product Mgt

Marketing

Simulate and search

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Three main stages

Develop components

Integrate components

Simulate and search

Optimization

Pricing Strategy

Search Algo

(multi-year) Integrated Framework

Profit

Volume
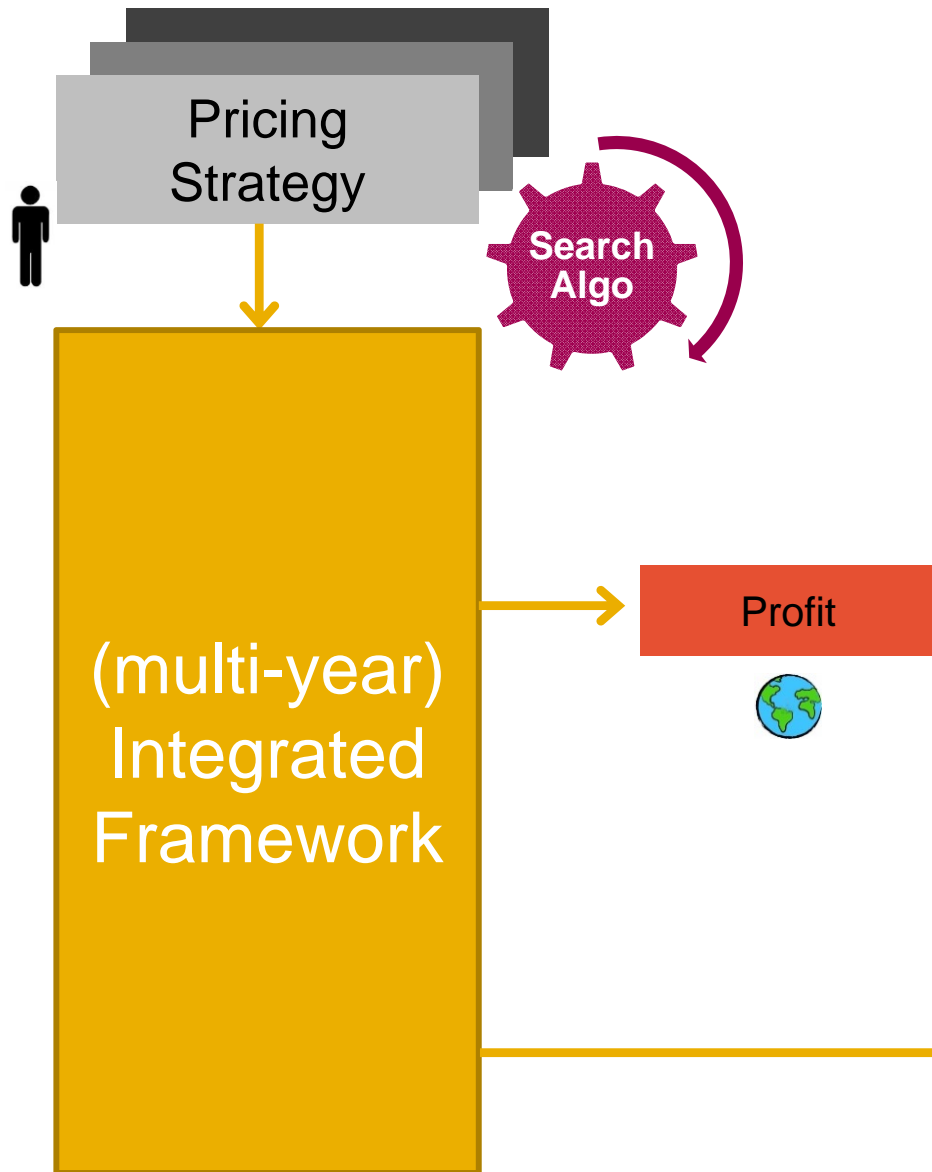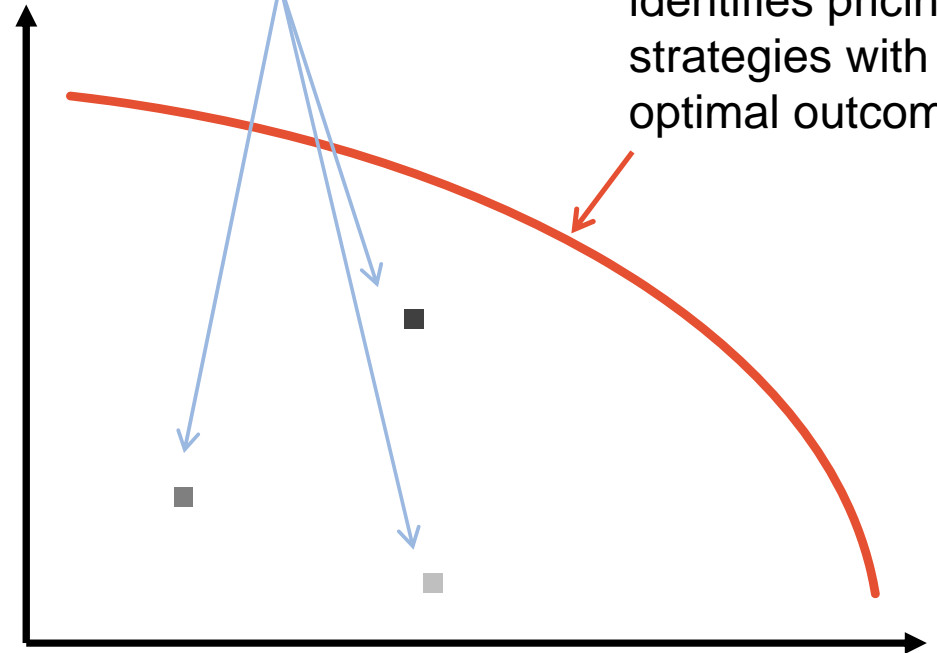
Price Integration quantifies chosen metrics for current and proposed pricing strategies

Price Optimization identifies pricing strategies with optimal outcomes

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Models, Hurdles and Solutions

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Scope

- Large number of possible analyses
  - By number of components: Claim Frequency, Severity , Conversion, Retention
  - By number of products
  - By the modelling techniques for the component: GLM, GAM, Neural Network, Boosting etc…
  - By the measures to be optimized: Life time value, Efficient Frontier
  - By the constraints: dislocation limit, minimum growth, etc…
  - By the projection periods

- Low hanging fruits
  - Personal lines
  - Loss cost models
  - Gradual approach
  - Shorten horizon for Customer Lifetime Value analysis

- All are possible sophistications

Models, Hurdles & Solutions

Current Premiums
Loss Models
Expense Model
Demand Model
Profit
Renewal Probability
Expected Profit

Data for Demand Models

- Understand the proposal process

- Transactions recording

- Separate exposure-change driven price changes and "true" price changes

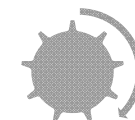- Future premiums

- Data scrubbing

Current Premiums
Loss Models
Expense Model
Demand Model
Profit
Renewal Probability
Expected Profit

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Demand Models

- ## Recent interest in insurance

- ## GLMs by default
    - ### Familiarity (bias?)
    - ### Synergies with loss cost modelling

- ## Main hurdle: new type of modelling
    - ### Don't underestimate

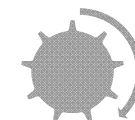- ## Validation extremely important

Current Premiums
Loss Models
Expense Model
Demand Model
Profit
Renewal Probability
Expected Profit

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Component Models

- Each component is CRITICAL

- Model weaknesses are prime target for optimization routine

- Things will change!
  - Models should adapt

Current Premiums
Loss Models
Expense Model
Demand Model
Profit
Renewal Probability
Expected Profit

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Metrics

- ## Typically
  - Some measure of profitability
  - Some measure of volume

- ## Other possibilities
  - Satisfaction?
  - Risk?
  - Dislocation?

- ## Two conditions:
  - depend on premiums
  - opposing functions of premiums

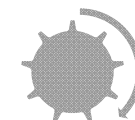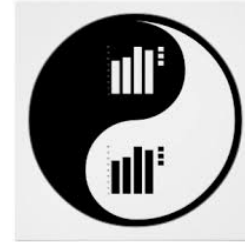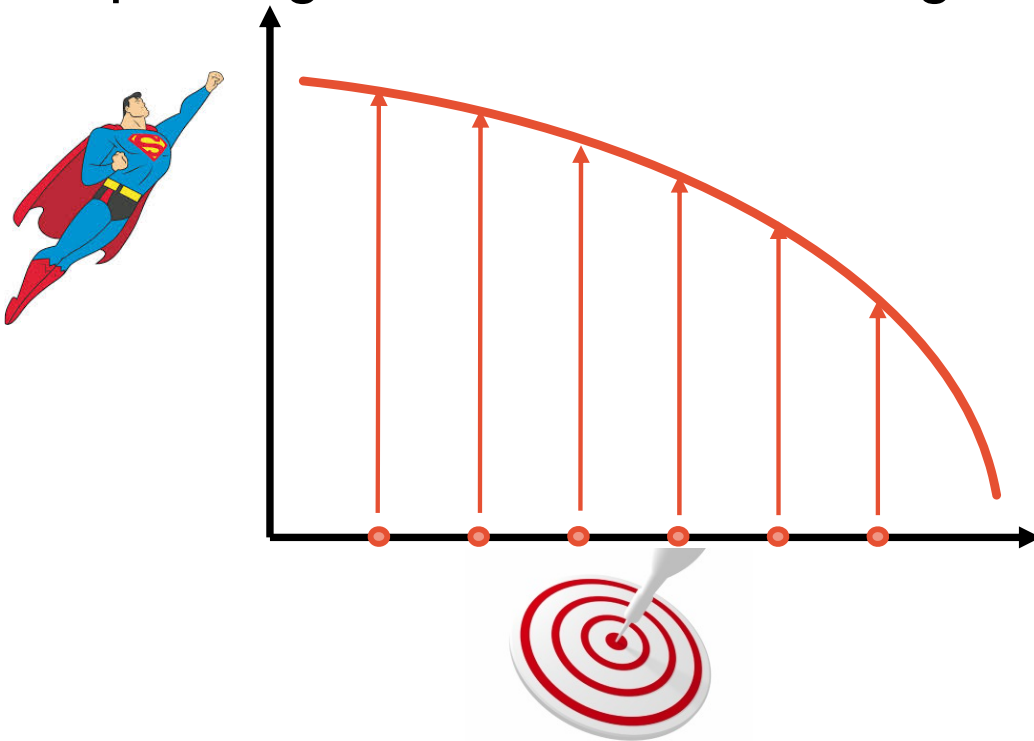| |
| --- |
| Current Premiums |
| Loss Models |
| Expense Model |
| Demand Model |
| Profit |
| Renewal Probability |
| Expected Profit |

Metrics

- R&D and Product collaboration
  - Define terminology (semantics matter)
  - Current vs. new metrics

- Improving/control vs. monitoring

Current
Premiums

Loss
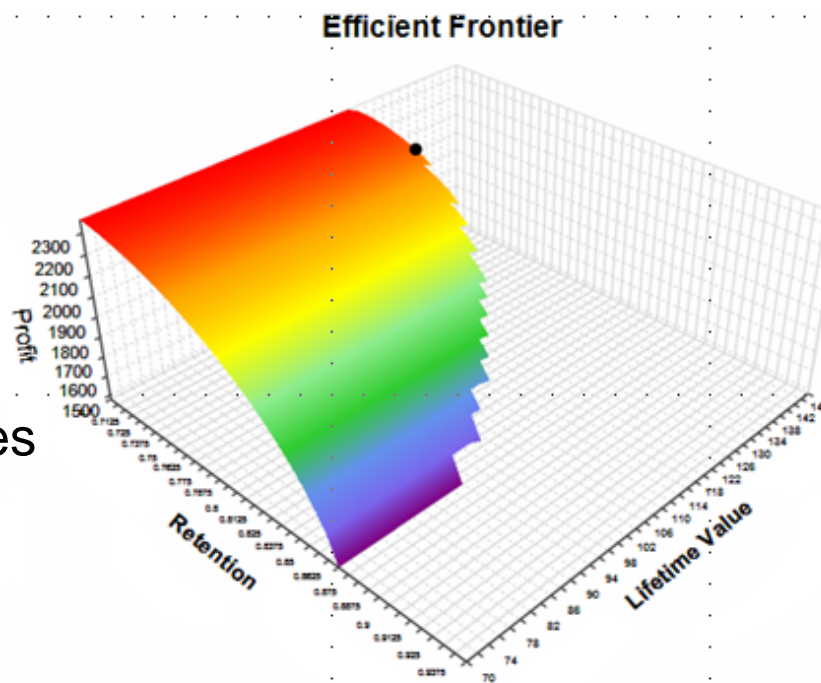Models

Expense
Model

Demand
Model

Profit

Renewal
Probability

Expected
Profit

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Optimization Model

- ## Methodology
  - A searching algorithm
    - Continuous vs discrete heuristics

- ## Lagrange
  - Gradient Descent
  - Effective method

- ## Regulatory constraints
  - same quote for same risk profiles

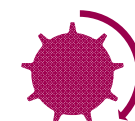- ## Existing and new business

| Current Premiums |
| Loss Models |
| Expense Model |
| Demand Model |
| Profit |
| Renewal Probability |
| Expected Profit |

Efficient Frontier

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Systems and Processes

- It's a complex analysis – how quickly can you run it again?

- Platform for integration
  - Smooth, flexible, adaptable
  - Enhanced productivity

- Identify new processes and build them
  - Internal operations and infrastructure
  - Communication protocols
  - Adjust production timetable

- Sponsor

- Dashboards
  - Track & review key indicators for product management
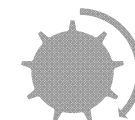 - Quick & easy digestion

| Current Premiums |
| Loss Models |
| Expense Model |
| Demand Model |
| Profit |
| Renewal Probability |
| Expected Profit |

Other issues

- Distributional change
- Competitor info
- Interest Rate
- Cut-off time
- Local convergence
- Consistency of implementation
    - Prospective vs. Retrospective
- Legal environment

"In theory, theory and practice are the same.

In practice, they are not"

- Albert Einstein

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Questions