Price Optimization

April 10, 2012
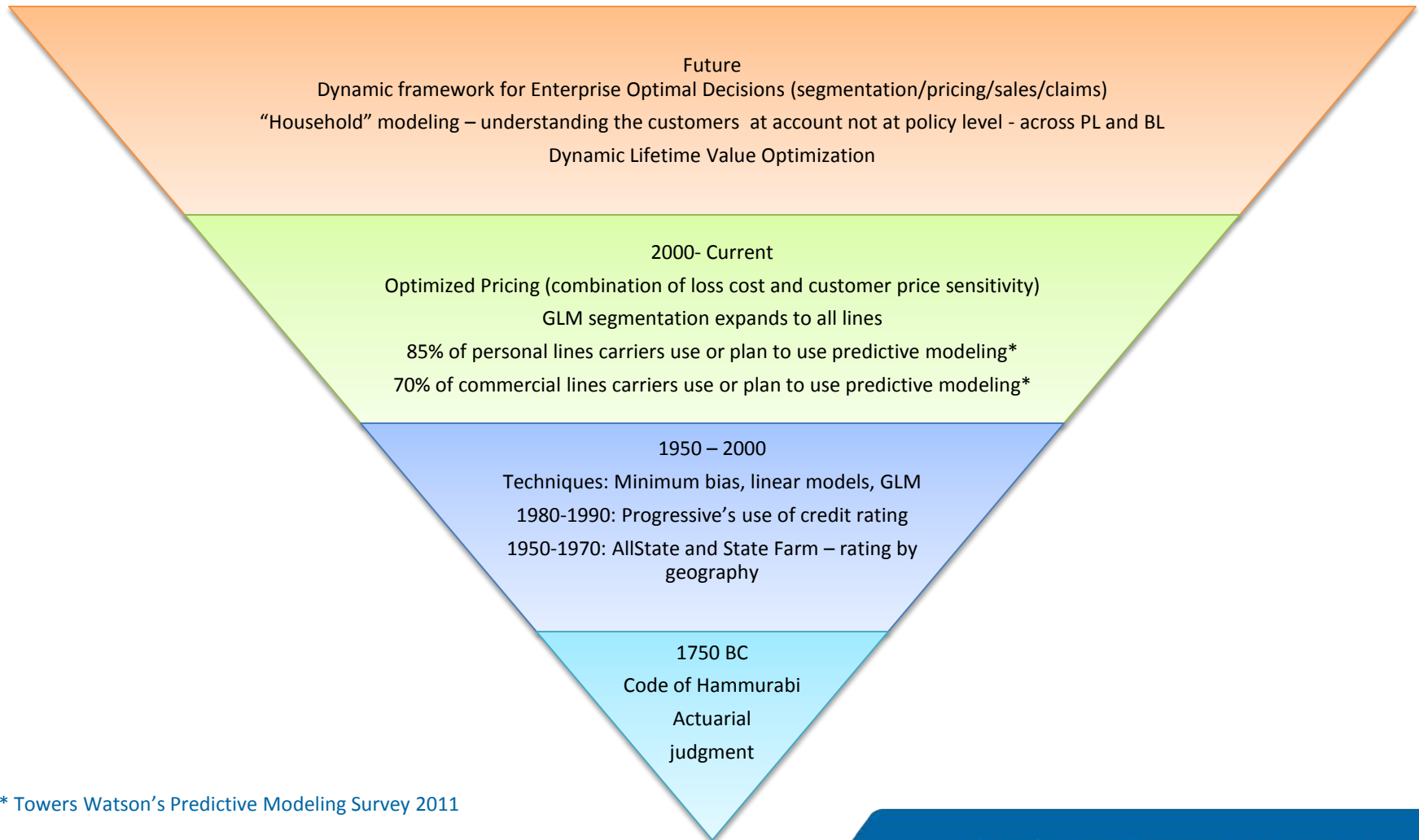
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Agenda

- **Price optimization basics**

- **Data**

- **Modeling**

- **Simulation**
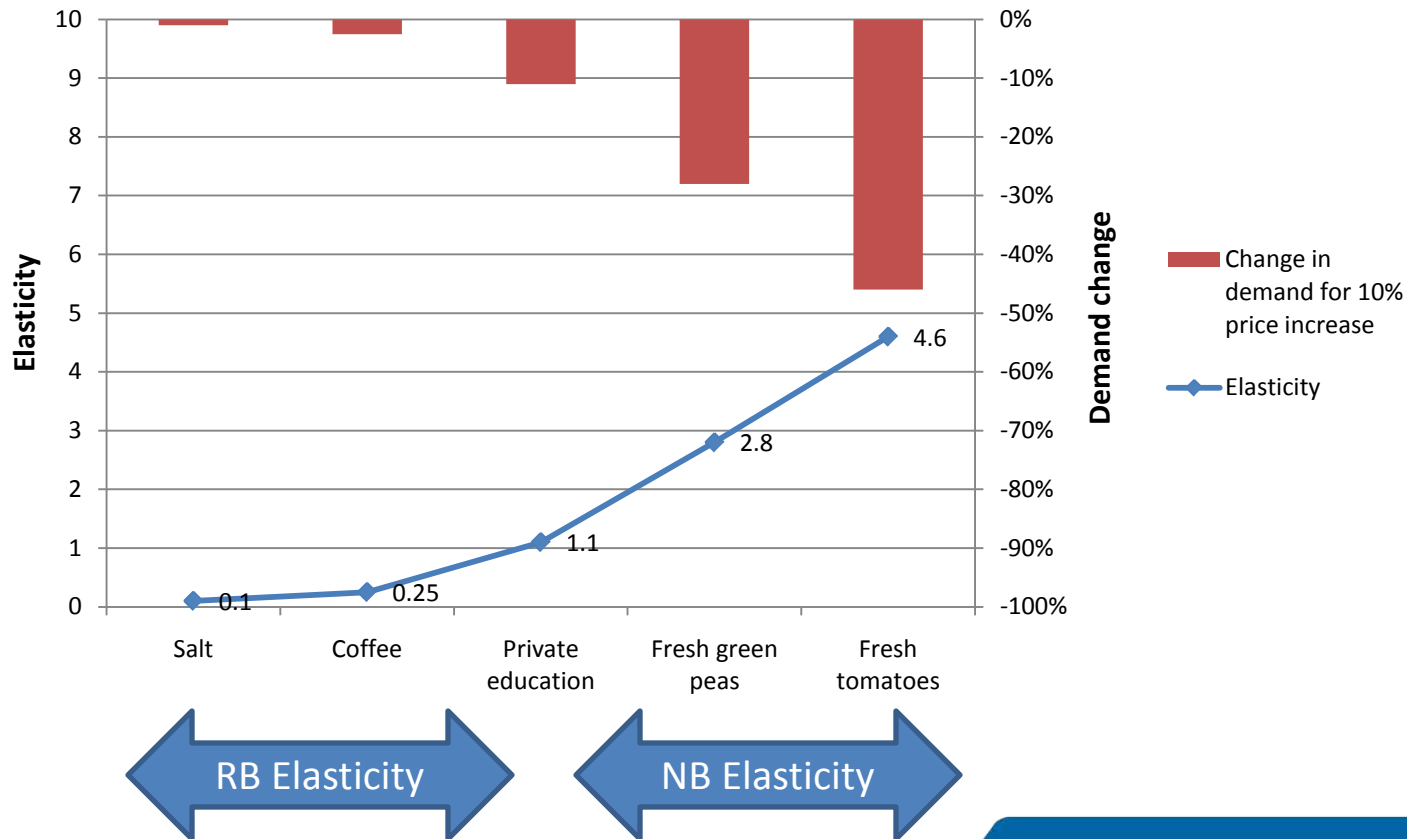
- **Conclusions/Benefits**

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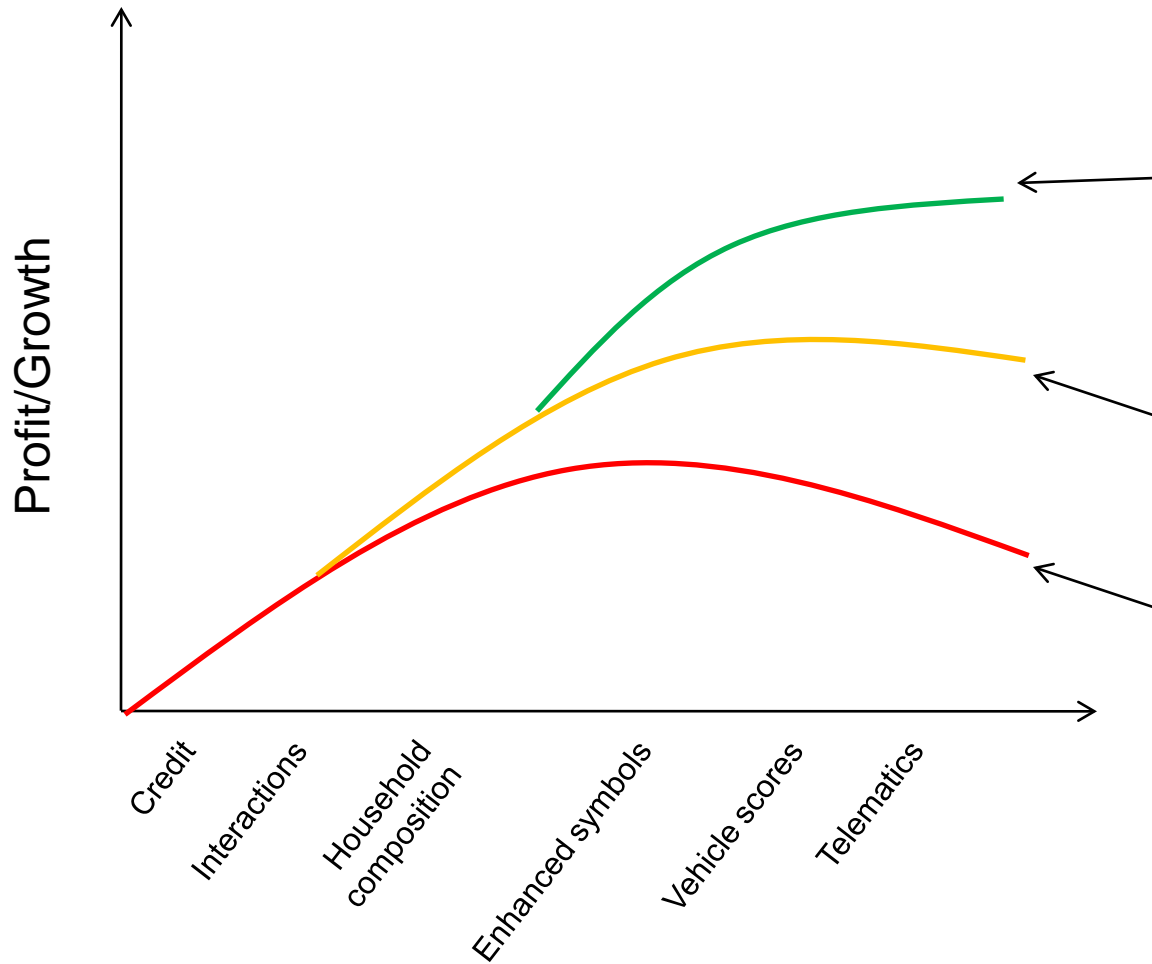
Historical perspectives on Pricing

Future
Dynamic framework for Enterprise Optimal Decisions (segmentation/pricing/sales/claims)
"Household" modeling – understanding the customers at account not at policy level - across PL and BL
Dynamic Lifetime Value Optimization

2000- Current
Optimized Pricing (combination of loss cost and customer price sensitivity)
GLM segmentation expands to all lines
85% of personal lines carriers use or plan to use predictive modeling*
70% of commercial lines carriers use or plan to use predictive modeling*

1950 – 2000
Techniques: Minimum bias, linear models, GLM
1980-1990: Progressive's use of credit rating
1950-1970: AllState and State Farm – rating by geography

1750 BC
Code of Hammurabi
Actuarial
judgment

* Towers Watson's Predictive Modeling Survey 2011

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Elasticity 101

- **Elasticity:** change in demand for a given change in price
- Is the price elasticity for tomatoes higher than the price elasticity for insurance?

Pricing Sophistication

Profit/Growth (y-axis)

New Rating Elements and Structures
(examples for illustration only)

x-axis labels: Credit, Interactions, Household composition, Enhanced symbols, Vehicle scores, Telematics

Pricing strategies

Price Optimization: Deeper understanding of consumer behavior ensures that sophisticated rating elements yield profit and growth

Competitive Intelligence + Judgment: Significant lift available through consideration of market forces

Cost Based: Diminishing or even negative returns due to disruption and the new business penalty

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Price optimization is the use of the pricing lever to meet financial objectives
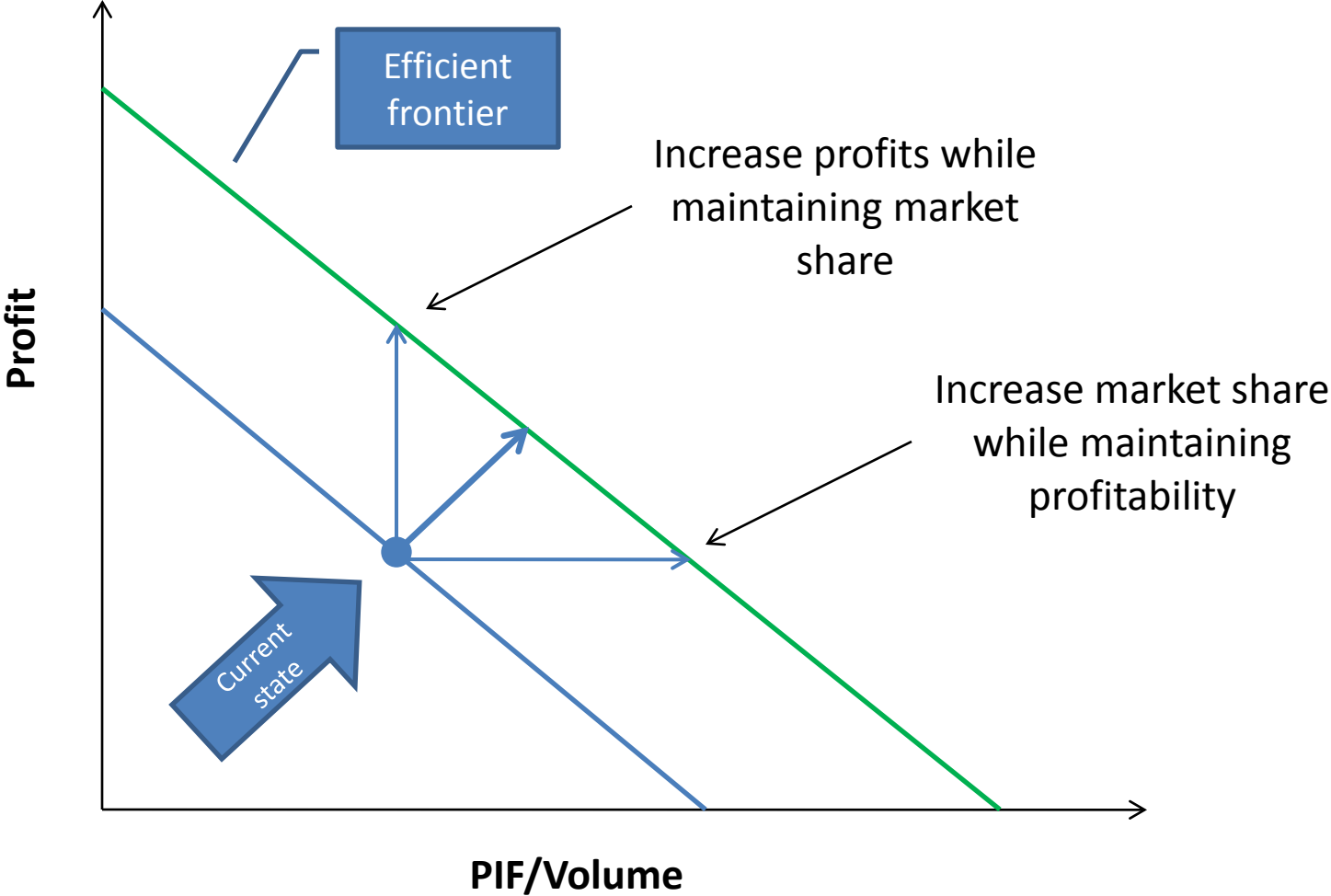
Price Optimization Components

- Cost models
  - Loss models
    - Don't need to use same variables used in pricing
    - Consider replacing bins with splines
  - Expense
    - Start simple
    - Consider new business versus renewal

- Elasticity models
  - New business
  - Renewal
  - Key transitions

- Multiyear simulation

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Data

- Can't bucket data like loss modeling… transitions are important
  - Suppose someone adds a youthful driver part way through a term:
  - Loss modeling typically places each portion of the term into a separate bucket
  - For price optimization, the transition is key. Datamart must be set up to capture this information.
- Need rate changes of various types… due to filed changes, natural transitions, and policyholder initiated changes
- Need quote data
- Need competitor prices on PIF/quotes… not made up risks
- One positive: elasticity modeling requires smaller quantity of data than loss modeling

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Elasticity modeling

- Elasticity = -(% change in volume)/(% change in price)

    = -(% change in strike rate)/(% change in price ratio)

  - Strike rate: close (conversion, hit) rate (NB) or retention rate (RB)
  - Price ratio: competitive index (NB) or premium change (RB)

- Modeling basics:

  - Regression (e.g., logistic) used to predict close rate or retention rate
  - "Price ratio" is one of the predictors, and elasticity is derived from its coefficient
  - Relevant attributes are interacted with the price ratio
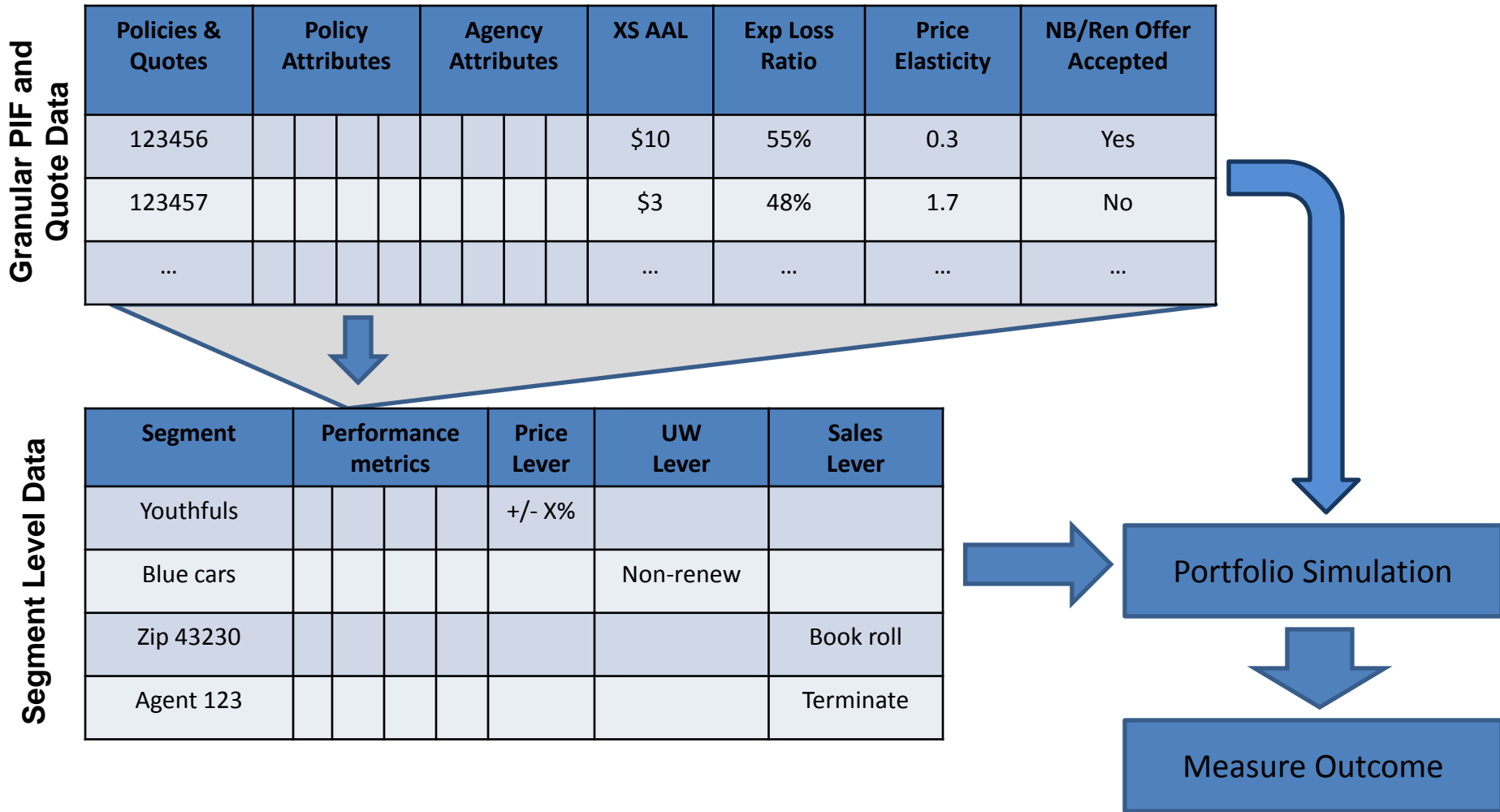 - Some transitions require separate elasticity models

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Elasticity modeling - Additional considerations

- Price versus price ratio
    - While price could be used in the model, price ratio simplifies the models.
    - A price "test" provides the cleanest data… but less practical in the U.S.

- Modeling method
    - Logistic regression ensures strike rates between 0 and 1.
    - Non-linear form required to guarantee that elasticity is in the right direction

- Correlation concerns
    - In loss modeling, correlations among the predictors is a minor concern.
    - In elasticity modeling, it is a critical concern.
    - The effect attributed to price must be correct, since price will be changing!
    - Only a price test ensures complete lack of correlation. Without it, elasticity modeling becomes a bit of an art.

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Simulation

- Simple segment level "simulation" can be misleading

- Policy level simulation (accounting for transition, elasticity, and underlying correlation) is hard

- Many optimal pricing decisions depend on a sophisticated understanding of policy transitions

  - Simple aging: driver age, home age, tenure, etc.

  - Stochastic changes for single attributes: limits change, single to multi-product, etc.

  - Complex policy changes: Adding youthful driver, replacing a car, etc.

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Simulation is used to predict the outcome of business decisions

Granular PIF and Quote Data

Policies & Quotes	Policy Attributes			Agency Attributes			XS AAL	Exp Loss Ratio	Price Elasticity	NB/Ren Offer Accepted
123456							$10	55%	0.3	Yes
123457							$3	48%	1.7	No
…							…	…	…	…

Segment Level Data

Segment	Performance metrics			Price Lever	UW Lever	Sales Lever
Youthfuls				+/- X%		
Blue cars					Non-renew	
Zip 43230						Book roll
Agent 123						Terminate

Portfolio Simulation

Measure Outcome

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Conclusions/Benefits

- Consultants claim a lift in "2-6 points of Combined Ratio"
- Better forecasting of financial results, even if no factor selections are influenced by these studies
- Better understanding of the impact of competitor strategies
- Replace anecdotal evidence and intuition with a quantitative framework for research, product, and field to debate merits of pricing decisions

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