

# Uncovering Opportunities from Understanding Price Elasticity

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# Agenda



What do demand models tell us?

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What is the value of incorporating demand models for pricing?

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Why has demand models not been widely adopted yet?

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How can we use demand models to make business decisions?

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How to get started?

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# What do demand models tell us?

# Understanding Demand

- A potential customer with the following profile asks for an insurance quote from us.
- We know he is:
  - A 40 year-old male driver
  - Drives a 3-year old Toyota Camry
  - No claims in the past 5 years
  - Lives in Marine Parade
- We quote him **\$800**

What is the probability of **acceptance**?

**Demand** is the quantity of a good that consumers are willing and able to purchase at a price.

Insurance

# Understanding Price Elasticity

- A potential customer with the following profile asks for an insurance quote from us.
- We know he is:
  - A 40 year-old male driver
  - Drives a 3-year old Toyota Camry
  - No claims in the past 5 years
  - Lives in Marine Parade
- We quote him **\$800 or \$900**

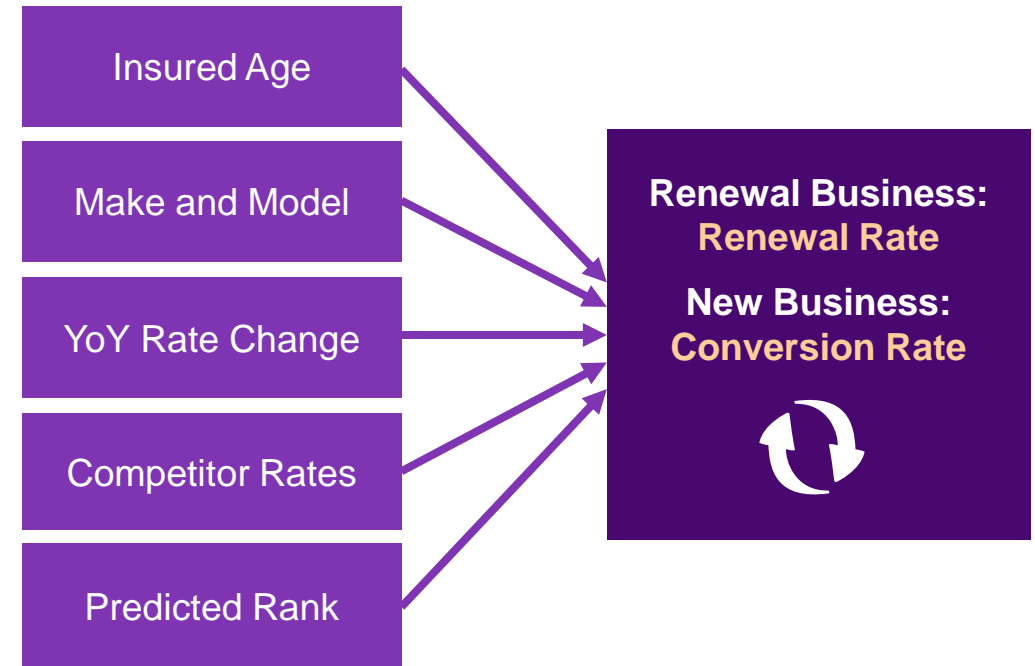
How does the probability of **acceptance** change?

**Demand** is the quantity of a good that consumers are willing and able to purchase at a price.

**Price Elasticity** is the measure of how sensitive the demand is to changes in price.

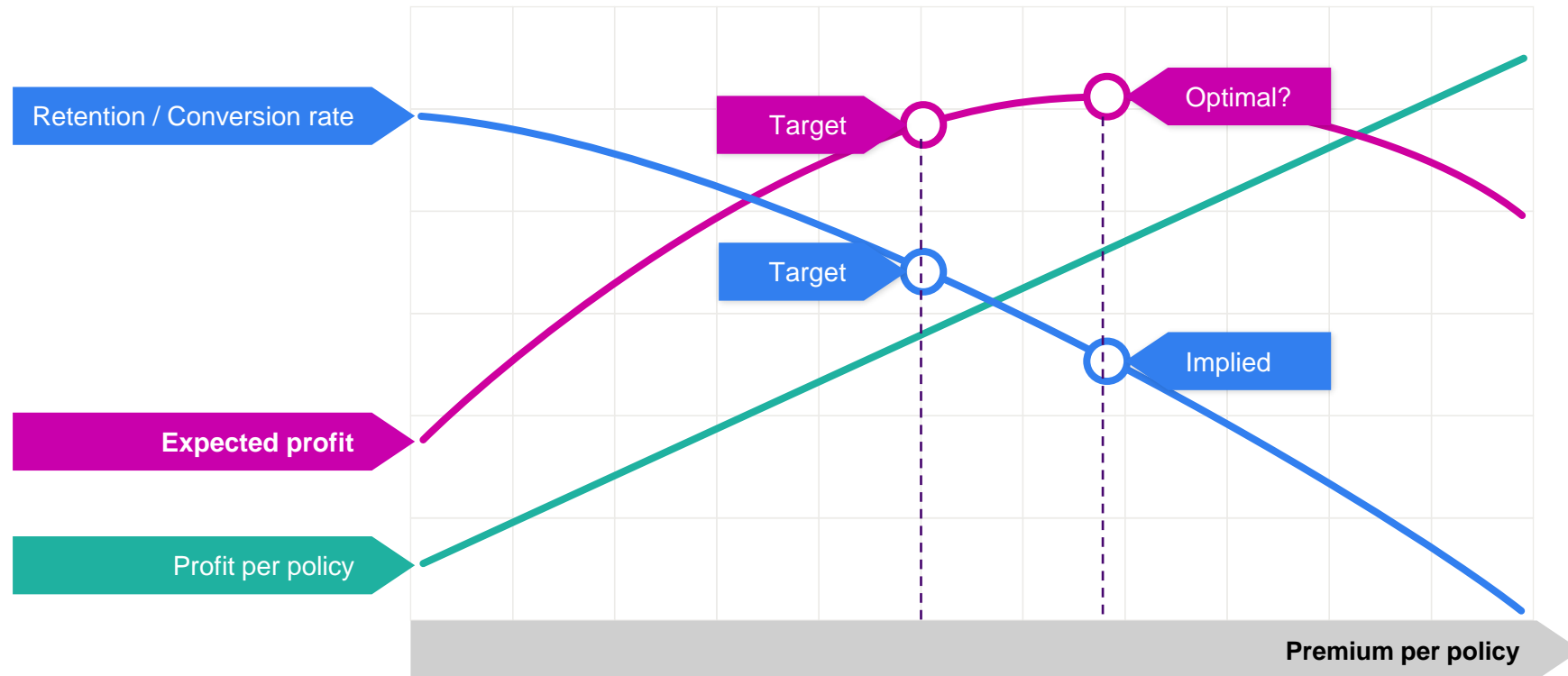
# What is a Demand Model?

- A model of **customer behaviour** which seeks to **predict future purchasing behaviour** based on an analysis of past purchasing behaviour
- Looks at the **propensity** for a customer to **purchase** a product and how this propensity changes with the price of the product



What is the value of incorporating demand models for pricing?

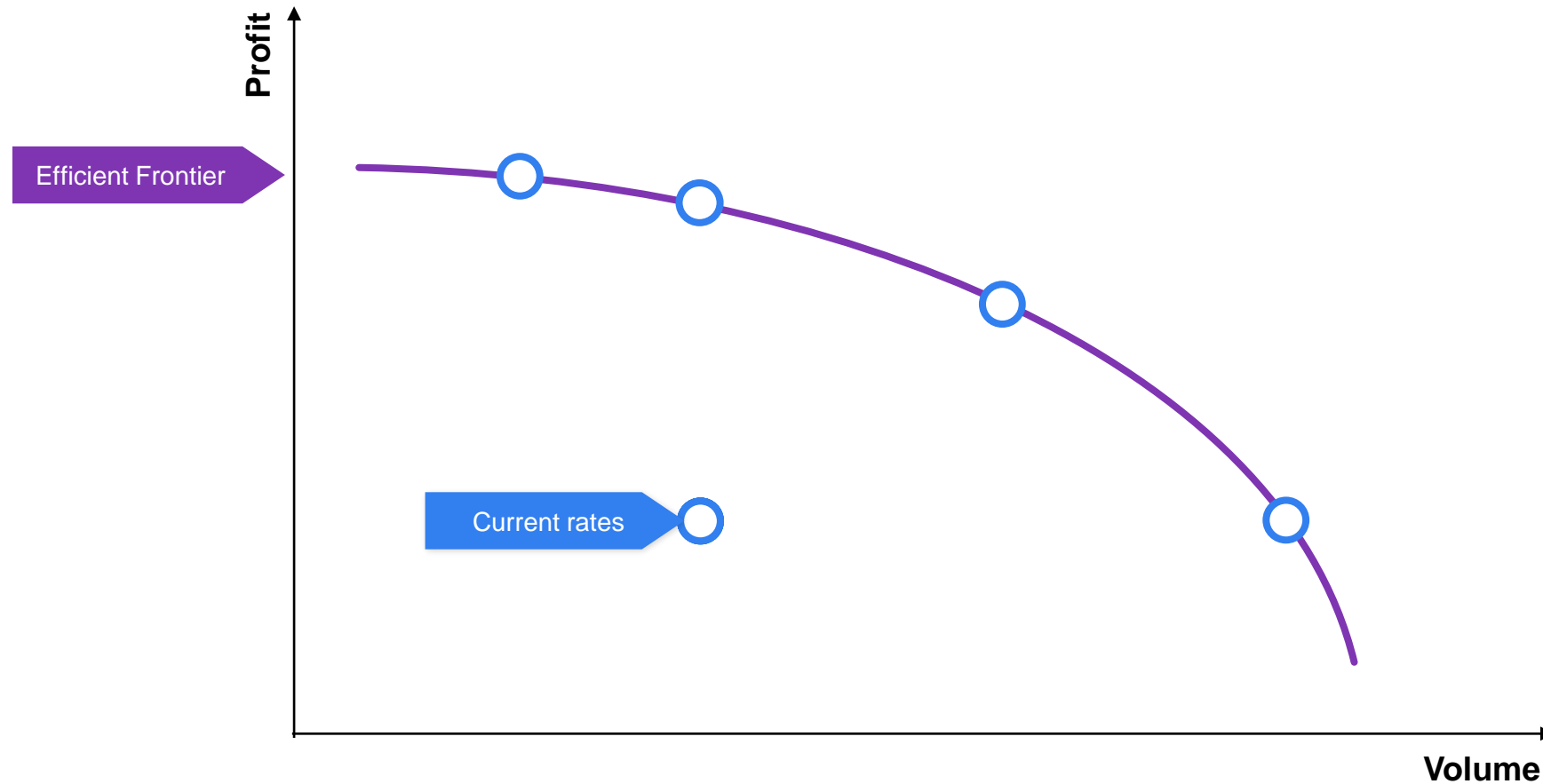
# The Profit-Volume Tradeoff





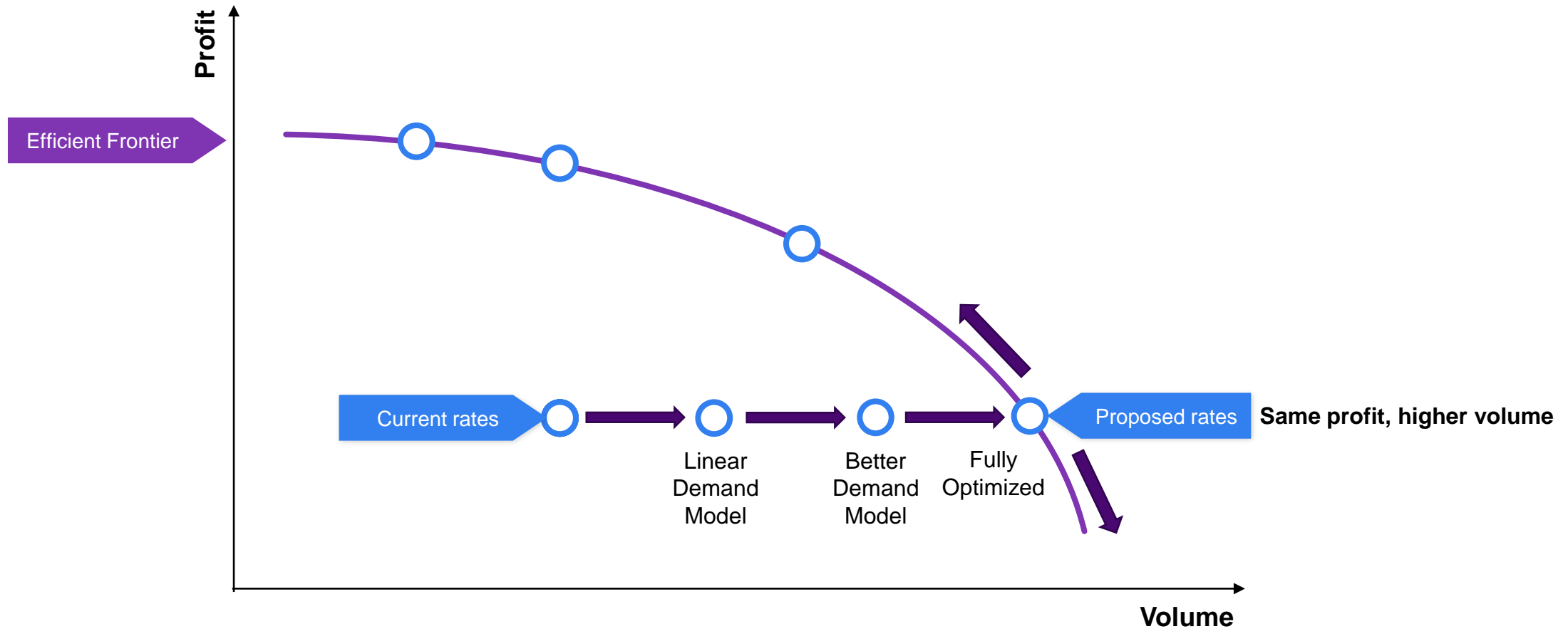
# Price Optimization

Inefficiencies drive opportunities to optimize



# Price Optimization

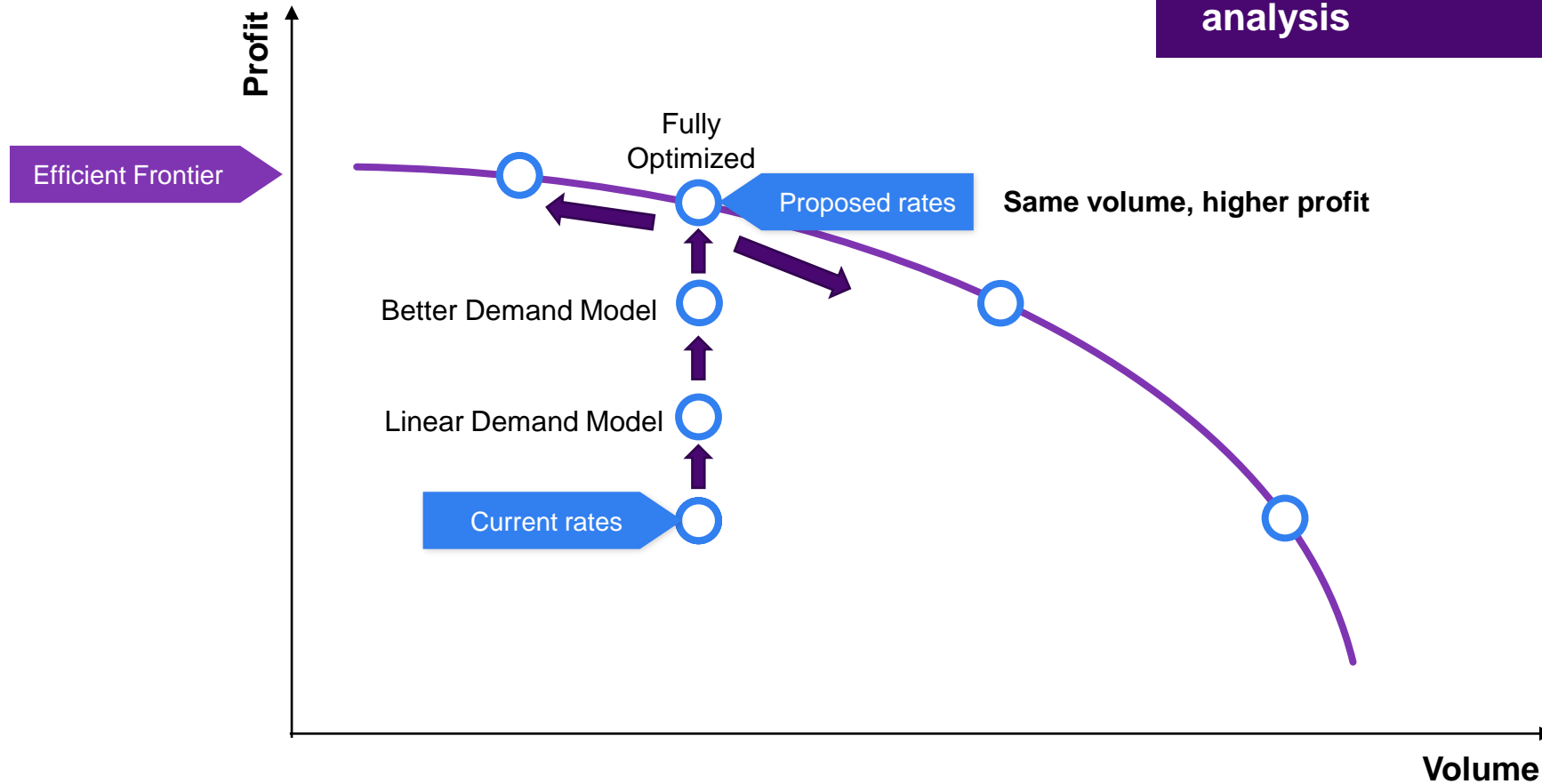
Inefficiencies drive opportunities to optimize



# Price Optimization

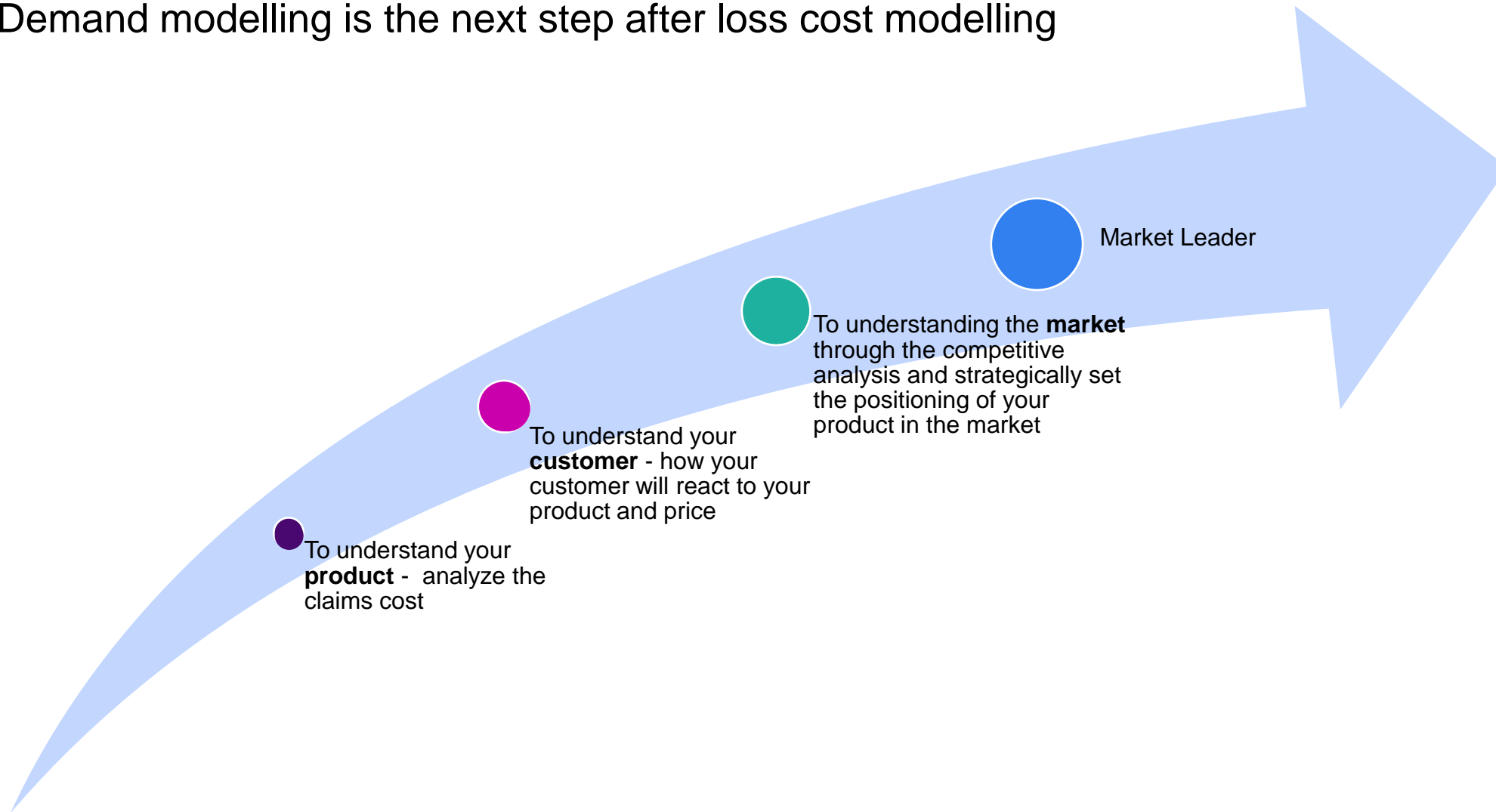
Inefficiencies drive opportunities to optimize

Underwriting results can be improved by incorporating demand models into pricing analysis



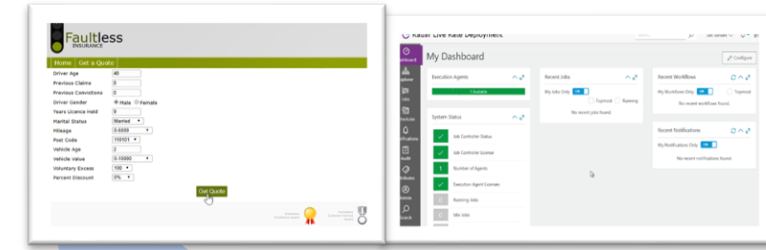
# Part of the Journey Toward Pricing Best Practice

Demand modelling is the next step after loss cost modelling



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Demand modelling is the next step after loss cost modelling



Dynamic pricing & agile rate deployment

Optimized pricing model

Market pricing model

Competitor analysis

Scenario test

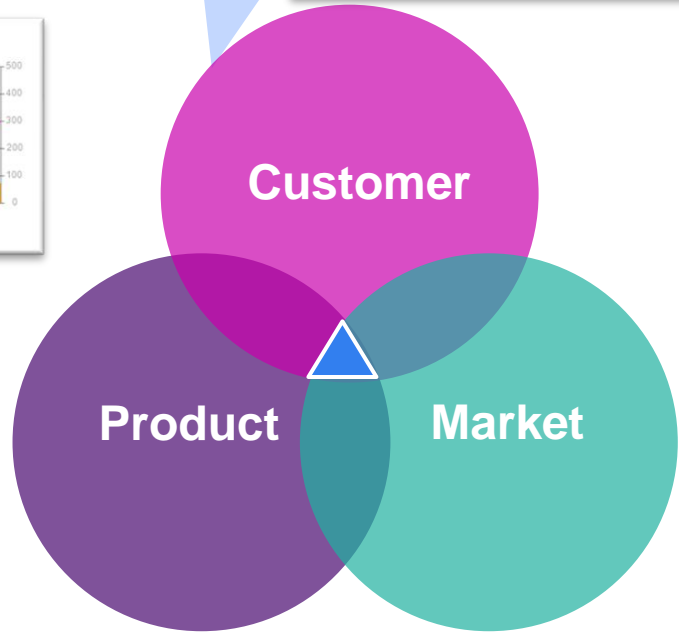
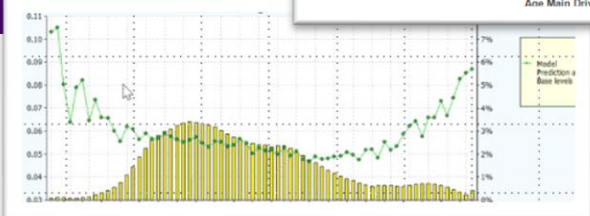
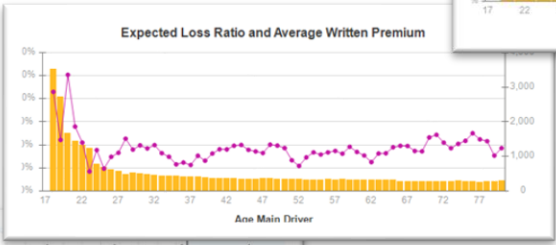
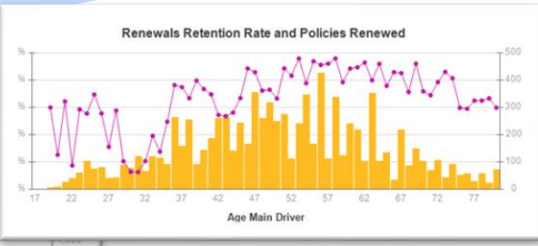
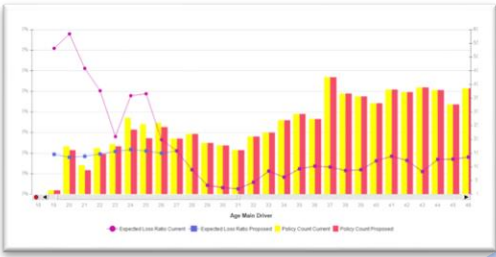
Better demand model

Simple demand model

MI dashboards

GLM loss cost model

Traditional 1 way analysis



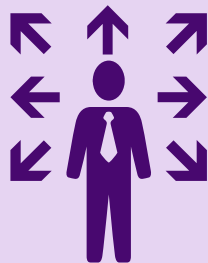
# Value of Incorporating Demand Model

Other potential insights that demand models provide

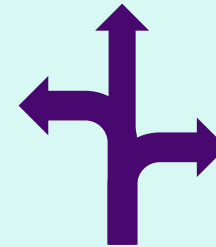
Overlay demand with profitability to identify target customer segments



Identify up-sell and cross-sell opportunities



Scenario testing to understand profit-volume tradeoff



Maximize customer lifetime value



Why has demand models not been widely adopted yet?

# Factors Hindering the Adoption of Demand Models

## Lack of quality data

- No existing quote database for new business
- Difficulty in obtaining competitor prices
- Data cleaning/management is too onerous



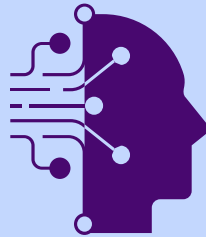
## Lack of capability and capacity

- Lack of predictive modelling expertise
- Conflicting priorities



## Lack the tools to perform the modelling

- Lack of software tools for modelling
- Insufficient computing power



## Regulatory constraints

- Tariff pricing limits extent of price optimization
- Restrictions on deviating from risk-based pricing (e.g. rate differential between new vs renewal business)
- Customer complaints / unfairly discriminatory

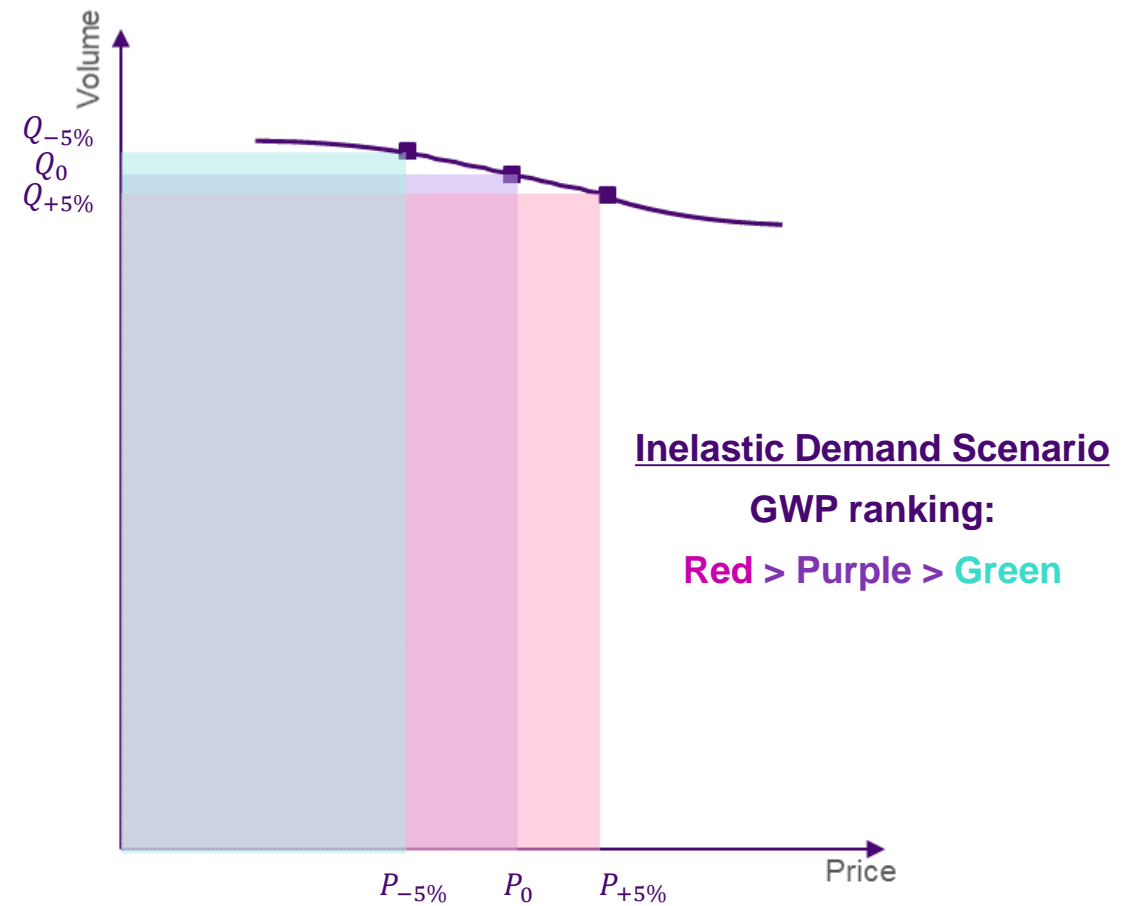
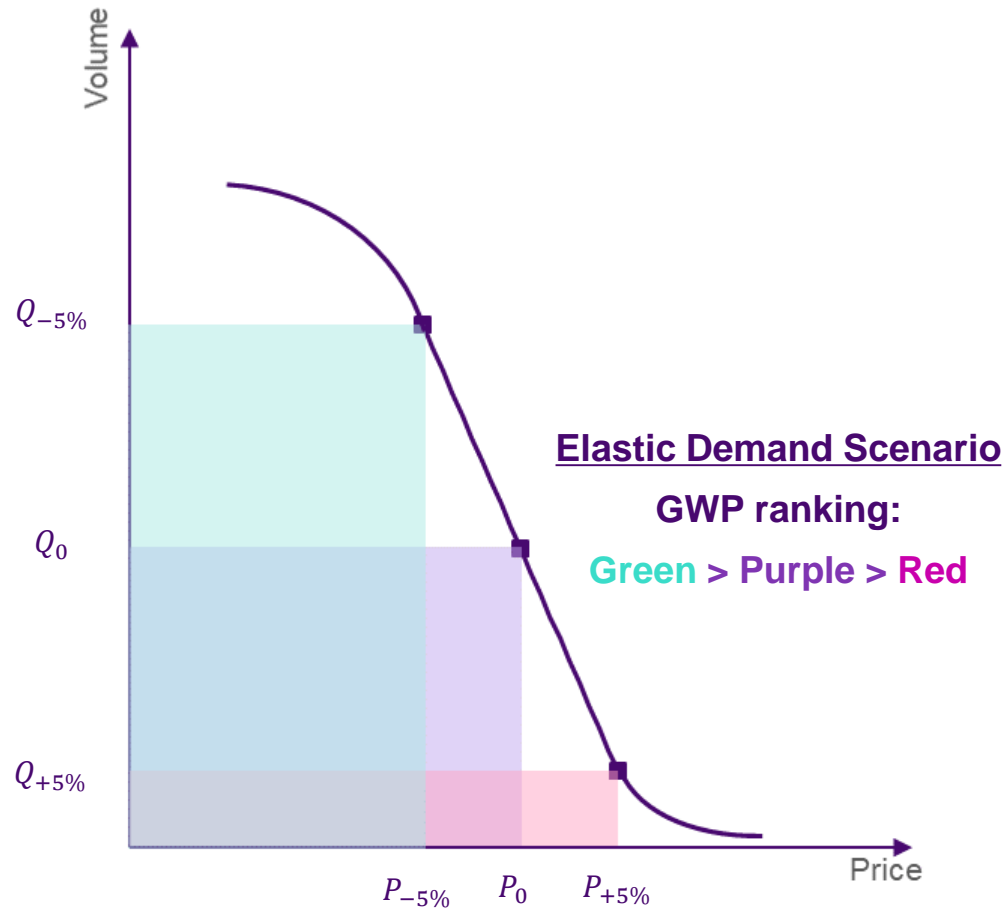




How can we use demand models to make business decisions?

# Why does Price Elasticity Matter?

Take different price actions depending on elasticity to improve business volume



# Optimizing Prices Based on Elastic Demand

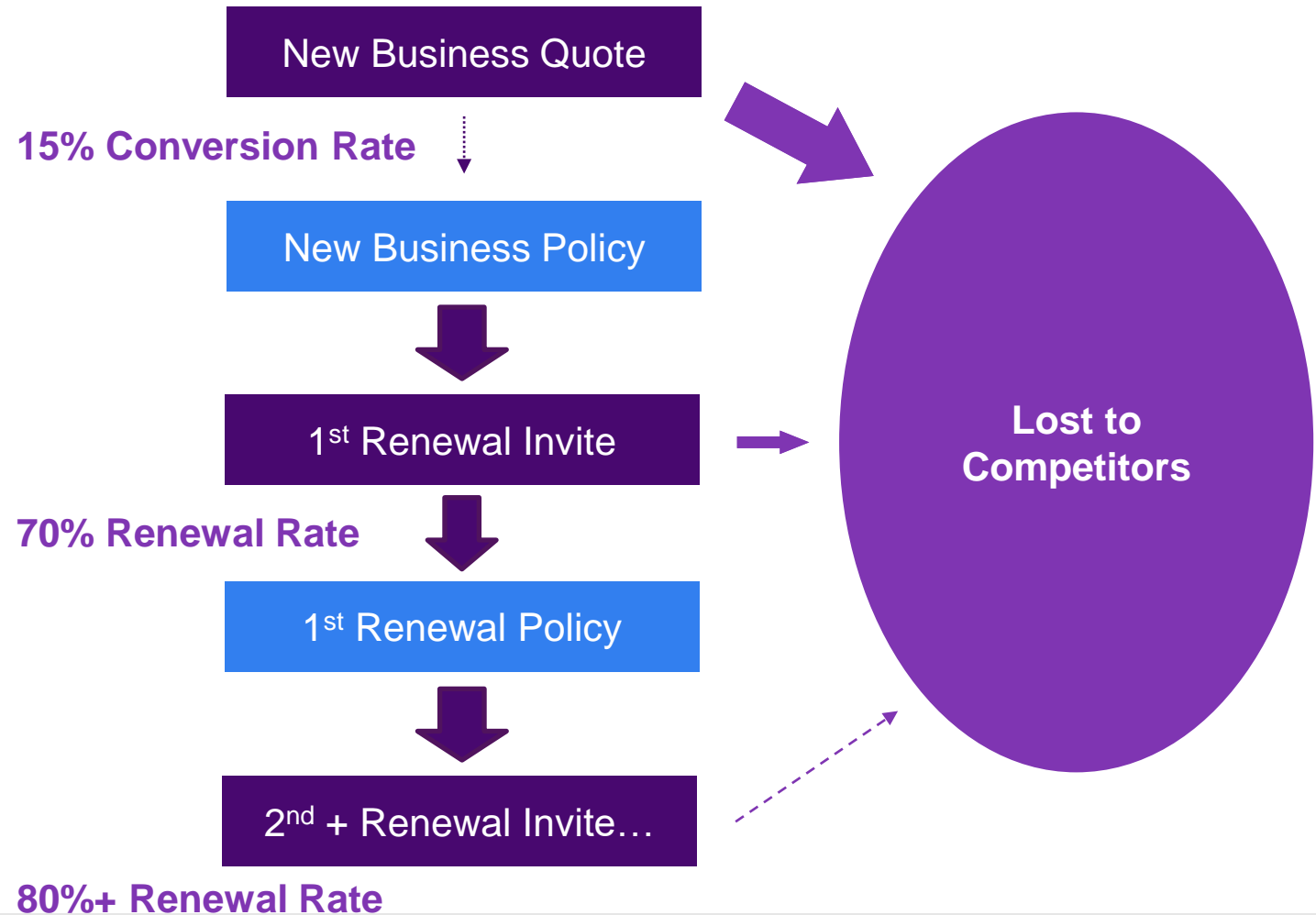
Loss ratio deterioration is not always bad

		Current	Option 1	Option 2
Rate change			-10%	+10%
Average premium rate	A	800	720	880
Average loss cost	B	400	400	400
<b>Average profit (before expenses)</b>	<b>C = A – B</b>	<b>400</b>	<b>320</b>	<b>480</b>
Price elasticity			3.0 (relatively elastic)	
Demand change			+30%	-30%
<b>Policy count</b>	<b>D</b>	<b>100</b>	<b>130</b>	<b>70</b>
Expected GWP	A x D	80,000	93,600	61,600
Expected claims	B x D	40,000	52,000	28,000
<b>Exp. profit (before expenses)</b>	<b>C x D</b>	<b>40,000</b>	<b>41,600</b>	<b>33,600</b>
<b>Expected loss ratio</b>		<b>50.0%</b>	<b>55.6%</b>	<b>45.5%</b>

Higher profit despite  
deterioration in loss ratio

# New Business / Renewal Strategy

- It is often more difficult to acquire new customers (more price-elastic) than retain existing customers (more price-inelastic)
- Aggressive “loss-leader” discounting / marketing to attract new business
- Progressively reduce discounting / increase rates on renewal business



# Customer Lifetime Value Analysis

## Multi-year modelling

Age 25 Driver	Prem	Loss + Expenses	Profit	Renewal Probability	Cum Renewal Probability	Weighted Average Profit
New	1,000	1,050	-50	100%	100%	-50
Renewal1	900	900	0	70%	70%	0
Renewal2	800	750	50	70%	49%	+24.5
Renewal3	700	600	100	80%	39%	+39.2

**4-year expected profit = +13.7**

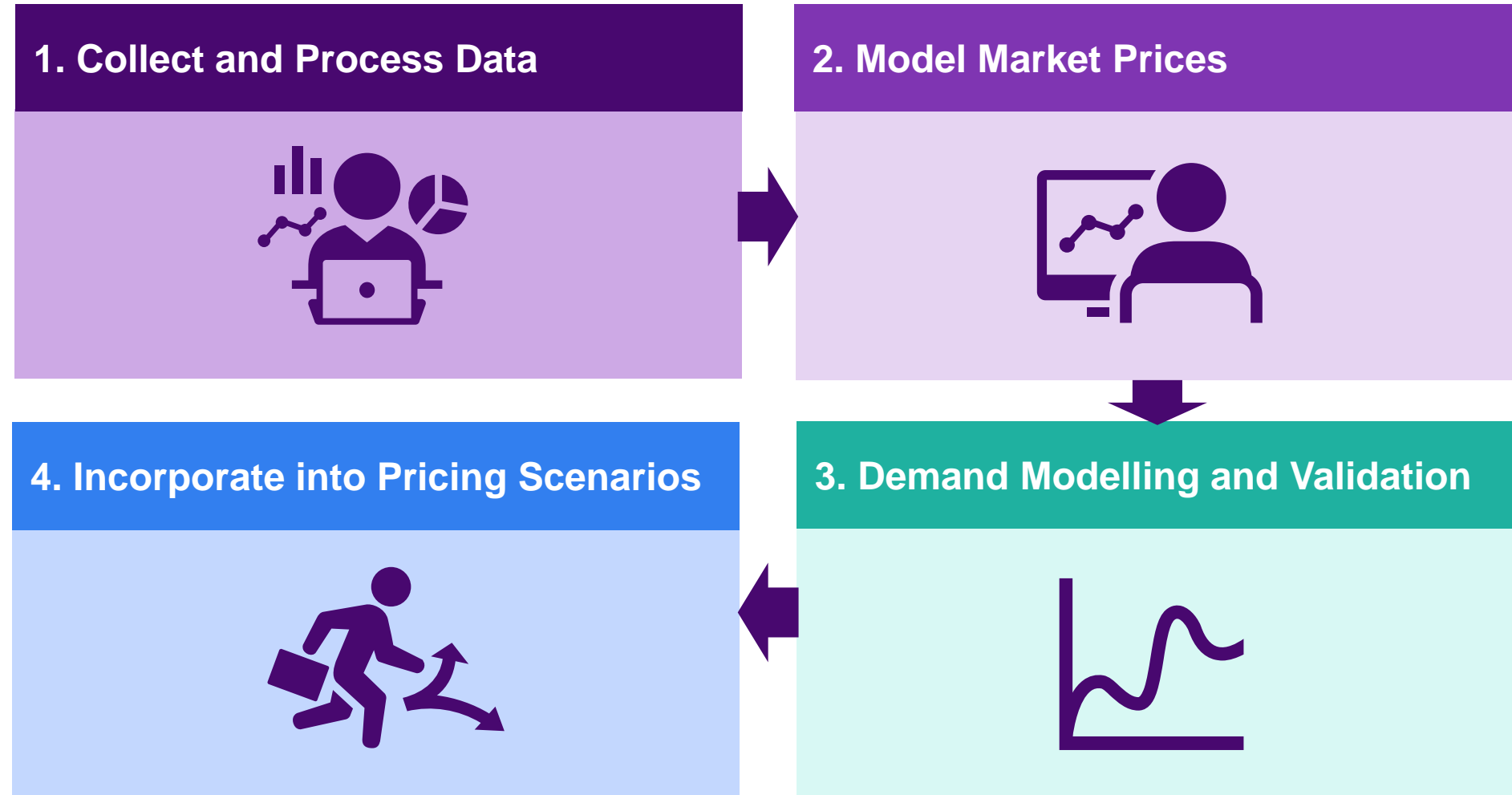
Age 70 Driver	Prem	Loss + Expenses	Profit	Renewal Probability	Cum Renewal Probability	Weighted Average Profit
New	600	550	50	100%	100%	+50
Renewal1	600	600	0	80%	80%	0
Renewal2	600	650	-50	80%	64%	-32
Renewal3	600	650	-50	90%	58%	-28.8

**4-year expected profit = -10.8**

# How to get started?

# How to Get Started with Demand Modelling?

Assess the business outcomes under different scenarios to set commercial rates



# Data Collection and Processing

Conversion and retention modelling should ideally be analyzed and modelled separately as new and renewal customers exhibit different purchasing behaviour

## Renewal Business – Retention Modelling

- Information of expiring policies due for renewal should be captured
- Policies from current and previous years may need to be merged to determine renewal flag and YoY premium change
- If there are mid-term endorsements, only the final renewal invitation should count.
- Cancelled policies not invited for renewal should be excluded
- Allow sufficient time for policyholder to accept the renewal
- Define a renewal flag (0 or 1) whether a renewal invite was accepted

## New Business – Conversion Modelling

- Information of all quotations should be captured, not just the successful conversions
- Define what is a unique quote e.g. if a customer varies the quote by modifying coverage options does it register as another quote
- Define a conversion flag (0 or 1) depending on whether a quote was converted into a policy or not
- Collect competitor prices



# Data Collection and Processing

Take appropriate steps to improve the quality of quotation data

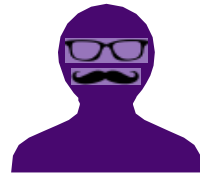
## Duplicate Quotes



<u>Quote ID</u>	<u>Name</u>
000001	P. Venkman
000002	P. Venkman
000003	P. Venkman
000004	P. Venkman
000005	P. Venkman

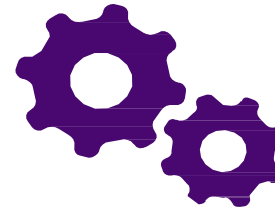
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## Fake Quotes



<u>Name</u>	<u>Email</u>
R. Stantz	Test@test.com
R. Stantz	NDSJDNBIASFB

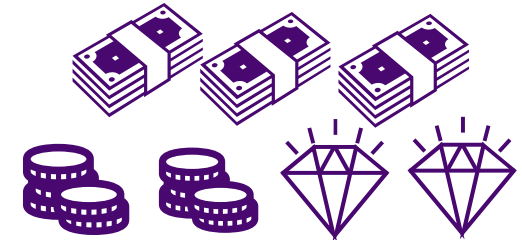
## Automated Quotes



<u>Name</u>	<u>Time</u>
E. Spengler	4.01am
W. Zeddemore	4.01am
D. Barrett	4.01am
J. Melnitz	4.01am
L. Tully	4.01am

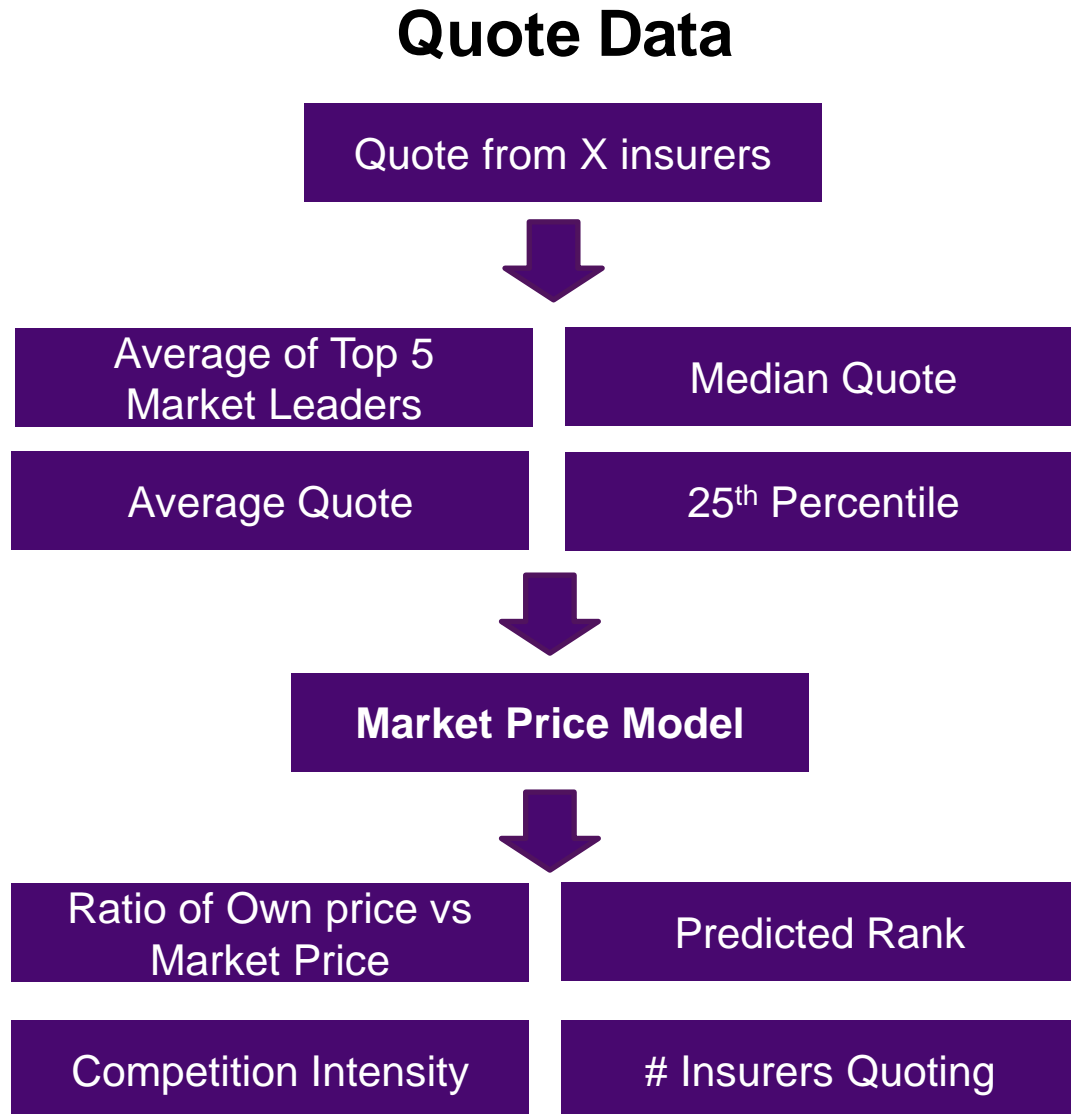
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## Uncompetitive Quotes



<u>Name</u>	<u>Premium</u>
Simon Limer	\$9,999.99

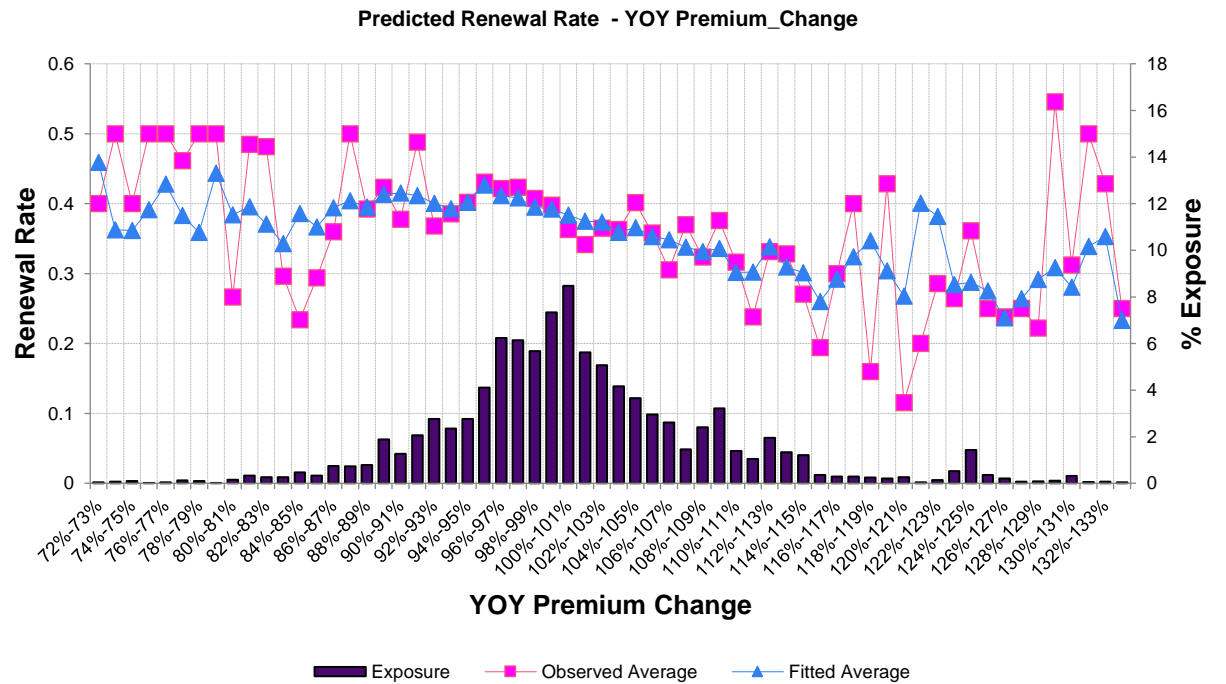
# Modelling Market Prices



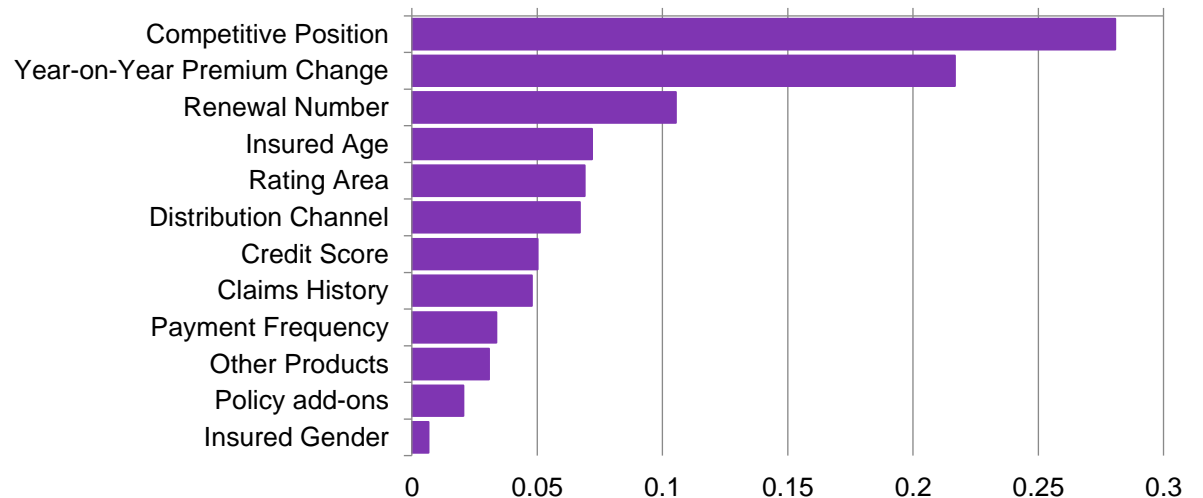
- As a start point, we can model metrics immediately available on recent quote data. This approach is the one most commonly employed by the market, with some market pricing models developed to inform pricing competitiveness
- Using the deconstructed prices from market pricing models, we can then calculate comparative statistics of own price vs market price and use this as a factor within the demand model.

# Modelling Demand

- A commonly used technique is to fit a Generalized Linear Model (GLM) with a logit link and binomial error structure
- Iteratively include variables in the model, considering
  - Statistical significance (e.g. chi-square test, AIC)
  - Does the trend make logical sense?
  - Correlations and interaction effects
  - Observed vs Fitted
  - Test on holdout dataset
- Machine learning methods such as Gradient Boosting Machines (GBM) can also be used to supplement GLMs

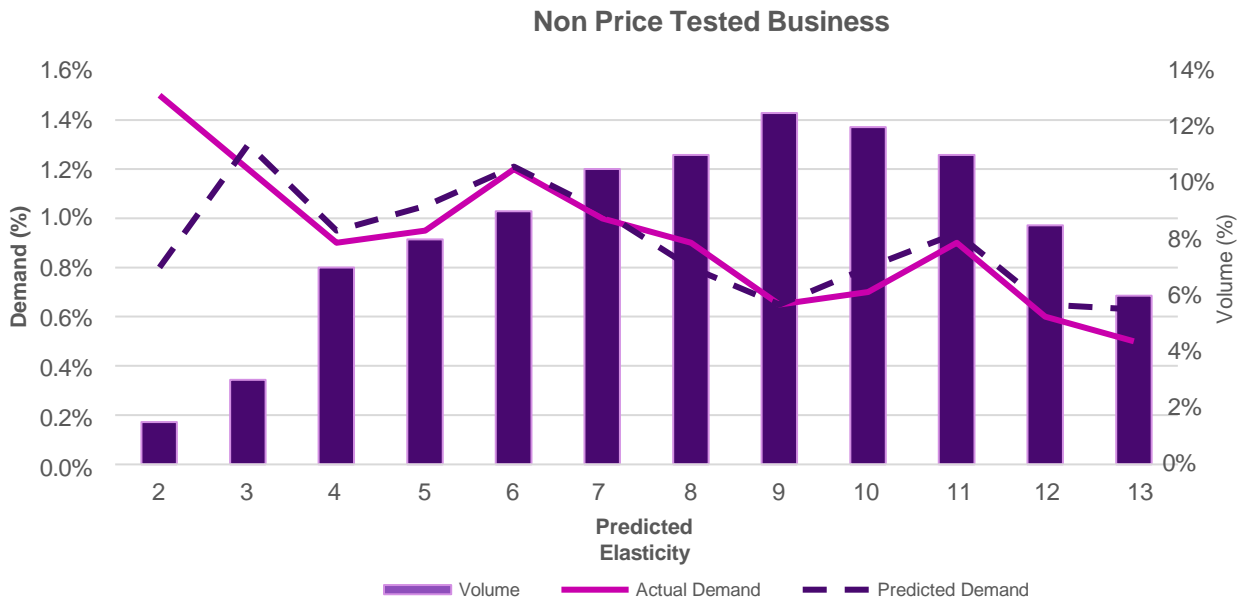


## Factor Importance

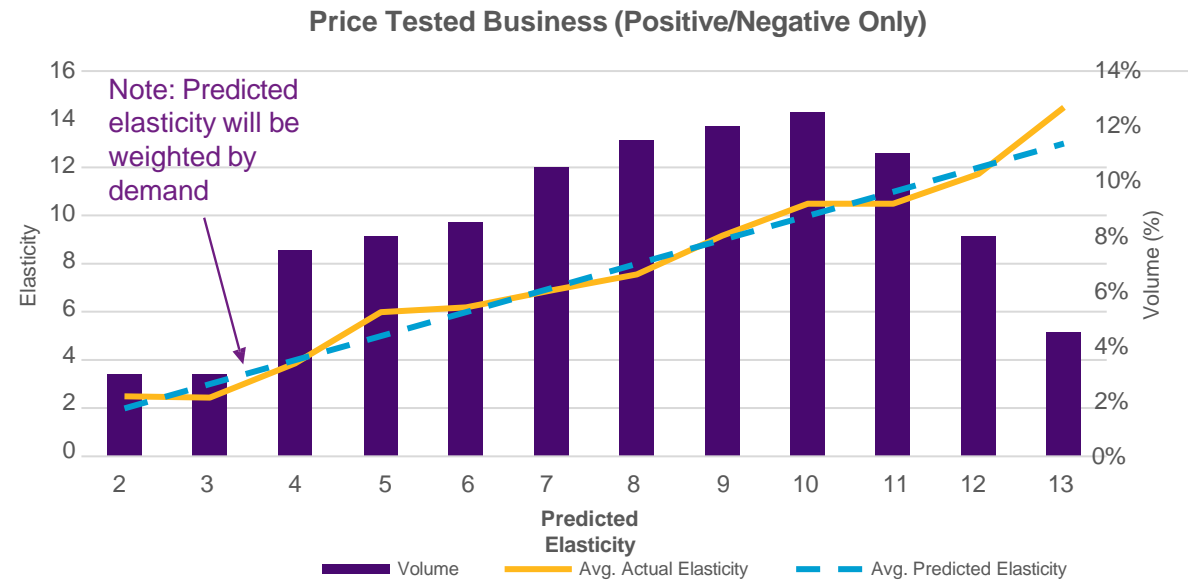


# Validating the Demand Model

**1** Validate model by looking at actual vs. predicted demand on non-price tested business, split by predicted elasticity

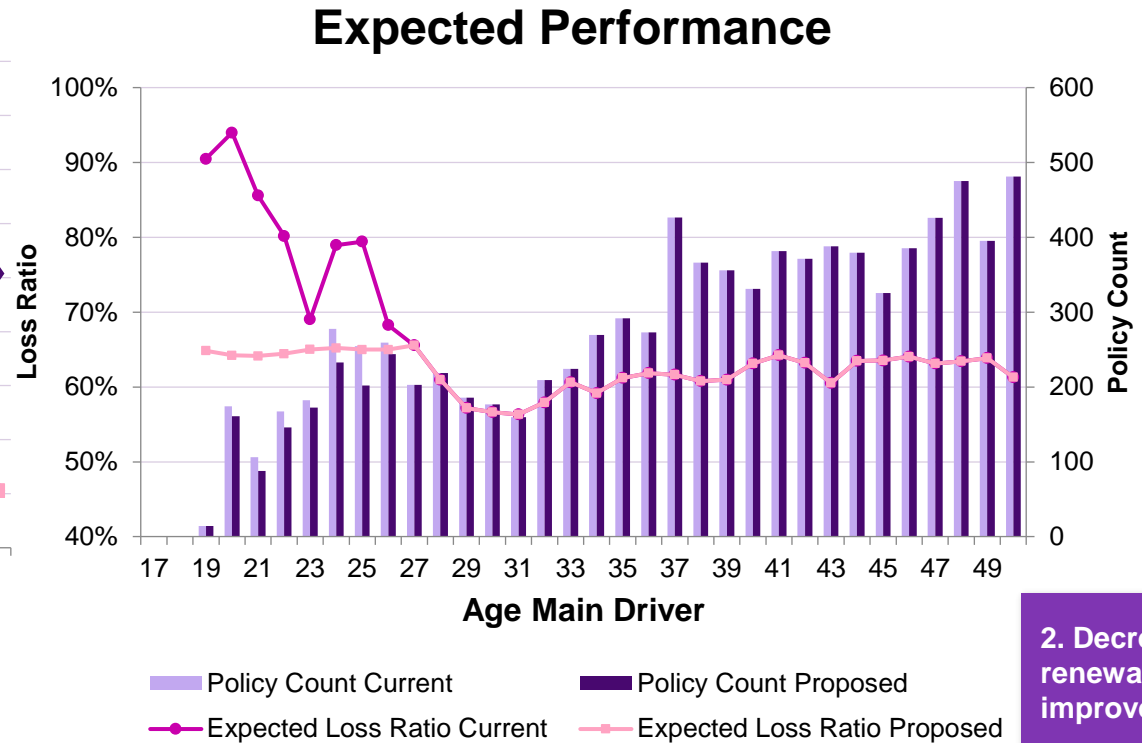
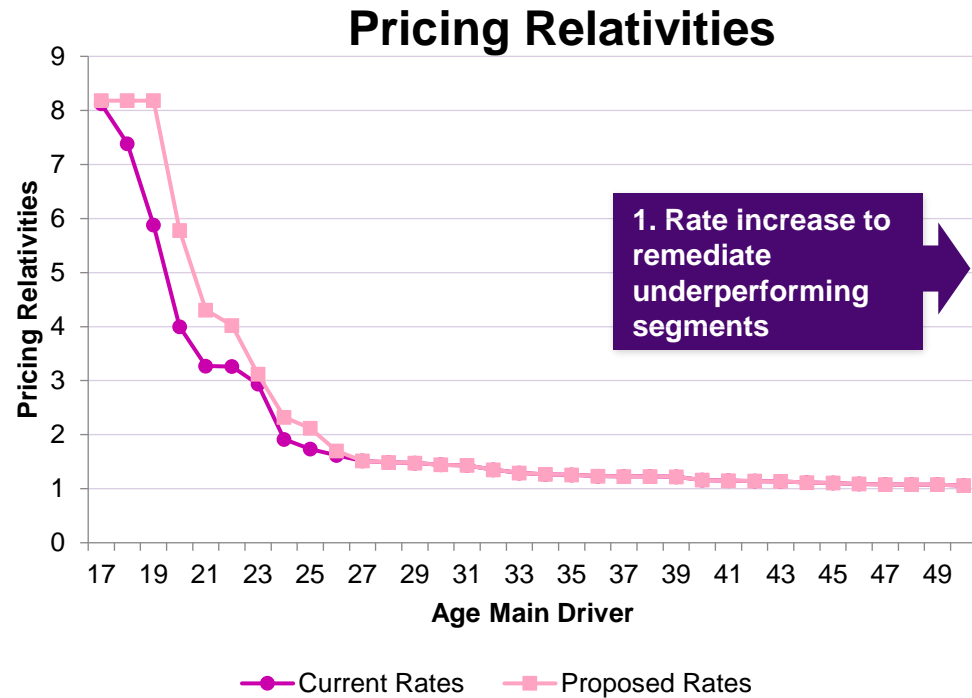


**2** Validate elasticity using lift charts, looking at positive price tests and negative price tests separately



Verify that predicted demand is broadly equal to actual demand for all predicted elasticities

# Incorporate Demand Models into Scenario Testing



3. Improvement in underwriting performance

	Policy Count	Cost	Contribution	Profit
Current	18,619	4,885,392	2,364,060	1,973,065
Proposed	18,443	4,754,453	2,669,345	2,282,047

4. Further price optimization



# It is not difficult to get started on demand modelling!

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Thank you!