Price Optimization

Case Study

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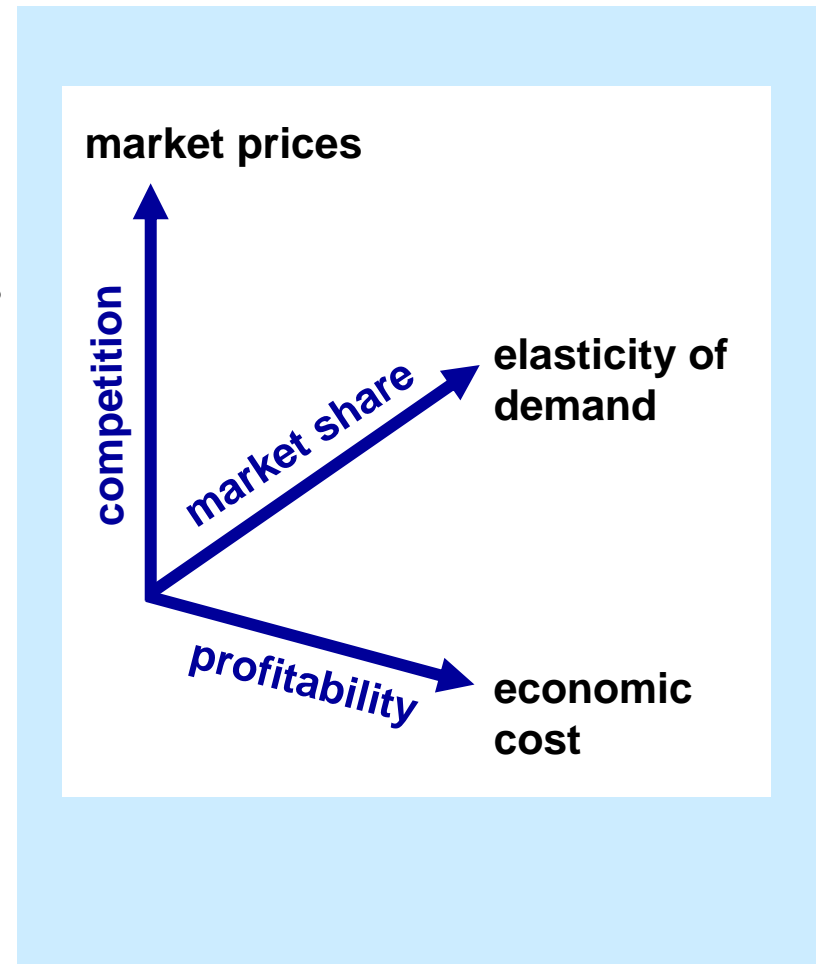**Senior Actuarial Analyst**

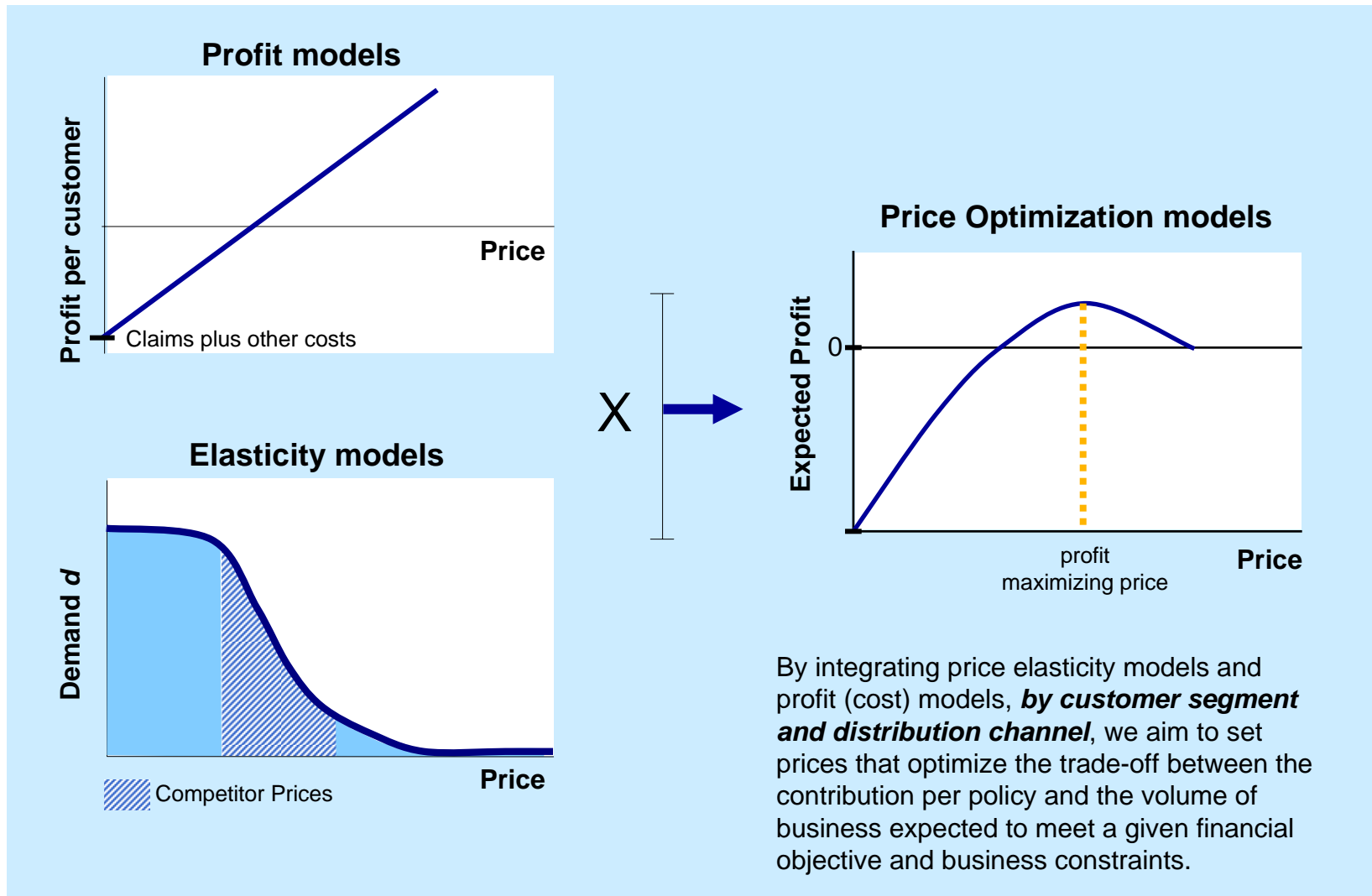*October 2008*

Introduction to price optimization

The next frontier in pricing management

- To set **optimized prices** we need......

  - **Cost models** which predict the net loss and allocated costs for different types of customers
  - **Competitive Market Analysis** which provides a thorough understanding of the marketplace in which a company is operating
  - **Customer price elasticity models** which reflect market competition and customer behavior so as to predict the new business and renewal rate at various prices for different types of customers
  - **Optimization techniques** which integrate these models to predict the profit/volume impact of price changes, and to identify the best price changes for a given financial objective within constraints

market prices

competition

market share

elasticity of demand

profitability

economic cost

The Price Optimization equation

Profit models

Profit per customer

Price

Claims plus other costs

Elasticity models

Demand *d*

Price

Competitor Prices

X →

Price Optimization models

Expected Profit

0

profit
maximizing price

Price

By integrating price elasticity models and profit (cost) models, *by customer segment and distribution channel*, we aim to set prices that optimize the trade-off between the contribution per policy and the volume of business expected to meet a given financial objective and business constraints.

Case study

Price optimization focused on better management of the renewal portfolio

Context

- The company was providing quotes for personal renewal considering only profitability, past claims experience and previous premium
- The market entered a price war

Objectives

- Improve the renewal process
- Forecast the impact of different strategies on profitability and premium volume
- Maximize retention and expected profit

Solutions Provided

- Claims cost per policy
- Competitive market analysis for the specific profile of the portfolio
- Elasticity of demand study
- Forecast tool to estimate renewal rate for a given pricing strategy
- Optimized prices subject to the objectives and business constraints of the company
- Evaluate different pricing strategies

Steps

- An analysis of claims (GLM model) and expenses was previously performed
- The steps were the following:
  1. Agree to objectives and constraints
  2. Gap analysis
  3. Competitive market analysis
  4. Renewal analysis
  5. Measure and model customer price elasticity for new and renewal business
  6. Optimization of pricings within constraints
  7. Implementation

Case study is based on a European company - rate regulations are different in the US

Agree to objectives and constraints

Illustrative example

- Initial project kick-off meeting to further understand the company's strategy and financial objectives for the Price Optimization process

- Establish:
    - Maximization/minimization function: Maximize Expected Profits
    - Time line (One year)
    - Business constraints:
        — Global (Target retention rate)
        — Individual (Base on individual policy profiles):
            – Number of claims in the previous years (0, 1, 2, >2)
            – Tenure (< 4 years; >= 4 years)
            – Historical loss ratio (<45%; >= 45%)
    - Implementation approach

Gap analysis

Illustrative example

- Understand how much of the information and analysis is already available through previous work

- Use existing company pure pricing models based on expected cost of claims as an input to the optimization process. This is a fundamental part of the process and one which will have a significant impact on profitability

- Understand the current rating structure and what enhancements and additional flexibility might be required to meet the objectives

- Assess cultural readiness for price optimization

Competitive Market Analysis (CMA)

Illustrative example

- CMA is a fundamental part of an insurance company's pricing management processes and a key input into the process of Price Optimization:

  - Understand the positioning of the company's rates in the market at any point in time

  - Help identify segments where the company's prices are relatively cheap/expensive relative to the market

  - Understand the intensity of competition in each segment

  - Understand the scope for price changes and what impact such changes would have on market positioning
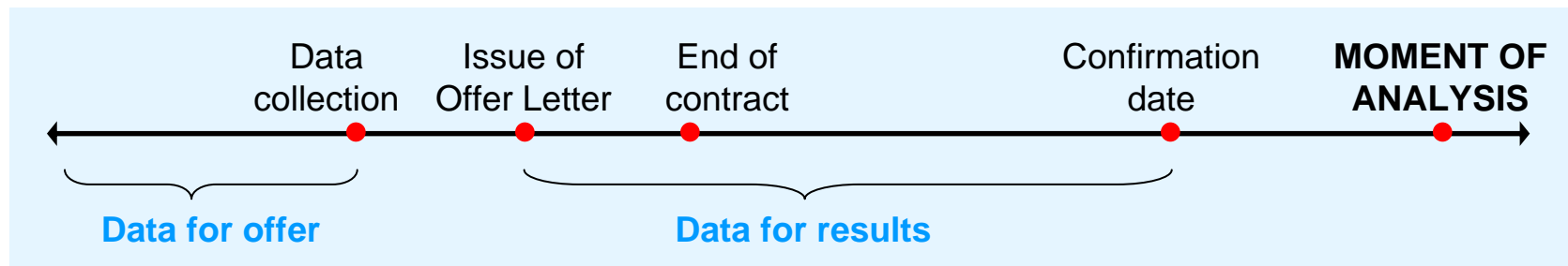
  - Key input into later steps

Renewal analysis

Illustrative example

- **What is it?**

  - The renewal rate is defined as a customer (who has been offered renewal) stays with the company 12 weeks after expiration date
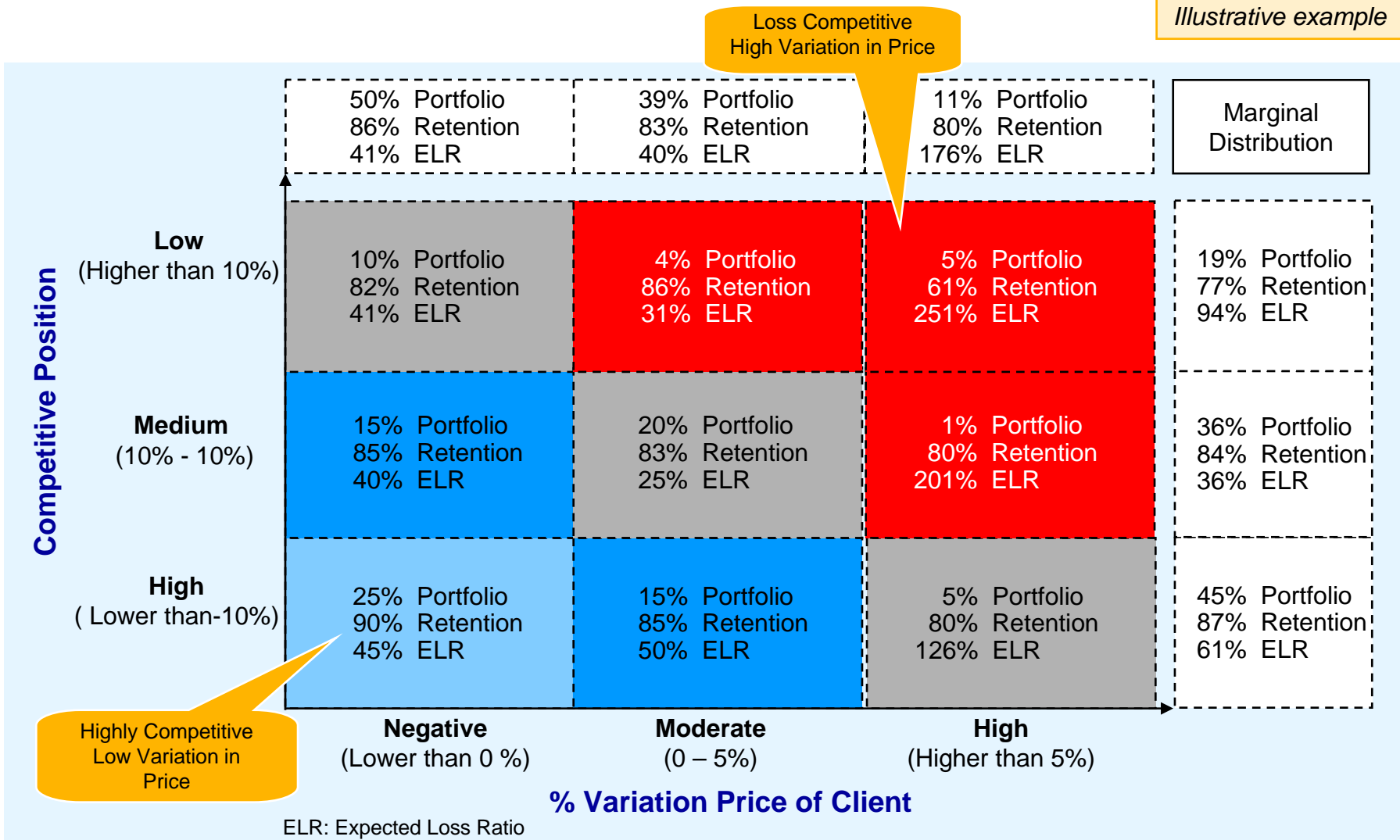
- **How is it used?**

  - Assess how variable the renewal rate is across the portfolio and identify segments of the business that have higher/lower than average rates

  - Combine with the CMA to assess how good a predictor the competitiveness measure is of retention - by customer segment and over time

  - Provide initial insight into customer elasticity; e.g., what happened to retention rates when previous price changes were implemented?

  - Assess how retention rate varies as a function of price change at renewal

- Data used for the statistical estimation of customer renewal demand:

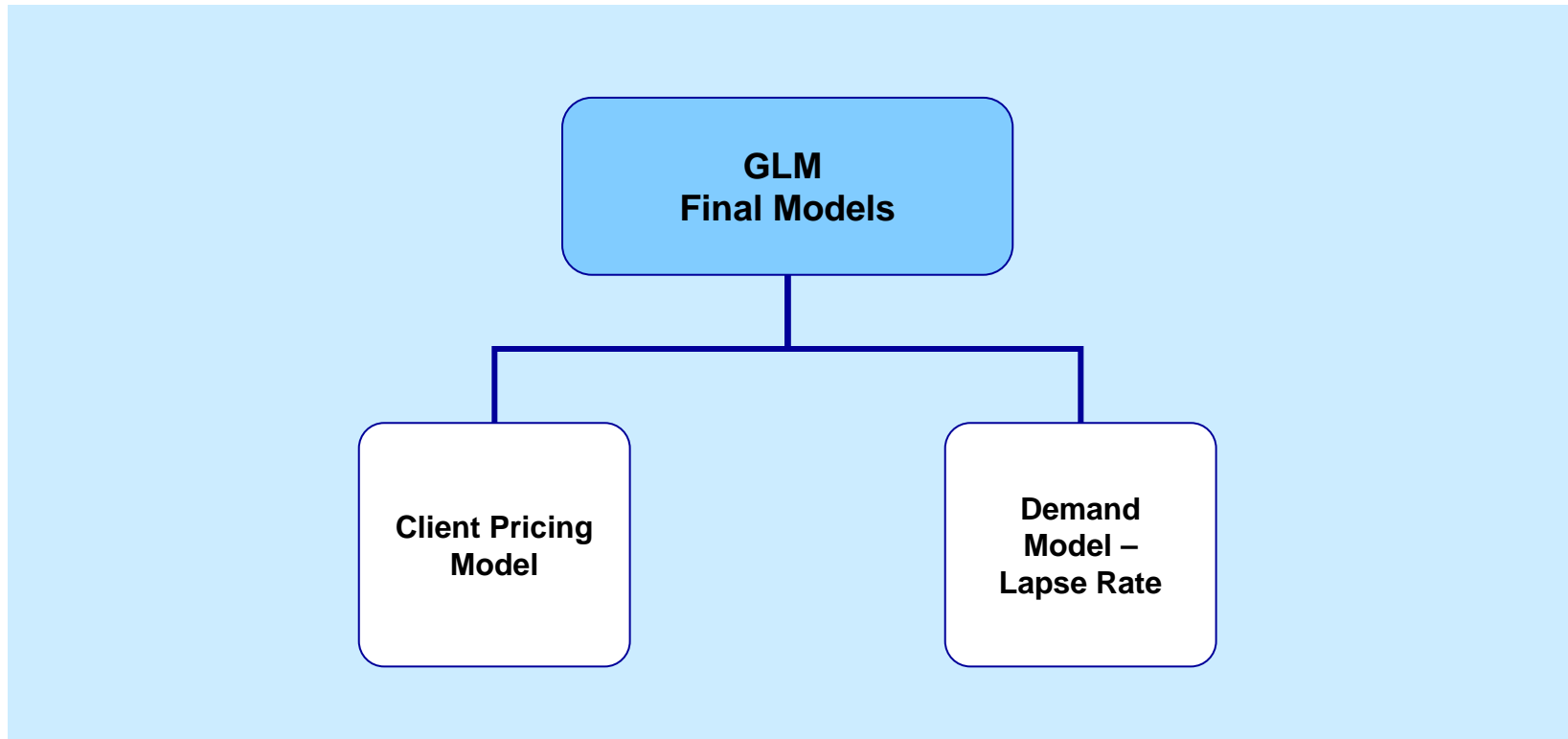 - All car policies renewed from January 2007 and December 2007

Data collection	Issue of Offer Letter	End of contract		Confirmation date	MOMENT OF ANALYSIS

Data for offer   **Data for results**

Price Variation vs. Competitive position

Illustrative example

**Loss Competitive
High Variation in Price**

	Negative (Lower than 0 %)	**Moderate** (0 – 5%)	**High** (Higher than 5%)	**Marginal Distribution**
	50% Portfolio / 86% Retention / 41% ELR	39% Portfolio / 83% Retention / 40% ELR	11% Portfolio / 80% Retention / 176% ELR	
Low (Higher than 10%)	10% Portfolio / 82% Retention / 41% ELR	4% Portfolio / 86% Retention / 31% ELR	5% Portfolio / 61% Retention / 251% ELR	19% Portfolio / 77% Retention / 94% ELR
Medium (10% - 10%)	15% Portfolio / 85% Retention / 40% ELR	20% Portfolio / 83% Retention / 25% ELR	1% Portfolio / 80% Retention / 201% ELR	36% Portfolio / 84% Retention / 36% ELR
High (Lower than-10%)	25% Portfolio / 90% Retention / 45% ELR	15% Portfolio / 85% Retention / 50% ELR	5% Portfolio / 80% Retention / 126% ELR	45% Portfolio / 87% Retention / 61% ELR

Competitive Position (y-axis)

% Variation Price of Client (x-axis)

**Highly Competitive
Low Variation in
Price**

ELR: Expected Loss Ratio

Customer price elasticity
Summary of models

```
        GLM
     Final Models
```

| Client Pricing Model | Demand Model – Lapse Rate |

Customer price elasticity
Possible explanatory variables

Policy characteristics

- Renewal month
- Discounts/surcharges
- Coverage
- Actual premium
- Absolute change in premium
- Percent premium change
- Amount of difference with market
- Percent of difference with market
- Policy years with carrier
- Account years with carrier

Risk characteristics (Driver)

- Driver
  - Years without claims
  - Driver's age
  - Driver's gender
  - Driver's years of experience
  - Driver's occupation
  - Additional driver presence
  - Additional driver's age
  - Additional driver's experience
- Vehicle
  - Type of vehicle
  - Model year
  - Symbol
  - Usage
  - Value

Customer characteristics

- Credit score
- Homeowner
- Demography
- Education
- Occupation

Others

- Payment type
- Payment term
- Distribution channel
- Cross sell
- Amount of agency-determined discounts
- Broker classification

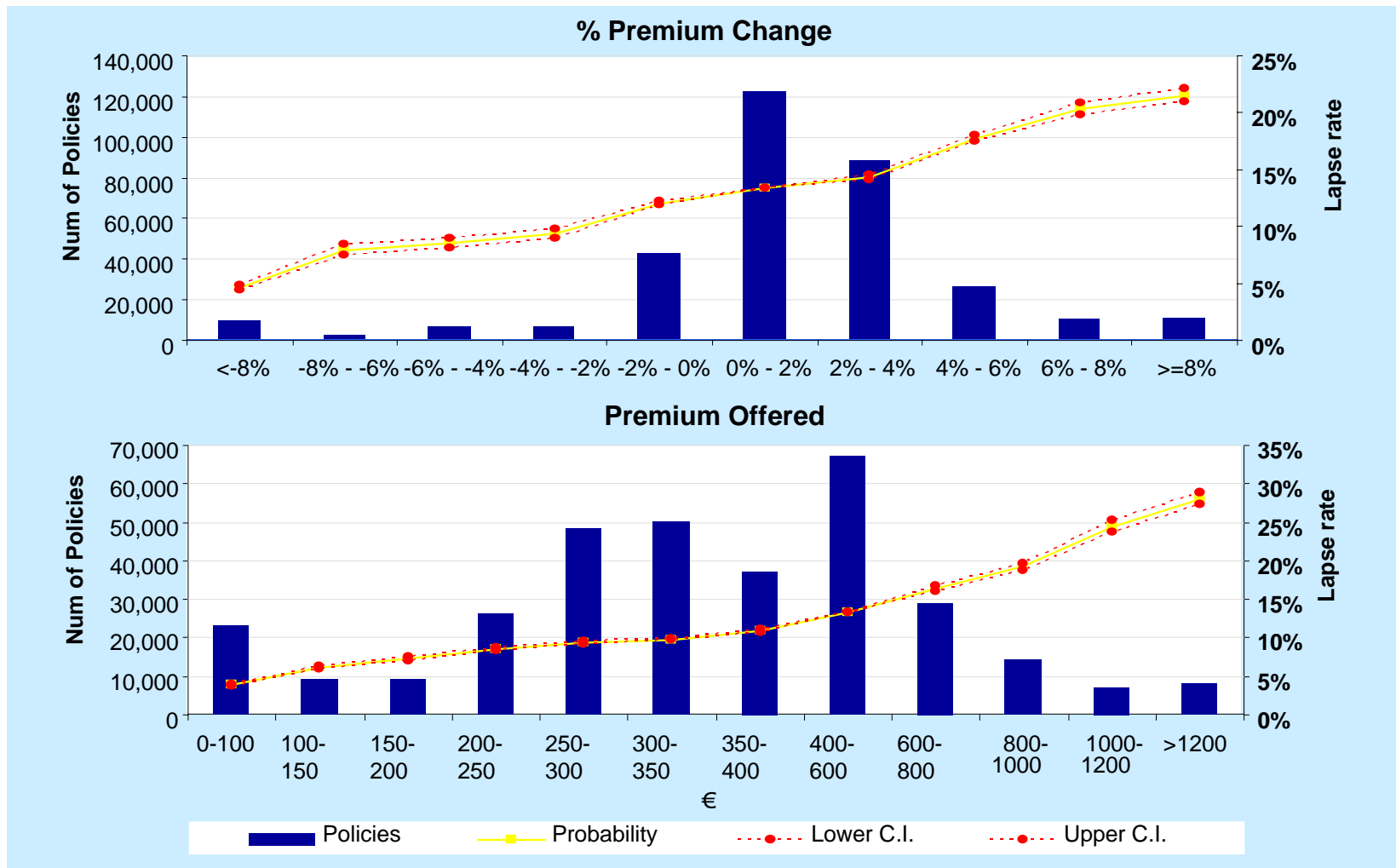# Customer price elasticity
Base profile

Illustrative example

Variables	Base Profile	Relativities Range	Explaining Capacity
Cross sell	ONLY MOTOR	0.40 - 1.00	31.0%
Premium offered	400-600 €	0.35 - 2.15	20.8%
Product	THIRD PARTY + WINDSCREEN	0.50 - 1.20	9.3%
% change premium	0% - 2%	0.40 - 1.60	8.4%
Payment type	BANK ACCOUNT	1.00 - 1.80	6.8%
Competitive position	< -5% MARKET	1.00 - 1.75	6.3%
Distribution channels	BROKER	0.80 - 2.10	4.1%
State	Zone 2	0.70 - 1.30	3.4%
Policy year with carrier	3-4	0.75 - 1.15	2.4%
Years without claims	5	0.80 - 1.25	2.2%
Age/Sex/Marital status	H40-54	0.70 - 1.25	1.3%
Driver's years experience	>20	1.00 - 1.50	0.9%
Type of Vehicle	Automobiles	0.85 - 1.45	0.4%

Intercept	0.15
Xb=Lineal Predictor	0.15
Lapse probability= Xb/(1+(Xb))	13.4%
Renewal probability= 1-Xb/(1+(Xb))	86.6%

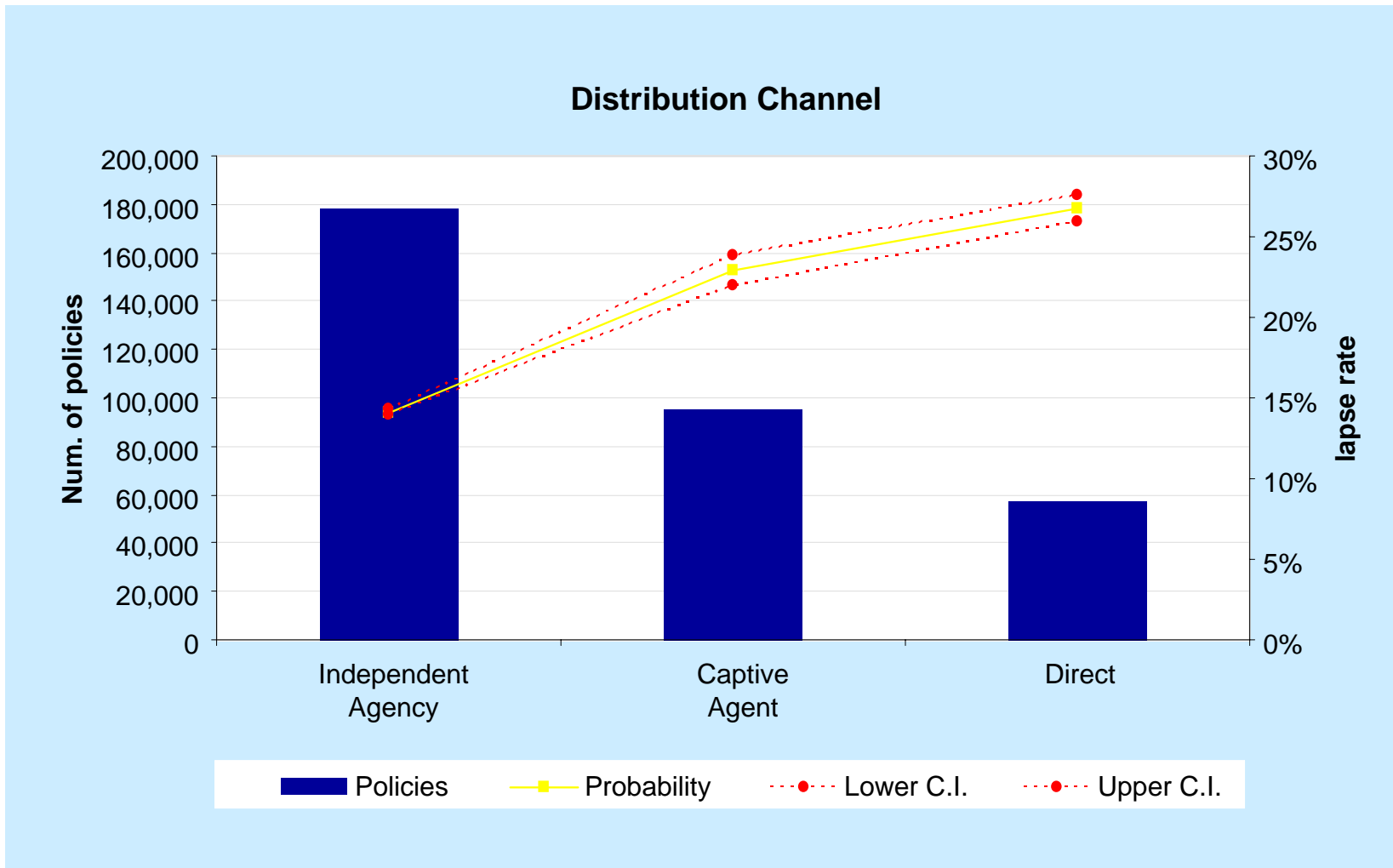# Customer price elasticity Results – Elasticity curve

Illustrative example

Customer price elasticity Results – Distribution Channel

Illustrative example

Distribution Channel

Optimization

■ This step involves combining the cost models (claims and expenses) and the customer price elasticity models derived in previous steps in order to determine the optimal profit loading by customer type

■ The optimal price will be the one that satisfies the company's objectives and constraints maximizing profitability along an efficient frontier subject to a certain volume of business.

Optimization:
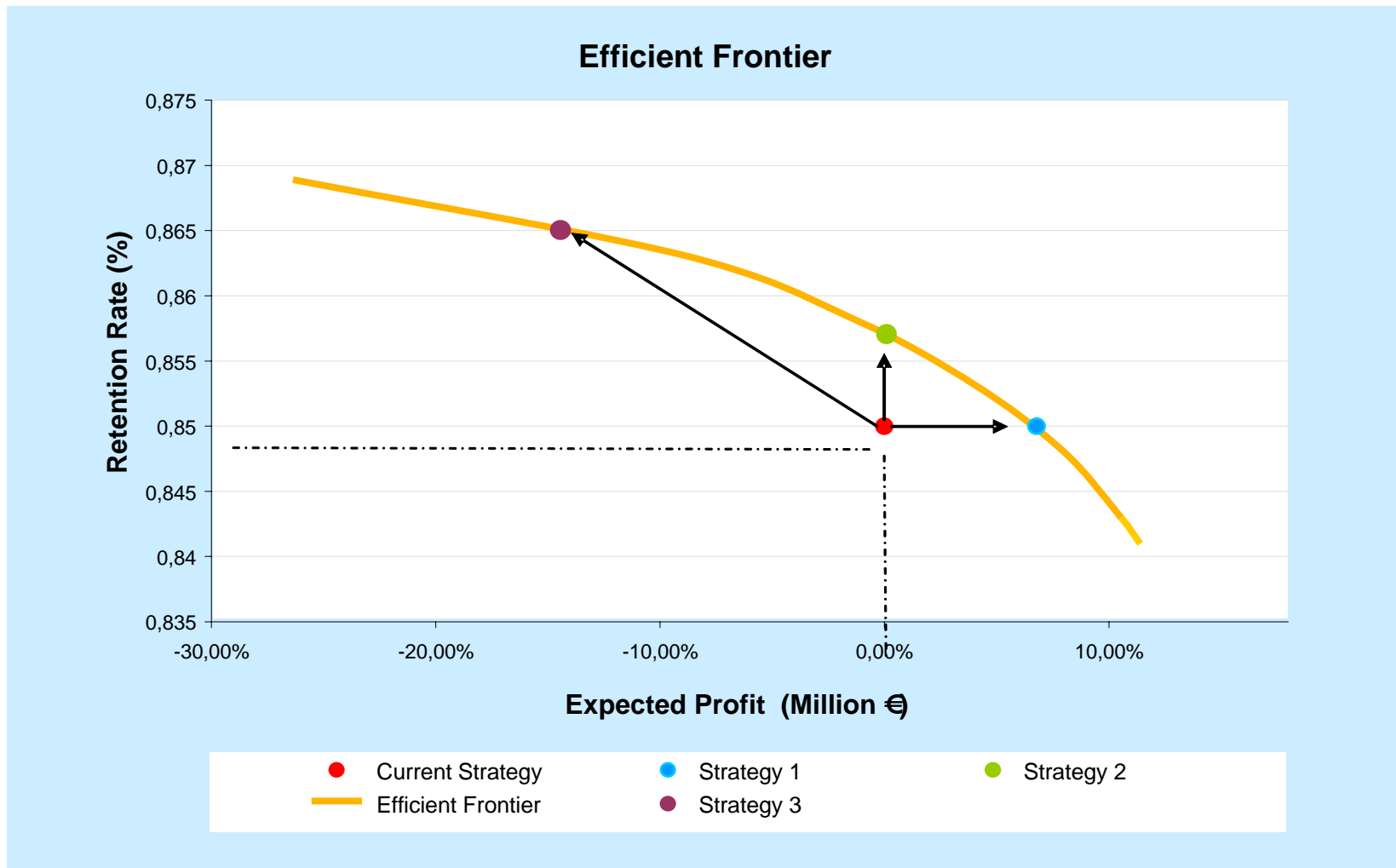# Individual constrains

Illustrative example

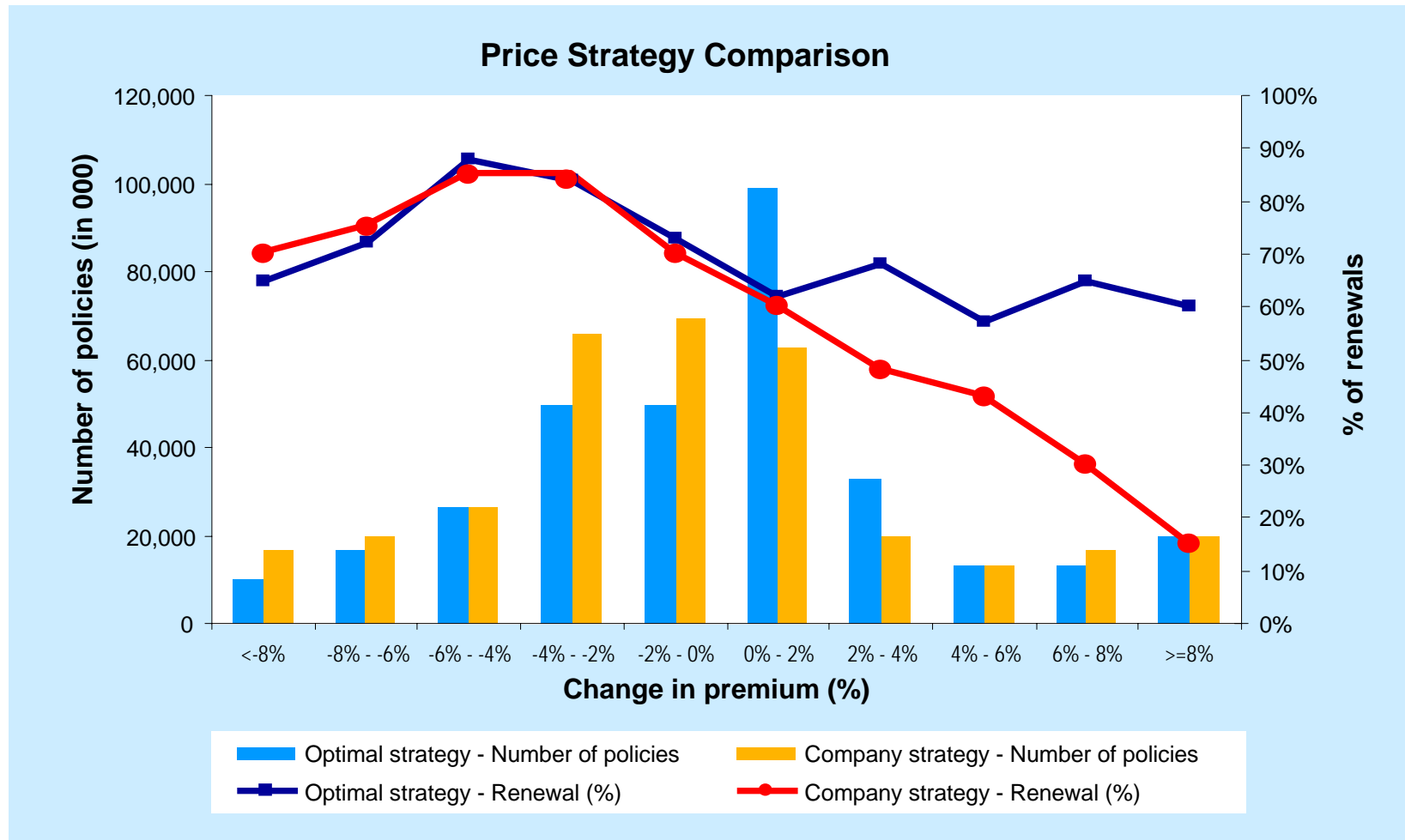| Number Of claims	Tenure	Loss Ratio	Minimum Limit	Maximum Limit	Group
0	>4 years	<45%	-5.00%	4.00%	A
		>45%	-2.00%	4.50%	B
	<4 years	<45%	-3.00%	5.00%	C
		>45%	-1.50%	5.50%	D
1	>4 years	<45%	0.00%	6.50%	E
		>45%	0.00%	8.00%	F
	<4 years	<45%	0.00%	10.00%	G
		>45%	0.00%	13.00%	H
> 2	>4 years	<45%	0.00%	13.00%	I
		>45%	0.00%	17.00%	J
	<4 years	<45%	0.00%	22.00%	K
		>45%	0.00%	25.00%	L

Optimization
Strategy 1: Maintain Retention/Increase Profits

- Comparison of company and optimized pricing schemes

Price Strategy Comparison

Legend:
- Optimal strategy - Number of policies
- Company strategy - Number of policies
- Optimal strategy - Renewal (%)
- Company strategy - Renewal (%)

X-axis: **Change in premium (%)** — <-8%, -8% - -6%, -6% - -4%, -4% - -2%, -2% - 0%, 0% - 2%, 2% - 4%, 4% - 6%, 6% - 8%, >=8%

Left Y-axis: **Number of policies (in 000)** — 0 to 120,000

Right Y-axis: **% of renewals** — 0% to 100%

Alternative Strategies: Results

Illustrative example

	Retention Rate	Average Premium	Expected Profit	Average Discount
Actual	85.0%	417	50.9	4.0
Strategy 1	85.0%	420	54.6	4.3
Strategy 2	85.7%	414	50.5	4.1
Strategy 3	86.5%	407	42.8	3.5

	Policy Renewal	Volume Premium	Expected Profit	Volume Discount
Actual*	86,596	36,082	4,411	345
Strategy 1*	86,584	36,336	4,724	376
Strategy 2*	87,329	36,195	4,409	355
Strategy 3*	88,161	35,850	3,776	311

* Thousand €

Optimization
Strategy 1: Maintain Retention/Increase Profits

■ Comparison of company and optimized pricing schemes

Strategy 1

Chart — Percent of Premium Variation (y-axis) vs Type of client (x-axis). Legend: Min (blue), Max (red), Medium (green).

Type of client	Min	Max	Medium
A	-4.90%	3.70%	-1.82%
B	-1.50%	2.40%	-0.10%
C	-2.80%	4.12%	-0.96%
D	-1.47%	3.90%	0.40%
E	-2.50%	5.90%	3.20%
F	-1.15%	7.10%	3.90%
G	-0.85%	9.10%	5.20%
H	-0.60%	11.22%	6.40%
I	-0.70%	11.90%	7.90%
J	-0.35%	14.90%	10.10%
K	-0.65%	18.30%	14.50%
L	-0.32%	22.50%	17.50%

Type of client
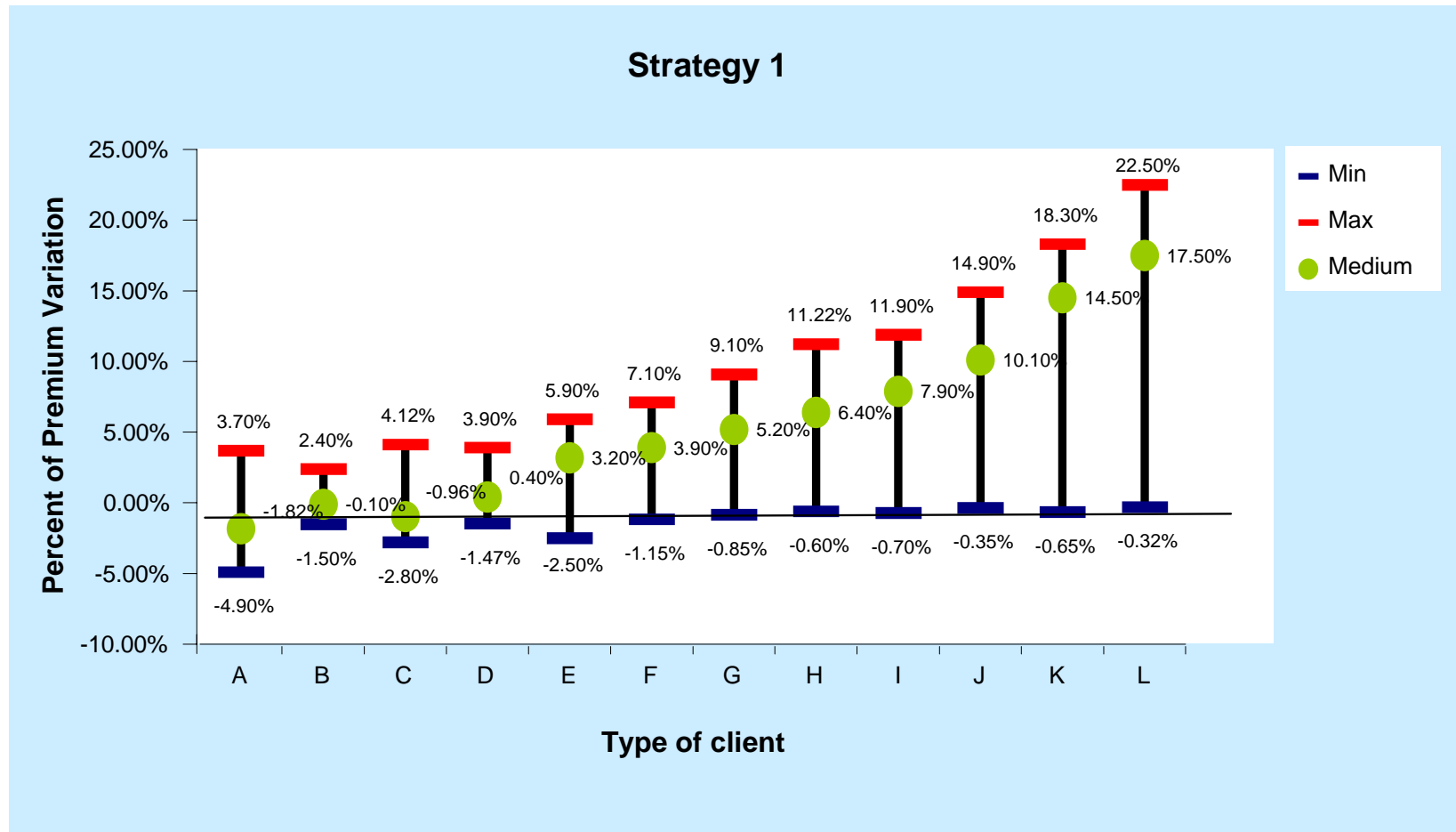
Implementation

- Optimized rates can be implemented in different ways:

  a. An algorithm that calculates the optimized price per individual customer based on their particular rating attributes. The algorithm can be built into the rating structure and operate in real-time

  b. A set of optimized premium rates that would fit into a tabular rating structure

- Given the IT investment, lead time, and other operational considerations generally companies implement approach (b) and migrate to (a) over time

Conclusion

Price Optimization: The next challenge

The insurance industry is highly competitive and maintaining

underwriting profits will continue to prove a challenge for everyone.

Improving profitability though efficiency and cost reduction

can only go so far.

Pricing management presents an unexplored opportunity for a

company to establish a competitive advantage and

<u>Price Optimization</u> is the next step.

Conclusions

- **Advanced statistical techniques** will be necessary for **managing a portfolio:**

  - Selecting profitable customers, leaving unprofitable ones to competition

    — Competing for the right risks at the right price

  - Implementing gradually to reduce market disruption

  - Maintaining benefits through frequent updates as loss costs, competitor pricing and customer behaviors change over time

  - Providing a solid basis to monitor the portfolio

- It is possible to **grow market share** without **compromising profitability**

- **Stay ahead of competition!**

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