

## PROPERTY/CASUALTY INSURANCE

## PRICE OPTIMIZATION FOR PROFIT AND GROWTH

Companies want both: profitability and business growth. Price optimization can achieve this balance and strengthen a company's hand against competitors.

By José Moreno Codina and Francisco Gomez-Alvado

To optimize their competitive position, companies need to know how sensitive clients are to changes in prices in order to predict the amount of business growth achievable within certain profitability levels. Effective analysis of price sensitivity and expected growth at alternative profit levels can increase the retention level of the renewal portfolio and new business conversion rates within predictable levels of profitability to arrive at an optimal overall strategy for the business.

### PRICE OPTIMIZATION

The process needed to conduct this analysis is called price optimization and was described in an article earlier this year ("Price Optimization for Innovative Insurers," *Emphasis* 2008/1). This article provides an example of how price optimization methods were successfully applied by one property and casualty company to improve the retention levels of a renewal portfolio to reach the desired level of overall profitability for the portfolio while meeting both management and regulatory constraints.

### A REAL-LIFE EXAMPLE

The company implemented price optimization for a book of over one million auto policies primarily distributed through an agent and broker network. The company had already conducted periodic competitive market analysis (CMA) studies that allowed it to understand its relative competitiveness by micro-market segment and by risk profile (see "Competitive Market Analysis in Personal Lines," *Emphasis* 2007/2). These studies gave it an advantage over competi-

tors that do not have or use this information in a rigorous way. Price optimization was seen by management as the next logical step and an opportunity to further exploit this market advantage.

Understanding your company's pricing at a fine level of detail is an important prerequisite to understanding the sensitivity of price changes; it is used, among other variables, in estimating the elasticity of demand for each policyholder risk profile. The output of these calculations identifies policyholder clusters that are more price elastic or inelastic. Through multivariate analysis and using generalized linear models (GLMs), we can determine the key variables that best describe those clusters. In this example, these included competitiveness, age, type of vehicle and geography, as well as variables not used directly in the rating process, such as recent claim experience or the existence of other products insured by the company.

### ELASTICITY OF DEMAND

The elasticity of demand is an algorithm that measures the relativity between changes in the incremental quantities of policies converted from the initial quotations, either new or renewal, compared with the price decrease that the company is prepared to give. Each company will have its own elasticity-of-demand curve, and separate curves for new and renewal business. *Exhibit 1* compares the elasticity of demand for a traditional distribution company and a direct writing company.

These algorithms are used to produce the behavior model, which estimates how the portfolio of customers, in aggregate, will

#### Steps used to take into account the competitive market analysis (CMA) in the price elasticity calculation

- For each customer risk profile, the average price offered by the market is estimated.
- The difference,  $d$ , of the company's price from the average market price is identified for each customer risk profile.
- $d$  is then introduced into the multivariate analysis to find out the extent to which the competitive position explains the price sensitivity of the corresponding customer profile.
- With this information, it is possible to determine the relative importance of the competitiveness factor and each of the other variables in the price elasticity of the customer profile.

#### Determining elasticity of demand

The approach models price elasticity using multivariate analysis.

- Information is first gathered and analyzed in a segmentation process similar to that used for the cost premium analysis.
- Multivariate techniques (GLMs) are used to model the likelihood of conversion or retention as a function of price.
- These customer price elasticity models are therefore based on rating factors, other client attributes and competitiveness.
- Elasticity of demand can be refined over time using price changes as a test of the estimation.

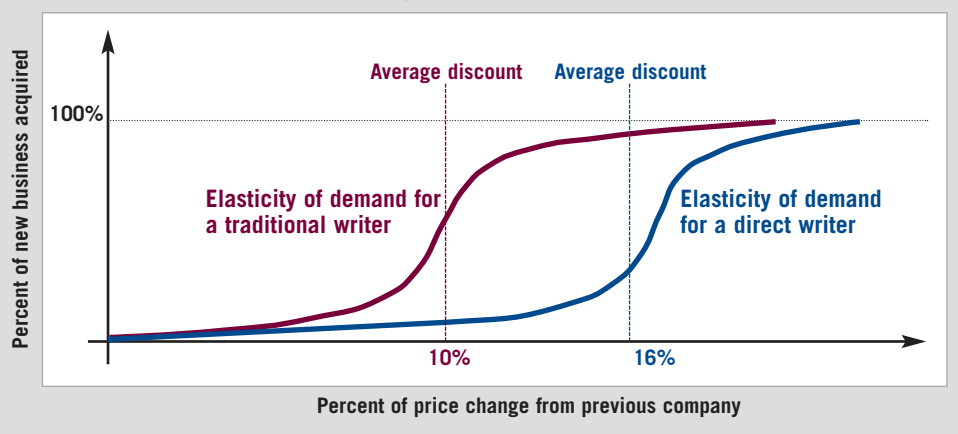


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### EXHIBIT 1 Customer behavior models: Elasticity of demand



react to price changes in new business or the renewal process.

We typically recommend starting with the renewal process because much more historical information is typically available. Companies have studied past price changes and, using their knowledge based on regular research and by applying CMA, they can determine their own competitive position on renewal. This information tends to make the process much easier for the renewal portfolio than for new business and was the case with the company in our study. Management opted to first perform the optimization analysis on the renewal portfolio and also began to compile the data needed for the new business analysis.

The behavior model provided the probability of renewal given a certain final pricing structure for each risk profile and therefore in aggregate for the whole portfolio.

Some companies opt to start the price optimization process for new business conversion. This is because they may have more data, the data is easier to obtain on competition for new business or they have maintained a good database from the quotation systems. (Users of Web sites and direct writers are often examples of companies with such good recordkeeping.)

The behavior model we constructed in this case included several submodels, including a model to predict the renewal rate, a model to predict the need for an agency discount and, if such discount was applicable, a model to predict its amount (subject to the company's desired limits). Also included is a model to predict if a change in coverage by the policyholder (e.g., to take a more restrictive cover) could be applied and, if so, a model to predict the change.

The explanatory variables of the model were determined through use of a multivariate analysis that used the historical

data of the company supplemented by some field testing, as the company is located in a jurisdiction where regulation permits such testing.

Using the behavior model, combined with the cost model and optimization techniques on the different realistic combinations of customer profiles in the portfolio, the retention level and the profitability for each possible portfolio was determined.

### COST MODEL

A critical element of an optimization process is a cost model that determines profitability by customer cluster. This model must reflect differences in estimated loss among clusters. For some companies, cost differences among clusters may be significant and should also be reflected. The level of profitability can be linked with the expected lifetime value of the policy. This requires additional calculations with forward-looking assumptions of retention levels for several years. This process can also be extended to include the estimated value of other products purchased by the customer.

In our case study, the company focused only on the renewal portfolio for a single line of business for a single renewal cycle.

### CONSTRAINTS

Constraints on the optimization process arise from both regulatory and management concerns.

The regulatory process may impose rules limiting the loadings (including the profitability) applied to the cost premium.

Jurisdictions differ on whether variation is allowed for individual customer prices or only at the class level. For example, in some jurisdictions, the final premium must be within a range of reasonable estimates of the loss premium after loading for expenses, profits and contingencies. Any such regulations are reflected as constraints in the optimization process, which means that the result is an optimized structure subject to the constraints.

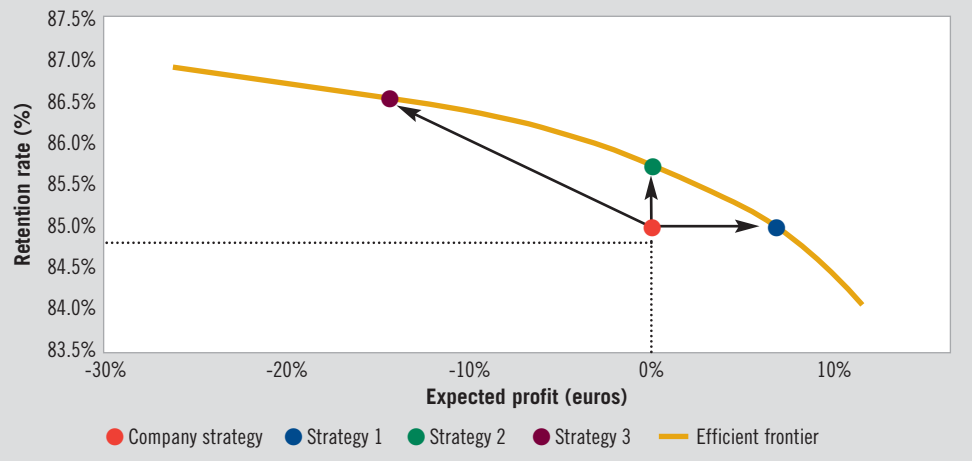
In addition, company management often imposes restrictions (e.g., never allow a premium below the risk premium, or never allow increases of more than X% or decreases of more than Y%). These restrictions are also reflected as constraints in the process.

### PROFITABILITY EFFICIENT FRONTIER

The result of the optimization process is an efficient frontier. For each renewal level, there is a combination of policies and prices that gives different profitability levels. But there is only one combination of policies and prices that gives the maximum profitability for a particular renewal level. The graph of the maximum profitability for each renewal level forms an efficient frontier. There are other suboptimal combinations for the same renewal level, but the profitability (measured by policy margin or overall) will be inferior.

*Exhibit 2* shows an example. The horizontal axis is the profit relative to the present policy mixture, which has an estimated renewal rate of 85%. This mix is represented by the red dot in the exhibit. Different

**EXHIBIT 2**  
Alternative strategies: Efficient frontier (illustrative)



combinations of prices by market cluster can produce a higher profit at the same 85% renewal rate or more renewals at the same relative profit. The current situation is clearly suboptimal. The green dot represents a different combination of customer risk profiles and prices at renewal that produces, with the same level of profitability, an increase of retention to approximately 85.7%. There is no other possible combination of prices that can produce a better retention level with the same profitability; therefore, this is an optimal point.

The optimal points of all possible combinations form the efficient frontier. In our example, the company's strategic priority was to increase renewal rate without sacrificing profitability, that is, to move up the graph rather than to the right.

The company was also prepared to consider reducing its profit margin per policy in order to increase the retention rate. This would suggest a strategy of pricing that would result in a movement toward a portfolio represented at the purple dot — a retention rate of 86.5% with a relative decrease in overall profitability of 15%. As this was the maximum decrease of profitability that the company was prepared to accept, management was presented with a range of acceptable options, all producing

an improvement in the current situation. The representation of these optimal combinations is the efficient frontier shown in Exhibit 2. The efficient frontier reflects the constraints imposed by regulation and by management. Different constraints (or no constraints) would produce different efficient frontiers.

One of the important lessons learned in this process is that the presentation of scenarios to the management team generates discussions that lead to consideration of other alternative strategies or reconsideration of the various constraints, often leading to several iterative policy discussions. The behavior model permits quick quantitative analysis of the many “what if” questions that emerge from the management review of the price optimization process.

### OPTIMIZATION CHANGES THE MIX OF BUSINESS

One of the strengths of the company in our example is the timely information that it has on its competitive market position for renewals. Because of this, we were able to help management understand how the mix of business is expected to change with the optimization process, based on an analysis of the relationship between retention and competitive position for a given price change.

**EXHIBIT 3****Price variation vs. competitiveness position (illustrative)**

	50% Portfolio 86% Retention 41% Loss Ratio		11% Portfolio 80% Retention 176% Loss Ratio	Marginal Distribution
Competitiveness position ↑	Poor (higher than 10%)		5% Portfolio 61% Retention 251% Loss Ratio	11% Portfolio 80% Retention 176% Loss Ratio
	Medium (10% to -10%)	20% Portfolio 83% Retention 25% Loss Ratio	1% Portfolio 80% Retention 201% Loss Ratio	
	Good (lower than -10%)	25% Portfolio 90% Retention 45% Loss Ratio		45% Portfolio 87% Retention 61% Loss Ratio
	Negative (lower than 0%)	Moderate (0% to 5%)	High (higher than 5%)	
	Percentage variation price on last renewal →			

Exhibit 3 depicts the situation before the price optimization exercise. Here we show the results of the analysis between the competitive positioning obtained from CMA (vertical axis) — the company's position price versus the average competition price — and the price variation of each policy in the renewal (horizontal axis).

In this case, the result was that the cluster of good competitiveness position (the carrier's rates are lower than the industry's) and negative price variation (the carrier's current prices have decreased from the previous renewal) had the highest retention rate, and the cluster of poor competitiveness and high price increases had the lowest retention rate.

We can also see that there is a positive correlation between competitiveness and retention rate, and a negative correlation between price variation and retention rate. However, the expected loss ratio (ELR) of each cluster must also be considered. Two parts of the portfolio (the red area) showed very high-loss-expected ratios and somewhat lower retention levels, while an important part of the portfolio, 20%, situated in a medium competitive position, showed a below-average retention rate and a very good loss ratio. Other parts

of the portfolio performed better than average both in retention levels and expected loss ratio. Note that the price optimization process is expected to change the portfolio mix.

When the price optimization process is finished, one would expect to find a smaller portion of the portfolio in the worst-expected cost level and better retention of the best risks.

### IMPLEMENTING OPTIMIZED RATES

The optimal price will be the one that satisfies the company's strategic objectives while maximizing profitability subject to the constraints required by management and regulation.

Optimized rates can be implemented in two different ways:

- as an algorithm that calculates the optimized price per customer based on the individual's particular rating attributes, which can be built into the rating structure and applied in real time
- as a set of optimized premium rates that would fit into a tabular rating structure.

The choice should consider the IT investment, lead time and other operational factors.

Usually an initial test is performed with some portion of the overall insurance company (e.g., in a particular state or in a particular part of the overall business that is representative of the totality). A feedback process will assess the actual results produced after the optimization has taken place. This must wait until the maturity of normal cancellations gives a reliable retention rate. Then these recent results can be used to refine the behavior model further.

Data collection and correct data interpretation are essential elements for a successful feedback process and should be planned in advance. Price optimization is not a one-time event, but rather a continuous process that keeps learning from its own results and refining the models.

### ADVANTAGE TO THE EARLY ADOPTERS

Our case study company improved its retention level by between half and one percentage point per renewal month. Experience in this field is still limited. As usual, there is an advantage for early adopters. We believe that this approach and the related techniques could well produce a differential of several points on the combined ratio, while at the same time allowing fulfillment of volume and growth objectives.

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