BUSINESS ANALYTICS AND STRATEGY

Project 2

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HIGH LEVEL TAKE-AWAY

1) Diagnosis: Our profitability is low and we aren’t making enough money. But we cannot afford to raise prices across the board.
2) Forecast: We would like an x% increase in our profits.
3) Add value through search: If the prices cannot be raised across the board, we restrict our search to a set of consumers where we can afford to do this. This set would typically comprise of consumers who aren’t in line with the amount of business that we do with them.
4) Choose: Select the consumers who are receiving disproportionate discounts. We will use the customer lifetime value metric in our analysis to look at the value they bring.
5) Commit: Renegotiate our commercial terms with this set of consumers.
6) Balanced Scorecard Strategy Map: We will get our customers in line with our targeted discount rate offerings. This will increase our overall profitability. Such a reduction in costs, in part, can be used to fuel growth and retention programs. This will increase our overall revenues.

MODEL

Hazard models are used to compute the probability that the customer is still with the company and hasn't gone to the competition. Let t be a random variable representing the time the customer attrites (dies) with probability density function $f(t)$. Let $F(t)$ be the cumulative distribution function such that $F(t) = \int_0^t f(t)dt$. The survivor function is given by

$$S(t) = P(T > t) = 1 - F(t) = \int_t^\infty f(t)dt$$

Now hazard function is the probability that the customer attrites in an instantaneous time period Δt given that the customer has remained with the firm till time t. This is given by

$$h(t) = \frac{f(t)}{S(t)}$$

For an exponential probability density function for time t, we have

$$f(t) = \lambda e^{-\lambda t}$$

$$S(t) = e^{-\lambda t}$$

$$h(t) = \lambda$$

Thus the hazard function for an exponential distribution is a constant.

Thus the retention rate,

$$r = 1 - h(t)$$

The value of a customer upto period τ is

$$\sum_{t=1}^{\tau} \frac{r^{t-1}(R_t - C_t)}{(1+\delta)^{t-1}}$$

Where R_t is revenue, δ is the discount rate and C_t is cost in period t.

We will assume a constant hazard rate and profit contribution to demonstrate a canonical methodology for computation. Thus

$$\sum_{t=1}^{\tau}\frac{r^{t-1}(R_t - C_t)}{(1+\delta)^{t-1}} = (R - C) + \frac{(R-C)r}{(1+\delta)} + \frac{r^2(R-C)}{(1+\delta)^2} + \cdots$$

$$\sum_{t=1}^{\tau}\frac{r^{t-1}(R_t - C_t)}{(1+\delta)^{t-1}} = (R - C)[1 + \frac{r}{(1+\delta)} + \frac{r^2}{(1+\delta)^2} + \cdots]$$

$$\sum_{t=1}^{\tau}\frac{r^{t-1}(R_t - C_t)}{(1+\delta)^{t-1}} = (R - C)(\frac{1}{1 - \frac{r}{(1+\delta)}})$$

$$\sum_{t=1}^{\tau}\frac{r^{t-1}(R_t - C_t)}{(1+\delta)^{t-1}} = (R - C)(\frac{1+\delta}{1+\delta - r})$$

Alternatively, we can model a weibull distribution for our data where

$$f(t) = (\frac{a}{b})(\frac{t}{b})^{a-1}e^{-(\frac{t}{b})^a}$$

$$F\ (t) = 1 - e^{-(\frac{t}{b})^a}$$

$$S(t) = \ e^{-(\frac{t}{b})^a}$$

$$h(t) = (\frac{a}{b})(\frac{t}{b})^{a-1}$$

The way the hazard function is parameterized above is how the rweibull in the software R is also modeled. So,

$$h(t) = b^{-a}at^{a-1}$$

This is the baseline hazard; we will further adopt the proportional hazard formulation to model covariates. Thus,

$$h(t) = b^{-a}at^{a-1}e^{\beta^T z}$$

Where, z are the covariates to be modeled

Integrating with respect to t we have the cumulative hazard function,

$$H(t) = (\frac{t}{b})^{a} e^{\beta^T z}$$

Multiplying by -1 and exponentiating we get the survivor function,

$$S(t) = \exp(-(\frac{t}{b})^{a} e^{\beta^T z})$$

We will make the following transformation $X = Log(T)$

$$P(X > x|z) = \exp(-(\frac{e^x}{b})^{a} e^{\beta^T z})$$

$$P(X > x|z) = \exp(-\exp[-alogb + \ ax + \ \beta^T z \,])$$

Now from the help file on the survreg function in R we have,

survreg's scale = 1/(rweibull shape)

survreg's intercept = log(rweibull scale)

So let μ and σ denote the intercept and scale of survreg. In addition, let us define

γ as the

regression coefficients of survreg. Further, the substitutions, $b = \ e^{\mu}$, $a = \frac{1}{\sigma}$

, and $\beta = \frac{-\gamma}{\sigma}$ give

$$P(X > x|z) = \exp(-\exp\frac{1}{\sigma}[x - \mu - \ \gamma^T z \,])$$

This is equivalent to

$X = Log\ (T) = \ \mu + \ \gamma^T z + \ \sigma W$

Where W is an extreme value random variable.

Such a model is estimated by maximizing the likelihood function,

$$L(.|t) = \prod_{i=1}^{n} f(t)^{v_i} S(t)^{1-v_i}$$

$$L(.|t) = \prod_{i=1}^{n} (\frac{a}{b})(\frac{t}{b})^{a-1} e^{-(\frac{t}{b})^{a}}{}^{v_i} e^{-(\frac{t}{b})^{a}}{}^{1-v_i}$$

With a covariate vector z we have,

$$L(.|t) = \prod_{i=1}^{n} (\frac{a}{b_1})(\frac{t}{b_1})^{a-1} e^{-(\frac{t}{b_1})^{a}}{}^{v_i} e^{-(\frac{t}{b_1})^{a}}{}^{1-v_i}$$

Where,

$$\frac{1}{b_1} = \frac{1}{b} e^{\frac{\beta^T z}{a}}$$

CANONICAL INPUT FOR THE CODE

Data required to compute the customer level hazard function:

1) Observation time for the customer (time)

2) Whether the customer is still observed to be with the firm (status)

3) Average price of the product and service availed by the customer (price)

4) Number of promotions received by the customer (promotions)

5) Number of Sales calls in any given period of time on an average (calls)

6) Size of the customer (size)

7) Type of product availed by the customer (product)

8) Customer segment (segment)

Data required to plot customer lifetime value (CLV) vs. discount:

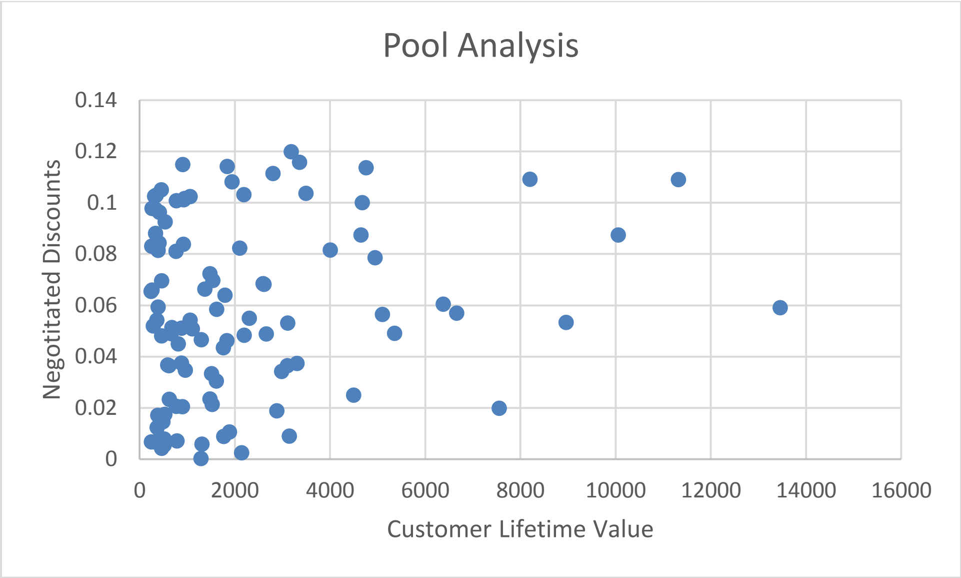
2) Revenue stream expected in the coming years (revenue)

3) Cost stream incurred for a customer by the firm in the coming years (cost)

4) Discount negotiated by the customer (discount)

5) Annual discount factor (factor)

CANONICAL OUTPUT OF THE CODE



ANALYSIS

A typical price waterfall begins with a list price. This is where the negotiations for discounts happen. Such discounts happen for a brief period of time and attempt to raise volume and market share. Other types of discounts include offers extended to the client via growth programs, promotion and inventory rebates among a host of other activities carried out by the firm.

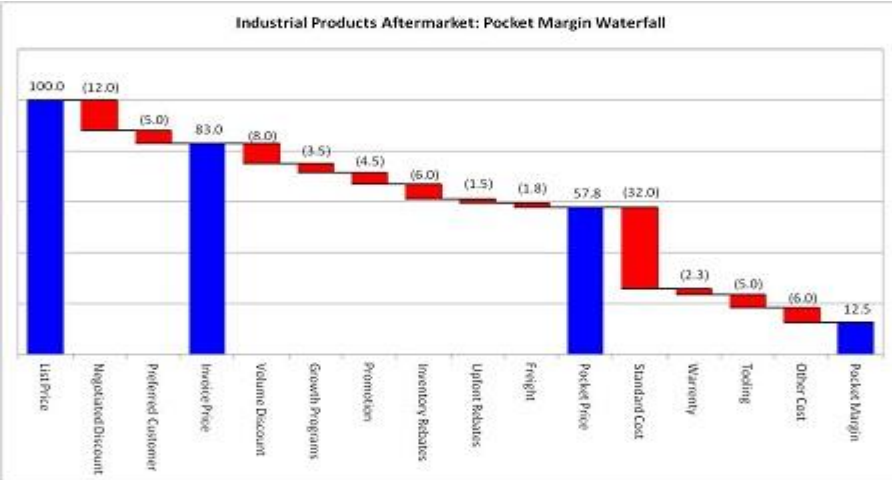


Fig. 1. Pricing Waterfall

We will attach the output of our code so as to provide context for analysis.

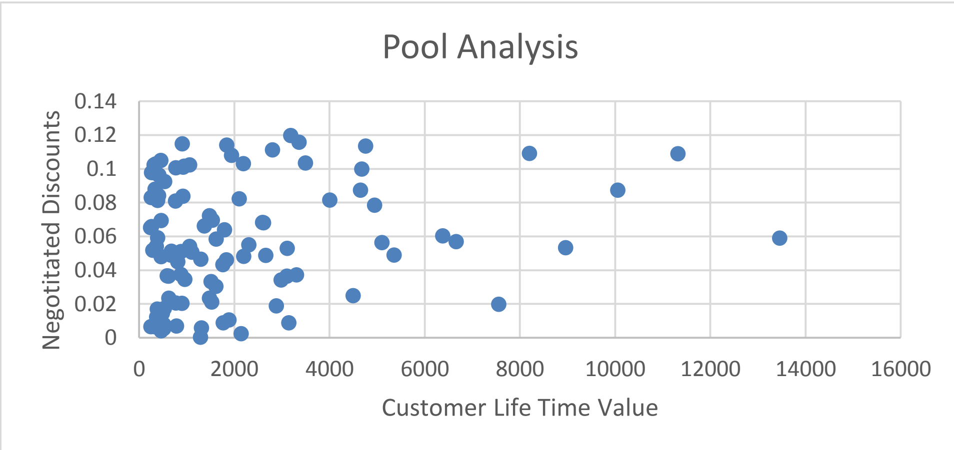


Fig. 2. CLV Pool Analysis

Firms typically carry out a profit pool analysis. But the profits generated are a snapshot at any given point of time. Instead of price and quantity, we will use the customer lifetime value and discounts to inform our analysis. So, we have plotted negotiated discounts offered to the customer vs the customer lifetime value (CLV). Such a method of analysis, we believe is more forward looking as it takes into account future revenue streams as well.

Pricing has to be one of the least understood facets of doing business and is usually driven by gut and competition. There are likely to be customers that receive high discounts despite not contributing to high CLV levels. To think of raising prices may seem disastrous at first; but we will not be carrying out such an exercise across the board but will engage in a discriminatory methodology wherein we will target only low performing customers to renegotiate discounts. Likewise, there are likely to be a number of customers who contribute to high CLV levels but are not offered substantial discounts. We will also target these customers to retain and increase their sales share. Thus, after analyzing say, for instance, negotiated discounts, we will carry out this mode of looking at CLV and discounts for each of the discount types that the firm offers like growth programs, promotions, and inventory rebates. From fig.1, even a 1% increase in the pocket price will lead to a 5% increase in pocket margin.

Also, concurrently, we will attack the problem from 2 other directions. Because of our renegotiations with the customers it is likely we will lose a percentage to the competition. We will put in place a growth program to acquire new customers. We will also deploy a loyalty program to increase customer retention rates. This should see us serving a better pool of clientele.