PRICING OPTIMIZATION SOLUTIONS:

A Business Proposal for e–Car

Introduction

e-Car's current loan pricing strategy is only able to convert 22 percent of potential customers. Because of its rates that are generally higher than the market price, it is estimated that e-Car lost 162,298 accounts in a span of 2.4 years from July 2002 to November 2004. This is equivalent to an opportunity loss of $749 million worth of profit, of which $372 million were for lost accounts wherein e-Car offered a less attractive rate than its competitors.

The abundance of information in the financial services industry and on customers' credit and risk profiles presents a huge opportunity to apply advance analytics in determining loan prices that both satisfy customers' needs and the lenders' tolerance for risk. Nomis Solutions presents a business case for the rationalization of the Price Optimization Software offering that guarantees increase in market share and increase in profit.

Data Used: Dataset provided by e-Car in an Excel format with over 200,000 data points

Business Case

The e-Car data contains more than 200,000 approved loan quotations made between 2002 to 2004. Exploratory Data Analysis presents the following information:

- $36.6 Million Total Gross Profits (by accounting for the cost of funds) from customer engagements based on approved quotations
- 22% Conversion Rate; 45,787 Customer Engagements relative to 208,085 approved loans
- $749 Million worth of total profits lost. This lost profit includes all the rejected loans by the prospective buyer due to incumbent pricing strategy and computed based on whichever is lower between e-Car and competitor rate, under the assumption that a customer would have likely accepted the lower rate regardless of which loan company offered it.

Other observations noted are as follows:

- e-Car's conversion rate drastically decreases with higher risk band, equivalent to higher-numbered Tier (Fig.1) due to e-Car's high APR for risky loan offers (Fig.2). The low conversion in Tiers 3 and 4 indicates customers' high sensitivity to higher prices.

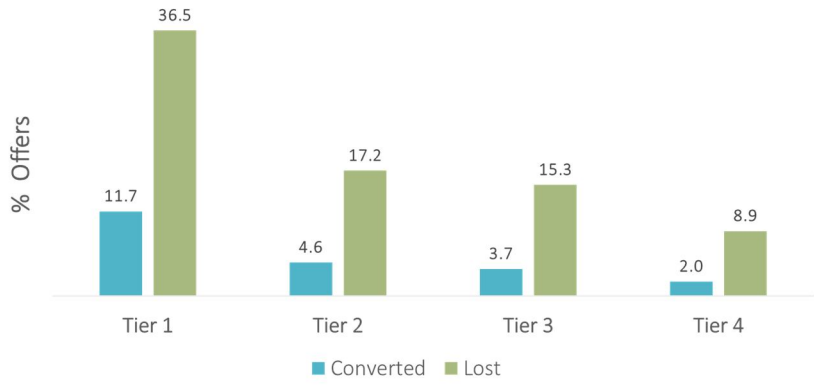

Fig. 1 e-Car conversion Rate per Tier

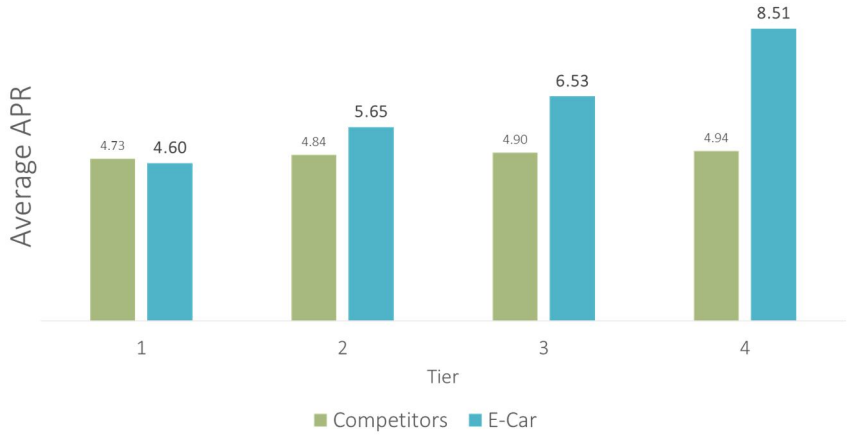

Fig. 2 Rate Comparison

- Low-risk accounts are still lost even if majority of e-Car rates are better (lower than competitor's rate) or the same as competition (Fig.3)

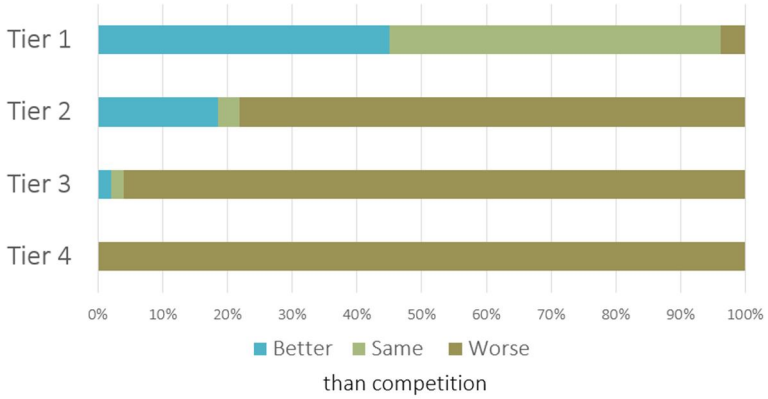

Fig. 3 e-Car Rates for Lost Accounts

- Tier 1 is the most attractive market to optimize APR since it has the largest market share left to capture (Fig.4)

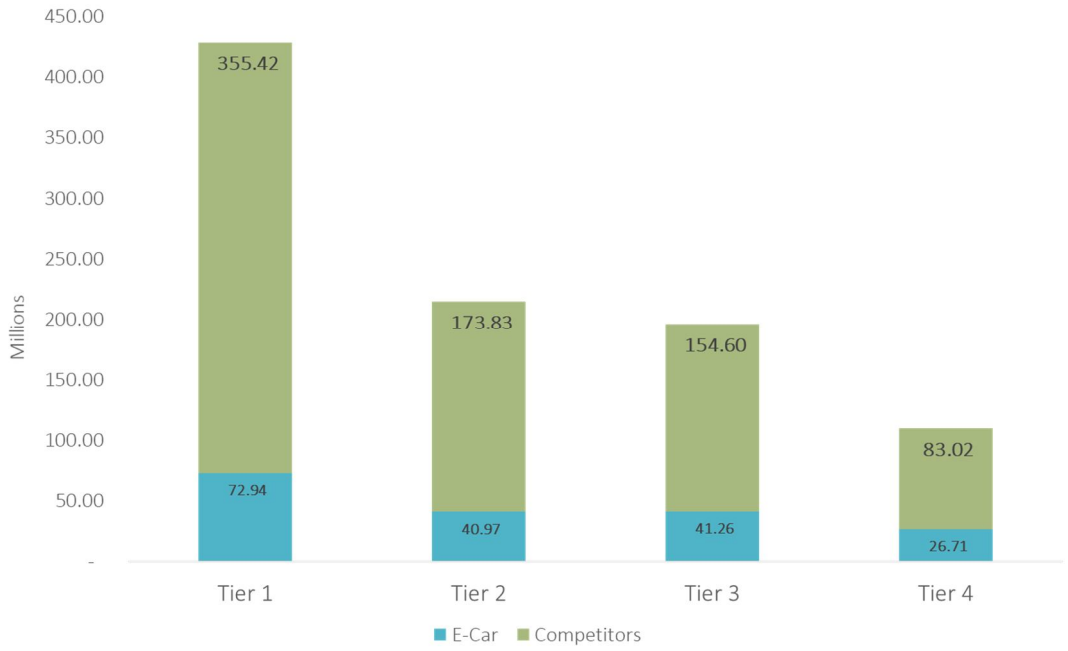

Fig. 4 Estimated Total Market Profit (Million USD)

Objective

"Apply advance analytics to formulate the optimal pricing strategy that maximizes customer conversion and profit."

Methodology: Building the Price Optimization Model

1. The team utilized machine learning (ML) regression models per Tier to determine the target Annual Percentage Rate (APR) based on customer–accepted quotations (where Outcome = 1). These models incorporated a customer's FICO score, preferred loan term, type of car to avail (new, refinanced, used), competitor's APR, cost of funds, and the type of the funding partner. Among these models, the Gradient Boosting Method (GBM) provided the highest accuracy, successfully predicting customer-accepted APR with 91.4%, 88.7%, 88.4%, and 86.1% accuracies for Tiers 1, 2, 3, and 4, respectively.

Summary of regressions results per Tier are as follows:

Test Accuracy of Optimal Pricing Models

Machine Learning Model	Tier Segment 1	2	3	4
Gradient Boosting Method	**91.4%**	**88.7%**	**88.4%**	**86.1%**
Random Forest	90.2%	88.2%	85.9%	85.5%
Linear Regression using Ridge regularization	75.8%	37.4%	38.2%	28.2%
Non-Linear Support Vector Regression	7.9%	1.1%	-1.3%	0.1%

"Gradient Boosting Regression model has been selected as the optimal model owing to its high accuracy across all customer tiers."

Optimal Parameters for the Gradient Boosting Method

Tier	Learning Rate	Max Depth	Max Features	Min Samples Leaf
1	0.1	6	0.5	2
2	0.2	6	0.5	4
3	0.2	6	0.5	3
4	0.2	6	0.5	2

2. Using the four GBM models, the team generated revised APR for Lost Customers per Tier
3. Potential profit was then calculated for accounts where calculated APR is lower than both the original e-Car rates and competitors' rates.

Analysis

The GBM model revealed that the main factor of successful customer conversion is the price offers of the competitors. Hence, to increase loan take-up, e-Car's prices must be optimized such that it is better than the competitors' rates but above the cost of funds.

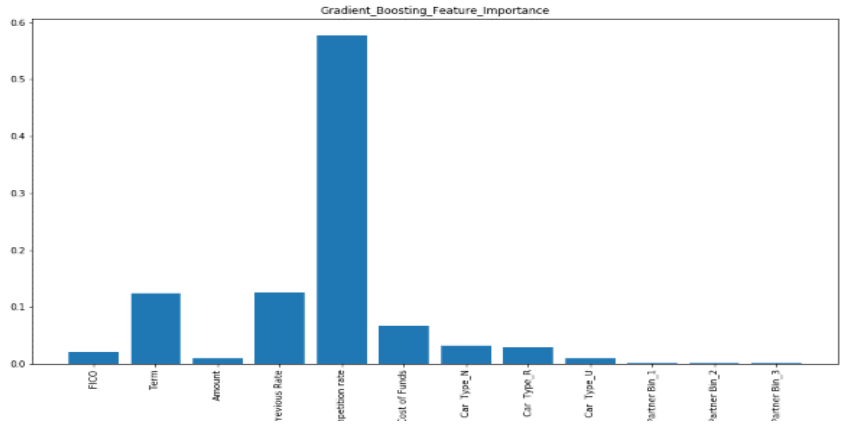

Fig. 5 **Competition Rate** is seen to be the dominant feature for the prediction of the Annual Percentage Rate across all Tiers

Optimizing the APR for customers who rejected the initial offer, the GBM predicted that to increase loan take-up, e-Car's prices must be lower than competitors' rate by around 3 percent for all loan terms.

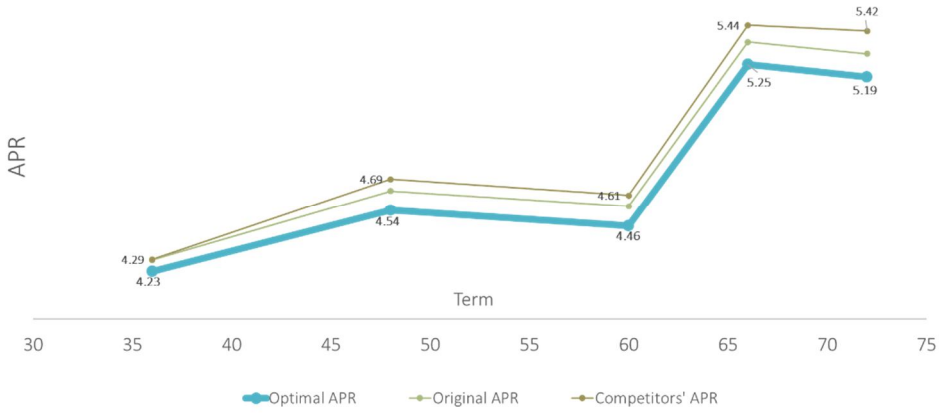

Fig. 6. Comparison of APRs (optimal, original, and competitors')

Upon proper customer segmentation and optimization of their APR using the same inherent pricing model that was used for successful converts (outcome 1 in the dataset), e-Car stands to gain **$232M in additional profits from 510,858 potential additional customer accounts.** This signifies improved market share to reach 70.8% in Tier 1 segment or among low-risk customers.

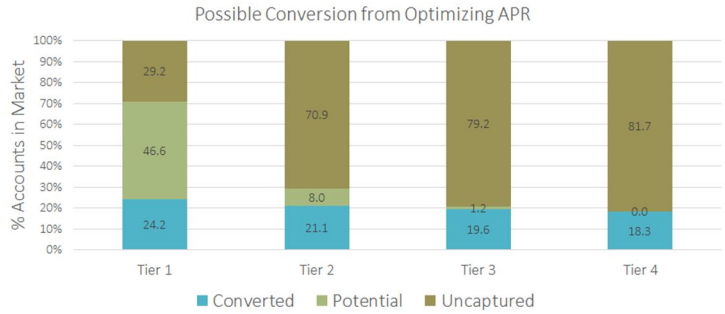

Fig. 7. Possible conversion from optimizing APR

Summary

- The stratification of the Annual Percentage Rates (APR) relative to indicated Tiers shows that e-Car is unable to maximize its earnings due to its current pricing strategy, especially for Tier 1 where the uncaptured market share is largest.

- e-Car is very prudent in tier 4 i.e. the high-risk segment, as its APR is higher compared to its competitors.

- Using the Pricing Optimization Software Solution, e-Car would be able to identify the appropriate APR relative to the FICO scores, Competitor's Rate, and the Cost of Funds, among other customer information.

- Market share in Tier 1 can possibly be tripled by optimizing APR within risk-tolerance of e-Car.

- Optimizing APR within e-Car's current rates per Tier is not enough to capture significant additional market share in Tiers 2, 3, and 4, as e-Car's accounts in those tiers have rates that are worse than those of the competition

Recommendations

- Apply APR generator model when offering rates to prospective customers

- Review e-Car's risk tolerance for Tier 3 and 4 customers
    - there is still a large market to capture in these segments
    - e-Car rates are significantly higher than competition for these segments

- Further Customer Segmentation is recommended for Tier and Car Type to determine appropriate application of the APR and Credit Terms which are acceptable to both e-Car and their Customers.