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TDI Project Proposal

August 12, 2020

A STRATEGIC MARKET AND COMPETITOR RESEARCH MACHINE

MOTIVATION

- All companies behave strategically.
- To do so, it is most valuable to know the behavior of their competitors.
  - Spying on them to acquire information?
- My proposal:
  - Use the company's internal data (+ any relevant external data) to infer competitor behavior.
- How?
  - Create hypothetical competitors by simulation, using some parametrized process.
  - Calibrate the model parameters to match the current state
  - Develop counterfactuals and robustness analysis.

(I will explain the analysis using the example project)

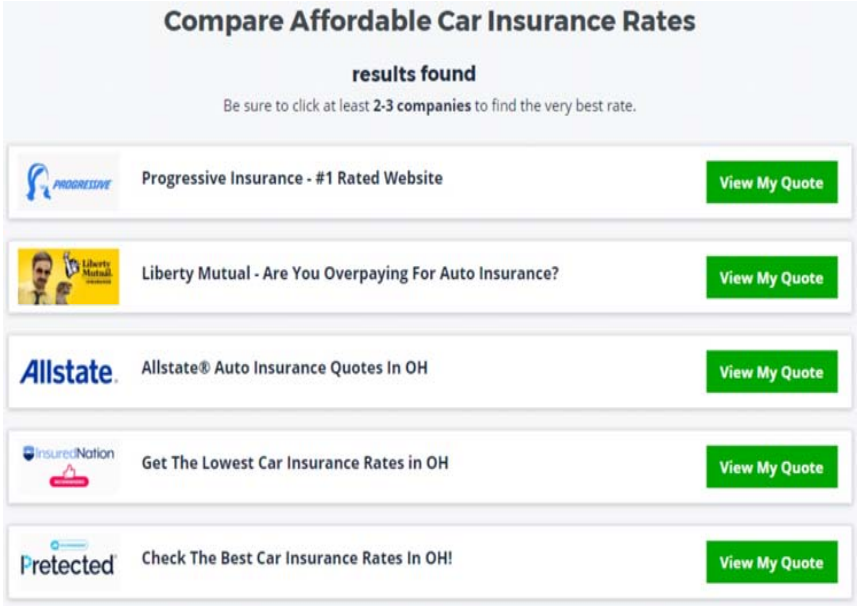
APPLICATIONS AND SCOPE

- This project will be a generalization of a project I have worked on recently
- Optimizing bidding behavior
  - Vertical search websites (for auto/home or health insurance, credit/loan applications, etc.)
  - I have done this for auto insurance bidding strategy.
- Optimal product pricing
  - A similar analysis can be applied for pricing a product.
  - We can use historical internal data on price, sales, locations, profits, etc.
- Others:
  - Almost any problem that involves interaction with competitors.

EXAMPLE PROJECT

Auto Insurance Vertical Search Website Bidding Strategy:

- Data limitations:
  - All important variables are binary (4 variables describing characteristics of potential customers: **I**nsured , **M**arried, 2**V**ehicles, 2**D**rivers)
  - A binary variable indicating weather that individual clicked the link
  - A binary variable indicating weather that individual purchased the policy
  - No variation in bid values (same bid across all data set)
  - No information on competitors' bid values



EXAMPLE PROJECT

Auto Insurance Vertical Search Website Bidding Strategy:

- Objective:
  1. Maximizing profits by focusing on the most profitable customer groups (based on their probability of click and purchases).
  2. A more challenging objective: Find the best bid price to achieve optimal rank for each customer group.
- How to achieve the goal:
  1. Because the customer characteristic variables are all binary + the fact that purchase conditional on click is very small percentage of available observations, the conventional machine learning methods don't offer much help.
  2. Given the fact that there is no variation in bidding price, it seems impossible to do any analysis.

EXAMPLE PROJECT (A GENERALIZABLE APPROACH)

My Algorithm

1. **Make some parametric assumptions about the competitors' behavior.** In this project I have made assumptions on the distribution of top 5 competitors' bids. (the results will prove if the assumptions are realistic)

   1) Many bidders, **2)** Normal distribution for top 5 bids, **3)** Finite variance

2. **Find an objective to match using the simulated observations.** In this project I have used the rank histograms as a matching criterion.

3. **Calibrate the parameters to minimize the matching error.** In the project I have estimated the mean and variance of the distribution from which the top 5 bids are generated.

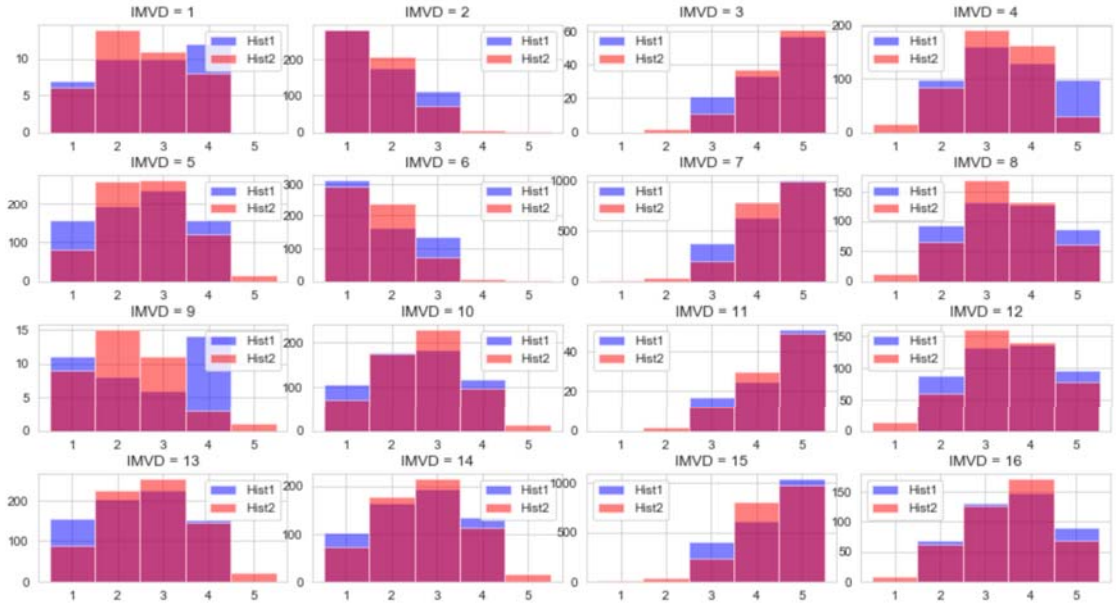
4. **Use the estimated parameters to generate the observations of competitors' behavior.** In the project I have generated the competitors' bid prices.

5. **Do analysis using the full data.** In the project I have estimated the optimal bids given the competitors' bids generated in step 4. I have done cost benefit analysis using optimal bids.

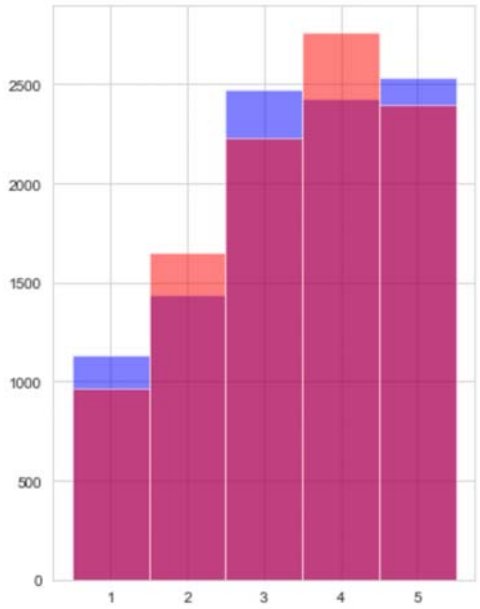
EXAMPLE PROJECT

Calibration Results:

Different customer groups



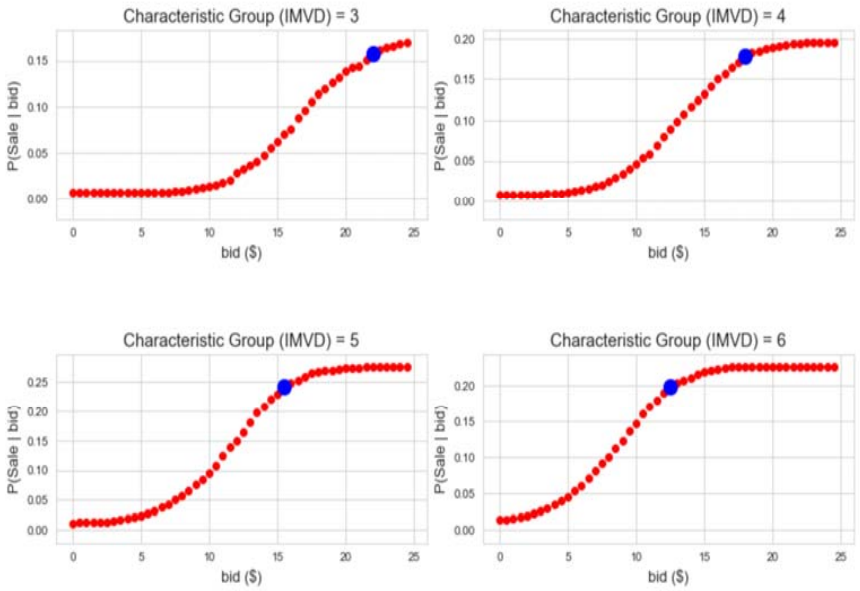
All groups



EXAMPLE PROJECT

Analysis using generated observations for competitors' bids:

Here the goal is to find a bid that maximizes the conditional probability of sale for each customer group.



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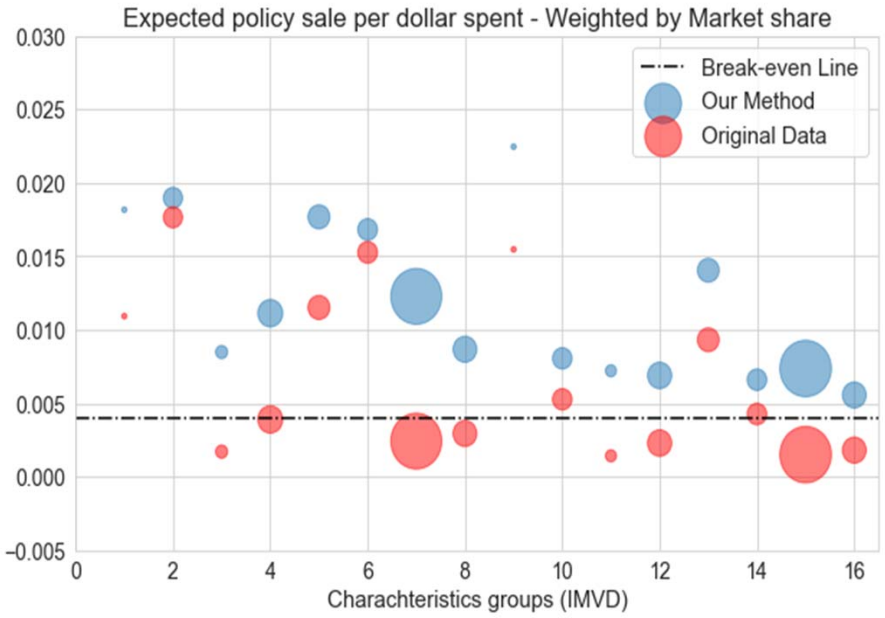

THANK YOU!

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https://github.com/saeedshaker/RootIC/blob/master/Root%20Insurance%20Challenge-Part%20II.ipynb