

True-Lift Modeling: Mining for the Most Truly Responsive Customers and Prospects

Kathleen Kane
Jane Zheng
Victor Lo¹
Alex Arias-Vargas

Fidelity Investments

¹Also with Bentley University



San Francisco,
March 14-15 2011



J.J.

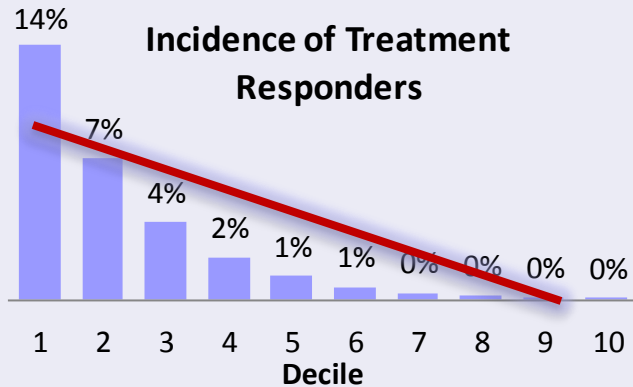
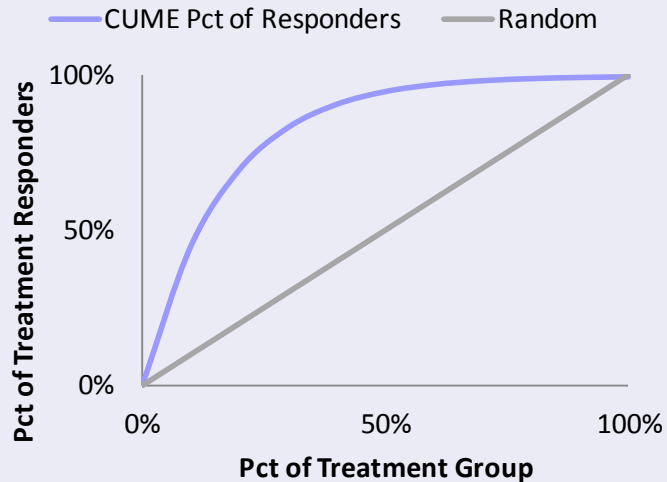
Stop spending direct marketing dollars on customers who would purchase anyway!

- True-lift modeling can identify:
 - which customers will purchase without receiving a marketing contact
 - which customers need a direct marketing nudge to make a purchase
 - which customers have a negative reaction to marketing (and purchase less if contacted)
- This discussion will describe:
 - the basic requirements needed to succeed with true-lift modeling
 - scenarios where this modeling method is most applicable
 - the pros and cons of various approaches to true-lift modeling

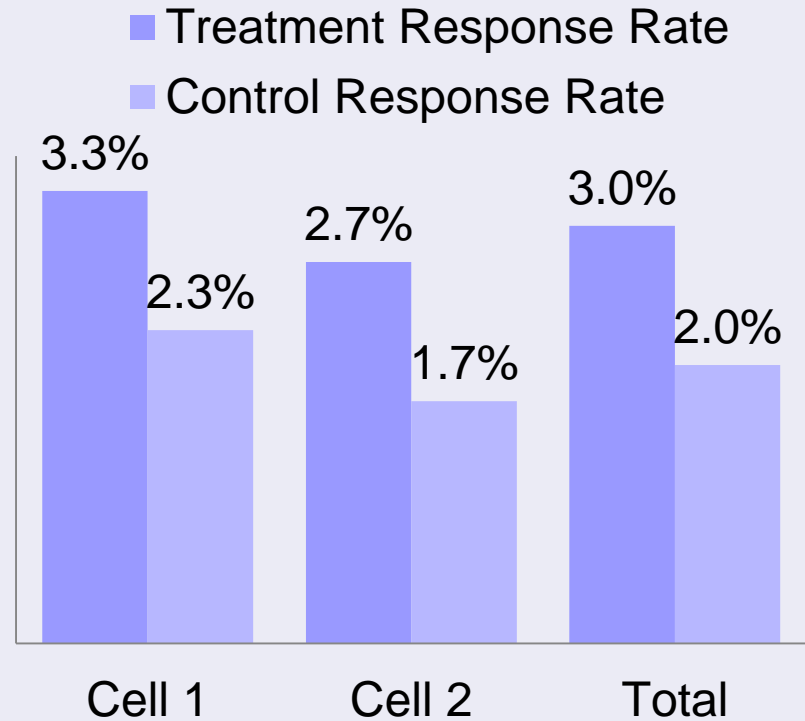
Outline

- Why do we need true-lift modeling? 10min
- What are the methods of true-lift modeling? 10min
- What is the context where true-lift modeling is most necessary & useful? 10min
- Questions 10min

What's wrong with this picture?

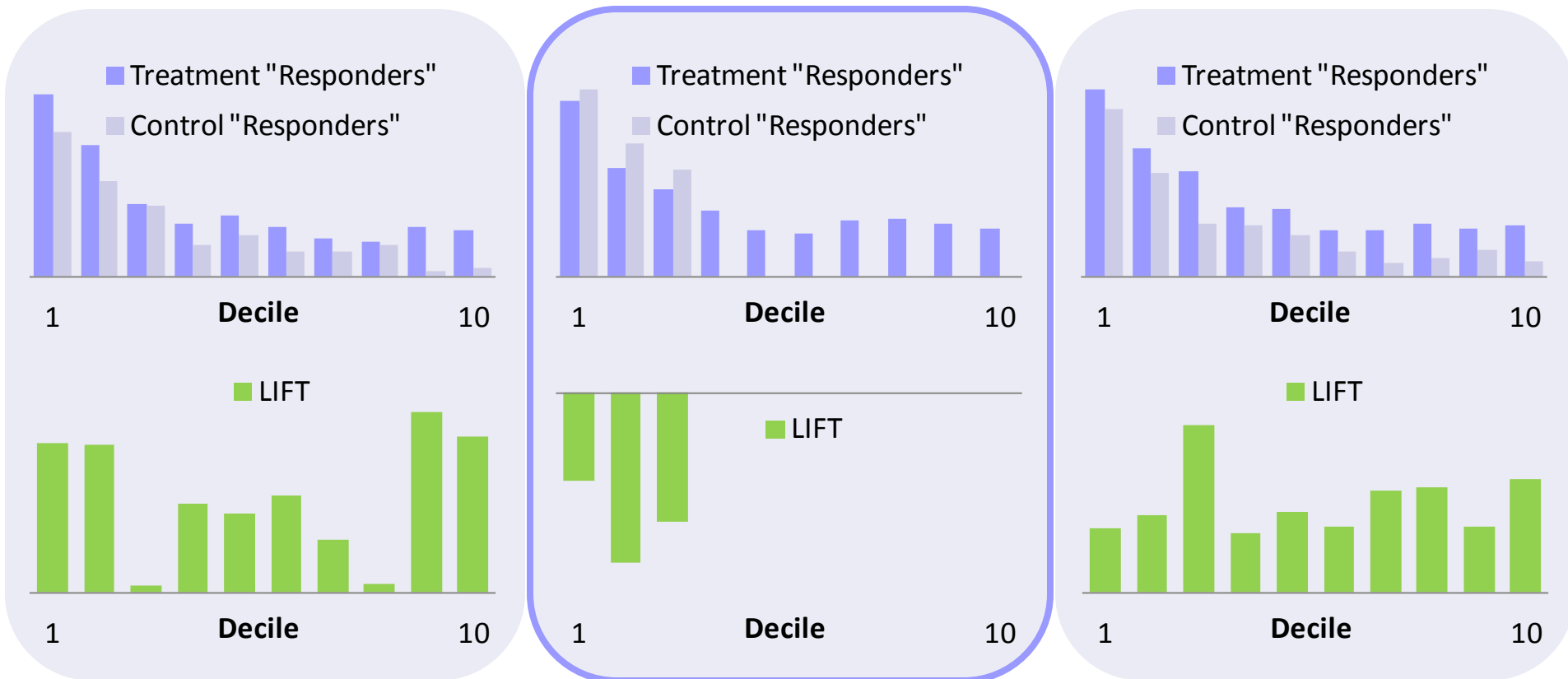


A successful response model



A successful marketing campaign

Measuring response models by lift over control



Why do we need true-lift modeling?

Look-alike model = find people who will take Action A

$$=P(A)$$

Standard response model = find people who will take Action A after receiving a treatment

$$=P(A | \text{Treatment})$$

True-lift model = find people who will take Action A **only** after receiving a treatment

$$=P(A | \text{Treatment}) - P(A | \text{no Treatment})$$

- Standard response models often behave more like Look-alike models than like True-lift models
- Why spend marketing \$\$\$ on people who would do Action A anyway?

Why do we need true-lift modeling?

Look-alike model = find people who will take Action A

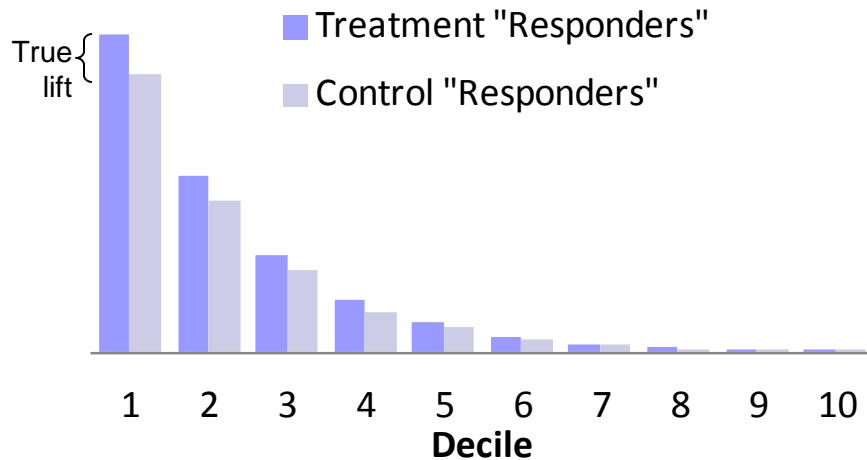
True-lift model = find people who will take Action A **only** after receiving a treatment

- **When is a look-alike model good enough?**
 - **Responders can only take Action A if they receive one unique marketing contact**
 - **Single channel**
 - **Single contact**
 - **No other way to take Action A**

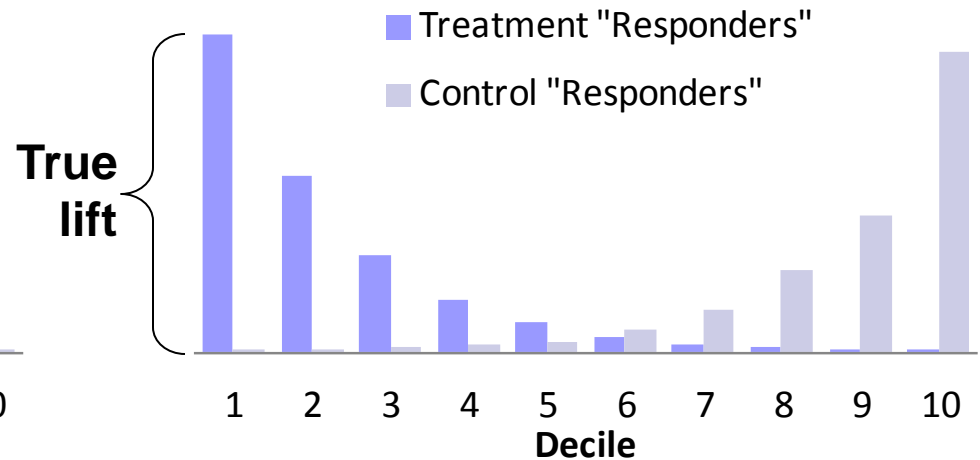
- **When is a true-lift model needed?**
 - **Responders have many opportunities to take Action A**
 - **Multiple channels**
 - **Multiple contacts**

The True-Lift model objective

- Maximize the Treatment responders while minimizing the control “responders”



A standard response model



A True-Lift response model

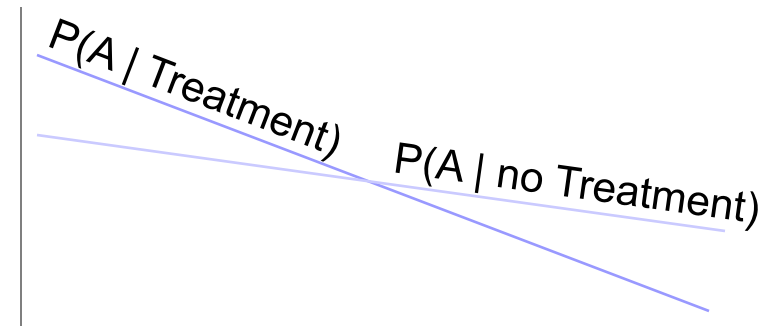


True-Lift model solutions

- A. Difference of two models: Treatment – Control
- B. Two sequential models: Treatment Actual – Control Prediction
- C. Binned & Averaged dependent variable

Solution A1: Difference of two models: Treatment - Control

- Model 1 predicts $P(A | \text{Treatment})$
 - Dependent variable = Action A
 - Model Population = Treatment Group
- Model 2 predicts $P(A | \text{no Treatment})$
 - Dependent variable = Action A
 - Model Population = Control Group

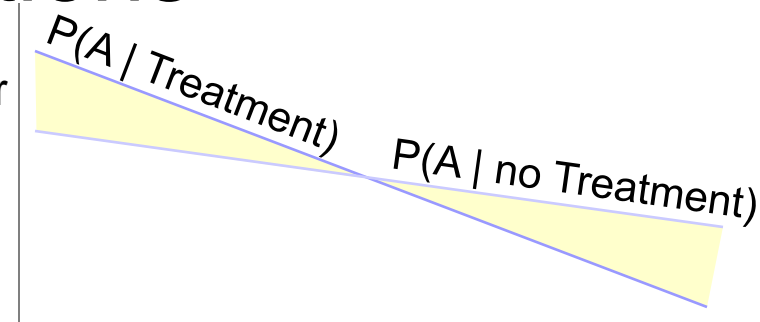


- Final prediction of lift =
$$\text{Model 1 Score} - \text{Model 2 Score}$$
- Pros: simple concept, familiar execution (x2)
- Cons: indirectly models true-lift, the difference may be only noise, 2x the work, scales may not compare, 2x the error, variable reduction done on indirect dependent vars

Solution A2: Single combined model using Treatment interactions

- Model population = Treatment & Control together
- Dependent variable = Action A
- Independent variables are attributes x,y,z:
- Conceptually:

Lift
↓



$$P(\text{Action A}) = P(A | \text{not Treated}) + P(A | \text{only if Treated})$$

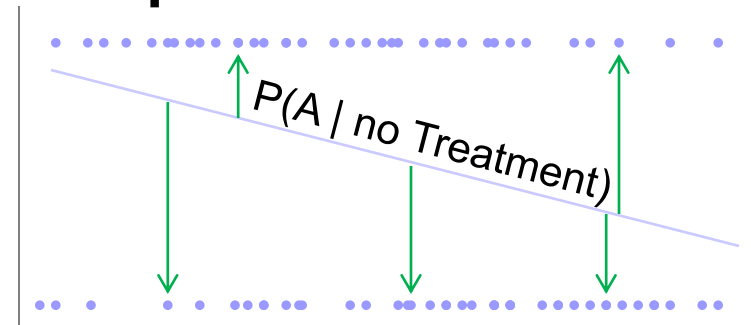
$$= \{\text{some coefficients}\} * \{x,y,z\} + 0/1 \text{ treatment flag} * \{\text{some coefficients}\} * \{x,y,z\}$$

During model development, the interaction flag is 0 for control records and 1 for treatment records

- Final prediction of lift = difference of two scores
 - = Prob(response if Treated) – Prob(response if not Treated)
 - = score with interaction flag set to 1 – score with interaction flag set to 0
- Pros: combined model minimizes compounded errors
- Cons: indirectly models true-lift; large number of independent terms; collinearity of terms; reduction needed; adding two model scores may compound errors

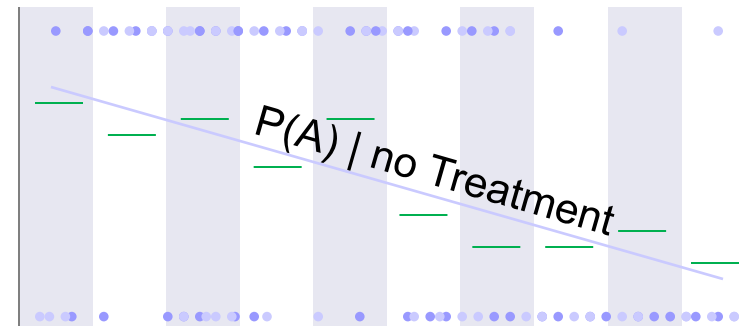
Solution B: Two sequential models: Treatment actual – Control prediction

- Model 1 predicts $P(A \mid \text{no Treatment})$
 - Dependent variable = Action A
 - Model Population = Control Group
- Model 2 predicts $P(A \mid \text{Treatment}) - P(A \mid \text{no Treatment})$
 - Dependent variable = Action A – Model 1 Score
 - Model Population = Treatment Group
- Final prediction of lift = Model 2 Score
- Pros: more directly models true-lift; identifies variables that are directly correlated with true-lift (some of which are drivers of lift)
- Cons: the Model 2 dependent variable contains Model 1 errors; 2x the work, Model 1 scores and Action A should (but might not) share the same scale



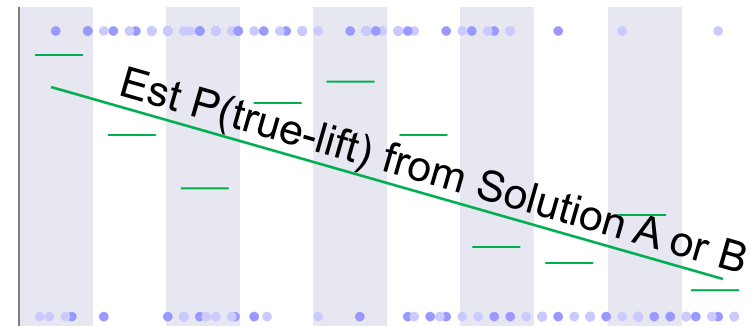
Solution C1: Binned & averaged dependent variable

- Model 1 predicts $P(A \mid \text{no Treatment})$
 - Dependent variable = Action A
 - Model Population = Control Group
- Create N bins for Treatment & Control population together, ranked by Model 1 score (control “response”)
- Calculate dependent variable value for each BIN:
Treatment response rate – Control response rate
- [Could stop here, using the bin average lift as the predicted lift, or continue with]:
- Model 2 predicts actual average lift of each bin
 - Dependent variable = Average lift within each bin
 - Model Population = Treatment Group
- Final prediction of lift = Model 2 Score
- Pros: directly models true-lift; identifies variables that are directly correlated with true-lift (some of which are drivers of true-lift)
- Cons: 2X the work; the approach requires variation in average lift across bins (which might not exist); control response needs to be correlated to true-lift response

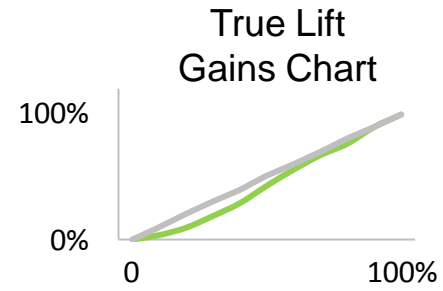
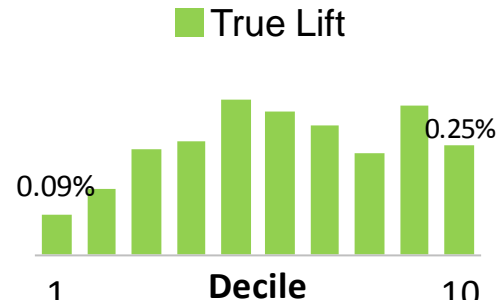
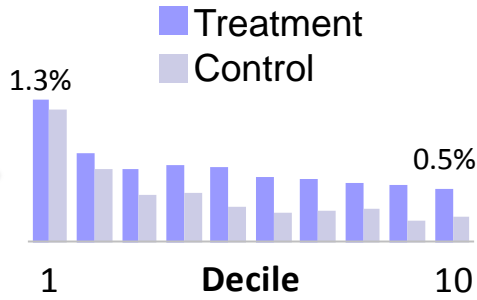


Solution C2: Solution A or B + binned & averaged dependent variable

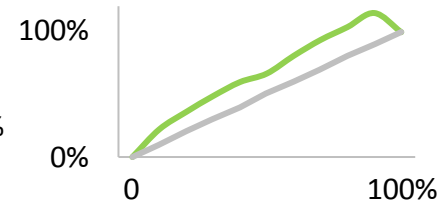
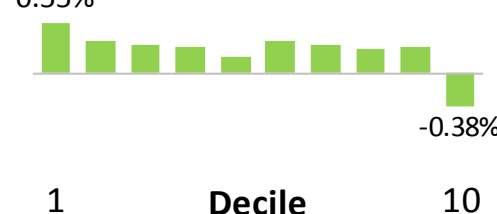
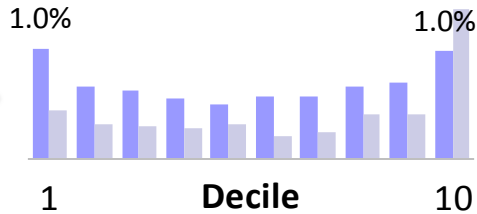
- Complete Solution A or B first to rank-order observations by estimated lift
- Use Solution A/B model score to rank and bin the observations: create N bins for Treatment & Control population together, ranked by Solution A/B score
- Calculate dependent variable value for each BIN:
 - Treatment response rate – Control response rate
- [Could stop here, using the bin average lift as the predicted lift, or continue with]:
- Model 3 predicts actual average lift of each bin
 - Dependent variable = Average lift within each bin
 - Model Population = Treatment Group
- Final prediction of lift = Model 3 Score
- Pros: directly models true-lift; this approach is more likely to maximize the variation in average lift across bins; identifies variables that are directly correlated with “lift” (some of which are drivers of lift)
- Cons: 3X the work



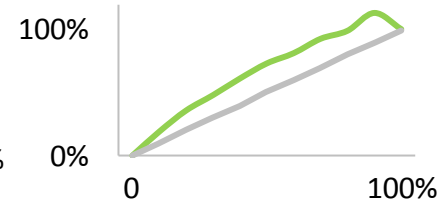
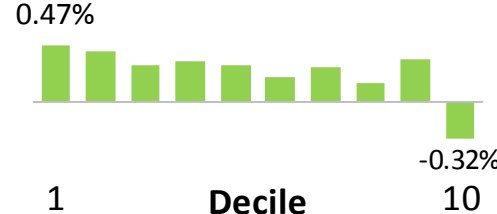
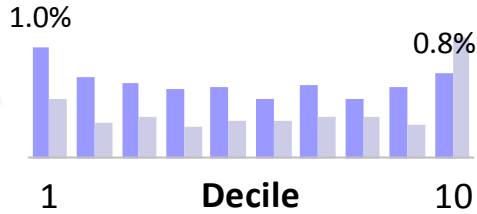
Standard response model



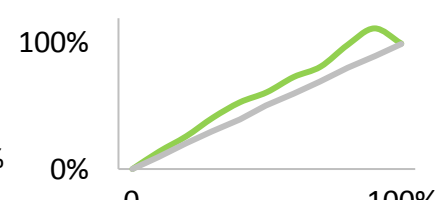
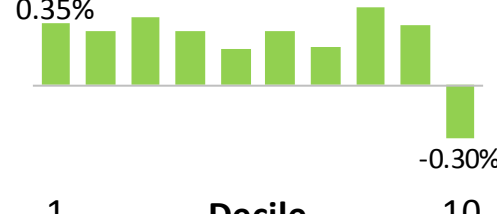
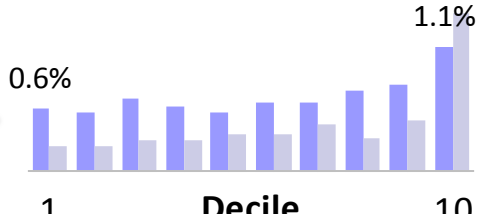
Solution A2: Single combined model with interactions



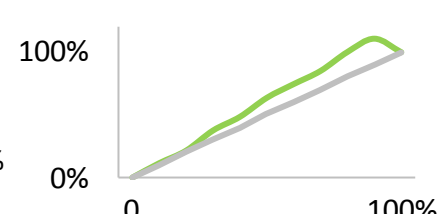
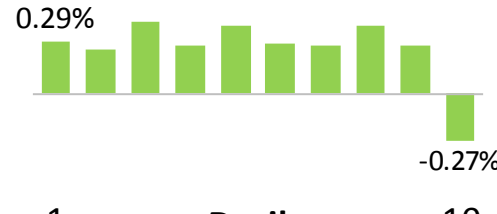
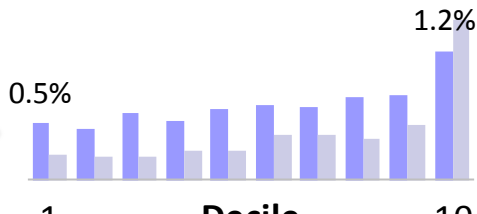
Solution B: Depvar = Treatment actual - Control prediction



Solution C1: Ranked & binned by Control model



Solution C2: Ranking & binned by Lift model



Simulated data

Other solutions, variations & applications

- Decision trees
 - Clustering / K-nearest neighbor
 - Bootstrapping
 - Optimization
-
- Personalized medicine
 - Other marketing situations (how to separate very similar groups who act differently)

Ideal conditions for true-lift modeling

- A randomized control group is withheld!
- Treatment does not cause all “responses”
- “Response” is not correlated to “lift” (i.e., response model is not good enough)
- Lift-to-noise ratio is large enough
- If overall lift is near 0, then you need pockets of both negative lift and positive lift
- Repeated campaigns, or at least test campaign precedes rollout

Stop spending direct marketing dollars on customers who would purchase anyway!

- True-lift modeling can identify:
 - which customers will purchase without receiving a marketing contact
 - which customers need a direct marketing nudge to make a purchase
 - which customers have a negative reaction to marketing (and purchase less if contacted)
- This discussion will describe:
 - the basic requirements needed to succeed with true-lift modeling
 - scenarios where this modeling method is most applicable
 - the pros and cons of various approaches to true-lift modeling

Glossary

- “Response” = taking the desired action (Action A); might have done Action A whether treated or not
- True-lift = taking the desired action (Action A) *only* in response to the Treatment; would not have done Action A if not treated (aka uplift, net lift, incremental lift)