Know Thy Customer: Predicting How Preference Translates into Choice

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PROFESSIONAL PRICING SOCIETY™

A Quick Survey (In the spirit of knowing my customer)

- **How many of you have done the following:**
  - Conducted an Economic Value (to the Customer) Analysis?
  - Conducted a conjoint or tradeoff analysis?
  - Estimated attribute utilities and/or demand based on purchase data?
  - None of the above?

- **How many of you:**
  - Have used utility estimates to build a choice or demand model?
  - Have used preprogrammed demand or choice models, such as Sawtooth?

Goals

- Improve your customer choice models so that they correspond more closely to the underlying choice process and real market data
- Enable improved estimates of customer response to price changes thus improving pricing decisions

Outline

- **Brief review of preference measurement and traditional demand modeling**
- **Challenges in fitting predicted preferences to real world data**
  - Accounting for the impact of marketing-related activities in choices
  - Accounting for individual customer choice decision processes
  - Accounting for group customer choice decision processes

Demand Modeling

- **If you consider customer value when you set price, you will use a model of demand**

- **Types of demand models**
  - *Implicit*: Using managerial judgment

  - *Empirical*: Generic Approaches
    - **Aggregation of individual choices**
      - Estimate preferences of individuals
      - Predict individual's choices and how they vary with price and other product design variations
      - Aggregate across individuals

    - **Estimate from aggregate choices**
      - Estimate how aggregate sales vary over time or across markets as a function of price, marketing activities and product features

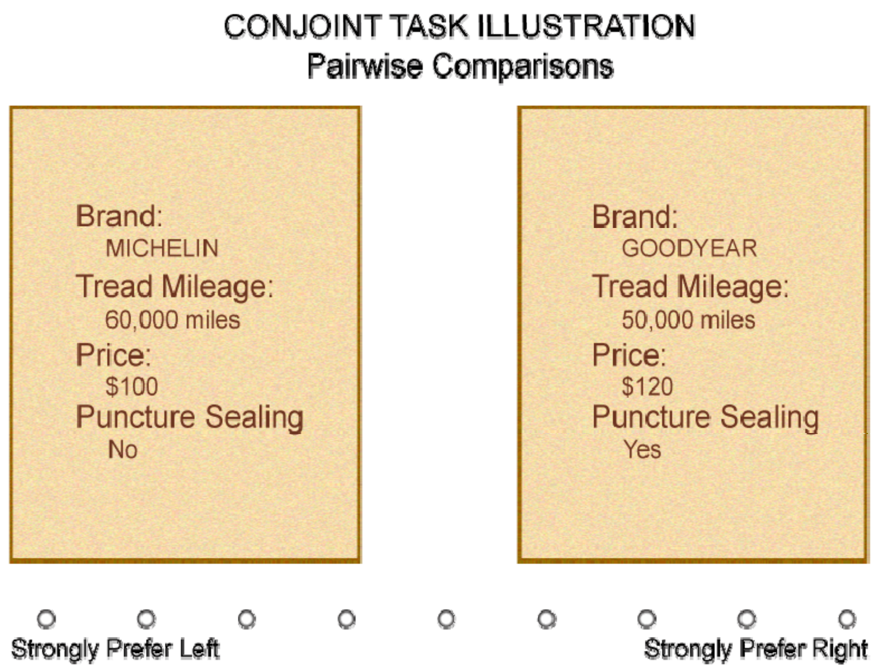
Approaches to Preference Measurement

- **Economic Value to the Customer Analysis**
  - **Reference/Replacement Value:** The present value of the incremental cost of the option to be replaced
  - **Differentiation Value:** The present value of differences in cost or revenue implications of the alternative to be valued
    - Cost of use (e.g. efficiency, operating speed)
    - Cost of maintenance
    - Set-up costs (installation and training)
    - Risk (likelihood of failure and resulting cost)
    - Performance quality of output
    - Adding value to customer's customer

Approaches to Preference Measurement

- **Tradeoff analysis (e.g. Conjoint)**
  - A survey driven approach
  - Determine relevant attributes and attribute values
  - Elicit preferences based on hypothetical product profiles

Sample Task:



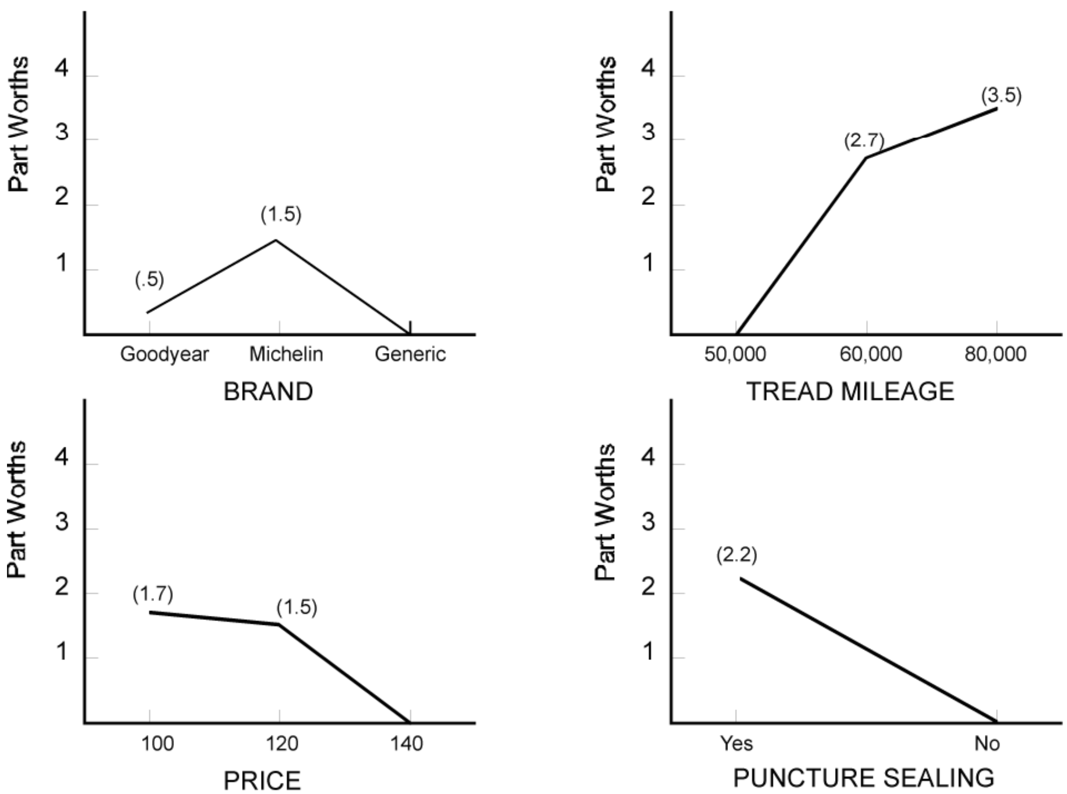
Approaches to Preference Measurement

- **Tradeoff analysis (e.g. Conjoint)**

Sample Output: Part-Worth Utility Estimates

CONJOINT OUTPUT ILLUSTRATION

Part-Worth Utilities



The utility of an alternative Is given by the sum of the part-worth utilities associated with its attributes

Basic Choice Modeling

- **Strict Utility Maximization**
  - Customers choose the most preferred alternative with certainty

- **Expected Utility Maximization**
  - Customers make random errors in estimating the utility of alternatives
  - Example: Logit Models

Us

$$\Pr(\text{Choose Product 1}) = \frac{e^{\beta\times\text{Utility of Product 1}}}{\sum_{i\in\text{Choice Set}} e^{\beta\times\text{Utility of Product } i} + e^{\beta\times\text{Utility of No Purchase}}}$$

Us + The Alternatives

  - Where β is an estimated parameter reflecting choice or model accuracy (ideally estimated based on past choices)

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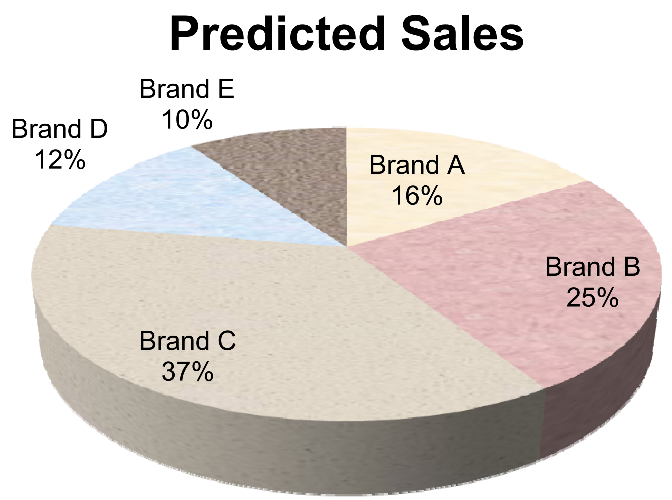
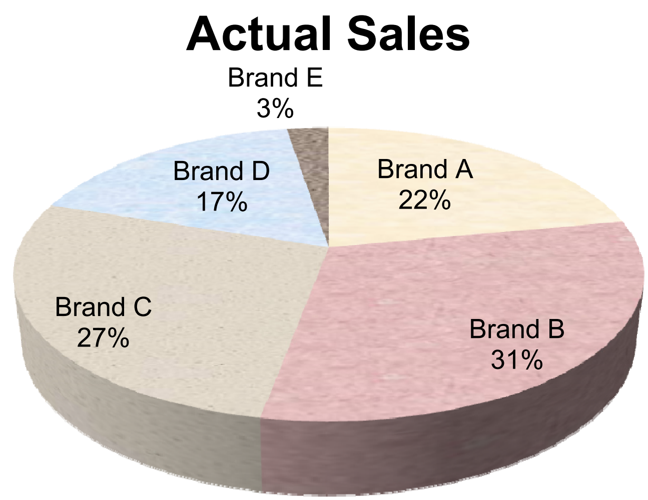
Challenges

- **The reality check:**

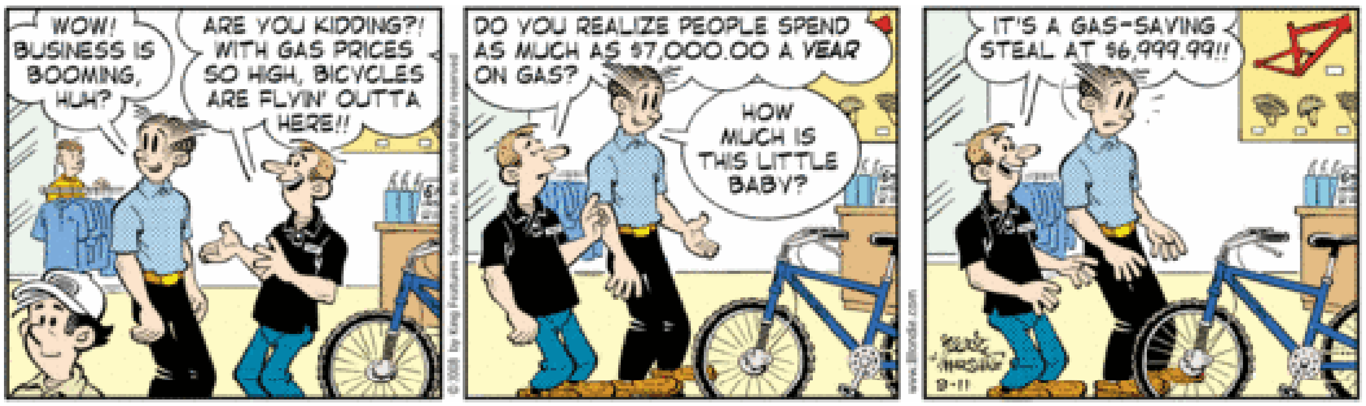




- **What could have gone wrong?**

Challenges

- **What could have gone wrong?**
  - **Preference model misspecification**



  - **A failure to account for marketing related variables**
  - **A failure to account for decision processes**

Modeling Challenges due to Marketing Influences

- **Problem: Customer perceptions may not correspond to what you think is reality**

- **Why?**
  - **May not believe that certain brands will have certain characteristics**
  - **Past experiences may not be representative**
    - May not have used the product before so don't know about features or benefits
    - May not know how to use a feature so don't appreciate benefits
    - May have had bad (or good) luck in the past
  - **May not have been exposed to information about a product's features or benefits or that information may not have been processed**
    - Some benefits may be taken for granted or ignored
    - Common in economic value to the customer analyses
  - **You may be mistaken**

Modeling Challenges due to Marketing Influences

- **Problem: Customer perceptions may not correspond to what you think is reality**

- **Pricing implications**
  - People make choices based on perceptions rather than reality
    - This may work for or against you
  - Price should be set to capture the desired share of customer's perceived value rather than your perceived value
    - Perceived value may be adjusted by marketing communications
    - Be careful about charging a price to take advantage of mistaken positive beliefs if there is a good chance that those beliefs will be corrected
  - **Customers should be asked about their perceptions of different product alternatives and brand choice predictions should be based on perceptions as opposed to an "objective" measure**

Modeling Challenges due to Marketing Influences

- **Problem: Customers evaluate product offerings in a context**

- **The attractiveness of a price will depend on**
  - How it compares to a *reference price* based on
    - Past experience
    - The prices of other alternatives
    - A list price
    - Prices that are higher than the reference price are treated less favorably than the same price would be in the absence of a reference price
  - How the price is framed
    - A discounted price versus a lower regular price - Some product categories have "reference discounts"
    - Fixed price versus a price based on the level of use, etc.

  - A statistical analysis of historical choice data is helpful to measure these effects

Modeling Challenges due to Marketing Influences

- **Problem: The product or brand may not be in the choice set**

- **Why?**
  - Customers may not be aware of the product
  - Their chosen vendor may not carry the product or display it effectively
  - It may be incompatible with technology they currently use

- **Pricing implications**
  - Price changes won't influence sales among these customers unless doing so brings the product or brand into the choice set
  - Non-price marketing efforts may need to be required to get the product considered

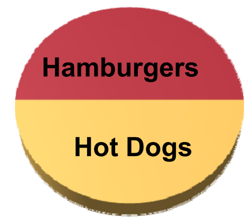
Modeling Individual Decision Processes

- **Traditional choice models assume that decision-makers process all available data and they will tend to choose the alternative that yields the highest utility (value)**
  - This may imply a lot of data processing on the part of the customer when making decisions, especially if there are many alternatives with many features

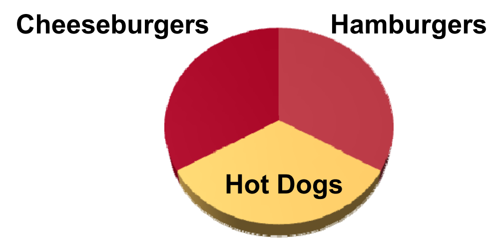
- **Problem: Decision-makers will often take steps to simplify the decision-making process**

Modeling Individual Decision Processes

- **Example:**
  - Consider a restaurant that servers hamburgers and hot dogs
    - Assume price is set so that the customer is indifferent between them



  - What is the probability of the customer’s choosing each alternative?
  - What happens if a cheeseburger is added to the menu?
    - Assume the price of the cheeseburger is just high enough to leave the consumer indifferent between all three alternatives
  - What is the probability of the customer’s choosing each alternative?



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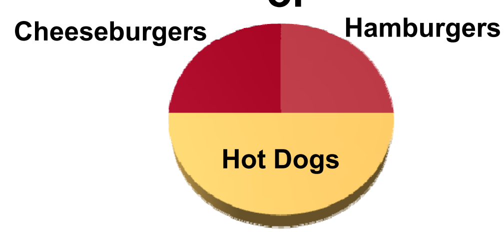


Modeling Individual Decision Processes

Nested Decision-Making

- **Customers will break alternatives down into categories**
  - They may eliminate some categories
  - They will choose among acceptable categories
  - When a category is chosen they will choose among alternatives within the category

Modeling Individual Decision Processes

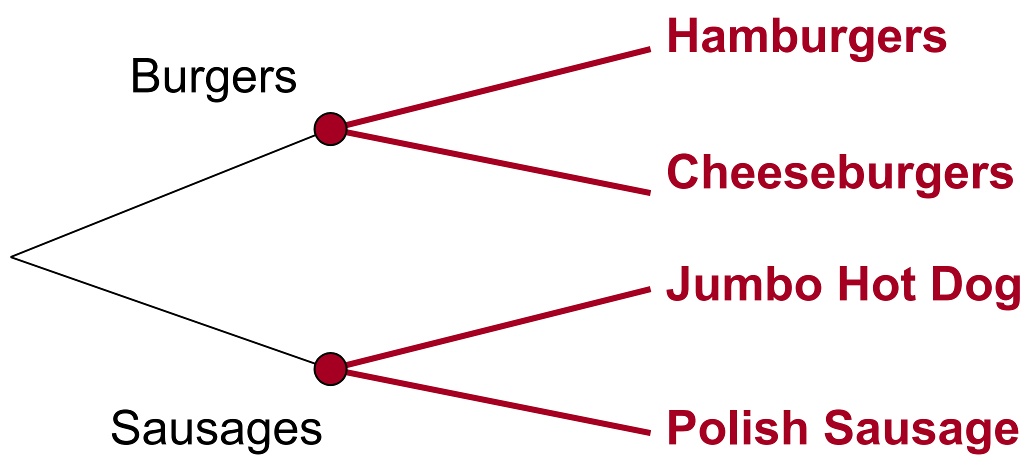
Nested Decision-Making

- **Examples:**
  - Decide on brand first and then which alternative to choose within the brand (traditional car shopping model)
  - Decide on product form first and then brand (beverages: bottles vs. cans, diet vs. non-diet, cola vs. non-cola, etc.)
  - Decide on vendor first and then choose an alternative offered by that vendor
    - Vendors may have different product offerings (implying different choice sets), different pricing, and different promotional activity
    - Vendor choice may or may not be influenced by the product category being considered

Modeling Individual Decision Processes

Predicting Choices with Nested Decision-Making

- **Example**



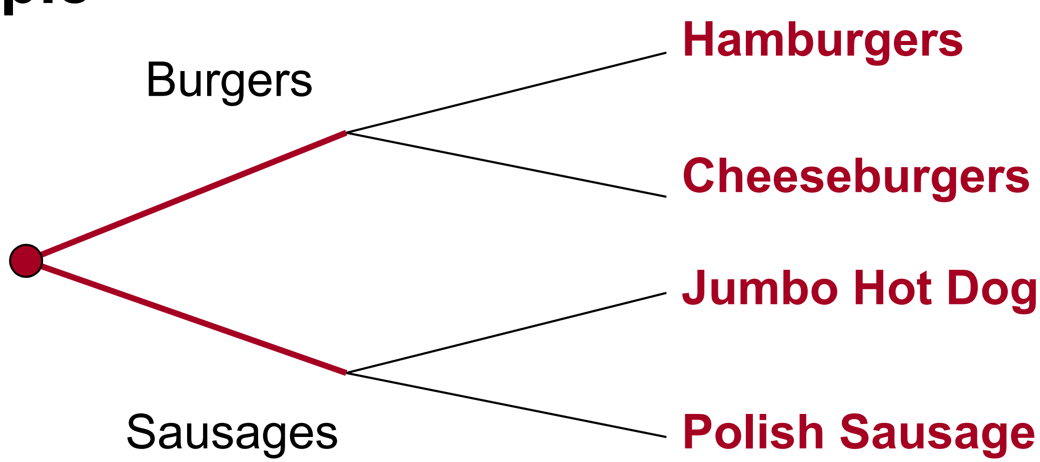
Procedure:

1. **Estimate choice probabilities within each category based on product utility**
   e.g. Pr(Hamburger|Burgers), Pr(Cheeseburger|Burgers)
2. **Estimate the expected utility of the category**
   e.g. EU(Burgers) =
   Pr(Hamburger|Burgers)xU(Hamburger)+ Pr(Cheeseburger|Burgers)xU(Cheeseburger)

Modeling Individual Decision Processes

Predicting Choices with Nested Decision-Making

- **Example**

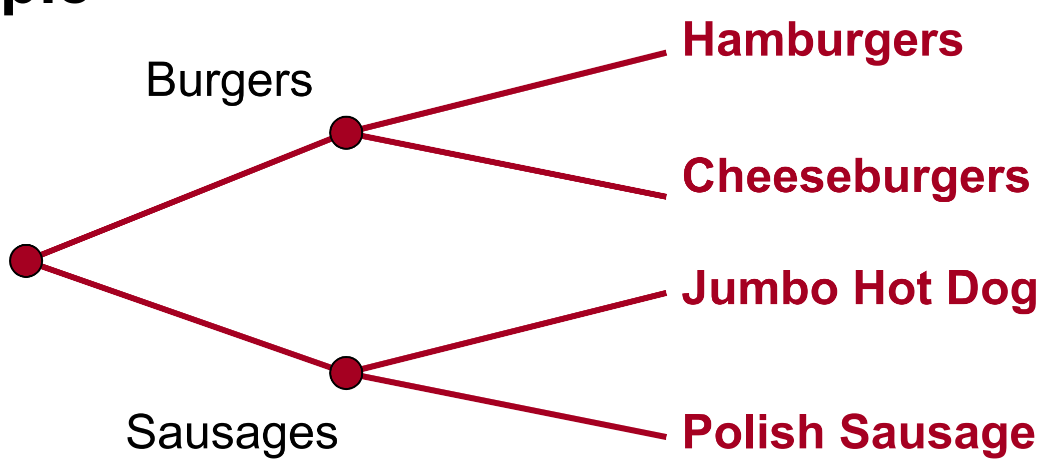


3. **Estimate category choice probabilities based on the expected utility of the category**

Modeling Individual Decision Processes

Predicting Choices with Nested Decision-Making

- **Example**



4. **Estimate product choice probabilities:**
   e.g. Pr(Hamburger) = Pr(Hamburger|Burgers)xPr(Burgers)

Modeling Individual Decision Processes

Nested Decision-Making

- **Deciding which nested structure is appropriate**
  - Ask customers about their decision-making process
  - Try different structures and see what fits the best
- **Pricing implications:**
  - Price response estimates may be biased if they don't separately account for:
    - The impact of price on category choice
    - The impact of price on band choice within the category

Modeling Individual Decision Processes

Eliminating “Unacceptable” Alternatives

- **Customers may have a set of “deal-breaking” criteria and will eliminate any alternatives that don’t satisfy those criteria regardless on how they perform on other attributes**

- **This effectively eliminates them from the choice set even with awareness**

- **Examples:**
  - The customer is purchasing under a strict budget and prices above that level won’t be acceptable regardless of quality
  - An imaging device that doesn’t have improved resolution over may not be considered

Modeling Individual Decision Processes

Eliminating "Unacceptable" Alternatives

- **Dealing with the issue:**
  - Survey customers to find out what the deal breakers are and eliminate alternatives that don't satisfy these criteria from their choice sets
    - Note: different customers may have different deal breakers so they may have different choice sets
  - To the extent possible eliminate the unacceptable from choice tasks used to estimate utility
    - It may be desirable to give different customers different conjoint tasks
    - New adaptive conjoint methodologies allow the exclusion of "deal breaking" attribute values

Modeling Individual Decision Processes

Simplifying the evaluation of alternatives

- **Customers may not consider all attributes**
  - Products often have many relevant attributes but customers often only consider a few of them
  - Economic value to the customer and conjoint analyses will often over-estimate the importance of less-important attributes

- **Dealing with the issue:**
  - Omit “less important” attributes when computing estimated utility or value of the different alternatives in the choice set
  - Test to see if doing so improves fit with real world data
  - Note: Customers may vary in the attributes they consider to be important

Group Decision Processes

- **Problem: There may be multiple parties who influence decisions**

- **Different parties may place different values on different features**

- **If you are estimating the value of only one party, your choice predictions will be biased**
  - Example: Medical equipment
    - Physician / Practitioner will value reliability, quality and ease of use
    - Administrators will be more interested in cost and the value of the equipment in driving business

Group Decision Processes

- **Dealing with the issue:**
  - **Estimate a joint utility function**
    - Have the relevant parties take a conjoint (or similar) survey jointly
    - Have the relevant parties take a conjoint (or similar) survey independently - Estimated utility can be approximated by a weighted average of the respondents
  - **Treat the decision as a sequential process (say with two decision makers)**
    - View one party as reducing the choice set by eliminating unacceptable alternatives
    - The second party can be viewed as choosing among the alternatives in the reduced choice set.
    - Example: Medical Equipment:
      - Administrator sets maximum cost or minimum economic value
      - Practitioner chooses from alternatives that satisfy the administrator's criteria

Summary

- **Traditional demand modeling methodologies may provide models that have substantial biases that may give misleading predictions about customer responses to price**

- **Things that should be considered when building demand models:**
  - The impact of marketing-related activities in choices
  - Accounting for individual customer choice decision processes
  - Accounting for group customer choice decision processes