Measuring Customer Preferences

In this module…

- Methods to assess willingness to pay
  - Surveys
  - Conjoint analysis
- Case applications
  - Adios Junk Mail
  - Portland Trailblazers
  - Fidelity Investments

By the end of this module you'll be able to…

- Evaluate the advantages and disadvantages of surveys as a means to determine willingness to pay (WTP)
- Analyze survey results and what they reveal about WTP

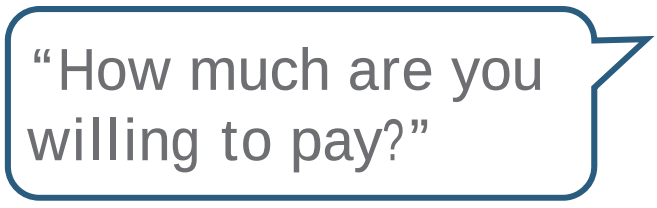
By the end of this module you'll be able to…

- Recognize opportunities when conjoint analysis could be useful in determining WTP
- Explain how conjoint analysis can be used to determine WTP
- Interpret conjoint analysis results and what they reveal about WTP

Obtaining Willingness to Pay from Surveys

Week 3

Surveys: Just Ask



Survey Advantages

Survey Disadvantage

Survey Disadvantage

How do you adjust surveys?

At what price would this product be so inexpensive that you would doubt its quality?

Sample Responses: Minimum Price

Minimum Price	Frequency	Percentage	Cumulative Percentage
1.0	1	9.1%	9.1%
4.0	2	18.2	27.3
5.0	3	27.3	54.5
10.0	3	27.3	81.8
15.0	1	9.1	90.9
20.0	0	0.0	90.9
25.0	1	9.1%	100.0%

How do you adjust surveys?

At what price would this product be so expensive that it wouldn't be worth it?

Sample Responses: Price at Which Product Is Not Worth Buying

Maximum Price	Frequency	Percentage	Cumulative Percentage
20.0	2	18.2%	18.2%
25.0	0	0.0	18.2
31.0	2	18.2	36.4
35.0	1	9.1	45.5
45.0	2	18.2	63.6
50.0	1	9.1	72.7
51.0	2	18.2	90.9
55.0	1	9.1%	100.0%

Sample Responses: Combined Data

Price	Percentage Who Feel the Price is Not Too Low	Percentage Who Feel the Price is Too High	Percentage Willing to Pay the Specified Price
1.0	9.1%	0.0%	9.1%
4.0	27.3	0.0	27.3
5.0	54.5	0	54.5
10.0	81.8	0.0	81.8
15.0	90.9	0.0	90.9
20.0	90.9	18.2	72.7
25.0	100.0	18.2	81.8
31.0	100.0	36.4	63.6
35.0	100.0	45.5	54.5
45.0	100.0	63.6	36.4
50.0	100.0	72.7	27.3
51.0	100.0	90.9	9.1
55.0	100.0	100.0	0.0%

Sample Responses: Combined Data

Price	Cumulative %	Cost	Margin	Profit
1.0	9.1%	5.0	-4.0	-0.36
4.0	27.3	5.0	-1.0	-0.27
5.0	54.5	5.0	0.0	0.00
10.0	81.8	5.0	5.0	4.09
15.0	90.9	5.0	10.0	9.09
20.0	72.7	5.0	15.0	10.91
25.0	81.8	5.0	20.0	16.36
31.0	63.6	5.0	26.0	16.54
35.0	54.5	5.0	30.0	16.35
45.0	36.4	5.0	40.0	14.56
50.0	27.3	5.0	45.0	12.29
51.0	9.1	5.0	46.0	4.19
55.0	0.0%	5.0	50.0	0.00

Still Problems with Surveys

- Increases the importance of price in the minds of respondents
- Isolates price from other attributes
- Solution: conjoint analysis

Obtaining Willingness to Pay from Conjoint Analysis

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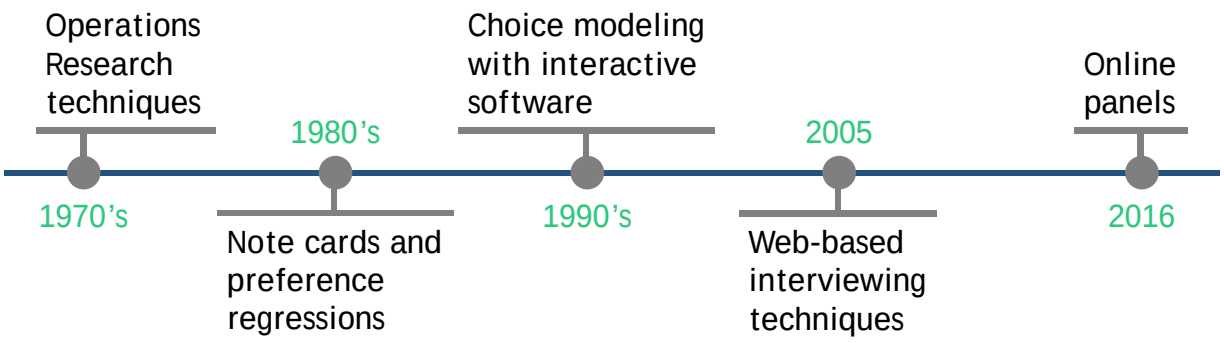
DARDEN SCHOOL OF BUSINESS

What is conjoint analysis?

Statistical technique to determine how people value different product attributes

The Evolution of Conjoint Analysis



Some Applications

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Why Conjoint Analysis?

Asking direct questions about preferences often leads to unenlightening answers.

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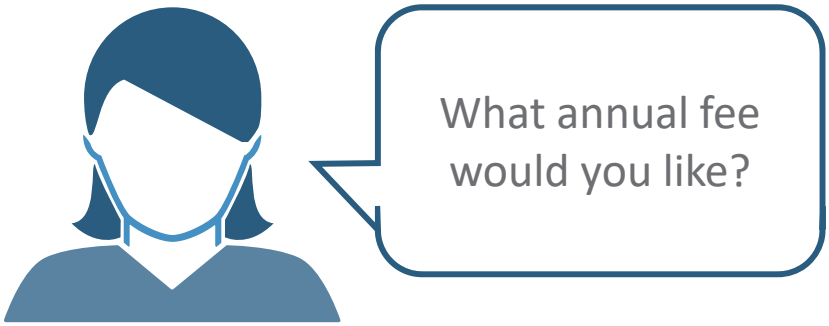

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Asking direct questions about preferences often leads to unenlightening answers.

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Asking direct questions about preferences often leads to unenlightening answers.

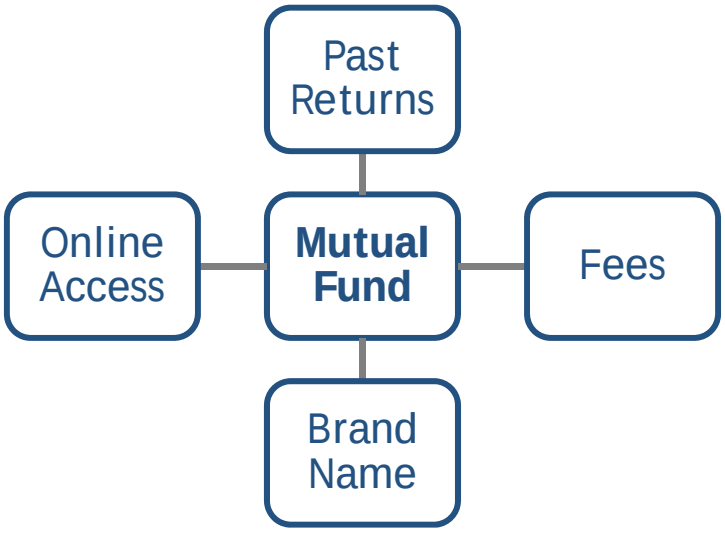
People want everything and they want it for free!

Why Conjoint Analysis?

- Aid for Pricing Decisions
  - Sellers want to increase profits by providing cost-effective products that consumers value.
  - First step is to determine the trade-offs consumers are willing to make among various attributes.

Conjoint Can Help When…

- Product or service can be decomposed into attributes



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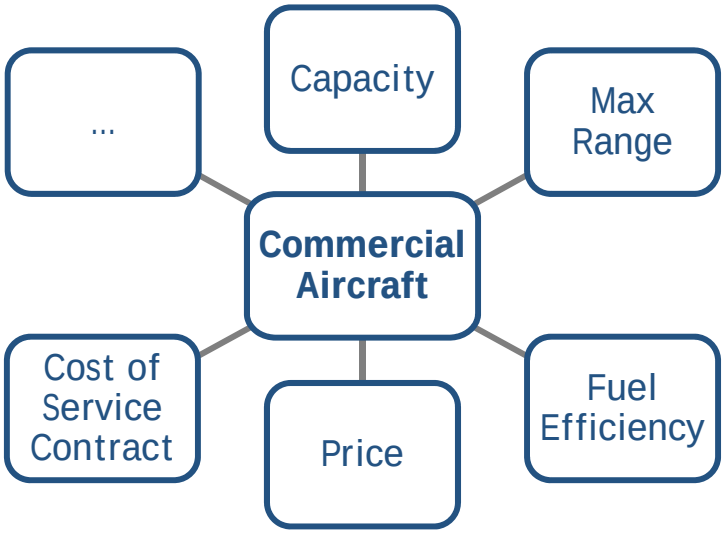
- Product or service can be decomposed into attributes



Conjoint Can Help When…

- Product or service can be decomposed into attributes

Clothing?

Conjoint Analysis: Steps 1 - 3

How Does Conjoint Work?

- Show consumers a series of hypothetical products defined by their attributes
- Ask the respondent to pick the product they like the best.
- Repeat 20-30 times.
- Use responses to estimate attribute-level utilities.

A Car Purchase!

BMW328i	Ford Focus Sedan	Ford Focus Hatchback	
 Photo by Ray T (Flickr)			
No Navigation System Pearl White Cloth Interior $21,000	GPS Navigation System Metallic Dark Blue Cloth Interior $27,000	GPS Navigation System Black Leather Interior $15,000	NONE: I wouldn't choose any of these.

Step 1 – Define Attribute List

- Select most important determinants of choice
- Assure independence (brand, price, color, etc.)
- Define by different levels

A Car Purchase!

BMW328i	Ford Focus Sedan	Ford Focus Hatchback	
 Photo by Ray T (Flickr)			
No Navigation System	GPS Navigation System	GPS Navigation System	NONE: I wouldn't choose any of these.
Pearl White	Metallic Dark Blue	Black	
Cloth Interior	Cloth Interior	Leather Interior	
$21,000	$27,000	$15,000	

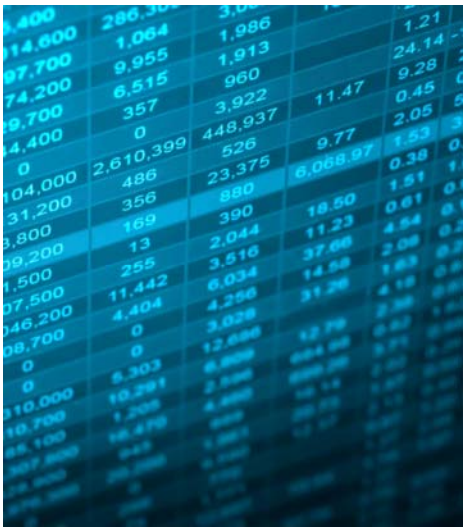
Five Attributes (Manufacturer, Navigation System, Color, Interior, and Price)

Step 2 - Formulate Levels

- Concrete and unambiguous
  - "Very Expensive" vs. "$250"
  - "Powerful" vs. "280 Horsepower"
- Mutually exclusive
  - Range = 5000 miles,
    Range = 6000 miles

Step 3 – Collect Data

- Via web-based experiments
- Recommend ≥ 500 respondents
- ≤ 30 questions per person
- Collect individual-level information to aid segmentation decisions



Conjoint Analysis: Step 4

Step 4 – Interpret Conjoint Results

	Effect	Std Err	t Ratio	Attribute Level
1	0.56175	0.03366	16.68973	1 1 High-Flyer Pro, by Smith and Forester
2	0.42966	0.03359	12.79133	1 2 Magnum Force, by Durango
3	-0.38322	0.04097	-9.35267	1 3 Eclipse+, by Golfers, Inc.
4	-0.60820	0.04598	-13.22687	1 4 Long Shot, by Performance Plus
5	-0.48436	0.03013	-16.07724	2 1 Drives 5 yards farther than the average ball
6	0.12408	0.02670	4.64707	2 2 Drives 10 yards farther than the average ball
7	0.36028	0.02605	13.82881	2 3 Drives 15 yards farther than the average ball
8	0.69630	0.03323	20.95452	3 1 $4.99 for package of 3 balls
9	0.21622	0.03502	6.17338	3 2 $6.99 for package of 3 balls
10	-0.08455	0.03783	-2.23478	3 3 $8.99 for package of 3 balls
11	-0.82797	0.04816	-17.19241	3 4 $10.99 for package of 3 balls

So what can you do with this?

- Determine which product people prefer
- Look at the trade-offs among different possible features
- Determine the ranking of attributes in determining choice
- Compute willingness-to-pay for design changes
- Do Propensity Modeling

Example 1 – Product Preference

- High-Flyer = .56
- 5 yards further = -.48
- $6.99 per pack = .22

- Total Utility = .30

- Long Shot = -.61
- 15 yards further = .36
- $8.99 per pack = -.08

- Total Utility = -.33

Example 2 – Attribute Trade-offs

Example 2 – Attribute Trade-offs

Currently Considered Model

- Magnum Force = .43
- 10 yards further = .12
- $6.99 per pack = .22

- Total Utility = .77

Would the average golfer rather have a ball that drives an additional 5 yards (15 yards further) or a price reduction to $4.99 per pack?

Answer:

.70 - .22 = .48 > .36 - .12 = .24

So, the answer is a decrease in price.

Example 3 Applied to Data

Example 3 – Attribute Importances

$$I_k = \frac{\overline{U_k} - \underline{U_k}}{\sum_{k \in K^I} \overline{U_k} - \overline{U_k}}$$

I_k = Importance of Attribute k

$\overline{U_k}$ = The utility for the most preferred level of attribute k

$\underline{U_k}$ = The utility for the least preferred level of attribute k

Example 3 Applied to Data

In our golf ball example the attribute importance of "Distance" is

$$\frac{.36 + .48}{(.36 + .48) + (.56 + .61) + (.70 + .83)} = .24$$

So "Distance" receives 24% of the decision weight

Example 4 – Willingness-to-Pay

Example 4 – Willingness-to-Pay

Currently Considered Model

- Magnum Force = .43
- 10 yards further than average = .12
- $8.99 for package of three = -.08

- Total Utility = .47

How much more would the average golfer be willing to pay for an increase in distance of 5 yards?

A little more complicated

Solving for Willingness-to-pay

1. Calculate utility gain for increase in distance.
2. Find the new price such that the utility loss between the original price and the new price exactly equals the utility gain from distance.
3. The difference between the new and original price is the increase in willingness-to-pay.

Example 4 - Solved

Step 1 – Calculate the utility gain from the increase in distance

$$.36 - .12 = .24$$

Steps 2 & 3 – Convert this utility difference to price difference

$$\underbrace{\frac{.24}{(.83 - .08)}}_{\text{Percent of the spread between relevant levels (price)}} = 32\% \longrightarrow .32 * (\$10.99 - \$8.99) = \underbrace{\$0.64}_{\text{Same spread converted to \$}}$$

Conjoint Analysis: Other ways to interpret data

What else can we do?

- Conjoint on different pre-specified groups of people
- Individual Level Estimation (can be paired with pre-conjoint questionnaire)
- Propensity Modeling in well-established categories with known competitors

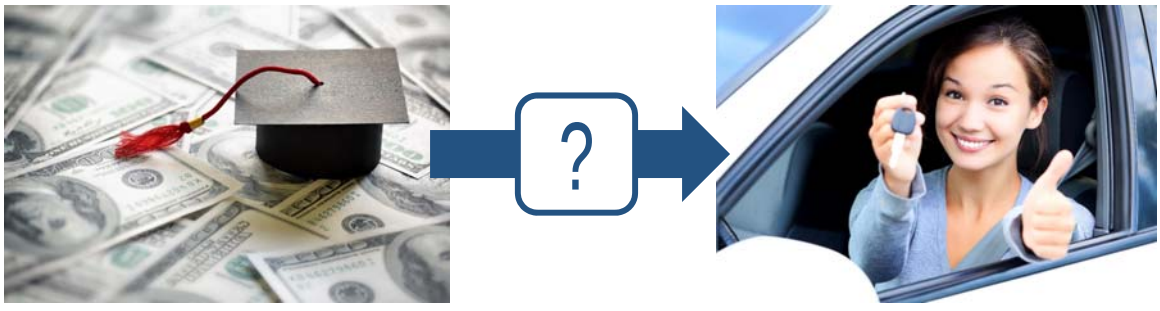
Individual-level Estimates

Respondent	BMW Sedan	BMW Coupe	Ford Focus Sedan	Ford Focus Hatch	Toyota RAV4	Toyota RAV4 SE	Honda Civic	Honda Civic Hybrid
1	2.39828	4.54993	-4.7628	-4.08511	1.31462	3.55454	-2.31486	-0.65461
2	3.30763	3.37268	-6.24778	-7.29882	2.47684	4.83768	-3.3038	2.85557
3	3.14568	4.02051	-6.28046	-7.94047	1.276	3.51911	-0.46688	2.7265
4	4.56831	0.04939	-0.44039	-0.3609	-3.54926	-3.56193	1.72693	1.56785
5	2.9334	0.59349	-5.13498	-5.13101	1.74416	3.7073	-1.98979	3.27743
6	5.77266	2.31919	-1.77075	-1.20794	-2.41787	-1.50966	-0.41225	-0.77338
7	4.28248	4.81814	-1.84859	-5.70413	-1.43073	-0.2303	-1.92626	2.03938
8	4.45856	3.19625	-3.90885	-3.43064	-1.05511	0.14475	-0.7209	1.31593
9	3.35941	-5.28706	-0.41723	-1.9106	0.49416	1.78402	1.40938	0.56791
10	5.82058	2.01266	-1.63909	-0.73046	-3.1304	-0.87553	1.53339	-2.99116
11	0.96517	-4.67506	-2.9534	-1.50383	2.33247	3.10678	0.63577	2.0921
12	-0.6957	-7.05813	-0.96397	1.24036	0.64557	0.48515	1.90432	4.44239
13	4.25949	11.17477	-2.83738	-3.5702	-4.48296	-1.92882	-1.99477	-0.62013
14	3.21762	-1.86988	-8.14894	-1.46983	7.85919	8.71665	-4.25496	-4.04987

Attribute Importances

Respondent	Manufacturer	Navigation System	Paint Color	Interior Trim	Price
1	33.1439	0.02627	11.49945	8.38334	46.94705
2	37.04382	0.30636	9.18799	1.03765	52.42428
3	31.03966	2.21329	12.69454	11.77796	42.27455
4	21.34981	5.57699	12.14978	1.40222	59.5212
5	25.28992	14.0824	9.12027	6.37411	45.1333
6	27.59547	9.04035	10.90169	5.87605	46.67644
7	31.46468	2.88079	7.35552	0.72867	57.57033
8	27.83282	15.10795	4.92767	0.25586	51.8757
9	24.60116	1.96144	5.83638	3.37165	64.22936
10	29.6392	2.71578	11.36309	2.14399	54.13794
11	21.31702	3.32434	8.34643	1.06406	65.94814
12	27.81568	2.25297	1.86778	3.37836	64.68521
13	57.21771	2.54506	7.35486	2.41709	30.46528
14	46.90336	5.17913	9.15097	10.98087	27.78567

What was I doing?



What was I doing?

- Correlation between reported debt and attribute importance for price = -.38
- If I translate debt into a monthly payment correlation reverses and = .26

What else can we do?

- Conjoint on different pre-specified groups of people
- Individual Level Estimation (can be paired with pre-conjoint questionnaire)
- Propensity Modeling in well-established categories with known competitors

Conjoint Analysis: Propensity Modeling

Propensity Modeling with Conjoint Analysis

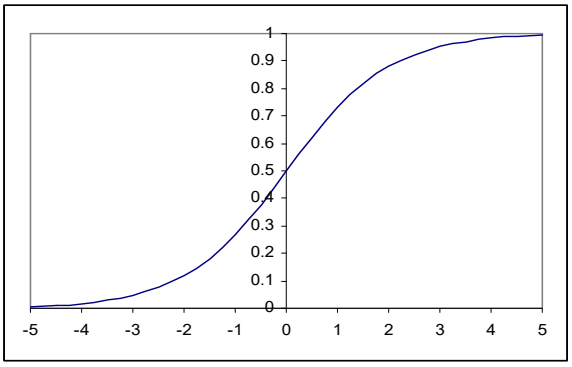
Choice-Based Conjoint Uses a Logit Model

$$S_i = \frac{e^{U_i}}{\sum_{j=1}^{n} e^{U_j}}$$

U_i = The utility of product i

Logit (or "Logistic" Function)

$$S_i = \frac{e^{U_i}}{\sum_{j=1}^{n} e^{U_j}}$$



Example 1 Revisited

- High-Flyer = .56
- 10 yards further = .12
- $8.99 per pack = -.08

- Total Utility = .60

- Eclipse = -.38
- 5 yards further = -.48
- $8.99 per pack = -.08

- Total Utility = -.94

What is the probability that the average person will purchase the Eclipse?

$$\frac{e^{-.94}}{e^{-.94}+e^{.60}} = .18$$

So average person = 18%

Propensities can be calculated at the individual level

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Use of demand forecast depends on..

- Stable set of competitors
- All competitors are evaluated on the same dimensions
- Assumes no competitive reaction on the given attributes
  - Better for industries with long product development times

What we can answer…

- Determine which product people prefer
- Look at the trade-offs among different possible features
- Determine the ranking of attributes in determining choice
- Compute willingness-to-pay for design changes
- Do Propensity Modeling

Measuring Customer Preferences Takeaways

Now you can…

- Evaluate the advantages and disadvantages of surveys as a means to determine willingness to pay (WTP)
- Analyze survey results and what they reveal about WTP

Now you can…

- Recognize opportunities when conjoint analysis could be useful in determining WTP
- Explain how conjoint analysis can be used to determine WTP
- Interpret conjoint analysis results and what they reveal about WTP