

MARKETING ANALYTICS



INDIAN SCHOOL OF BUSINESS











MANISH GANGWAR

Marketing

- What do firms do? What's the objective?
- What is most important to achieve this objective?
- What is the role of marketing? What do marketers do?
- What is the role of analytics in marketing?

Global 1200 Large Public Companies (Year 2018)

Forbes Global 2000 list includes publicly-traded companies from 60 countries. Collectively, they account for **\$39.1 trillion in sales**, **\$3.2 trillion in profit**, \$189 trillion in assets and \$56.8 trillion in market value

	#1	ICBC	China	\$65.3 B	\$43.7 B	\$4,210.9 B	\$311 B
	#2	China Construction Bank	China	\$43.2 B	\$31.2 B	\$3,691.6 B	\$261.2 B
	#3	JPMorgan Chase	United States	\$38.2 B	\$26.5 B	\$2,609.8 B	\$387.7 B
	#4	Berkshire Hathaway	United States	\$235.2 B	\$39.7 B	\$700.7 B	\$491.9 B
	#5	Agricultural Bank of China	China	\$29.3 B	\$29.6 B	\$3,439.3 B	\$184.1 B
	#6	Bank of America	United States	\$29.2 B	\$20.3 B	\$2,328.5 B	\$313.3 B
	#7	Wells Fargo	United States	\$202.1 B	\$21.7 B	\$1,915.4 B	\$265.3 B
	#8	Apple	United States	\$247.3 B	\$33.3 B	\$397.5 B	\$926.9 B
	#9	Bank of China	China	\$118.2 B	\$26.4 B	\$3,204.2 B	\$128.6 B
	#10	Ping An Insurance Group	China	\$41.6 B	\$43.9 B	\$1,066.4 B	\$181.4 B



<https://www.forbes.com/global2000/list/>

Average Revenue Break-up (Large Public Companies)

Average Revenue Break-up

Fixed Cost Variable cost Profit

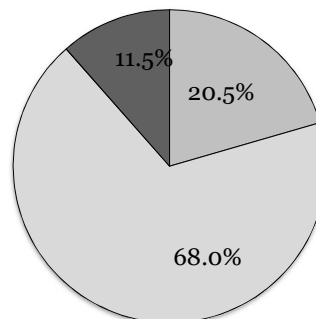
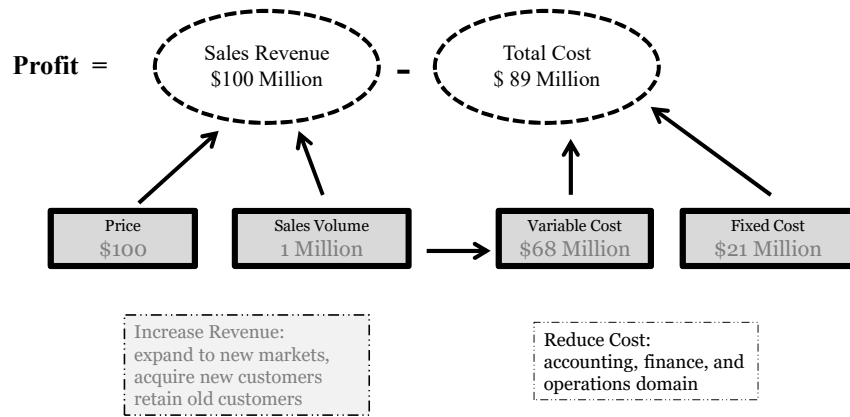


Exhibit 1-2 from "The Price Advantage"
by Baker, Marn, and Zawada



Fundamental Axiom of Economics



impact of 1% improvement in



Global 1200 Profit Levers: McKinsey Study

(1% improvement in..... yields increase)

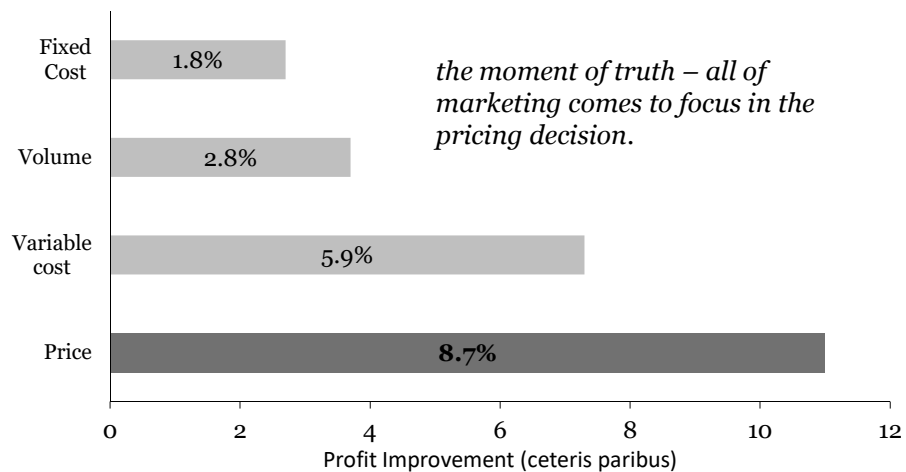


Exhibit 1-2 from "The Price Advantage" by Baker, Marn, and Zawada

Marketing Differentiation



Berg (Canada) Type: Still Size: 0.75 Liters Price: \$20 Sweet ●●●●● Salty Smooth ●●●●● Complex	Iskilde (Denmark) Type: Still Size: 1.00 Liters Price: \$12 Sweet ●●●●● Salty Smooth ●●●●● Complex	Ferrarelle (Italy) Type: Sparkling Size: 1.00 Liters Price: \$12 Sweet ●●●●● Salty Smooth ●●●●● Complex	Hildon (UK) Type: Still Size: 0.75 Liters Price: \$12 Sweet ●●●●● Salty Smooth ●●●●● Complex	Fiji (Fiji) Type: Still Size: 1.00 Liters Price: \$10 Sweet ●●●●● Salty Smooth ●●●●● Complex
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Bottle water sales in US \$14B More expensive than gasoline

One has a sweet taste and is the perfect accompaniment to sushi, another is "distinctively soft" and goes with salads

420 Volcanic - spring water from Tai Tapu, New Zealand, **£21 (42cl)**
(Found at the bottom of an extinct volcano)
Verdict: Extremely spritzy on the palate with a tangy mineral finish. Delicious.

Mahalo Deep Sea Water - deep sea water, Kailua-Kona, Hawaii, **£20 (71cl)**
(From a fresh water 'lake' on the ocean floor. It remains separate from sea water because it is cooler and has a different salinity)
Verdict: Very rounded quality on the palate. Would be good with shellfish.

Berg - Iceberg water from Newfoundland, Canada, **£15 (50cl)**
Verdict: Clean dry and firm with no sweetness at all.

Finé (left) - artesian water from Shuzenji, Japan, **£15 (72cl)**

(low mineral content)
Verdict: Quite bland and lacking character. Hint of seaweed, so good with sushi.

Cloud Juice - rainwater from King Island, Australia, **£9 (75cl)**
Verdict: 'Full flavoured, acidic - would go well with rich food.'

Iskilde - artesian spring water from the Mosso Conservation area in Denmark, **£9 (1 litre)**
Verdict: 'Lively on the palate with a flinty, crisp style. Great with herring.'

Wattwiller - spring water from Wattwiller, France, **£9 (50cl)**
(Discovered by the Romans, high mineral content)
Verdict: Clean, mineral quality on the palate. Very refreshing. Would be good with fish.



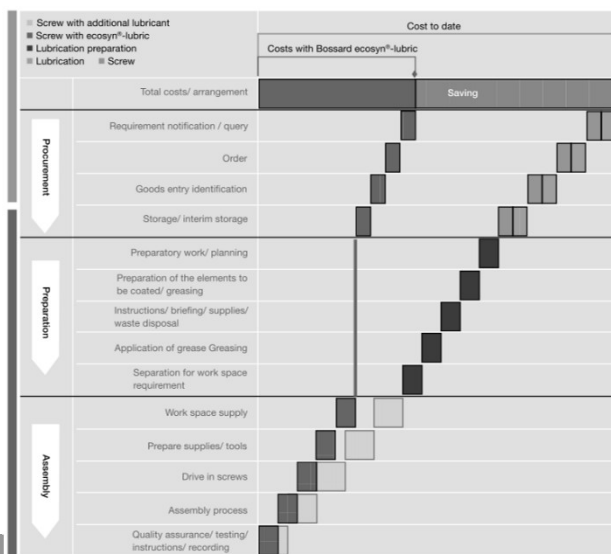
O-ring Seal



- You company developed a new O-ring that has *twice the corrosive resistance power* (O-rings are used to seal the valves on pipes that carry corrosive material)
- Currently market price of leading O-ring is \$5 per ring.
- **How would you market and price this product?**



Bossard ecosyn-lubric Screw



Discussion Point

- How do consumers choose among alternatives?



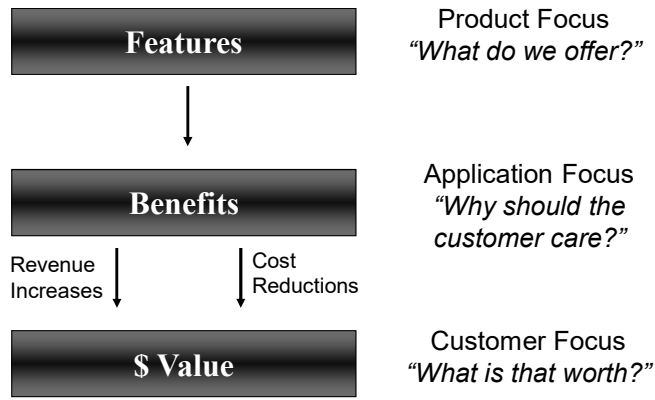
Key Concepts for Understanding Value

Customer will buy a product if the net perceived benefits from buying that product outweighs the net perceived benefit she receives from an alternative.

In economic terms, $CS_A > CS_B$



Key is to Quantify Value



Everyone talks value but few actually walk the talk



Quantifying Benefits (Conjoint Analysis)



MANISH GANGWAR

Aid to Understand Value

- Sellers want to increase profits by providing **cost-effective** products that **consumers value**.
- Key to this process is to determine the what and how much consumers care about various attributes.
- <https://www.youtube.com/watch?v=kGHXO4mzRog>
- <https://www.youtube.com/watch?v=Su2qIrTmv1c>



Some Commercial Applications of Conjoint Analysis

Consumer Non-Durables

1. Bar soaps
2. Hair shampoos
3. Carpet cleaners
4. Synthetic-fiber garments
5. Gasoline pricing

Industrial/Business Goods

1. Copying machines
2. Printing equipment
3. Job offers to MBA's
4. Data transmission
5. Lap top computer

Other Products

1. Automotive styling
2. Automobile tires
3. Car batteries
4. Ethical drugs
5. Employee benefit package

Financial Services

1. Branch bank services
2. Auto insurance policies
3. Health insurance policies
4. Credit card features
5. Consumer discount card

Transportation

1. Air Canada
2. IATA
3. American Airlines
4. Canadian National Railway
5. Amtrak

Other Services

1. Car rental agencies
2. Telephone service pricing
3. Hotels
4. Online vs. print subscription
5. Employment agencies



Conjoint Can Help When...

- Product or service can be decomposed into attributes.
 - Credit Card = APR + Brand + Credit Limit...
 - Mutual Fund = Past Returns + Fees + Brand Name + Online Access
 - Commercial Aircraft = Capacity + Max Range + Fuel Efficiency + Price + Cost of Service Contract + ...
 - Smart Phone = RAM + Processor + Screen Size + Camera ...



Direct Question (Preferences)

You could ask consumers how important different features are on a 9-point scale: Importance Rating (1-9)

- | | |
|---------------------|----------------------|
| 1. RAM | 1 2 3 4 5 6 7 |
| 2. Processor | 1 7 |
| 3. Operating System | 1 7 |
| 4. Size of Screen | 1 7 |
| 5. Battery Life | 1 7 |
| 6. etc. | |



Motivating Example

How will you decide what features to include and what price to charge?

1. 2GB**RAM**..... 3GB
2. 1Ghz**Processor**..... 2Ghz
3. 10'**Screen size**.....12'
4. 24 **Battery life**36
5. 4-G**Compatible**or not
6. 12,000.....**Price**.....15,000



Conjoint Data Collection in Nutshell

- Show consumers a series of hypothetical products defined by their attributes.
- Ask the respondents to pick or rank order or rate the products (not attributes).
- Use responses to estimate attribute importance weights and partworths
 - (we will use regression).



SIMPLE EXAMPLE OF CONJOINT ANALYSIS

Oops! Your bank just went belly up and you need to pick a new credit card.
 Each card offers different credit limits and interest rates.
 Click on the card that best suits you.
 Then, repeat until all cards are gone.

<p>\$5,000 15% APR 4000 0012 3456 7899 06/00 - 06/00 V CARDHOLDER NAME</p>	<p>\$15,000 15% APR 3790 123456 78001 H E JOHNSEN</p>	<p>TRANSIT EMPLOYEE PERSONAL CREDIT CARD \$10,000 15% APR 3790 123456 78001 H E JOHNSEN</p>
<p>\$10,000 25% APR 3790 123456 78001 H E JOHNSEN</p>	<p>TRANSIT EMPLOYEE PERSONAL CREDIT CARD \$15,000 20% APR 3790 123456 78001 H E JOHNSEN</p>	<p>\$5,000 20% APR 3790 123456 78001 H E JOHNSEN</p>
<p>\$10,000 20% APR 4000 0012 3456 7899 06/00 - 06/00 V CARDHOLDER NAME</p>	<p>TRANSIT EMPLOYEE PERSONAL CREDIT CARD \$5,000 25% APR 3790 123456 78001 H E JOHNSEN</p>	<p>\$15,000 25% APR 4000 0012 3456 7899 06/00 - 06/00 V CARDHOLDER NAME</p>

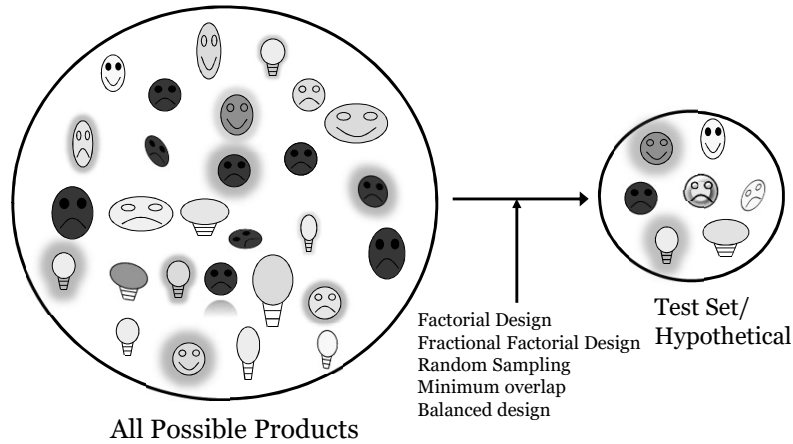
ISB

Overview : Step 0

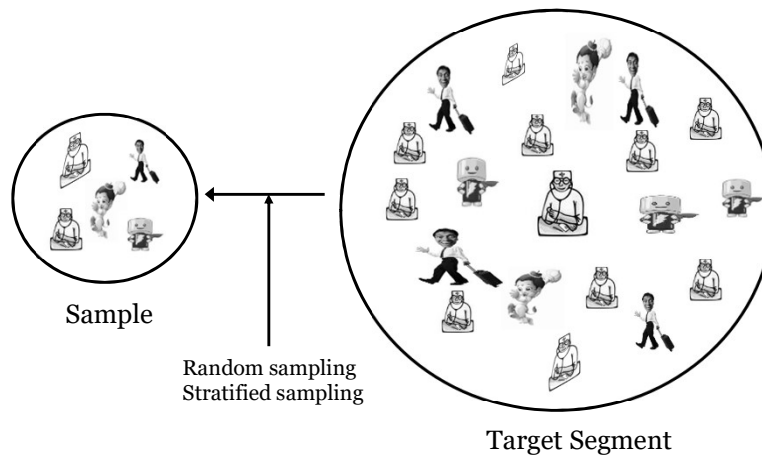
- Find relevant attributes
 - ✦ Judgment
 - ✦ Interviews
 - ✦ Focus group study
 - ✦ Purchase process study
 - ✦ Expert Opinions
- Choose only attributes which are important for decision making.
 - segmentation will help in reducing number of attributes

ISB

Select Subset using Scientific Method Using Factorial Design

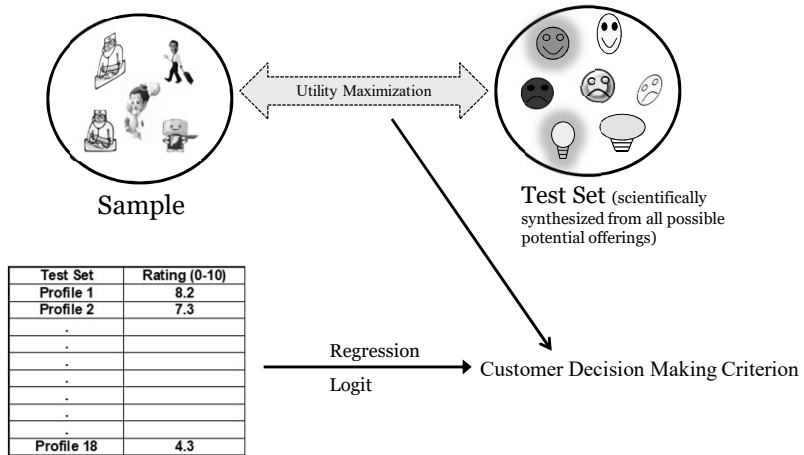


Select Sample from Target Population



Collect Preferences

Test Set (Hypothetical Products)

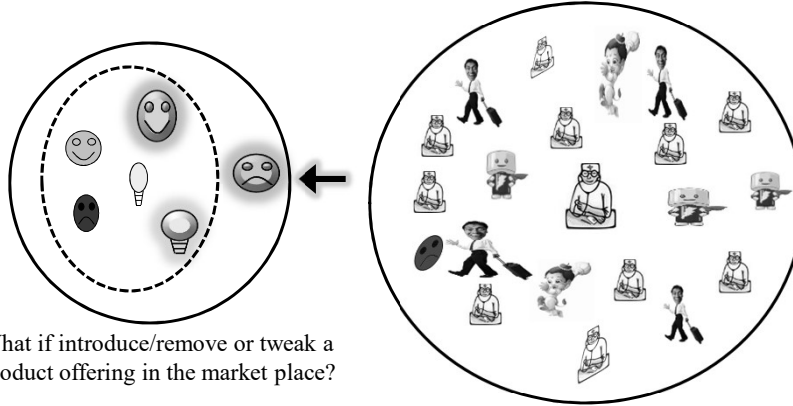


The Customer Utility Function

$$U = 0.11 + 2.26 \times \text{Sears} + 2.97 \times \text{Goodyear} + 2.48 \times \text{Miles}_{40K} + 3.44 \times \text{Miles}_{50K} + 1.62 \times \text{Price}_{\$50} + 1.37 \times \text{Price}_{\$60} + 1.25 \times \text{White} + \mathcal{E}$$

Conjoint Experiment is Over
Now We can ask Managerial Questions

Managerial Question Example



What if introduce/remove or tweak a product offering in the market place?

Target Population



Major Steps of Conjoint Studies

Step 1&2: Attribute List Formulation. A business problem is defined and an attribute (features) list is developed to study the problem.

Step 3,4&5: Data Collection. Respondents are asked to express the trade-offs they are willing to make among product features by rating, sorting or choosing among hypothetical product concepts.

Step 6: Data Analysis. A set of preference values or part worth "utilities" is derived from the data collected, they reflect the trade-offs each respondent made.

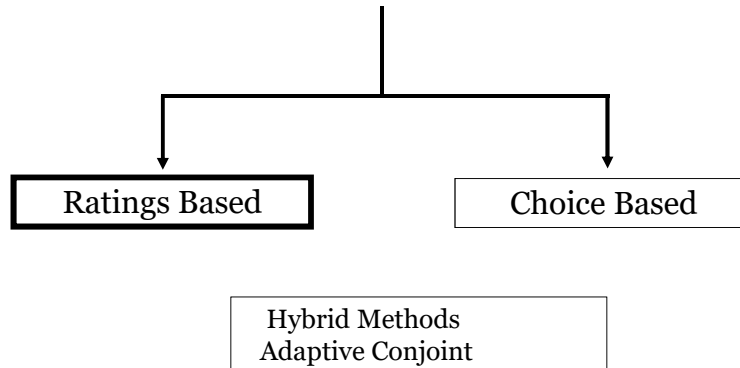
Market Simulation. The utility values are used to predict how buyers will choose among competing products and how their choices are expected to change as product features and/or price are varied.

The value of conjoint analysis is in its ability to estimate choice behavior for a wide range of market scenarios



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Conjoint Analysis



Conjoint Analysis

Step 0: Context, current offerings, customer types

Step 1: Determine ***Relevant Attributes***

You want enough attributes and attribute levels to make the task realistic, but not too many to make the task explode. Exploratory research is particularly valuable in aiding this decision.

Step 2: Determine ***Relevant Levels*** for each attribute

Caveats: Relevant Levels

- Levels are assumed to be mutually exclusive: a product concept can have *one and only one* level of each attribute
 - Attribute: Add-on features
 - level 1: Sunroof
 - level 2: GPS System
 - level 3: Video Screen
 - Level 4: None
 - If you define levels in this way, you cannot determine the value of providing two of these features at the same time
- Levels should have concrete/unambiguous meaning. Consider...
 - "Very expensive" vs. "Costs \$575"
 - "Weight: 5 to 7 kilos" vs. "Weight 6 kilos"
 - One description leaves meaning up to individual interpretation, while the other does not.



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Product Attributes and Levels

- Consider a situation in which a manufacturer of steel-belted replacement tires is interested in measuring consumers' tradeoffs among the following attributes:

Tread Life

30,000 miles
40,000 miles
50,000 miles

Side-Wall Color

Black
White

Brand

Sears
Goodyear
Goodrich

Price

\$50/tire
\$60/tire
\$70/tire



Design Attributes and Levels

- Consider a situation in which product/ service manufacturer is interested in measuring consumers' tradeoffs among several attributes:

Attribute 1

Level 0
Level 1
Level 2

Attribute 2

Level 1
Level 2

Attribute 3

Level 0
Level 1
Level 2

Attribute 4

Level 0
Level 1
Level 2

- There are $3 \times 3 \times 3 \times 2 = 54$ potential combination. Use a factorial design table to reduce number of profiles to be rated in conjoint experiment



Step 3: How Many Product Profiles

- Ratings Based Conjoint
 - Full design requires lots of profiles
 - Factorial design (conceptually similar to DoE)
 - ✦ Use some statistical software

Profile	X1	X2	X3
1	1	1	1
2	2	1	1
3	1	2	1
4	2	2	1
5	1	1	2
.	.	.	.
.	.	.	.
.	.	.	.

- Important to remember that profiles are coming out of scientific design and may not look appealing, feasible etc, etc, do not tweak the design unless you are expert.



Step 4a: Design Bundles (Product Profiles)

A3	B3	C3	D2
Brand	Tread Life	Price	Side Wall
0	0	0	0
0	1	1	0
0	2	2	1
1	0	1	1
1	1	2	0
1	2	0	0
2	0	2	0
2	1	0	1
2	2	1	0
0	0	2	1
0	1	0	0
0	2	1	0
1	0	0	0
1	1	1	1
1	2	2	0
2	0	1	0
2	1	2	0
2	2	0	1
Sears - 0	30k - 0	\$50 - 0	White - 0
Goodyear - 1	40k - 1	\$60 - 1	Black - 1
Goodrich - 2	50k - 2	\$70 - 2	



Step 4b: Convert Bundles in to Product Profiles

Bundles	A3	B3	C3	D2
	Brand	Tread Life	Price	Side Wall
1	Sears	30k	\$50	White
2	Sears	40k	\$60	White
3	Sears	50K	\$70	Black
4	Goodyear	30k	\$60	Black
5	Goodyear	40k	\$70	White
6	Goodyear	50K	\$50	White
7	Goodrich	30k	\$70	White
8	Goodrich	40k	\$50	Black
9	Goodrich	50K	\$60	White
10	Sears	30k	\$70	Black
11	Sears	40k	\$50	White
12	Sears	50K	\$60	White
13	Goodyear	30k	\$50	White
14	Goodyear	40k	\$60	Black
15	Goodyear	50K	\$70	White
16	Goodrich	30k	\$60	White
17	Goodrich	40k	\$70	White
18	Goodrich	50K	\$50	Black





Step 5 a: Collect response from a consumer

Card	A3 Brand	B3 Tread Life	C3 Price	D2 Side Wall	Customer Rating
1	Sears	30k	\$50	White	5
2	Sears	40k	\$60	White	7
3	Sears	50K	\$70	Black	6
4	Goodyear	30k	\$60	Black	5
5	Goodyear	40k	\$70	White	7
6	Goodyear	50K	\$50	White	9
7	Goodrich	30k	\$70	White	0
8	Goodrich	40k	\$50	Black	3
9	Goodrich	50K	\$60	White	6
10	Sears	30k	\$70	Black	2
11	Sears	40k	\$50	White	8
12	Sears	50K	\$60	White	8
13	Goodyear	30k	\$50	White	6
14	Goodyear	40k	\$60	Black	7
15	Goodyear	50K	\$70	White	7
16	Goodrich	30k	\$60	White	2
17	Goodrich	40k	\$70	White	4
18	Goodrich	50K	\$50	Black	6

Step 5 b: Convert Information in to Numbers

A3 Brand	B3 Tread Life	C3 Price	D2 Side Wall	Customer Ratings
0	0	0	0	5
0	1	1	0	7
0	2	2	1	6
1	0	1	1	5
1	1	2	0	7
1	2	0	0	9
2	0	2	0	0
2	1	0	1	3
2	2	1	0	6
0	0	2	1	2
0	1	0	0	8
0	2	1	0	8
1	0	0	0	6
1	1	1	1	7
1	2	2	0	7
2	0	1	0	2
2	1	2	0	4
2	2	0	1	6
Sears - 0	30k - 0	\$50 - 0	White - 0	
Goodyear - 1	40k - 1	\$60 - 1	Black - 1	
Goodrich - 2	50k - 2	\$70 - 2		



Dummy Variable Regression

To represent J levels in an attribute, we need J-1 dummy variables.

So we need two dummy variable each for brand, thread, price and, only one for color.

A dummy variable X takes on the value of 1 if the product has that level of the attribute and 0 otherwise.

The “coefficient” β are called the utility weights or “partworths.” The utility function is a regression equation with dummy variables given as follows:

$$R = \beta_0 + \beta_1 \times \text{Sears} + \beta_2 \times \text{Goodyear} + \beta_3 \times \text{Miles}_{40K} + \beta_4 \times \text{Miles}_{50K} + \beta_5 \times \text{Price}_{550} + \beta_6 \times \text{Price}_{560} + \beta_7 \times \text{White} + \mathcal{E}$$



Step 6: Setting up the Regression

Rating	Sears	Goodyear	Mile40	Mile50	Price50	Price60	White
5	1	0	0	0	1	0	1
7	1	0	1	0	0	1	1
6	1	0	0	1	0	0	0
5	0	1	0	0	0	1	0
7	0	1	1	0	0	0	1
9	0	1	0	1	1	0	1
0	0	0	0	0	0	0	1
3	0	0	1	0	1	0	0
6	0	0	0	1	0	1	1
2	1	0	0	0	0	0	0
8	1	0	1	0	1	0	1
8	1	0	0	1	0	1	1
6	0	1	0	0	1	0	1
7	0	1	1	0	0	1	0
7	0	1	0	1	0	0	1
2	0	0	0	0	0	1	1
4	0	0	1	0	0	0	1
6	0	0	0	1	1	0	0

$$R = \beta_0 + \beta_1 \times \text{Sears} + \beta_2 \times \text{Goodyear} + \beta_3 \times \text{Miles}_{40K} + \beta_4 \times \text{Miles}_{50K} + \beta_5 \times \text{Price}_{50} + \beta_6 \times \text{Price}_{60} + \beta_7 \times \text{White} + \mathcal{E}$$



Regression output

SUMMARY OUTPUT

Regression Statistics

Multiple R	0.9253
R Square	0.8562
Adjusted R Square	0.8550
Standard Error	0.8790
Observations	900

ANOVA

	df	SS	MS	F	Significance F
Regression	7	4102.638333	586.09119	758.549155	0
Residual	892	689.2016667	0.77264761		
Total	899	4791.84			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.11	0.0879	1.2514	0.2111	-0.0625	0.2825
Sears	2.26	0.0718	31.4893	0.0000	2.1191	2.4009
Goodyear	2.97	0.0718	41.3820	0.0000	2.8291	3.1109
Mile40	2.48	0.0718	34.5082	0.0000	2.3358	2.6175
Mile50	3.44	0.0718	47.9771	0.0000	3.3025	3.5842
Price50	1.62	0.0718	22.6184	0.0000	1.4825	1.7642
Price60	1.37	0.0718	19.0422	0.0000	1.2258	1.5075
White	1.25	0.0622	20.0306	0.0000	1.1230	1.3670



Attribute Importance

$$I_k = \frac{\overline{U}_k - \underline{U}_k}{\sum_{k \in K} \overline{U}_k - \underline{U}_k}$$

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



Attribute Importance

- A measure of how much **influence each attribute has** on people's choices
- Maximum possible change in utility by just changing levels of this attribute

○ Brand: (max-min)	= 2.97	2.97/9.28 = 32%
○ Thread Life: (max-min)	=3.44	---- 37%
○ Price: (max-min)	=1.62	---- 17%
○ Color: (max-min)	=1.25	---- 13%
○ Total	=9.28	100%
- Importance is directly affected by the **range of levels** you choose for each attribute.
- Importance run from 0 to 100 and are **ratio scaled**, meaning that you can apply multiplication/division operations. An importance of 20 is twice as important as a 10.
- The familiar scaling makes it easier for managers to interpret than part worth utility scores. However they are misleading if computed from pooled data that does not account for differences in respondents.



Managerial Questions

- Which brand has the highest brand equity?
- Estimate the price premium for Goodyear over Goodrich.
- At a particular local market, there are 3 products available:
 - {Goodyear, 40K miles, \$60, Black},
 - {Goodrich, 30K miles, \$50, White},
 - {Sears, 50K miles, \$70, Black}.
- What will happen if Goodrich launches a new black walled tyre?
 - How much of that will come from your own product and how much will come from competitors?
 - What price to charge for white tires to minimize cannibalization of own product.



Market Simulator

- Step 1:
- Calculate the U's for each product (alternative in the market) for each respondent.
- Step 2:
- Calculate choice probability for each respondent.
$$\frac{\exp(U_i)}{\sum_{j=1}^n \exp(U_j)}$$
- Step 3:
- Sum up choice probabilities to get market share



Choice Probabilities

			Product 1	Product 2	Product 3	New Product
		Brand	Goodyear	Goodrich	Sears	Goodrich
		Miles	40,000	30,000	50,000	40,000
		Price	\$60	\$50	\$70	\$50
		Color	Black	White	Black	Black
Parameter	Value					
Intercept	0.11		1	1	1	1
Sears	2.26		0	0	1	0
Goodyear	2.97		1	0	0	0
Goodrich	0.00		0	1	0	1
Miles=40K	2.48		1	0	0	1
Miles=50K	3.44		0	0	1	0
Miles=60K	0.00		0	1	0	0
Price=\$50	1.62		0	1	0	1
Price=\$60	1.37		1	0	0	0
Price=\$70	0.00		0	0	1	0
Sidewall=White	1.25		0	1	0	0
Sidewall=Black	0.00		1	0	1	1
		Utility	6.93	2.98	5.81	4.21



Market Share

- Old Market

- Product A: $\exp(6.93)/\exp(6.93)+\exp(2.98)+\exp(5.81) = 0.74$
- Product B: $\exp(2.98)/\exp(6.93)+\exp(2.98)+\exp(5.81) = 0.01$
- Product C: $\exp(5.81)/\exp(6.93)+\exp(2.98)+\exp(5.81) = 0.24$

- New Market

- Product A: $\exp(6.93)/\exp(6.93)+\exp(2.98)+\exp(5.81)+\exp(3.96) = 0.71$
- Product B: $\exp(2.98)/\exp(6.93)+\exp(2.98)+\exp(5.81)+\exp(3.96) = 0.01$
- Product C: $\exp(5.81)/\exp(6.93)+\exp(2.98)+\exp(5.81)+\exp(3.96) = 0.23$
- New Product: $\exp(4.21)/\exp(6.93)+\exp(2.98)+\exp(5.81)+\exp(4.21) = 0.05$



Major Steps of Conjoint Studies

Step 1&2: Attribute List Formulation. A business problem is defined and an attribute (features) list is developed to study the problem.

Step 3,4&5: Data Collection. Respondents are asked to express the trade-offs they are willing to make among product features by rating, sorting or choosing among hypothetical product concepts.

Step 6: Utility Calculation. A set of preference values or part worth "utilities" is derived from the data collected, they reflect the trade-offs each respondent made.

Market Simulation. The utility values are used to predict how buyers will choose among competing products and how their choices are expected to change as product features and/or price are varied.

The value of conjoint analysis is in its ability to estimate choice behavior for a wide range of market scenarios



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Conjoint Analysis

- Conjoint is very powerful for incremental products. Categories that are in growth and maturity stage.
- Conjoint is very useful for product line and price optimization in competitive markets.
- Conjoint may not be very useful for new product category, where they have no prior experience of the product usage.

