A Consultant's Guide to Conjoint Analysis Reporting

Agenda

- Utilities
- Importances
- Simulations
  - Shares
  - Sensitivity Analyses
  - Optimizations
- Extensions
  - Target analysis
  - Willingness-to-Pay
  - Needs-based segmentation to identify latent subgroups of respondents
  - Simulation as part of a larger forecasting process

Example

If these were your only choices for vacation packages, which would you choose?

* (Price shown is per person based on double occupancy and includes airfare, breakfast each day, & hotel taxes.)

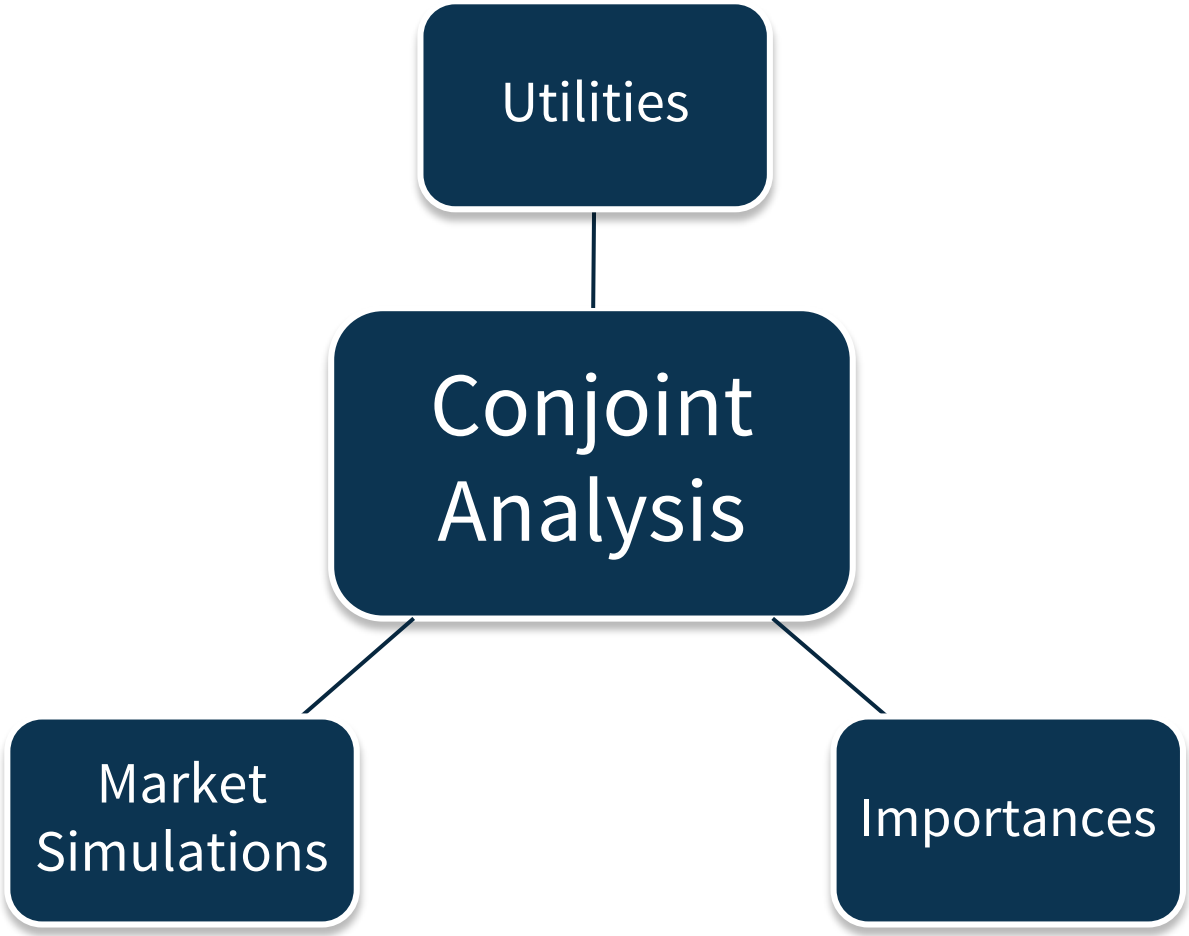
(1 of 8)

	Package A	Package B	Package C
Destination:	Chicago, IL	Anaheim, CA	San Francisco, CA
Number of Nights:	3 nights	7 nights	7 nights
Accommodation:	Upscale (3 star hotel)	Luxury (5 star hotel)	Moderate (2 star hotel)
Hotel Type:	Business (with meeting/business services)	Business (with meeting/business services)	Boutique (with distinct style/character)
Car Rental:	Compact car rental	None included	Full-Size/SUV car rental
* Price (per person):	$810	$1,800	$1,190
	○	○	○

Attributes & Levels

Destination	Number of Nights	Accommodation	Hotel Type	Car Rental	Price /Person
Las Vegas, NV	3 nights	Moderate (2 star hotel)	Business	None included	Low
Orlando, FL	5 nights	Upscale (3 star hotel)	Resort	Compact car rental	Med
Anaheim, CA	7 nights	Deluxe (4 star hotel)	Boutique	Full-Size/ SUV car rental	High
San Francisco, CA		Luxury (5 star hotel)			
Chicago, IL					
New York, NY					
Washington, DC					

Three Conjoint Analysis Outputs



UTILITIES

Using the recommended hierarchical Bayesian estimation, we get utilities at the individual level

Respondent ID	Las Vegas, NV	Orlando, FL	Anaheim, CA	San Francisco, CA	Chicago, IL	New York, NY	Washington, DC	4 nights	5 nights	7 nights
1	-3.33944	0.42789	-1.31194	2.19363	-0.82321	2.47521	0.37786	-1.12278	1.4346	-0.31182
2	1.30733	0.59604	1.28824	0.11337	-0.67345	0.85844	-3.48996	-2.59689	0.77977	1.81712
3	2.46724	1.15315	-2.71995	-1.34013	0.4452	1.50931	-1.51482	1.14757	-0.65759	-0.48997
4	4.31363	-0.38359	1.32277	-0.9165	-5.58378	1.81393	-0.56646	-0.96787	0.41429	0.55358
5	2.13868	6.31037	-0.45078	1.28186	-5.92346	-2.9283	-0.42837	-0.25176	0.64293	-0.39116
6	-2.13776	0.28114	-0.46356	-1.47508	-0.28751	3.02081	1.06195	-0.48457	0.73823	-0.25366
7	-1.11194	2.00293	-0.46946	0.84078	-0.30533	-0.67378	-0.28319	2.88335	0.15652	-3.03987
8	-0.60684	0.29928	3.03742	0.58451	-1.97661	0.04308	-1.38083	-1.33965	0.88005	0.4596
9	-3.99102	3.13667	-2.28517	1.70841	0.21598	0.45141	0.76371	0.30904	0.756	-1.06504
10	-1.84925	1.8197	-0.40498	-0.70439	0.00386	3.11289	-1.97782	-1.39087	0.50447	0.8864

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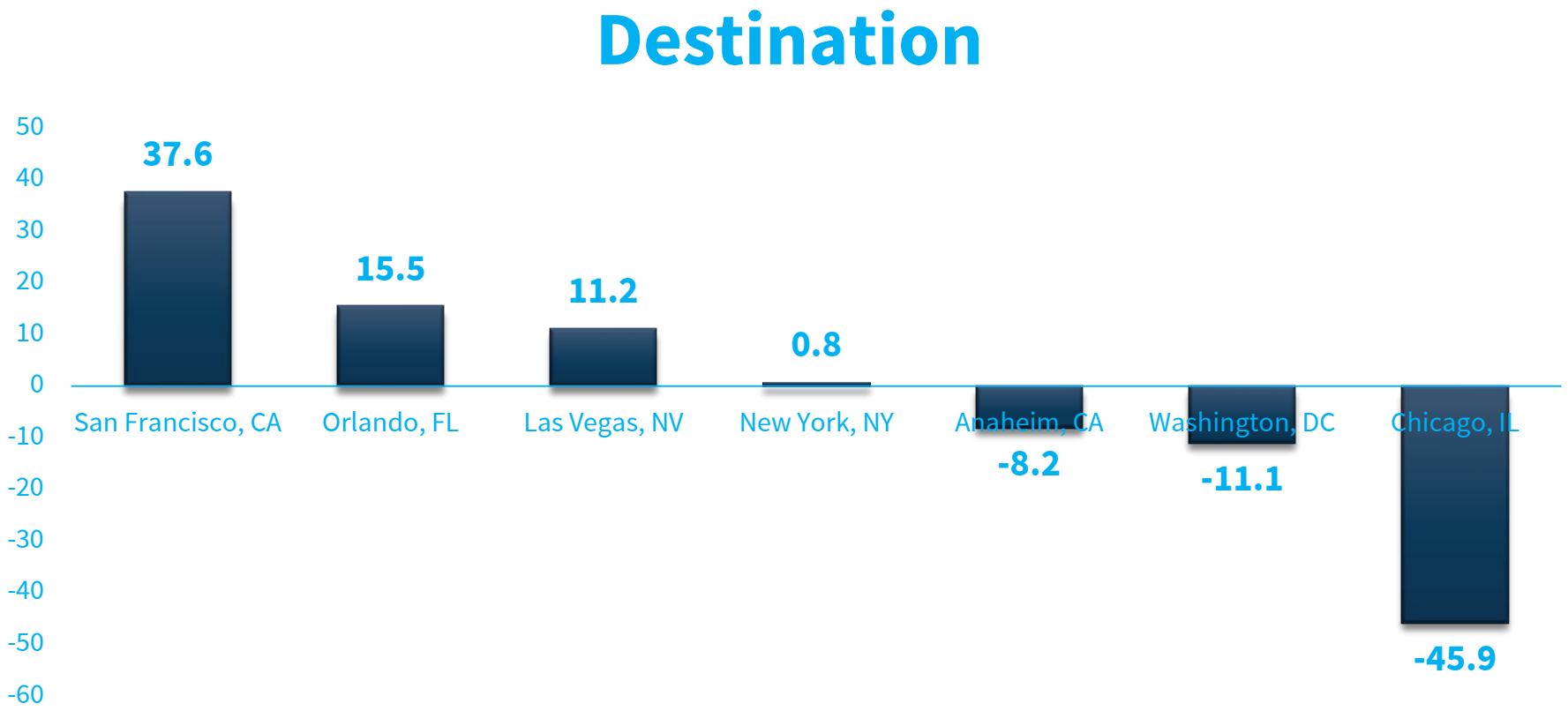
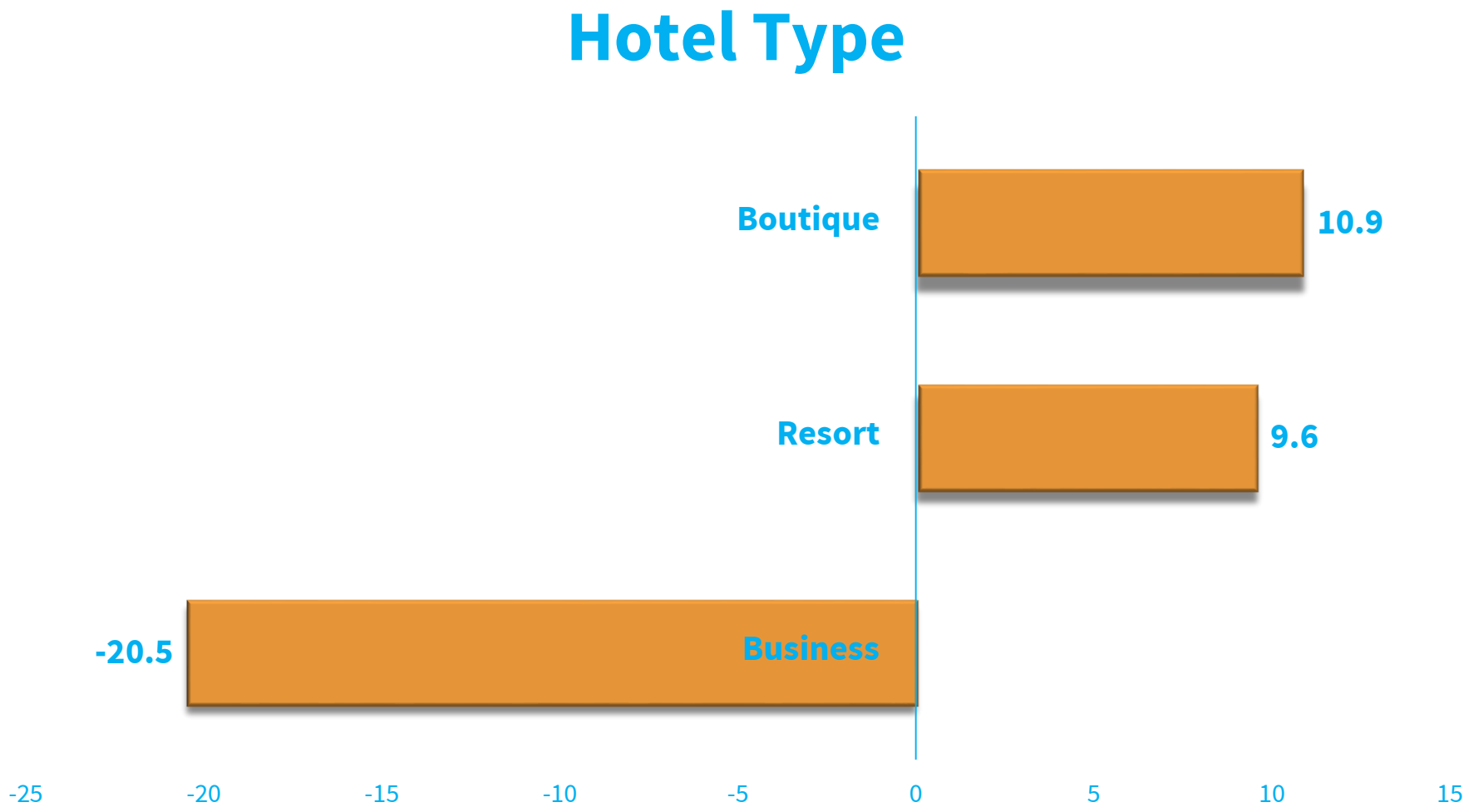
Levels	Utilities	Standard Deviations	Lower 95% CI	Upper 95% CI
Las Vegas, NV	11.2	78.6	0.7	21.58
Orlando, FL	15.5	69.4	6.3	24.75
Anaheim, CA	-8.2	71.7	-17.7	1.34
San Francisco, CA	37.6	50.1	31.0	44.29
Chicago, IL	-45.9	69.3	-55.1	-36.68
New York, NY	0.8	64.4	-7.8	9.35
Washington, DC	-11.1	54.7	-18.3	-3.8

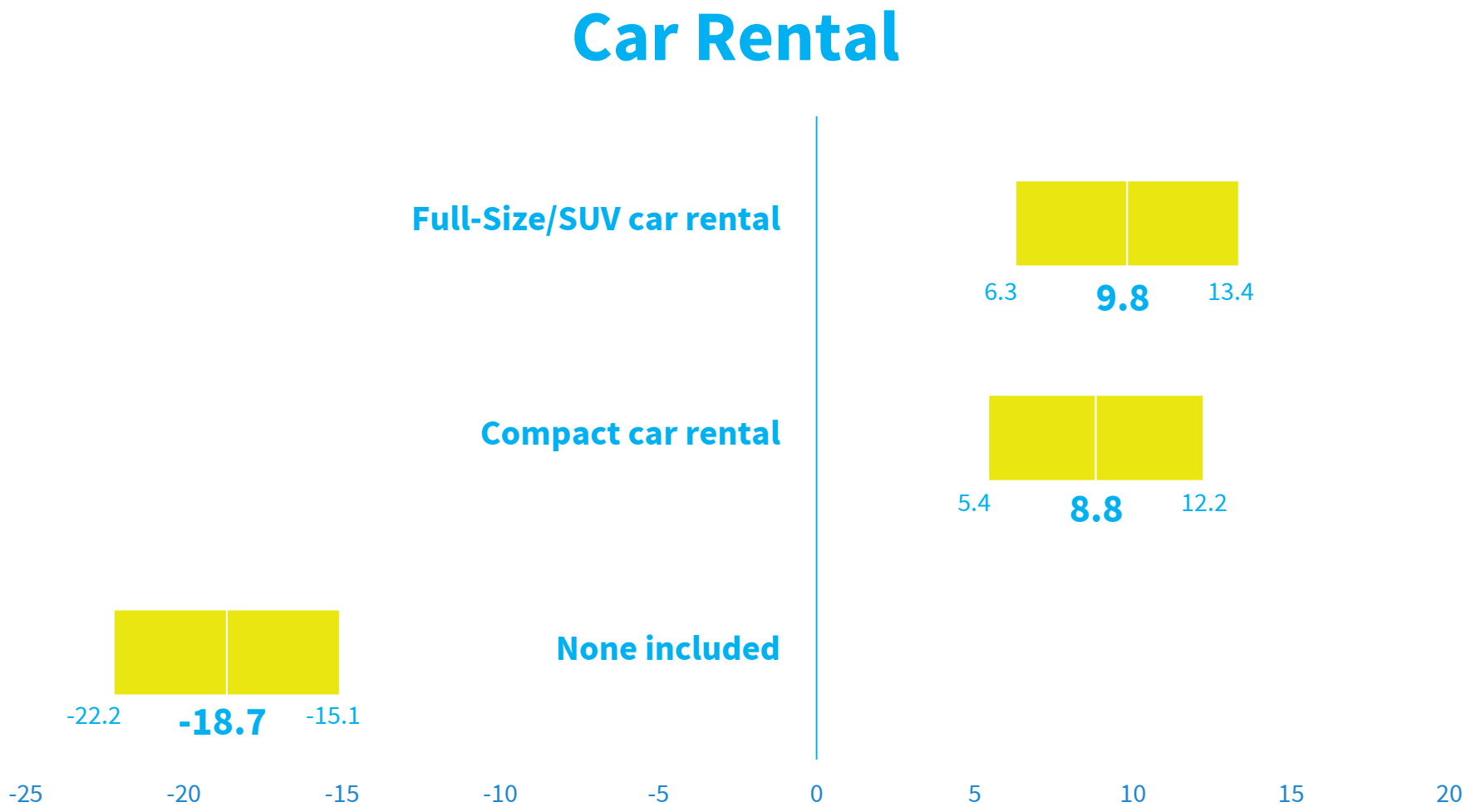
Bar Charts


Destination
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
37.6
15.5
11.2
0.8
-8.2
-11.1
-45.9
San Francisco, CA
Orlando, FL
Las Vegas, NV
New York, NY
Anaheim, CA
Washington, DC
Chicago, IL

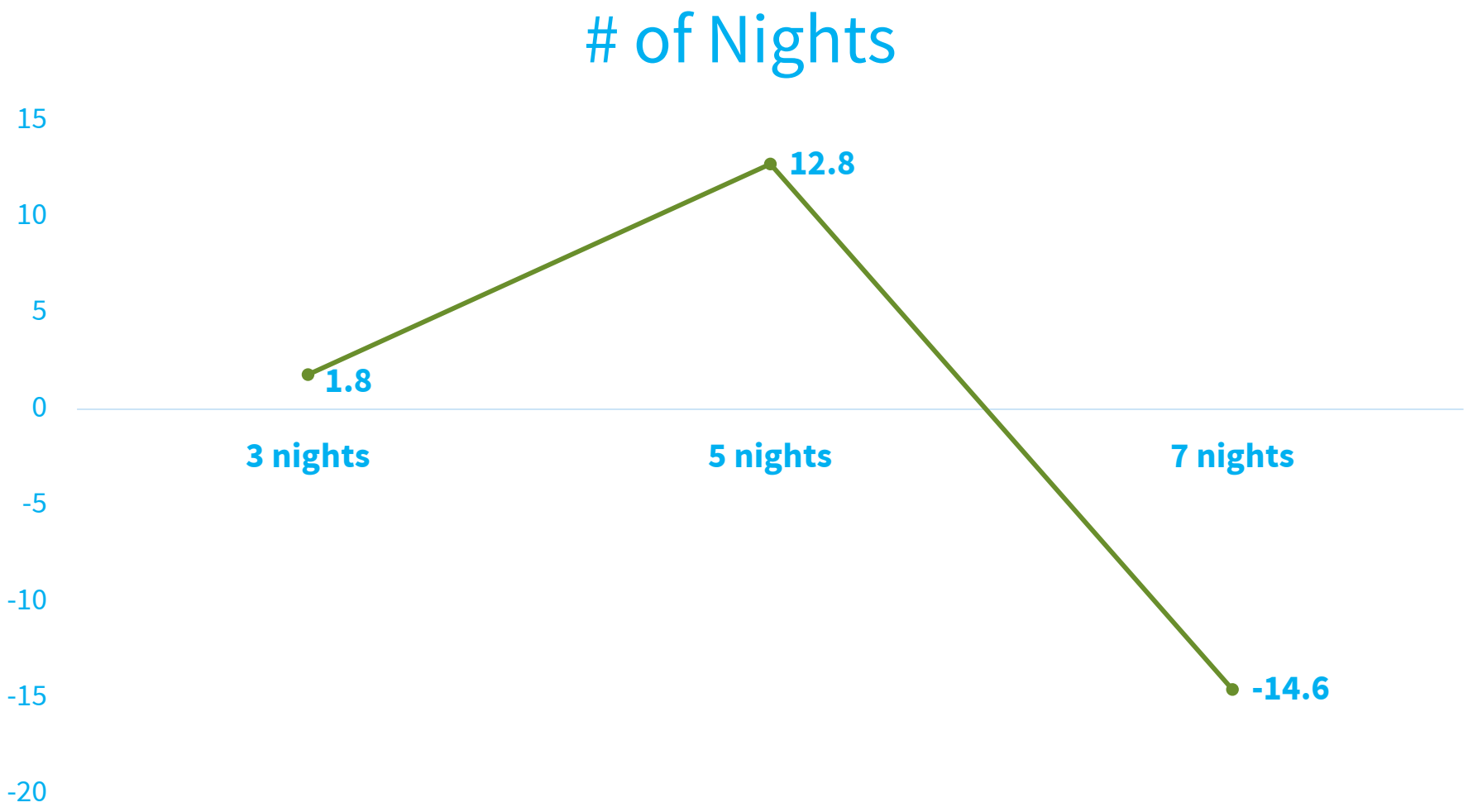
Tornado Chart



Tornado Chart with Confidence Bands



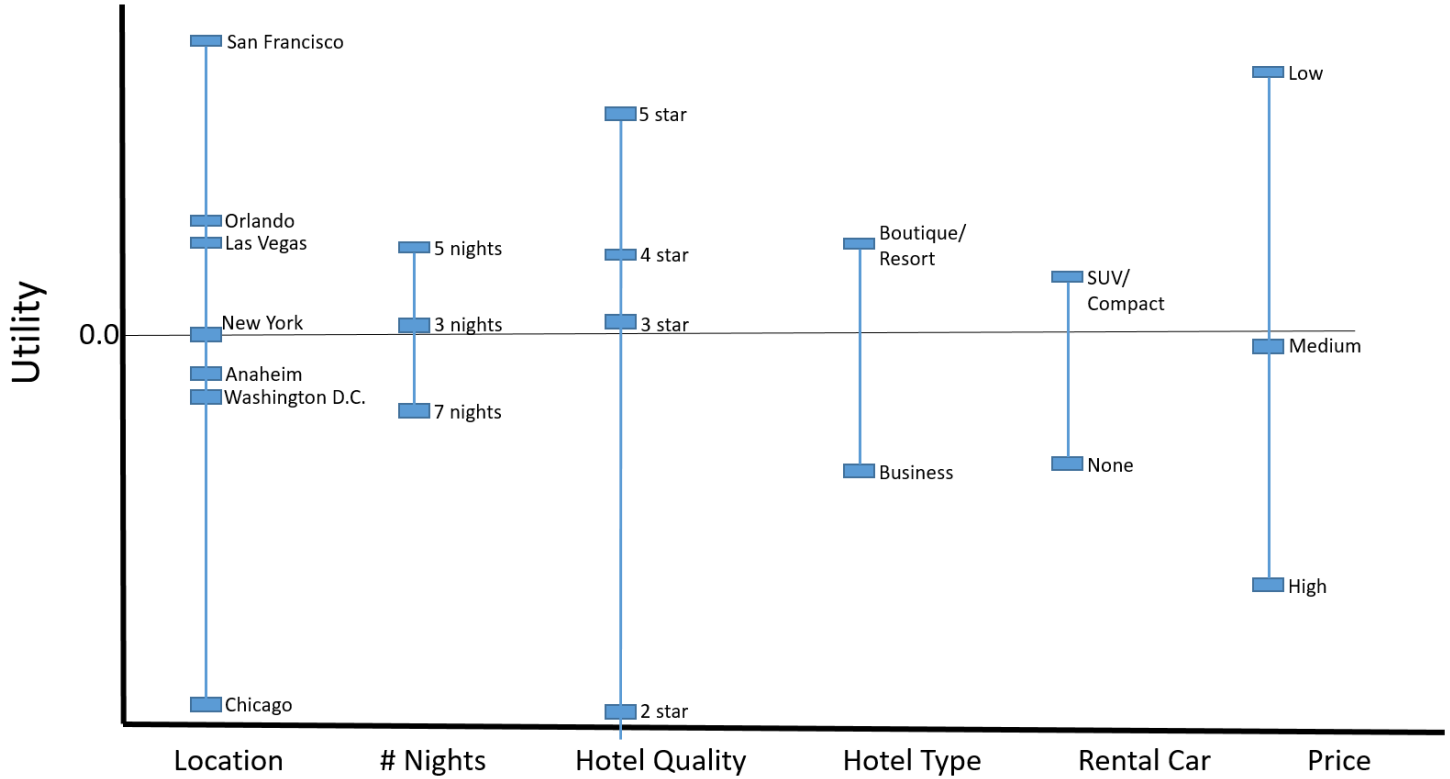
Line Chart


# of Nights
15
10
5
0
-5
-10
-15
-20
1.8
12.8
-14.6
3 nights
5 nights
7 nights

Line Chart by Segment

Thermometer Chart

- We could show all the attributes together on a page with a separate “thermometer” for each attribute (note each attribute is zero-centered)



IMPORTANCES

Importances are derived by taking the best minus the worst level of each attribute, percentaged

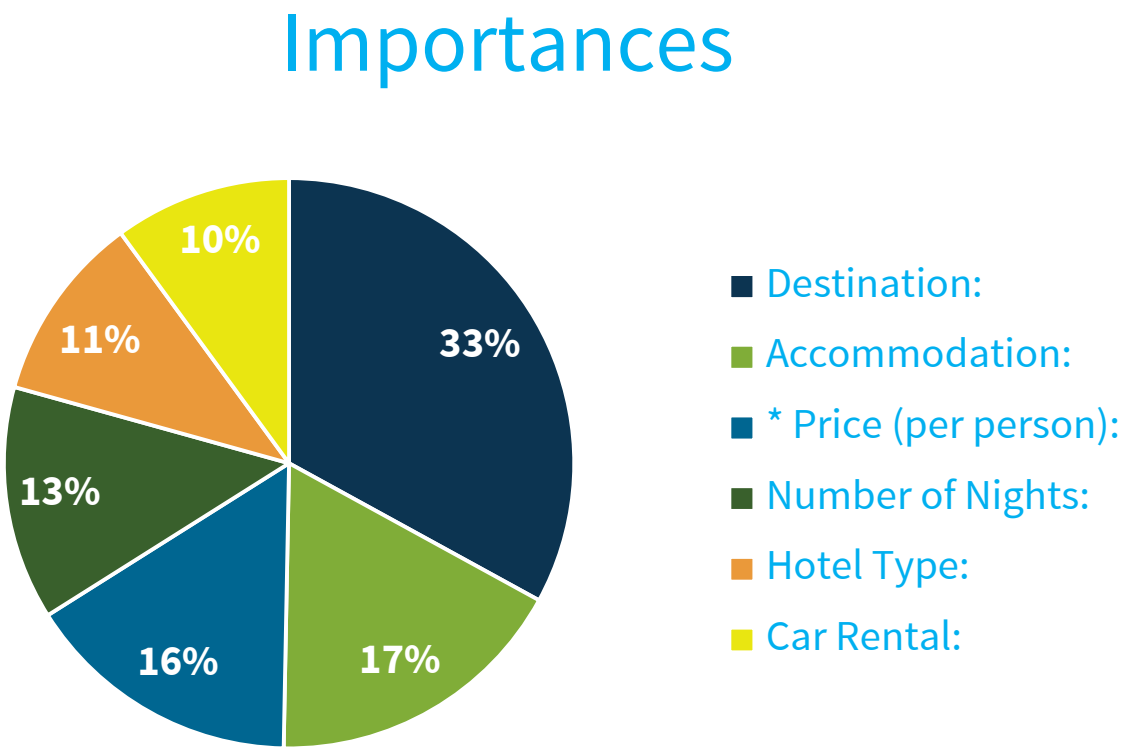
Respondent ID	Destination	# of Nights	Accomodation	Hotel Type	Car Rental	Price (per person)
1	30%	13%	19%	13%	16%	9%
2	21%	19%	15%	10%	21%	14%
3	28%	10%	20%	13%	3%	26%
4	43%	7%	24%	1%	3%	22%
5	63%	5%	11%	13%	6%	2%
6	34%	8%	17%	12%	17%	12%
7	15%	29%	17%	8%	11%	20%
8	23%	10%	24%	12%	16%	14%
9	37%	9%	10%	26%	10%	8%
10	26%	12%	22%	3%	11%	26%

...

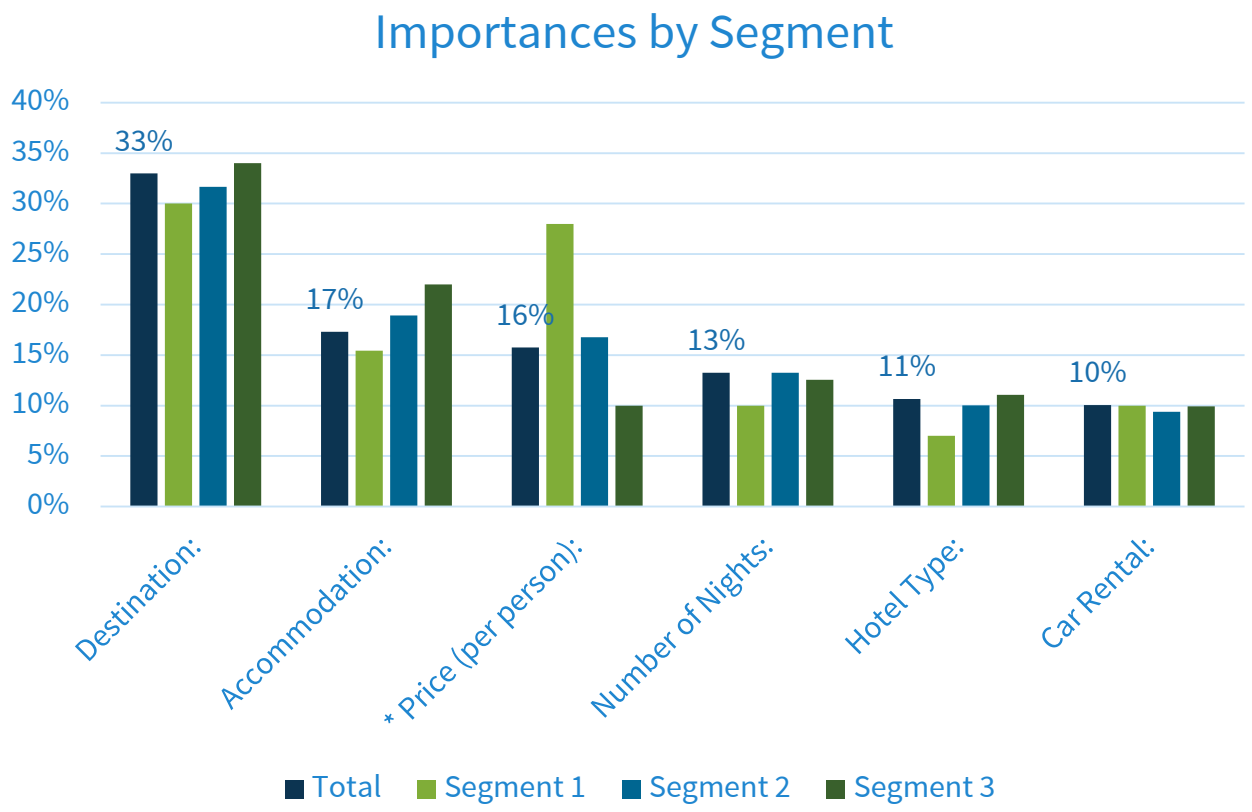
Attributes	Importances	Standard Deviations	Lower 95% CI	Upper 95% CI
Destination:	33%	11%	31%	34%
Accommodation:	17%	8%	16%	18%
* Price (per person):	16%	8%	15%	17%
Number of Nights:	13%	7%	12%	14%
Hotel Type:	11%	6%	10%	11%
Car Rental:	10%	6%	9%	11%

- NOTE - Importance scores are directly affected by the range of levels you choose for each attribute, the number of attributes, etc.

Pie Chart



Bar Chart by Segment



SIMULATIONS

Why Conduct Market Simulations?

- Examining just utilities and importances only gets you so far
- Average utilities cannot tell the whole story

Consider the following utilities:

	Blue	Red	Yellow
Respondent #1	50	40	10
Respondent #2	0	65	75
Respondent #3	40	30	20
Average	30	45	35

Red has the highest average preference
But, does any one respondent prefer red?

Simulators can help you answer strategic questions like…

- At what price will people switch to competitor?
- Will new product cannibalize our own sales?
- How can we modify benefits package to reduce cost while maintaining employee satisfaction?
- Should we launch a high-end product or a budget model?
- How much more price sensitive are people this year than last?

Conjoint Analysis is an Additive Model

- How much a respondent likes a product is simply the total of the utility values for the attribute levels that describe that product

- Therefore, we can create a market simulator that is essentially a “choice laboratory” for testing a multitude of real-world possibilities

Destination:	Number of Nights:	Star Hotel:	Hotel Type:	Car Rental:	Price: (per Person)	Share of Preference
Las Vegas	3 nights	4 star	Business	None	$650	16.8%
Orlando	5 nights	3 star	Business	Full Size	$920	20.9%
Anaheim	7 nights	4 star	Boutique	Compact	$1,190	14.6%
San Francisco	3 nights	5 star	Boutique	Full Size	$810	26.0%
Chicago	7 nights	5 star	Resort	Compact	$1,500	10.9%
New York	5 nights	5 star	Boutique	None	$1,380	7.4%
Washington D.C.	3 nights	2 star	Business	Full Size	$650	3.4%

Change Product Specifications Here...

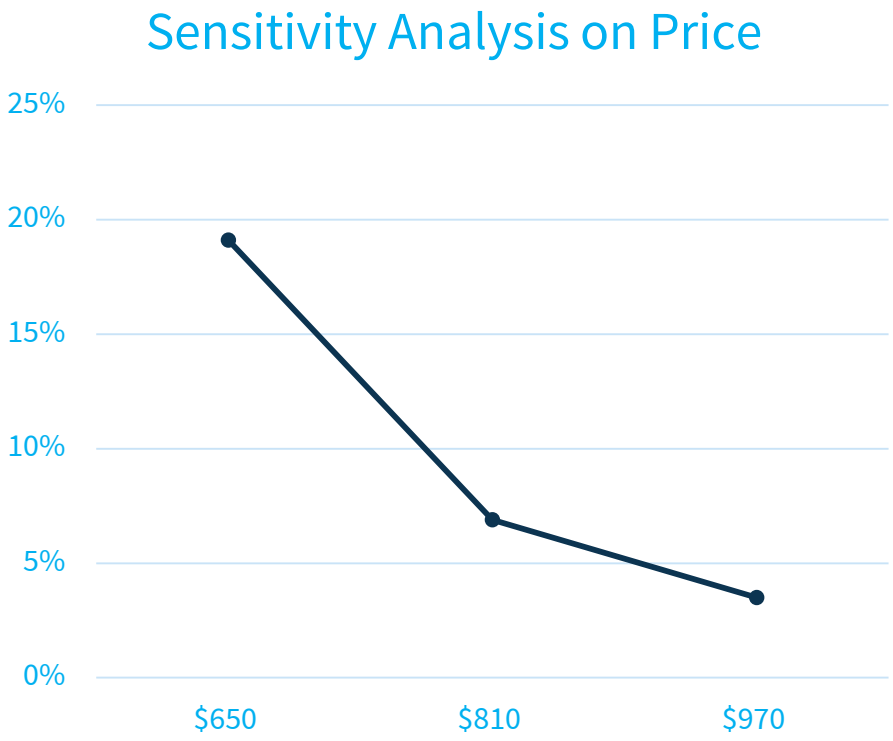
Results Are Displayed Here...

Conjoint Market Simulation Assumptions

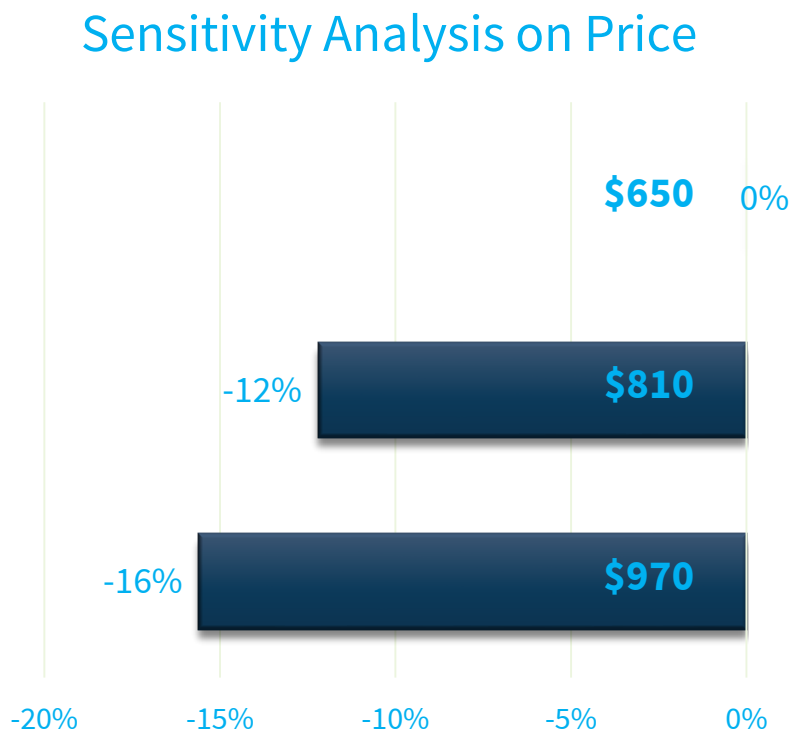
- We have interviewed the right people
- Each person is in the market to buy
- We've used a proper measurement technique
- Respondents have answered reliably and truthfully
- All attributes that affect buyer choices in the real world have been accounted for
- Equal availability (distribution)
- Respondents are aware of all products
- Long-range equilibrium (equal time on market)
- Equal effectiveness of sales force
- No out-of-stock conditions

SENSITIVITY ANALYSIS

Sensitivity Analysis Using Market Simulator

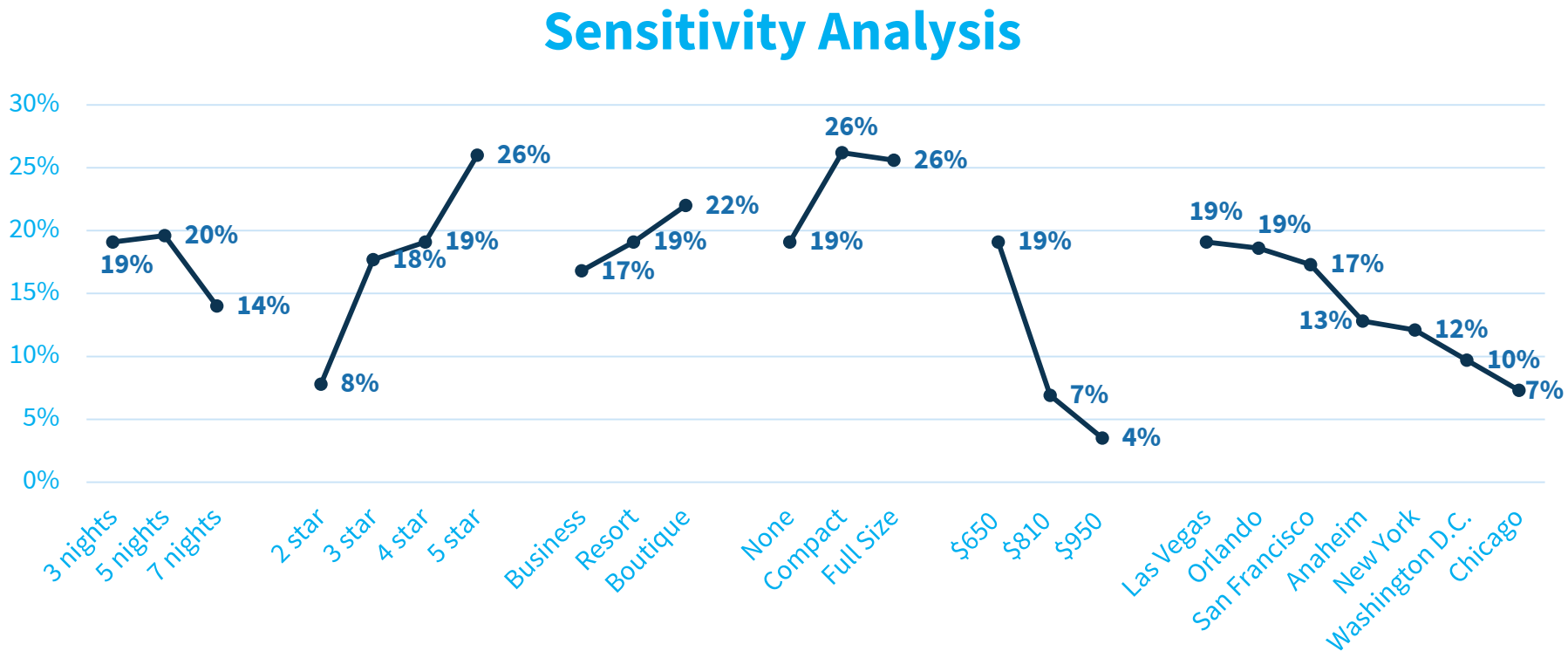


Sensitivity Analysis on Price attribute showing SOP in Line Chart



Sensitivity Analysis on Price attribute showing change in SOP in Tornado Chart

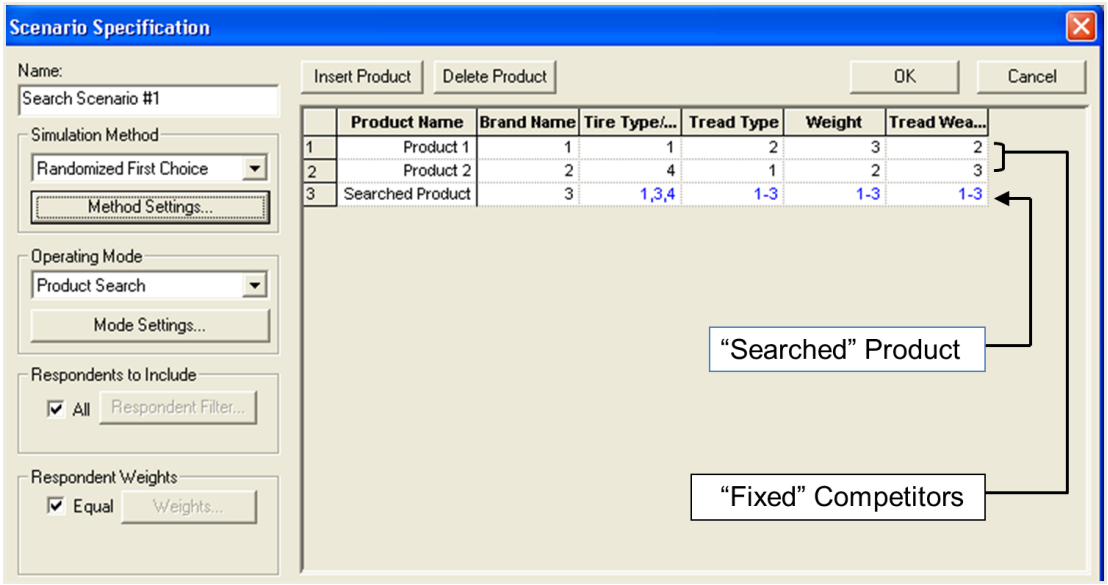
Sensitivity Analysis (cont.)



Sensitivity Analysis showing all attributes at once in Line Chart. The base case is {3 nights, 4 star, Resort, No Car Rental, $650/person in Las Vegas} hence why SOP is always 19% at these levels.

Optimization

- Optimal with respect to what?
  - Share
  - Revenue
  - Profitability
- Subject of optimization
  - A product
  - A portfolio of products



EXTENSIONS

Target Analysis Simulator

- Standard simulator

Scenario A			
	Trip 1	Trip 2	Trip C
Location	Las Vegas	Orlando	San Francisco
Nights	3	5	4
. . .	. . .	. . .	. . .
Price	$650	$895	$1,100
Share	55%	33%	12%

Target Analysis Simulator

- Dynamically profiles the respondents who choose each alternative in a simulation

Scenario A			
	Trip 1	Trip 2	Trip C
Location	Las Vegas	Orlando	San Francisco
Nights	3	5	4
. . .	. . .	. . .	. . .
Price	$650	$895	$1,100
Share	55%	33%	12%
Profile of Those Choosing Each Alternative (Column Percentages)			
Demographics	Trip 1	Trip 2	Trip C
Female	39%	61%	48%
Median age	64	54	38
. . .	. . .	. . .	. . .
Median HH income	$64K	$67K	$71K
Behaviors			
Annual leisure trips	2.2	1.4	1.8
. . .	. . .	. . .	. . .
% of trips for business	39%	24%	51%
Psychographics (top 2 box agreement)			
I hate travel	8%	12%	13%
A cruise would be fun	67%	55%	43%
. . .	. . .	. . .	. . .
Travel is a special event	56%	66%	43%

Willingness to Pay - Measuring $ Value of Features

- Simulated test markets
  - Vary prices/features across cells of respondents
  - Essentially a conjoint experiment where each respondent sees a single profile or choice set
  - Requires very large sample sizes
- Contingent valuation
  - Direct questioning method
  - Give respondents a complete description of the good, service feature
  - Then ask them how much they would be willing to pay to get it
  - Still used sometimes but falling out of favor

Willingness-to-Pay from Conjoint Analysis

- If our attribute and our price variable are measured as linear functions, then

$$WTP = Price\ Range * \frac{Attribute\ coefficient}{Price\ coefficient}$$

- For example, we measured prices in the range of $100 - $200, our price coefficient is 5.2 and the coefficient for an attribute (say length of warranty that ranges from 3 months to 12 months) is 2.2, the respondents' WTP for the longer warranty is

$$WTP = \$100 * \frac{2.2}{5.2} = \$42$$

WTP for Categorical Variables

- The same formula applies if we model attributes as categorical variables instead as linear functions
- We just use the levels of the attribute for which we want to calculate WTP

Caveats about WTP

- Hypothetical bias: respondents can spend survey dollars more liberally than dollars from their wallets (their wallets are full and their credit cards are empty)
- WTP can be affected by competitive effects (maybe I'm theoretically willing to spend $40/month, but if it's available for $10/month no one will ever see that $40
- Attribute non-attendance can make for small, or even zero utilities, which can make WTP astronomically large
  - Some analysts constrain price utilities to be positive
  - In economics a common solution is to force price to be a fixed utility common across respondents while feature utilities can vary across respondents

Advice for WTP

- Having respondent-level HB values gives us better options for handling some of these problems
- At a minimum, calculate at the respondent level and report median WTP, which prevents extreme measures from influencing the WTP estimate
- Better still, calculate from simulations rather than directly from utilities
  - Simulate Products A and B
  - A has the feature, B does not
  - A is at the current market price
  - Set B's price such that the two products each have a 50% share
  - This is the simulation-based WTP

Needs-based Segmentation

- We can use conjoint utilities for segmentation
  - Use them as basis variables for segmentation by making them the inputs to cluster analysis
  - Or run latent class multinomial logit to derive segments of respondents with similar utilities
- Either way what results are segments of respondents with different preferences and who we expect will behave differently in simulations (and in the market)

Conjoint as Input to a Forecasting System

- Often the total value of a marketing program is a function of both the size of the market and the share of the market a client can capture
- Conjoint analysis can help with the market share part (though shares may be further influenced by other measurable factors)
- Market size may be a function of altogether different variables

Forecasting BGM Sales c. 1987

- Background
  - In the late 1980s the market for patient-use blood glucose monitors was exploding
  - Any forecast had to take into account both the share among patients and the number of patients
  - Moreover different patient populations had different adoption trajectories
- Conjoint could handle the share piece

Forecasting BGM Sales c. 1987

- The number of patients depended on many factors (and separately by patient segment):
  - Incidence of new diagnoses
  - Conversion rate of new and existing patients
  - Patient mortality rate
  - Incidence of disease, therapy and behavioral characteristics (e.g. adoption spiked after a second hospitalization)
- The resulting tool used a Monte Carlo forecast to account for uncertainty in each variable, and the conjoint simulator was a small piece of the whole

Want to learn more?

- Huntington Beach, CA May 22-24
  - 3 day choice modeling workshop
- Park City, UT July 17-21
  - 3 day choice modeling workshop
  - Becoming an Expert in Conjoint Analysis Seminar NEW!
  - Menu-Based Choice (MBC) Workshop

QUESTIONS?

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APPENDIX

Avoid these common mistakes…

- Don't tell your client that the results will "directly tells us how many people will buy this product"
  - Conjoint gives us preference share
  - Several factors separate preference shares from market shares
- Conjoint analysis does not assess how good or bad a level of an attribute is
  - We only learn how much more or less utility one level has compared to other levels of that attribute
  - Just like in MaxDiff, the highest utilities supply only relative information (maybe it's like *the smartest kid in summer school)*
- Just like any quant survey, weigh the pros and cons of increasing sample size
  - Doing so will reduce your confidence intervals and standard errors
  - But it takes a quadrupling of sample size to cut standard errors in half

Chapman, C.N. (2013). 9 Things Clients Get Wrong About Conjoint Analysis. Proceedings of the 2013 Sawtooth Software Conference, Dana Point, CA, October 2013, pp. 1-11.

And consider this…

- Conjoint analysis is a great technique for pricing research, but be mindful that there are typically many more factors that could impact price than allotted for in the exercise or model.
- Build a simulator! If you only look at the averages, or each feature independent of the other features, you may be missing out on the bigger picture.
- Be careful when reporting importances – they're relative!
  - Including (or omitting) a very popular or unpopular level on one attribute will alter the "importance" of every other attribute!

Chapman, C.N. (2013). 9 Things Clients Get Wrong About Conjoint Analysis. Proceedings of the 2013 Sawtooth Software Conference, Dana Point, CA, October 2013, pp. 1-11.