Advanced Quant Techniques

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The Superiority of Panel Research
A Fast Food Choice Modelling Example

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The Superiority of Panel Research
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Introduction

- We are seeing a global initiative to ensure quality standards of online panels.
- Online panels provide both valid real world replication and cost effectiveness.
- Only online panels offer effective administration of the latest modelling methods to take place e.g. choice modelling.

Introduction 2

- We present a fast food choice modelling case study using online panel research.
- The study illustrates the use of online panel data for a fast food industry market participant in Australia.
- The client wanted to be able to simulate real market impact by changing a number of product factors.

Introduction 3

- Specifically, the client wanted to understand
  - Optimal pricing
  - Optimal meal bundles
  - Preference differences between lunch and dinner trade
  - Retention and churn forecasts based on simulations of price and profit scenarios

Benefits of Online Panels: The Sample

- In Australia internet penetration is 80+%.
- Unconstrained by geography.
- Respondents can *"log on"* at any location.
- Respondents therefore find it easier to participate in marketing research via online than previously.

Benefits of Online Panels: Suitability to Designs

- Online research is well suited to experimental designs used for choice experiments.

- Experimental designs call for intricate and complex representations of factors and factor levels e.g.

Attributes	$Alternative_A$	$Alternative_B$	$Alternative_C$
A	1	3	2
B	2	1	3
C	3	2	1

Benefits of Online Panels: Visual Tasks and Data

- Online research provides a visual medium where the researcher can simplify the complexity of combinations presented to respondents.
- As respondents click through the choice tasks they can easily see what changes.
- Collecting data is automated as the respondent completes each task.

Benefits of Online Panels: Opportunity for Weighting

- Respondents can belong up to 10+ panels for any number of reasons, one of which is an additional income source.
- The degree of panel membership a respondent is classified into accounts for panel composition bias in demographics, behaviours and attitudes (Fine et al., 2006).
- In order to remove panel composition bias to tap into the large respondent panel base (n=400,000+), a non-parametric weighting scheme is applied that simultaneously removes the bias whilst weighting to the population (Fine et al., 2007)

The Case Study: A Fast Food Discrete Choice Experiment

SAMPLE

- The panel we used contained over 400,000 respondents.
- Randomisation of strata fulfilment provided an un-biased solicitation process.
- The client's customers were screened for recent purchase; meal occasion; demographics; in-restaurant or drive-through purchase.

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EXPERIMENTAL DESIGN

- Premised on an experimental design allowing for a systematic combinatorial mixing of alternatives, attributes and levels (Street and Burgess 2007).

- Respondents were provided blocks of 16 tasks based on a fractional factorial design.

The Case Study: A Fast Food Discrete Choice Experiment

VALIDITY

- To ensure realism, we included each respondent's *actual last meal purchase* and the *real market price* at the time of purchase

- We used this information in each choice task to force the respondent into a *real market* trade-off scenario

- This made the experiment a *realistic decision process* as would occur in the real market

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Scenario Number: Example of the choice tasks

You last purchased	*Price you most likely paid*
Meal Type$_k$	$24.50

Menu items in scenario	Potential new menu prices
Meal$_A$	$25.70
Meal$_B$	$27.60
Meal$_C$	$25.70
Meal$_D$	$17.30

When you last visited <Client>, if the menu item's prices were as shown, would you have chosen the same meal component you did then, or would you have made a different choice?

- ○ Same as last purchase
- ○ Meal$_A$
- ○ Meal$_B$
- ○ Meal$_C$
- ○ Meal$_D$

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USING STATED AND REVEALED PREFERENCE DATA

- As mentioned, we asked respondents for their last meal purchased.

- This enabled the *combining* of stated data (what respondents chose) to revealed data (what they had done in the past – their last meal purchase

- The process allows for simulation of *real market behaviour*

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SAMPLE SEGMENTS

		Occasion Segment	
		Lunch	Dinner
Purchase Segment	Self	a	c
	Family	b	d

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WEIGHTING TO REMOVE SAMPLE AND PANEL COMPOSITION BIAS

- Respondents who register on online panels can belong to >1 panel.
- Fine et al. (2006) found *differences* in demographics, attitudes and behaviour, *due to panel composition*.
- A non-parametric weighting scheme using CART was developed to model *main effects* and *n-way interactions* to simultaneously remove panel bias and weight to population.

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EXAMPLE OF REMOVING PANEL BIAS FOR PRIVATE HEALTH INSURANCE

	Panel composition					
Private Health Insurance	*1*	*2*	*3-4*	*5-7*	*7+*	Total
Unweighted	52.86	49.54	42.24	38.99	36.96	45.47
Demographic Weighting	65.44	62.26	54.25	51.33	48.11	58.35
CART Weighting	56.95	55.84	47.41	45.00	40.19	50.82
					Pop^n	51.00

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Attributes	Un-weighted β	Demographic Weight β	Cart Weight β
β0	-3.733	-4.762	-4.429
β1	-0.258	-0.190	0.054
β2	-0.146	0.075	0.487
β3	1.773	2.342	1.792
β4	0.170	-0.220	-0.190
β5	0.047	0.116	0.033
β6	0.031	0.052	0.071
β7	-0.043	0.094	0.085
β8	-0.443	-0.470	-0.587
β9	-0.079	-0.147	-0.199
β10	-0.239	-0.298	-0.450

legend: *p<0.05; **p<0.01; ***p<0.001

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COMPARING MODEL FIT BETWEEN *DEMOGRAPHIC* AND *CART WEIGHTING*

Fit Statistics	Un-weighted	Demographic Weight	Cart Weight
McF's ρ^2	0.1019	0.1251	0.1422
LL	-1,178	-1,212	-952
AIC	2,444	2,512	1,991
BIC	2,653	2,724	2,193

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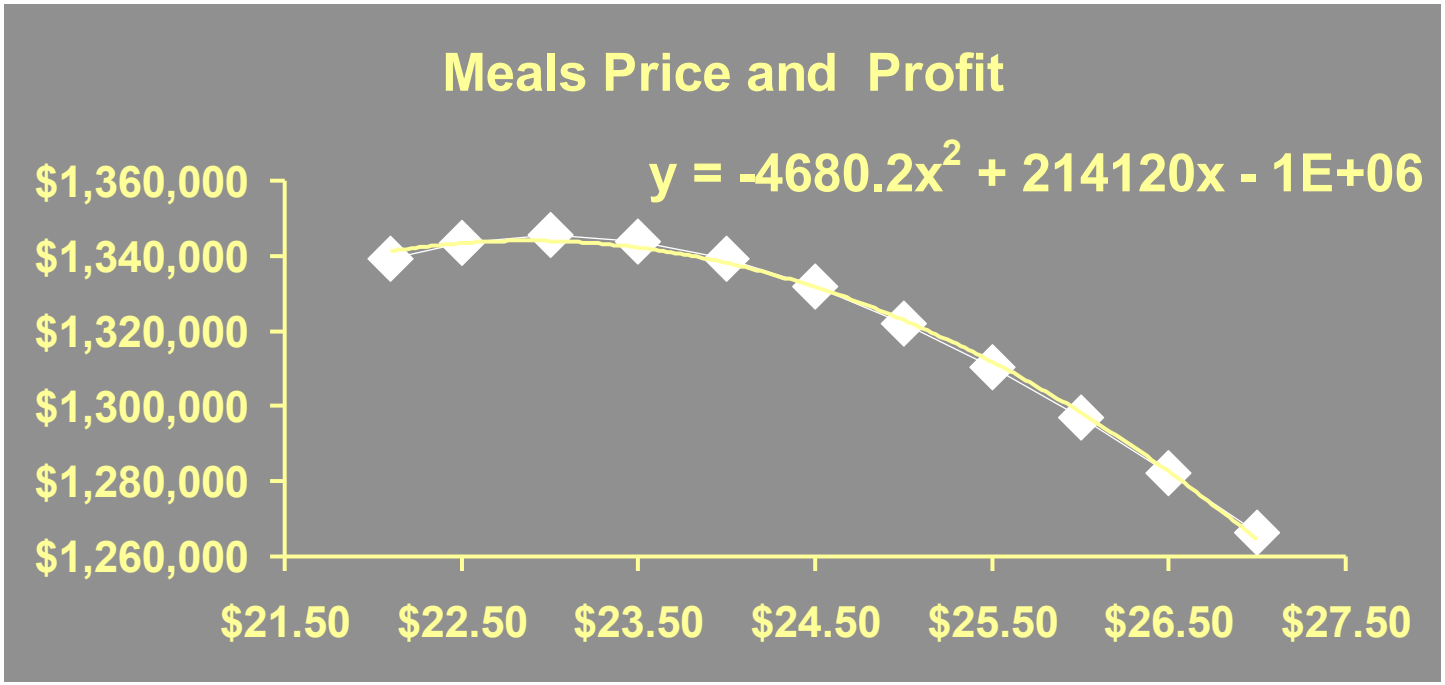
ANALYSIS

- McFadden's (1974) (MNL) used to derive the utilities for each menu item and associated attributes and levels



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DECISION SUPPORT SYSTEM (DSS)

- Revenue and Profit Simulator

Profit Optimization based on 100,000 customers matching selection criteria							
	Meal Price	Meal Cost	Revenue	Cost	Meal Profit	Profit Bound	Customer Numbers
Meal 1	24.5	7.56	587,043	181,145	405,898	2,000,000	23,961
Meal 2	28.5	10.61	911,123	339.193	571,929	2,000,000	31,969
Meal 3	28.5	10.63	228,079	85,069	143,010	2,000,000	8,003
Meal 4	15.75	4.55	293,734	84,856	208,878	2,000,000	18,650
Total			2,019,979	690,264	1,329,715		82,583
Gain			0	0	0		0

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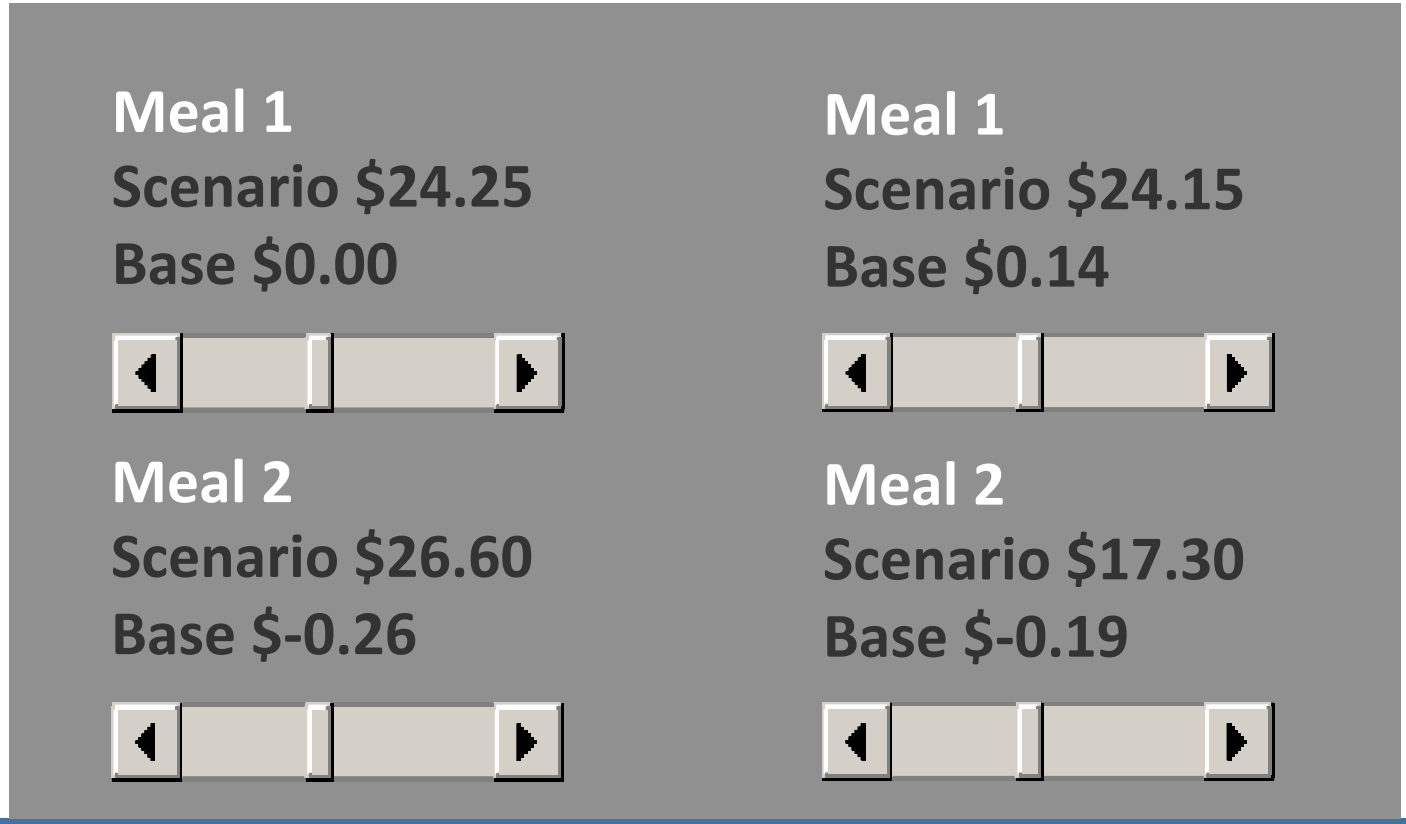
DECISION SUPPORT SYSTEM (DSS)

- Price change facility



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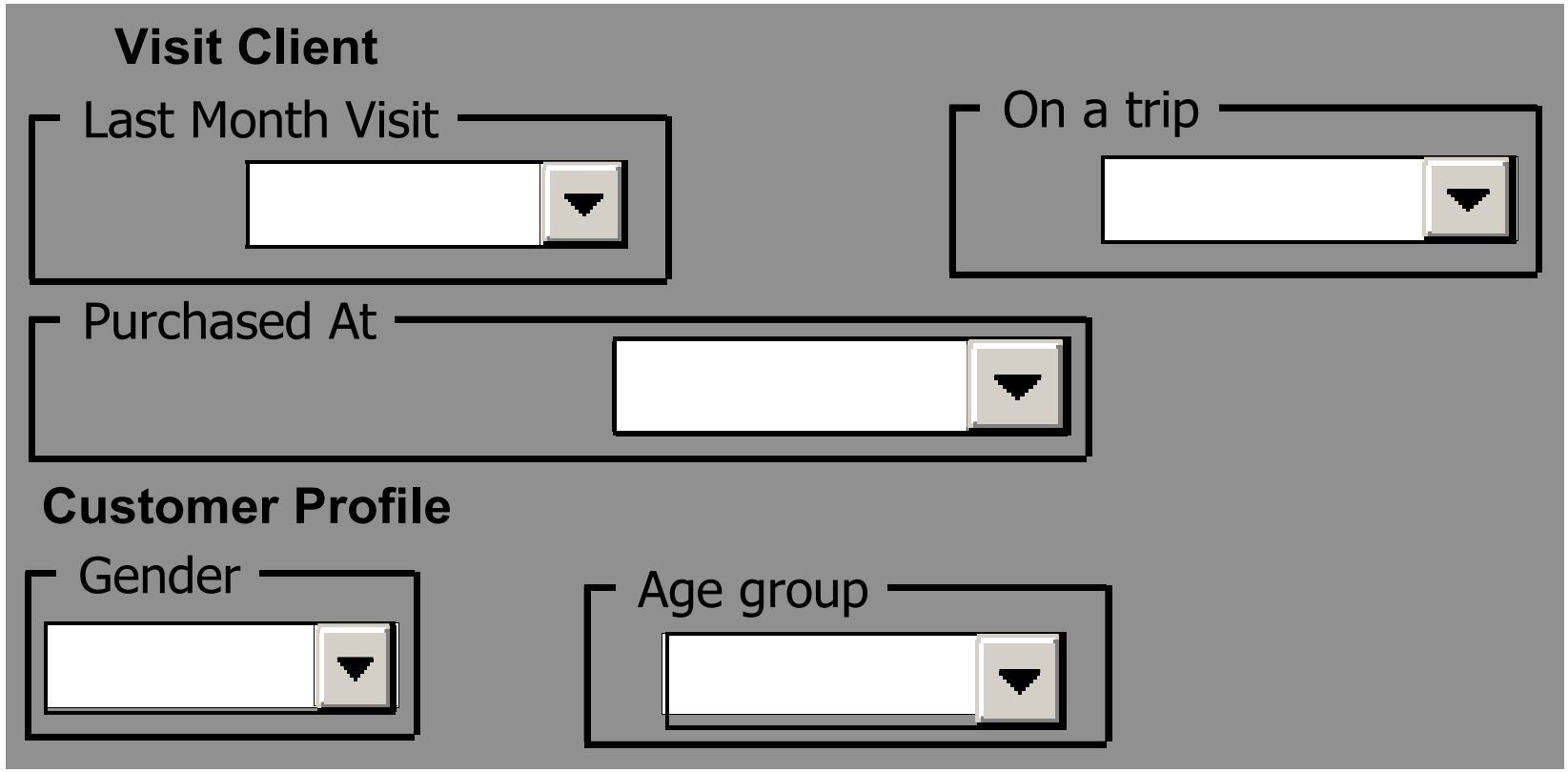
DECISION SUPPORT SYSTEM (DSS)

- Covariates



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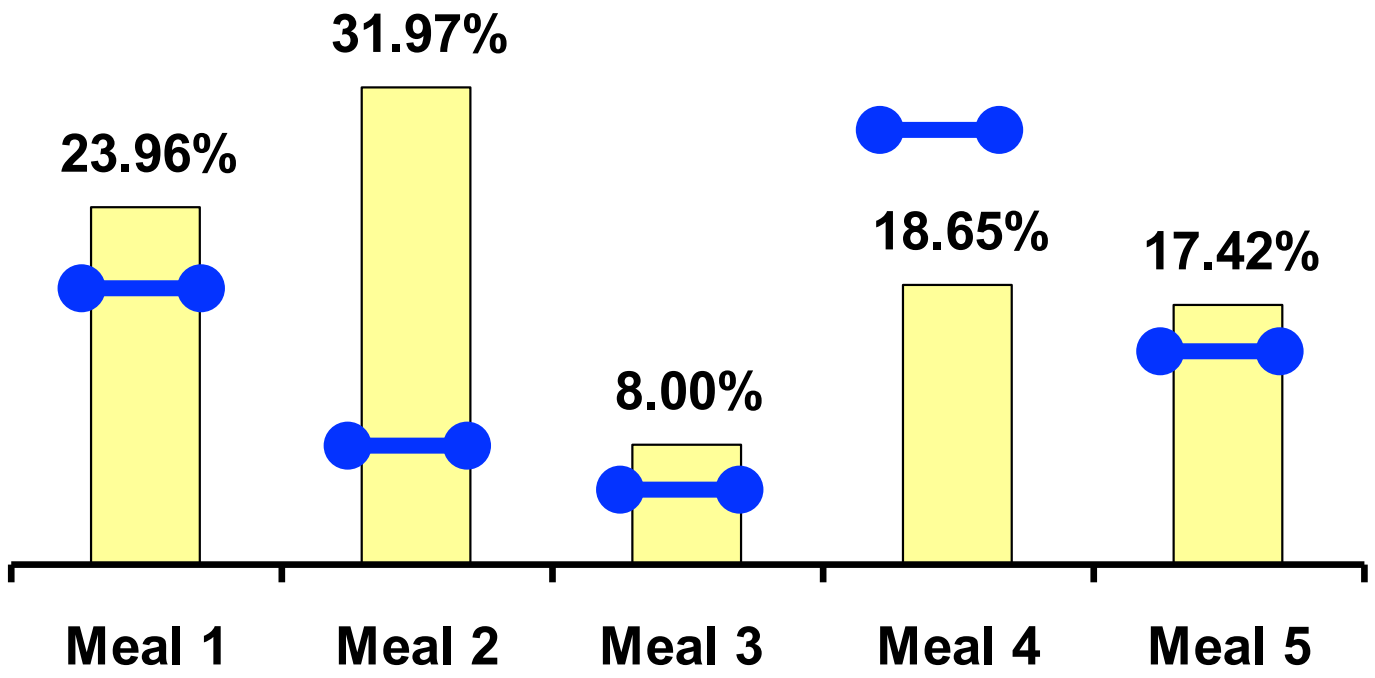
DECISION SUPPORT SYSTEM (DSS)

- Market Share Statistics



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DECISION SUPPORT SYSTEM (DSS)

- Market Share meal scenario simulation

Market Share Simulation	Scenario %	Current %	Change %
Meal 1	8.0	8.0	0.0
Meal 2	31.0	33.0	-2.0
Meal 3	22.4	26.4	4.0
Meal 4	20.6	21.1	-0.50
Not visit	15.4	15.4	0.0

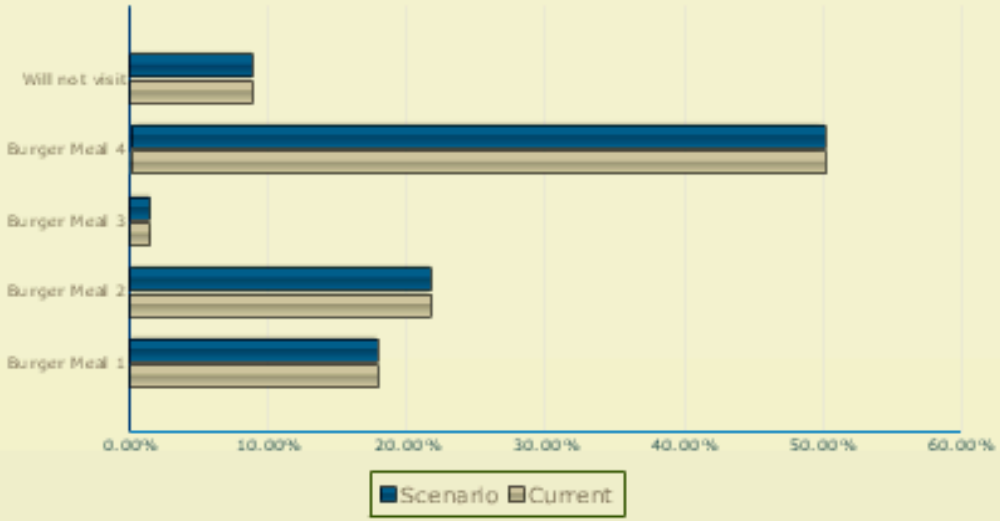
DSS For Burger Meal Purchase

Burger Meal 1 24.50
22.10 27.00

Burger Meal 2 28.50
25.70 31.40

Burger Meal 3 28.50
25.70 31.40

Burger Meal 4 15.75
14.20 17.30



Visited Restaurant Last

Yes | No | All

Purchased on a trip

Yes | No | All

Purchased in the restaurant

In Restaurant | Drive Thru | All

Gender

Male | Female | All

Age Group

18 to 19
20 to 24
25 to 29
30 to 34
35 to 39

	Scenario	Current
Burger Meal 1	17.85%	17.85%
Burger Meal 2	21.70%	21.70%
Burger Meal 3	1.40%	1.40%
Burger Meal 4	50.22%	50.22%
Will not visit	8.83%	8.83%

100,000 Consumers	Unit	Revenue	Profit
Burger Meal 1	17847	$437,263.32	$302,336.35
Burger Meal 2	21701	$618,479.14	$388,231.29
Burger Meal 3	1400	$39,886.45	$25,009.50
Burger Meal 4	50219	$790,946.06	$562,450.53
Will not visit	8833	$0.00	$0.00
Total	100000	$1,886,574.97	$1,278,027.68

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Conclusion

- **Online panel can easily control for:**
  - complex data requirements regarding for choice modelling methods;
  - easy to understand visual tasks for respondents; and
  - the ability to tailor representations of past behaviour for each respondents, such as last purchase, on the fly.

Conclusion 2

- Online research can easily match data from past behaviours (revealed preference) to data from the choice experiment (stated preference)
- This feature allows for *realism* in predicting preferences and behaviour
- In online research the key to enhancing prediction even higher is to ensure optimal weighting of the sample corrects for panel bias.
- A CART weighting procedure does this by accounting for all effects

Conclusion 3

- The latest developments in experimental design (Street and Burgess 2007) can easily be incorporated via online research.

- The complexity of factorial designs coupled with *version* and *strata fulfilment* requirements are only made possible with online research data collection.

- Using optimally efficient experimental designs means that the researcher can *optimise* parameter estimates.

Conclusion 4

- The aid of a Decision Support System (DSS) is the key to presenting choice modelling results to the client.
- DSSs make research results both intuitive and easy to understand
- DSSs can also extend the original simulation with tools such as profit simulators based on real consumer behaviour data.

Conclusion 5

- Online research methods therefore provide for a richer and more flexible experimental and data collection methods, when compared to CATI and CAPI.

- The ability for a researcher to get closer to the consumer's decision process we believe will be increasingly sought after.

- We hope to have demonstrated the value of on-line panels when used for complex research.

Q & A

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