When Consumers Go Beyond Choice: Models for Trade-Up and Change in Consideration Set

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in4mation insights

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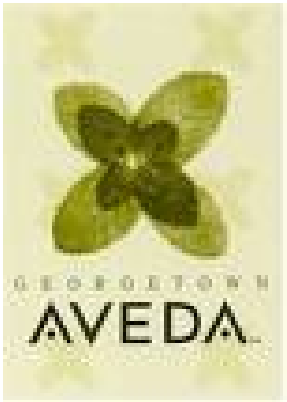
Trade-up is a jump

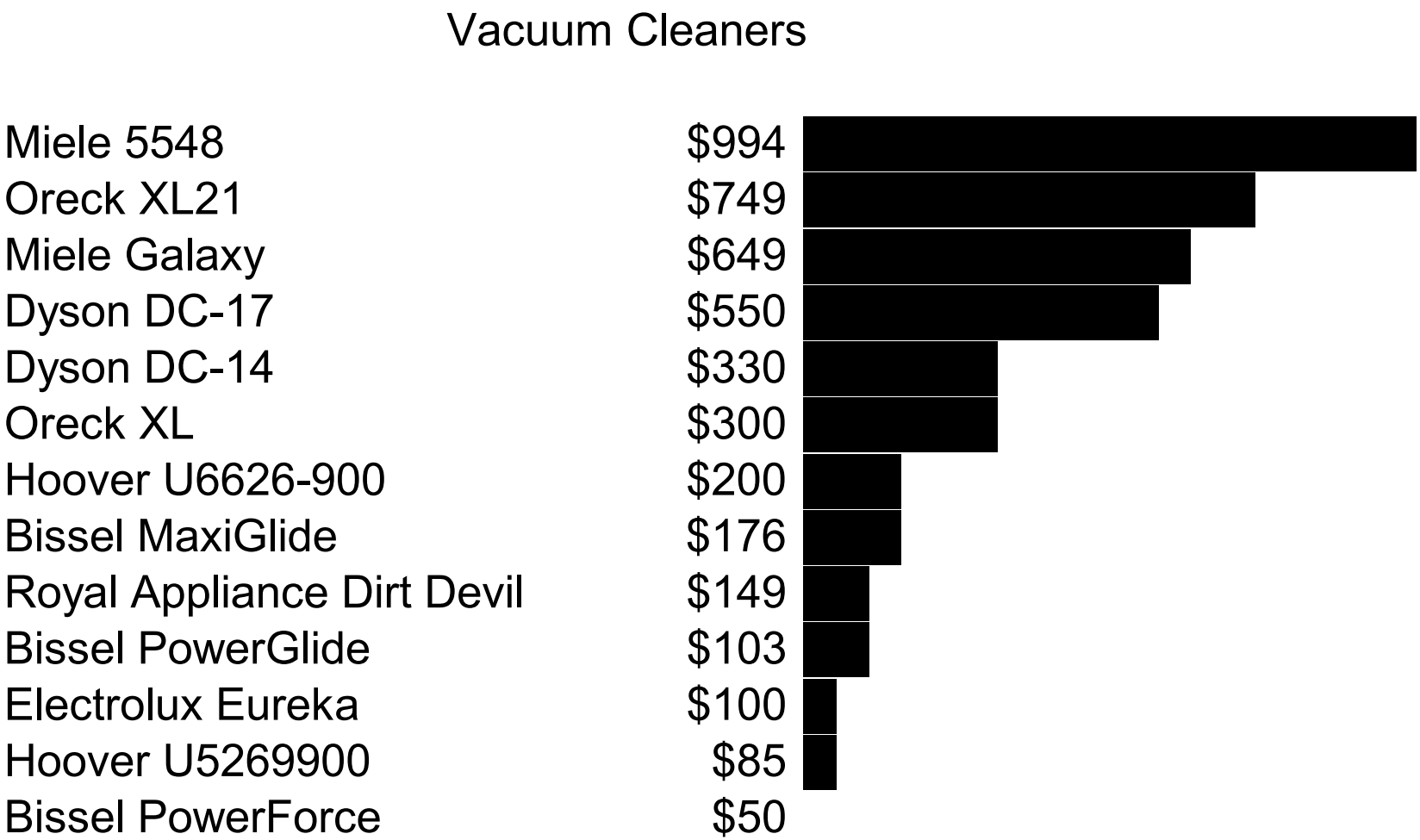
- Trade-up occurs when a consumer makes a jump from an inferior to a superior good
- The trade-up event is often associated with a change in lifestage, personal priorities or in disposable income
- The notion of trade-up was popularized by Michael J. Silverstein and Neil Fiske in 2003 in their book “Trading Up: The New American Luxury”
- We are interested in the trade-up decision – its relationship to variables under our control (e.g. advertising, endorsements) and those that are not (e.g., age, income). We want to know how much a consumer is willing to spend in the category versus an “outside good.”

Trade-up has become a familiar part of the American consumer landscape



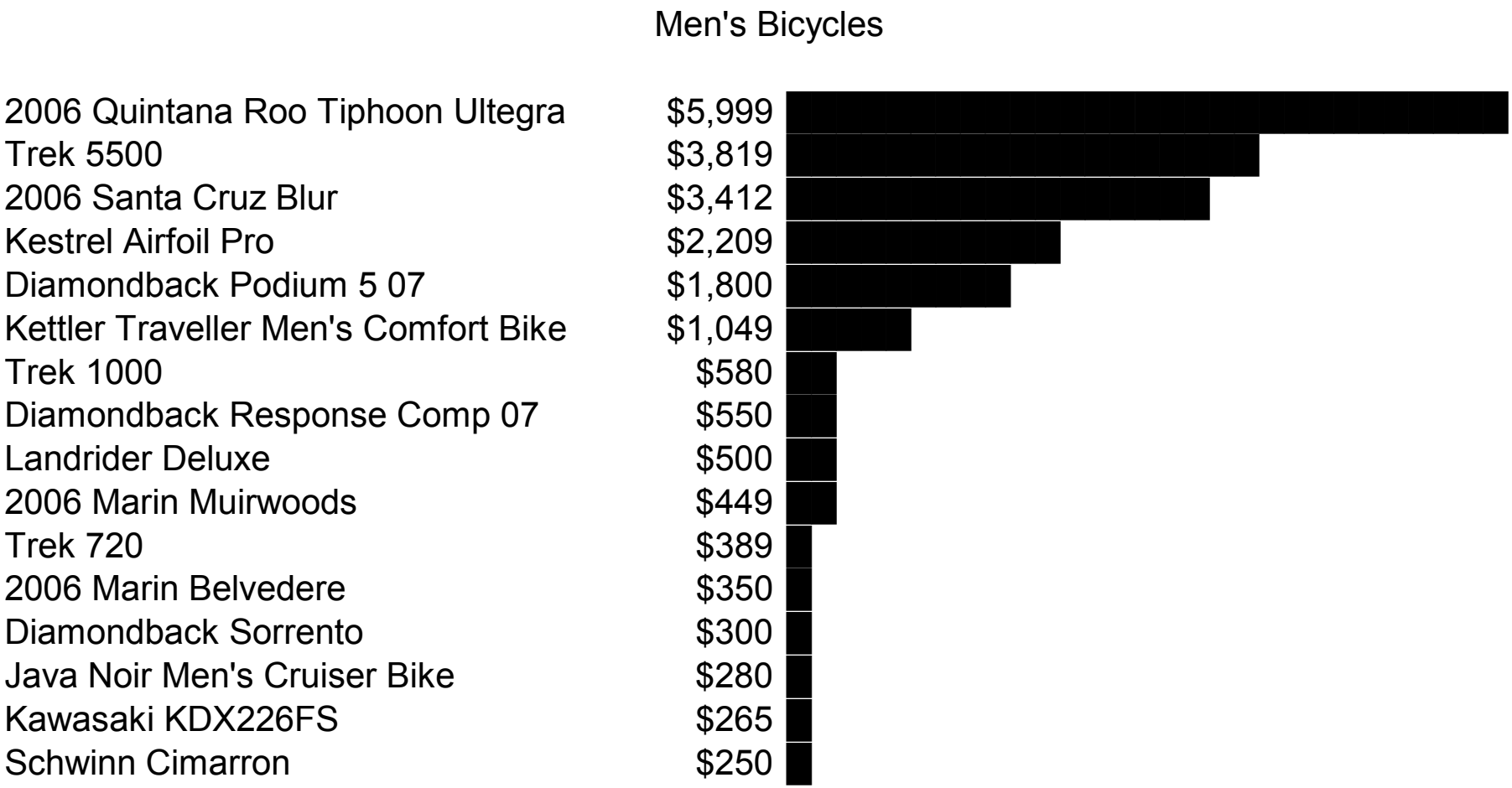
Category	Fair Quality	Trade-up
Shampoo	Loreal	Aveda
Skin Cream	Jergens	Neutrogena
Girl's Dolls	Cabbage Patch	American Girl
Home Goods	Pottery Barn	Restoration Hardware
Automobiles	Cadillac	BMW, Lexus, Audi
Vodka	Smirnoff, Stolichnaya	Grey Goose, Skyy Blue
Stoves	Jenn Air	Viking
Razors	Sensor/manual	Fusion/battery
Fridges	Kitchen Aid	Subzero
Wine	Twin Valley	Yellow Tail
Beer	Budweiser	Heineken, Corona
Washing Machines	GE Profile	Whirlpool Duet

Trade-up products are superior: they transcend the simple sum of feature utilities



Trade-up products require a disproportionate amount of a consumer's resources.

Trade-up may be linked to changes in lifestage or disposable income



Requirements of the trade-up model

- We were seeking a model that can distinguish three different factors:
  - Affordability
  - Preference
  - Trade-up
- Affordability is defined as the maximum amount a consumer will spend on a category
- Preference is the utility of the brand or the item (as in traditional logit)
- Trade-up is an asymmetric effect that favors the superior good as consumers spend more in the category
  - Can be associated with products, product classes or features of products

Key differences with MNL

- Standard logit (including HB) has a strong assumption that the items in the choice set be “near-perfect substitutes.”
  - The IIA property of proportional draw is powerful and useful for near-perfect substitutes but breaks down in the presence of superior goods
- Nested logit models deal with dissimilar choices but require that a problem be compartmentalized *a priori* into subsets where IIA holds
  - They do not address trade-up from one subset to another
- Trade-up models include a category allotment that may be spent if the deal is good, or partially spent otherwise
  - This requires a model of category expenditure and the presence of an “outside good”

Economics of the MNL Logit Model

$$u(x) = \sum_k \psi_k x_k$$ ← Linear utility

$$Pick\ i\ if\ \frac{\psi_i}{p_i} \geq \frac{\psi_k}{p_k}$$ ← Bang-for-the-buck

$$\begin{aligned}
\Pr(i) &= \Pr\left(\ln \psi_i - \ln p_i \geq \ln \psi_k - \ln p_k \ \ \forall k\right) \\
&= \Pr\left(\ln \bar{\psi}_i - \ln p_i + \varepsilon_i \geq \ln \bar{\psi}_k - \ln p_k + \varepsilon_k \ \ \forall k\right) \\
&\vdots \\
&= \frac{\exp\left[\beta_{0i} - \beta_p \ln p_i\right]}{\sum_k \exp\left[\beta_{0k} - \beta_p \ln p_k\right]}
\end{aligned}$$ ← Extreme value errors lead to logit model. Budget constraint not present.

Economics of the Nonhomothetic Model

$$u(x) = \sum_{k=1}^{K} \psi_k(u)\, x_k = \sum_{k=1}^{K} \exp\left[\alpha_k - \kappa_k u\right] x_k$$

marginal utility depends on u

For $\kappa > 0$, choice model is discrete (x=0,1).

For $\kappa_i < \kappa_j$, brand i is less penalized by u (superior good)

Nonhomothetic Model

$$\ln u(x,z) = \ln u(x) + \tau \ln(z)$$ ← z is outside good

$$\sum_{k=1}^{K} x_k p_k + z = E$$ ← E is budget constraint

$$E = \gamma_0 + \gamma_1 v$$ ← v affects E

Affordability…	E
Preference …	brand intercepts
Tradeup …	κ

Random effect specification

All model parameters are specified as random-effects:

$$\beta_h = \left(\beta_{01h}, \beta_{02h}, \ldots, \beta_{0Kh}, \kappa_{1h}, \ldots, \kappa_{jh}, \gamma_{0h}, \gamma_{1h}, \tau\right)' \sim N\left(\Delta z_h, V_\beta\right)$$

$$\Delta = \left(\underset{\sim}{1}, rec., income, age, income \times age\right)$$

Estimation by Bayesian MCMC

Health Care Example

- N=1323 respondents
- Stratified sample
  - 334 high tech buyers
  - 326 mid tech buyers
  - 663 low tech buyers
- p=40 products
  - 19 low tech products
  - 6 mid tech products
  - 15 high tech products
- Broad price range:
  - Mid tech 10x low tech; High tech 10x mid-tech
- Purchase of high-tech products likely to be influenced by:
  - Professional recommendation
  - Information acceleration via video stimulus
  - Health problems likely to increase with age
  - Income a key driver of affordability of high tech solutions

Model Results

Model	**Parameters** (40 products + outside good)	**Log Marginal Density**
1. Nonhomothetic	40 β_0's, 3κ's, τ, γ_1, γ_2	-21,801
2. MNL	40 β_0's, β_{price}	-22,503
3. Homothetic	40 β_0's, 3 κ's = 0, τ, γ_1, γ_2	-23,522

Parameter Table

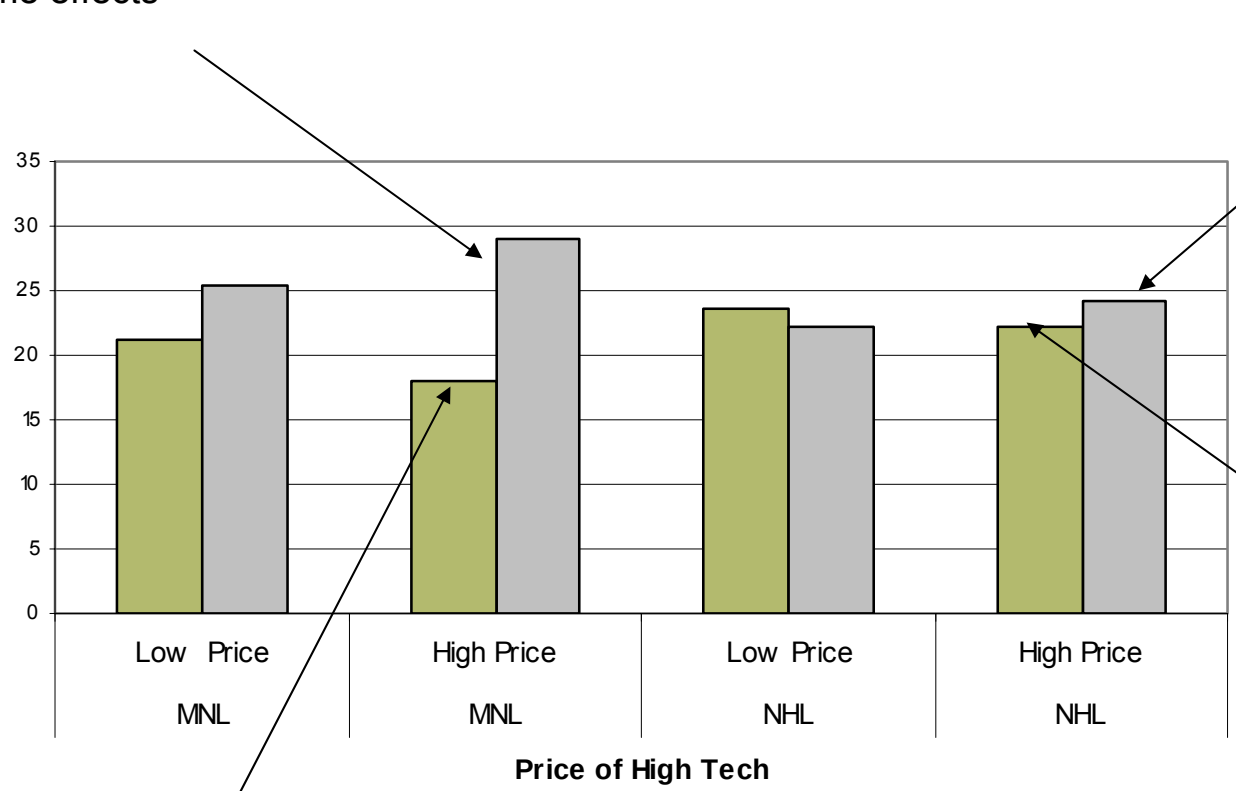
	UPPER MODEL				
Parameter (likelihood)	**Intercept**	**Recommend-ation**	**Income**	**Age**	**Income x Age**
Kappa Low-Tech	-0.85	4.75	0.83	8.93	-5.89
Kappa Mid-Tech	-3.18	4.49	0.34	8.70	2.90
Kappa High Tech	-4.05	-1.66	-2.18	2.67	8.74
Expenditure - Intercept	2.48	1.10	0.33	-2.05	0.71
Expenditure - Video	0.23	0.34	-0.11	0.53	-2.09

What we found

- NHL and MNL models provided similar shares for low-tech goods and for the outside good (or “none’)
- Among the likely target for high/medium tech the model performance was different:
  - NHL predicted higher shares for high-tech goods
  - NHL “outside good” was lower than MNL “none”
  - NHL models demonstrated more interaction between high-tech and mid-tech
  - NHL models were less responsive to simulated price changes in high tech
  - NHL models had higher share prediction for private label goods and lower shares for club goods
- Most differences can be traced to the model form
  - Direct modeling of income effects via “E”
  - Asymmetric trade-up effects (3 kappas)
  - A strong relationship between the lifestage-related variables in the upper model and the parameters

Differences between NHL and MNL models:

MNL model estimate of "none" is governed by IIA – demonstrates sourcing that does not take account of income effects

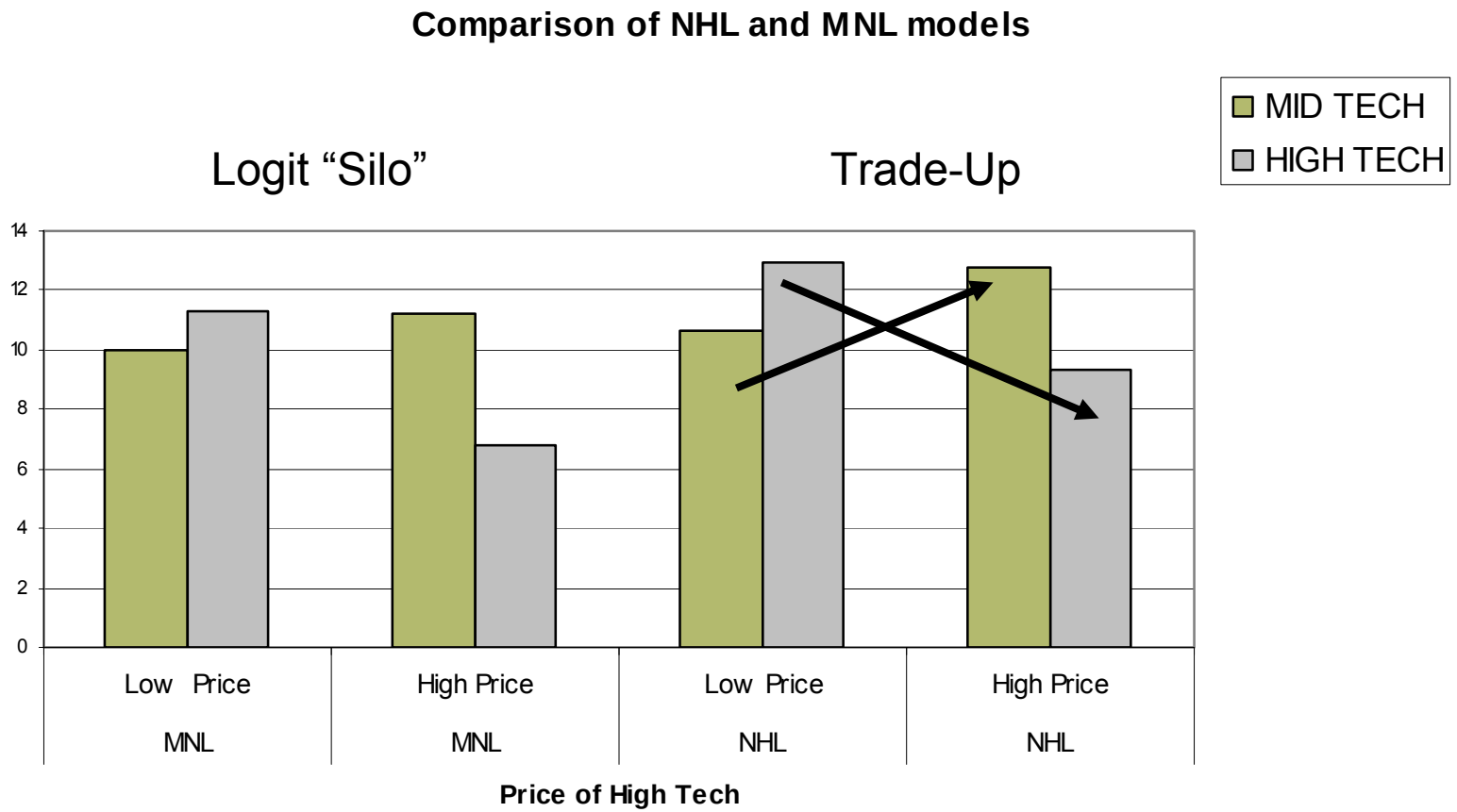


NHL estimate of the "outside good" includes income effects and is smaller than "none"

Share levels are higher for mid and high tech in NHL, especially at higher price points

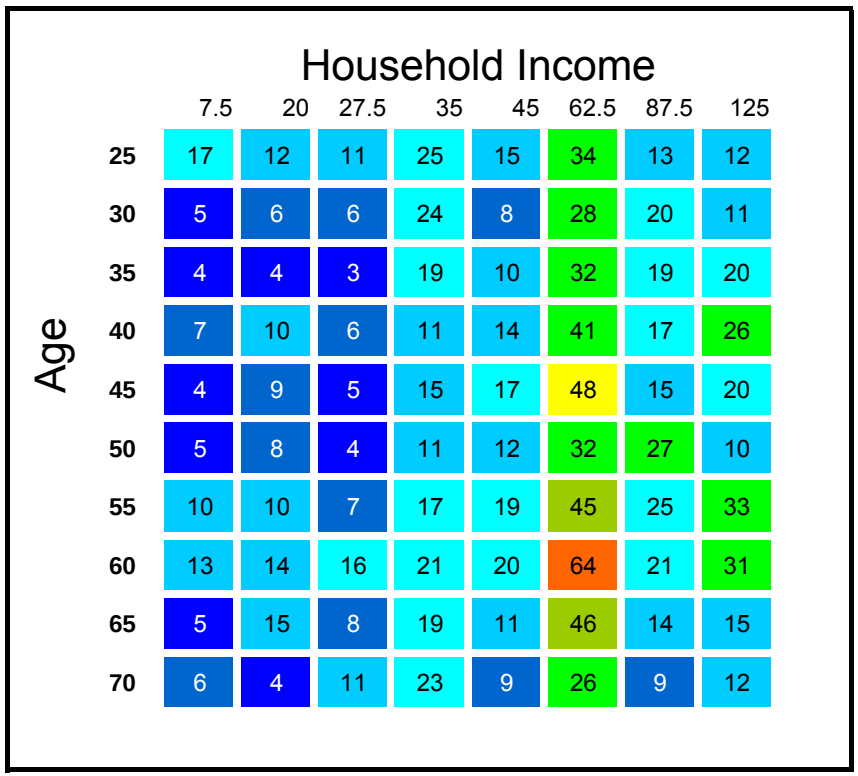
More price impact in MNL but misleading – direct modeling of E in the NHL incorporates income effects vs the purely compensatory effect of the MNL price parameter

Price simulations reveal more interplay in the NHL models between the mid and high technology tiers

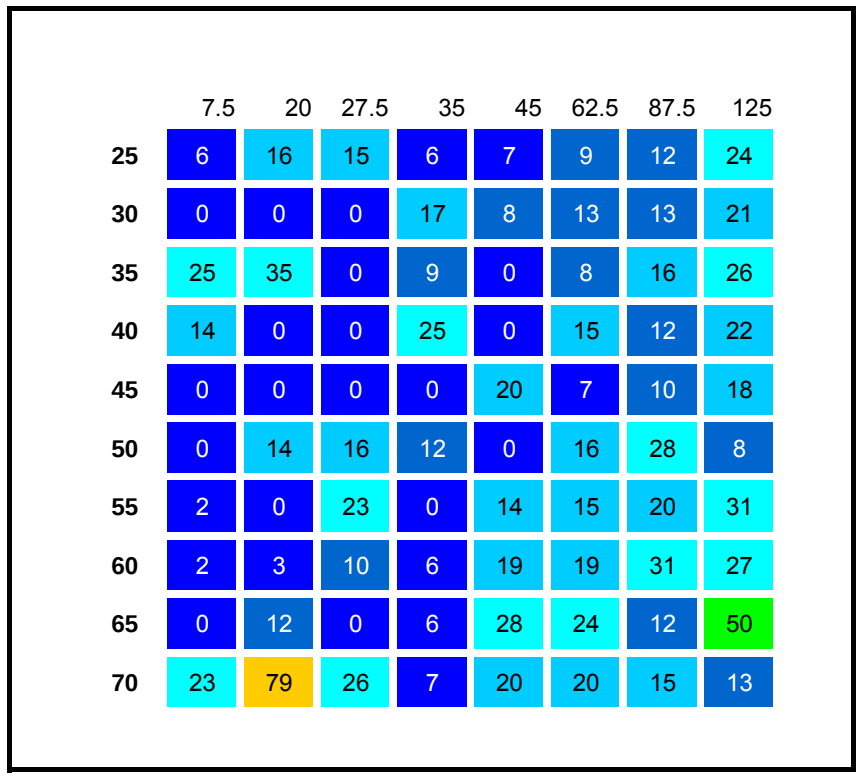


Age x income grids are useful to evaluate the responsiveness of various targets

Respondent Counts

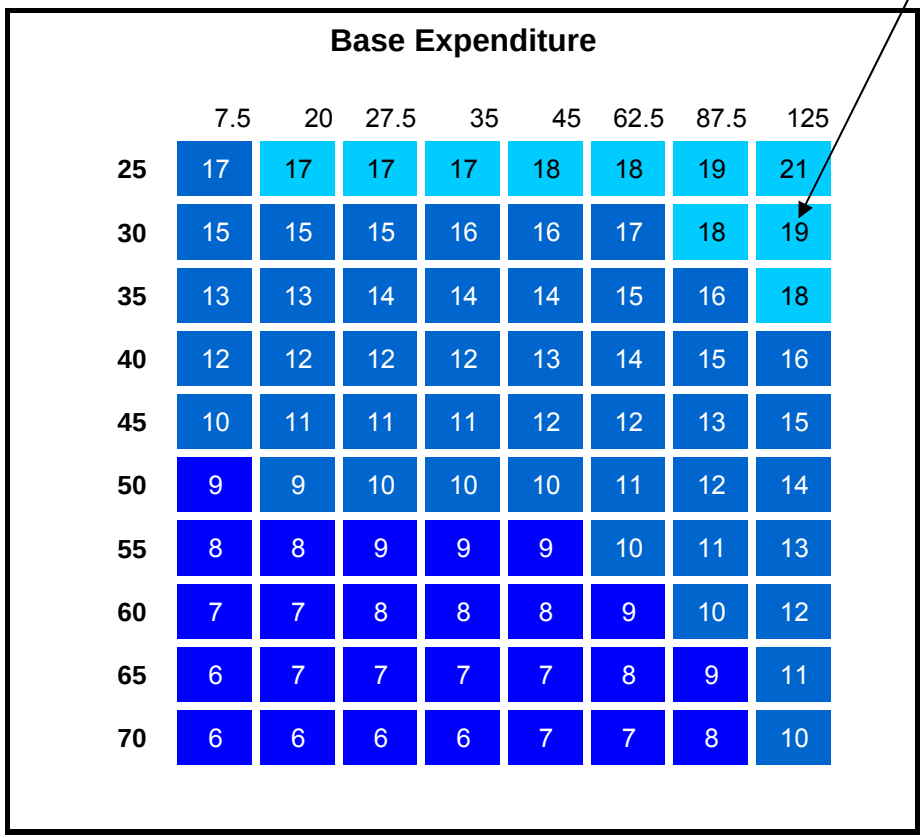


% Respondents who have received a professional recommendation



Using the regression function in the upper model, we are able to predict the shrinkage points for model parameters

Adults 25-30 who make a household income of $125k will pay about $19



For those receiving a professional recommendation, the shrinkage points show greater willingness to spend

Base Expenditure

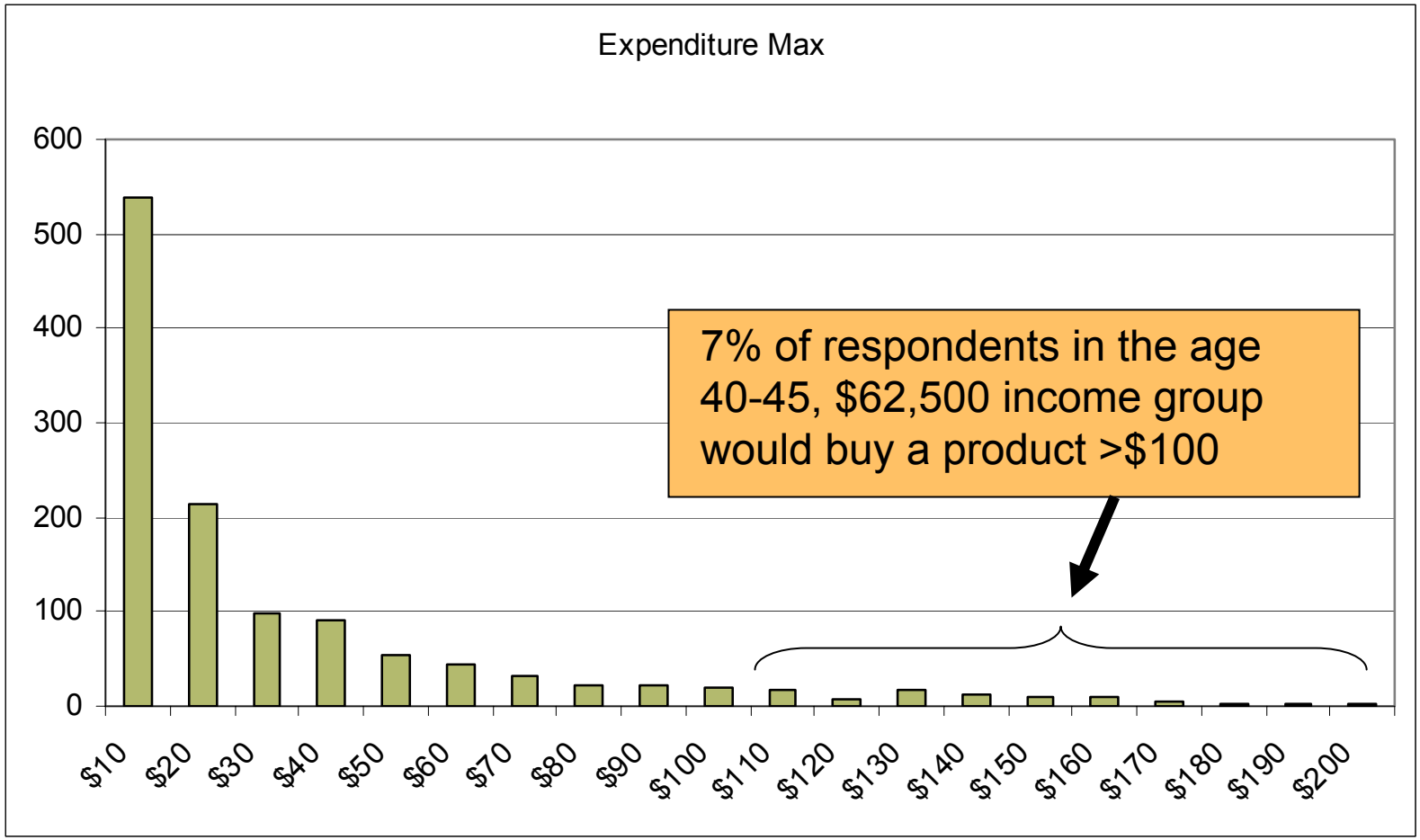
	7.5	20	27.5	35	45	62.5	87.5	125
25	17	17	17	17	18	18	19	21
30	15	15	15	16	16	17	18	19
35	13	13	14	14	14	15	16	18
40	12	12	12	12	13	14	15	16
45	10	11	11	11	12	12	13	15
50	9	9	10	10	10	11	12	14
55	8	8	9	9	9	10	11	13
60	7	7	8	8	8	9	10	12
65	6	7	7	7	7	8	9	11
70	6	6	6	6	7	7	8	10

Base Expenditure- With Recommendation

	7.5	20	27.5	35	45	62.5	87.5	125
25	50	51	52	53	54	55	58	62
30	44	46	46	47	48	50	53	57
35	39	41	41	42	43	45	48	53
40	35	36	37	38	39	41	44	49
45	31	32	33	34	35	37	40	45
50	27	29	29	30	31	33	36	42
55	24	25	26	27	28	30	33	38
60	21	23	23	24	25	27	30	36
65	19	20	21	22	23	24	28	33
70	17	18	19	19	20	22	25	30

Younger high-income respondents are willing to spend $50-$60 on this category if they have a professional recommendation

The individual parameter values for “E” are shifted based on the shrinkage points



The high-tech video has a modest impact on the willingness to spend for the general population

Base Expenditure

	7.5	20	27.5	35	45	62.5	87.5	125
25	17	17	17	17	18	18	19	21
30	15	15	15	16	16	17	18	19
35	13	13	14	14	14	15	16	18
40	12	12	12	12	13	14	15	16
45	10	11	11	11	12	12	13	15
50	9	9	10	10	10	11	12	14
55	8	8	9	9	9	10	11	13
60	7	7	8	8	8	9	10	12
65	6	7	7	7	7	8	9	11
70	6	6	6	6	7	7	8	10

Impact of High Tech Video

	7.5	20	27.5	35	45	62.5	87.5	125
25	16	17	17	18	19	21	24	29
30	15	16	17	17	18	19	22	25
35	15	15	16	16	17	18	20	23
40	14	15	15	15	16	17	18	20
45	13	14	14	14	15	15	16	18
50	13	13	13	14	14	14	15	16
55	12	13	13	13	13	13	13	14
60	12	12	12	12	12	12	12	12
65	12	11	11	11	11	11	11	11
70	11	11	11	11	11	10	10	10

However, the high-tech video can double the spending for people who have received a recommendation

Base Expenditure- With Recommendation

	7.5	20	27.5	35	45	62.5	87.5	125
25	50	51	52	53	54	55	58	62
30	44	46	46	47	48	50	53	57
35	39	41	41	42	43	45	48	53
40	35	36	37	38	39	41	44	49
45	31	32	33	34	35	37	40	45
50	27	29	29	30	31	33	36	42
55	24	25	26	27	28	30	33	38
60	21	23	23	24	25	27	30	36
65	19	20	21	22	23	24	28	33
70	17	18	19	19	20	22	25	30

Impact of High Tech Video - With Recommendation

	7.5	20	27.5	35	45	62.5	87.5	125
25	67	71	74	77	81	88	100	122
30	64	68	70	72	76	82	91	108
35	62	65	66	68	71	76	83	96
40	59	62	63	64	66	70	76	85
45	57	59	60	61	62	65	69	75
50	55	56	57	57	58	60	63	67
55	53	53	54	54	55	56	57	59
60	51	51	51	51	51	52	52	53
65	49	49	48	48	48	48	47	47
70	47	46	46	46	45	44	43	41

Incremental expenditure can then be evaluated based on different drivers

Base + Recommendation + Video = Total
$21 + $41 + $60 = $122

Incremental Expenditure For Rec

	7.5	20	27.5	35	45	62.5	87.5	125
25	33	34	35	35	36	37	39	41
30	30	30	31	31	32	33	35	38
35	26	27	28	28	29	30	32	35
40	23	24	25	25	26	27	29	33
45	21	21	22	22	23	25	27	30
50	18	19	20	20	21	22	24	28
55	16	17	17	18	19	20	22	26
60	14	15	16	16	17	18	20	24
65	13	13	14	14	15	16	18	22
70	11	12	12	13	14	15	17	20

Incremental Expenditure For Video

	7.5	20	27.5	35	45	62.5	87.5	125
25	17	20	22	24	27	33	42	60
30	20	22	24	25	28	32	39	51
35	22	24	25	26	28	31	35	43
40	25	26	26	27	28	29	32	36
45	26	27	27	27	28	28	29	30
50	28	28	27	27	27	27	26	25
55	29	28	28	27	27	26	24	21
60	29	28	28	27	26	25	22	17
65	30	29	28	27	26	23	20	14
70	30	28	27	26	25	22	18	11

Direct modeling of expenditure shows the same pattern but greater range than the MNL

Base Expenditure

	7.5	20	27.5	35	45	62.5	87.5	125
25	17	17	17	17	18	18	19	21
30	15	15	15	16	16	17	18	19
35	13	13	14	14	14	15	16	18
40	12	12	12	12	13	14	15	16
45	10	11	11	11	12	12	13	15
50	9	9	10	10	10	11	12	14
55	8	8	9	9	9	10	11	13
60	7	7	8	8	8	9	10	12
65	6	7	7	7	7	8	9	11
70	6	6	6	6	7	7	8	10

Price Coefficient MNL

	7.5	20	27.5	35	45	62.5	87.5	125
25	-0.97	-0.97	-0.98	-0.98	-0.99	-1.00	-1.01	-1.02
30	-0.98	-0.99	-0.99	-0.99	-1.00	-1.00	-1.01	-1.02
35	-1.00	-1.00	-1.00	-1.01	-1.01	-1.01	-1.02	-1.02
40	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02
45	-1.03	-1.03	-1.03	-1.03	-1.03	-1.03	-1.03	-1.02
50	-1.05	-1.05	-1.04	-1.04	-1.04	-1.04	-1.03	-1.02
55	-1.06	-1.06	-1.06	-1.05	-1.05	-1.04	-1.04	-1.02
60	-1.08	-1.07	-1.07	-1.07	-1.06	-1.05	-1.04	-1.02
65	-1.10	-1.09	-1.08	-1.08	-1.07	-1.06	-1.05	-1.02
70	-1.11	-1.10	-1.10	-1.09	-1.08	-1.07	-1.05	-1.02

The MNL model is attempting to approximate expenditure effects with one coefficient

Preference and trade-up vary by lifestage

The more negative the value the more the high-tech is perceived as a trade-up

High Tech Alphas (Preference)

	7.5	20	27.5	35	45	62.5	87.5	125
25	0.35	0.36	0.37	0.38	0.39	0.4	0.43	0.47
30	0.31	0.32	0.32	0.33	0.34	0.35	0.38	0.41
35	0.27	0.28	0.28	0.28	0.29	0.3	0.32	0.34
40	0.23	0.23	0.24	0.24	0.24	0.25	0.26	0.28
45	0.19	0.19	0.19	0.19	0.2	0.2	0.21	0.22
50	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
55	0.11	0.11	0.11	0.1	0.1	0.1	0.09	0.09
60	0.07	0.07	0.06	0.06	0.06	0.05	0.04	0.02
65	0.03	0.02	0.02	0.01	0.01	0	-0.02	-0.04
70	-0.01	-0.02	-0.02	-0.03	-0.04	-0.05	-0.07	-0.1

High Tech Kappas (Trade-Up)

	7.5	20	27.5	35	45	62.5	87.5	125
25	-2.45	-2.96	-3.26	-3.56	-3.96	-4.67	-5.68	-7.19
30	-2.56	-3	-3.27	-3.54	-3.9	-4.53	-5.43	-6.77
35	-2.66	-3.05	-3.29	-3.52	-3.84	-4.39	-5.18	-6.36
40	-2.76	-3.1	-3.3	-3.5	-3.78	-4.25	-4.93	-5.95
45	-2.86	-3.14	-3.31	-3.48	-3.71	-4.11	-4.68	-5.54
50	-2.96	-3.19	-3.33	-3.46	-3.65	-3.97	-4.43	-5.12
55	-3.06	-3.23	-3.34	-3.45	-3.59	-3.83	-4.18	-4.71
60	-3.16	-3.28	-3.35	-3.43	-3.52	-3.69	-3.94	-4.3
65	-3.26	-3.33	-3.37	-3.41	-3.46	-3.55	-3.69	-3.89
70	-3.36	-3.37	-3.38	-3.39	-3.4	-3.41	-3.44	-3.47

However, preference and trade-up do not have the same pattern across lifestages

Trade-up to high-tech is more likely for a high-income, young to middle age niche

High Tech Alphas (Preference)

	7.5	20	27.5	35	45	62.5	87.5	125
25	0.35	0.36	0.37	0.38	0.39	0.4	0.43	0.47
30	0.31	0.32	0.32	0.33	0.34	0.35	0.38	0.41
35	0.27	0.28	0.28	0.28	0.29	0.3	0.32	0.34
40	0.23	0.23	0.24	0.24	0.24	0.25	0.26	0.28
45	0.19	0.19	0.19	0.19	0.2	0.2	0.21	0.22
50	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
55	0.11	0.11	0.11	0.1	0.1	0.1	0.09	0.09
60	0.07	0.07	0.06	0.06	0.06	0.05	0.04	0.02
65	0.03	0.02	0.02	0.01	0.01	0	-0.02	-0.04
70	-0.01	-0.02	-0.02	-0.03	-0.04	-0.05	-0.07	-0.1

High Tech Kappas (Trade-Up)

	7.5	20	27.5	35	45	62.5	87.5	125
25	-2.45	-2.96	-3.26	-3.56	-3.96	-4.67	-5.68	-7.19
30	-2.56	-3	-3.27	-3.54	-3.9	-4.53	-5.43	-6.77
35	-2.66	-3.05	-3.29	-3.52	-3.84	-4.39	-5.18	-6.36
40	-2.76	-3.1	-3.3	-3.5	-3.78	-4.25	-4.93	-5.95
45	-2.86	-3.14	-3.31	-3.48	-3.71	-4.11	-4.68	-5.54
50	-2.96	-3.19	-3.33	-3.46	-3.65	-3.97	-4.43	-5.12
55	-3.06	-3.23	-3.34	-3.45	-3.59	-3.83	-4.18	-4.71
60	-3.16	-3.28	-3.35	-3.43	-3.52	-3.69	-3.94	-4.3
65	-3.26	-3.33	-3.37	-3.41	-3.46	-3.55	-3.69	-3.89
70	-3.36	-3.37	-3.38	-3.39	-3.4	-3.41	-3.44	-3.47

Preference for high-tech is (weakly) related to age – younger people have a higher base preference

…and the pattern is completely reversed in the mid-tech tier

Preference for mid-tech is highest for younger, low income people…

Trade-up to mid-tech is a function of age (younger are more likely)

Mid Tech Alphas (Preference)

	7.5	20	27.5	35	45	62.5	87.5	125
25	1.3	1.23	1.19	1.15	1.09	1	0.86	0.65
30	1.09	1.03	0.99	0.95	0.9	0.81	0.68	0.48
35	0.89	0.83	0.79	0.75	0.71	0.62	0.5	0.31
40	0.68	0.63	0.59	0.56	0.51	0.43	0.32	0.14
45	0.48	0.43	0.39	0.36	0.32	0.24	0.14	-0.02
50	0.27	0.22	0.19	0.16	0.13	0.06	-0.04	-0.19
55	0.07	0.02	0	-0.03	-0.07	-0.13	-0.22	-0.36
60	-0.14	-0.18	-0.2	-0.23	-0.26	-0.32	-0.41	-0.53
65	-0.34	-0.38	-0.4	-0.42	-0.46	-0.51	-0.59	-0.7
70	-0.55	-0.58	-0.6	-0.62	-0.65	-0.7	-0.77	-0.87

Mid Tech Kappas (Trade-Up)

	7.5	20	27.5	35	45	62.5	87.5	125
25	-4.87	-4.9	-4.92	-4.94	-4.97	-5.02	-5.09	-5.19
30	-4.51	-4.53	-4.54	-4.55	-4.56	-4.58	-4.61	-4.66
35	-4.16	-4.15	-4.15	-4.15	-4.15	-4.14	-4.14	-4.13
40	-3.8	-3.78	-3.77	-3.75	-3.74	-3.71	-3.67	-3.6
45	-3.44	-3.4	-3.38	-3.36	-3.33	-3.27	-3.19	-3.08
50	-3.08	-3.03	-2.99	-2.96	-2.91	-2.83	-2.72	-2.55
55	-2.73	-2.65	-2.61	-2.56	-2.5	-2.4	-2.25	-2.02
60	-2.37	-2.28	-2.22	-2.17	-2.09	-1.96	-1.77	-1.49
65	-2.01	-1.9	-1.83	-1.77	-1.68	-1.52	-1.3	-0.97
70	-1.66	-1.53	-1.45	-1.37	-1.27	-1.09	-0.83	-0.44

…and lowest for older high-income people

A professional recommendation increases the trade-up appeal of high tech…

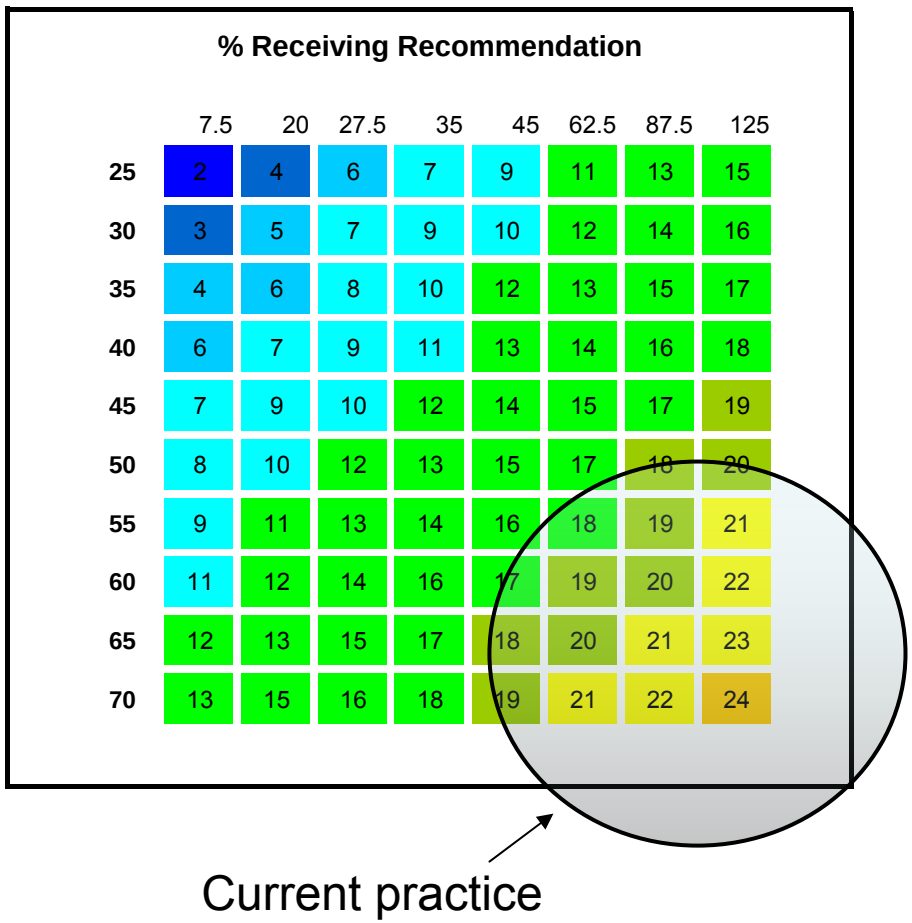
High Tech Kappas - No Recommendation

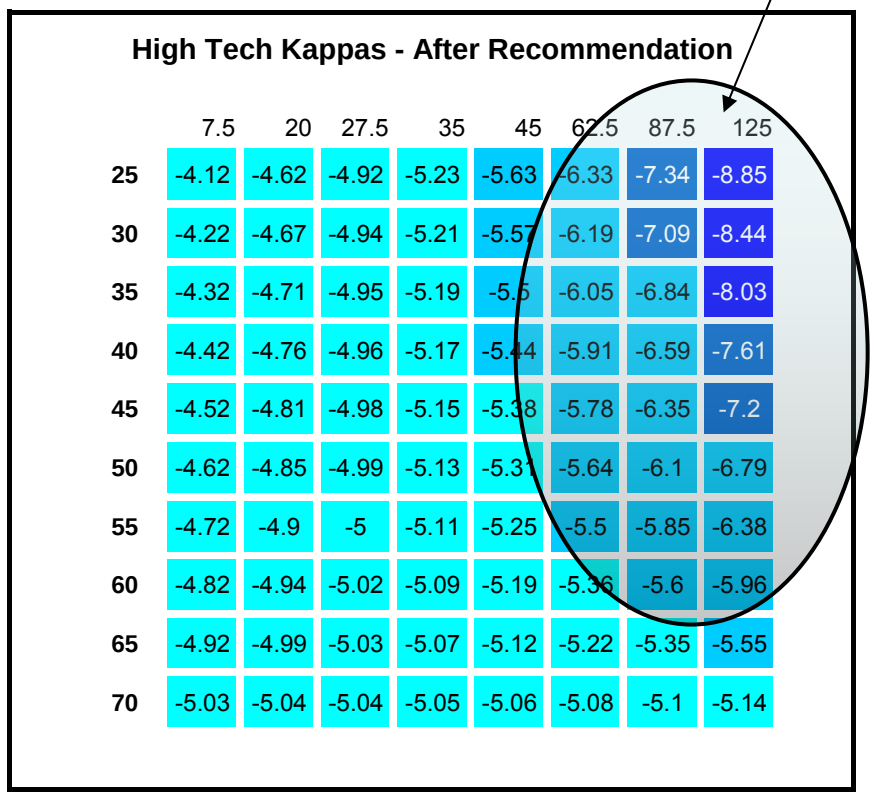
	7.5	20	27.5	35	45	62.5	87.5	125
25	-2.45	-2.96	-3.26	-3.56	-3.96	-4.67	-5.68	-7.19
30	-2.56	-3	-3.27	-3.54	-3.9	-4.53	-5.43	-6.77
35	-2.66	-3.05	-3.29	-3.52	-3.84	-4.39	-5.18	-6.36
40	-2.76	-3.1	-3.3	-3.5	-3.78	-4.25	-4.93	-5.95
45	-2.86	-3.14	-3.31	-3.48	-3.71	-4.11	-4.68	-5.54
50	-2.96	-3.19	-3.33	-3.46	-3.65	-3.97	-4.43	-5.12
55	-3.06	-3.23	-3.34	-3.45	-3.59	-3.83	-4.18	-4.71
60	-3.16	-3.28	-3.35	-3.43	-3.52	-3.69	-3.94	-4.3
65	-3.26	-3.33	-3.37	-3.41	-3.46	-3.55	-3.69	-3.89
70	-3.36	-3.37	-3.38	-3.39	-3.4	-3.41	-3.44	-3.47

High Tech Kappas - After Recommendation

	7.5	20	27.5	35	45	62.5	87.5	125
25	-4.12	-4.62	-4.92	-5.23	-5.63	-6.33	-7.34	-8.85
30	-4.22	-4.67	-4.94	-5.21	-5.57	-6.19	-7.09	-8.44
35	-4.32	-4.71	-4.95	-5.19	-5.5	-6.05	-6.84	-8.03
40	-4.42	-4.76	-4.96	-5.17	-5.44	-5.91	-6.59	-7.61
45	-4.52	-4.81	-4.98	-5.15	-5.38	-5.78	-6.35	-7.2
50	-4.62	-4.85	-4.99	-5.13	-5.31	-5.64	-6.1	-6.79
55	-4.72	-4.9	-5	-5.11	-5.25	-5.5	-5.85	-6.38
60	-4.82	-4.94	-5.02	-5.09	-5.19	-5.36	-5.6	-5.96
65	-4.92	-4.99	-5.03	-5.07	-5.12	-5.22	-5.35	-5.55
70	-5.03	-5.04	-5.04	-5.05	-5.06	-5.08	-5.1	-5.14

But this is not aligned with the current practice of recommendation





Better target

Current practice

The current practice of recommendation is effective at turning off older high-income people to the mid-tier

Mid-Tech Kappas - No Recommendation

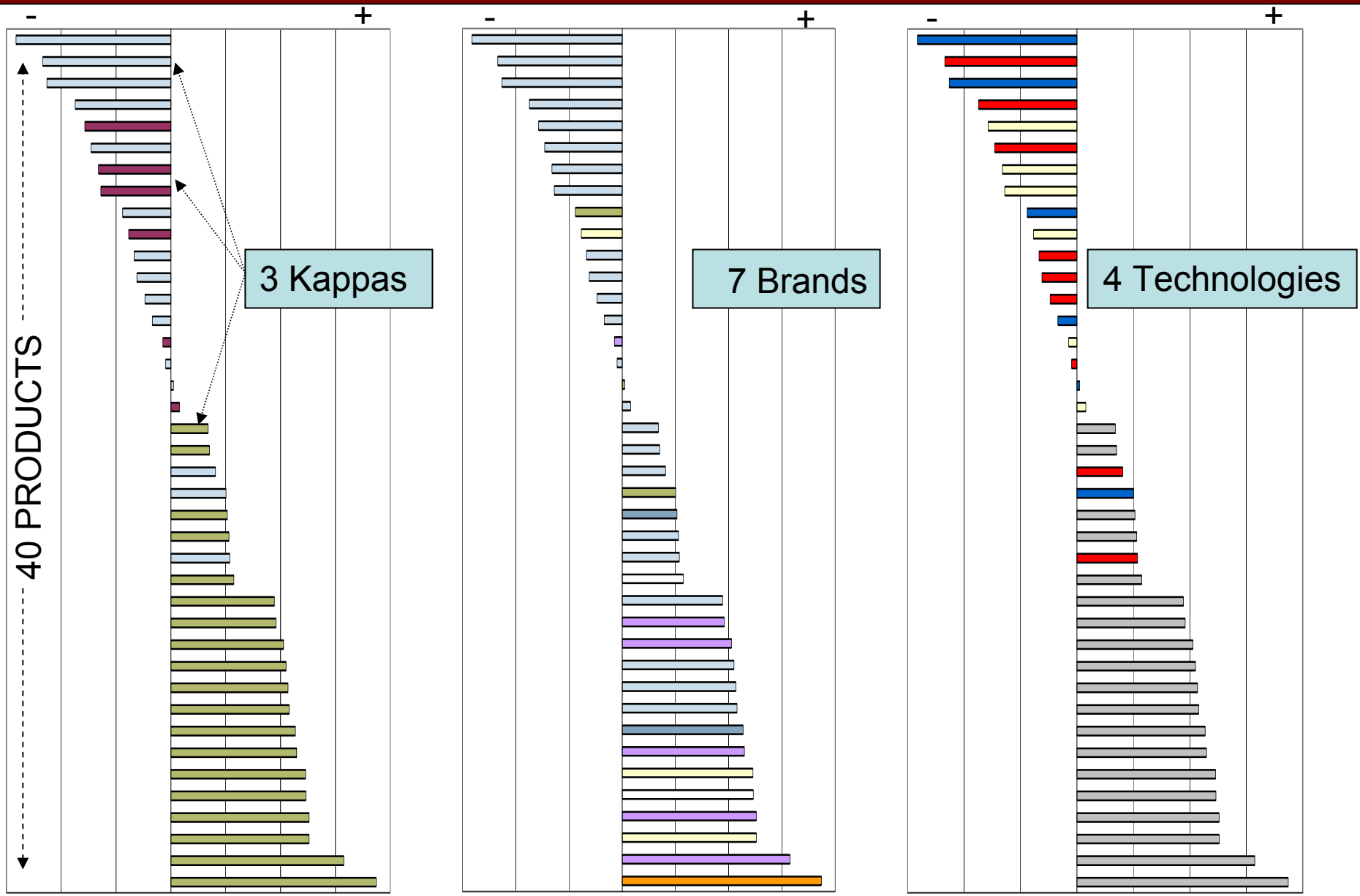
	7.5	20	27.5	35	45	62.5	87.5	125
25	-4.87	-4.9	-4.92	-4.94	-4.97	-5.02	-5.09	-5.19
30	-4.51	-4.53	-4.54	-4.55	-4.56	-4.58	-4.61	-4.66
35	-4.16	-4.15	-4.15	-4.15	-4.15	-4.14	-4.14	-4.13
40	-3.8	-3.78	-3.77	-3.75	-3.74	-3.71	-3.67	-3.6
45	-3.44	-3.4	-3.38	-3.36	-3.33	-3.27	-3.19	-3.08
50	-3.08	-3.03	-2.99	-2.96	-2.91	-2.83	-2.72	-2.55
55	-2.73	-2.65	-2.61	-2.56	-2.5	-2.4	-2.25	-2.02
60	-2.37	-2.28	-2.22	-2.17	-2.09	-1.96	-1.77	-1.49
65	-2.01	-1.9	-1.83	-1.77	-1.68	-1.52	-1.3	-0.97
70	-1.66	-1.53	-1.45	-1.37	-1.27	-1.09	-0.83	-0.44

Mid-Tech Kappas - After Recommendation

	7.5	20	27.5	35	45	62.5	87.5	125
25	-0.38	-0.41	-0.43	-0.45	-0.48	-0.53	-0.59	-0.69
30	-0.02	-0.04	-0.05	-0.05	-0.07	-0.09	-0.12	-0.17
35	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.36
40	0.69	0.71	0.73	0.74	0.76	0.78	0.83	0.89
45	1.05	1.09	1.11	1.14	1.17	1.22	1.3	1.42
50	1.41	1.47	1.5	1.53	1.58	1.66	1.77	1.94
55	1.77	1.84	1.89	1.93	1.99	2.1	2.25	2.47
60	2.12	2.22	2.27	2.33	2.4	2.53	2.72	3
65	2.48	2.59	2.66	2.72	2.81	2.97	3.19	3.53
70	2.84	2.97	3.04	3.12	3.23	3.41	3.67	4.05

Older, high income people reject the mid-tier technology

There may be alternative parsimonious codings of kappa that predict better



Conclusions:

- The nonhomothetic model is superior to the MNL model for categories where goods are in competition but are not substitutes
- Trade-up behavior is often related to changes in lifestage
  - Bayesian upper-model “mechanics” are useful for exploring this
- Affordability, preference and trade-up are separate aspects of the trade-up problem
  - A single price coefficient does not work
  - Many “willingness to pay” metrics based on MNL/conjoint break down because of this
- Care must be taken to separate variables that are under our control from those that are not

References

- Rossi, P.E., Allenby, G.M., McCulloch, Robert (2005), *Bayesian Statistics and Marketing*, Chichester: John Wiley & Sons Ltd. pp 122-124
- Allenby, G.M., Rossi, P.E. (1991) Quality perceptions and asymmetric switching between brands. *Marketing Science* **10**, pp 185-205
- Allenby, G.M., Shively, T.S., Yang S., Garratt, M.J. (2004) A choice model for packaged goods: Dealing with discrete quantities and quantity discounts. *Marketing Science*, **23**, pp 95-108