BUMK742: Advanced Marketing Analytics

Project #3

Evaluating Sales Promotion Effects Using Scanner Panel Data

Group Number: #4

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Honor Pledge:
We pledge on our honor that we have not given or received any unauthorized assistance on this assignment.

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Executive Summary

This study observes and analyzes how different sales promotion methods can affect individual households' buying patterns, including category purchase, brand choice, and the quantity purchased for a particular category, and how it has implications for both the retailer and the manufacturers. We used the scanner panel data to develop three independent models and found diversified effects of different promotional methods. We found out that feature ads are the most effective for retailers to increase the attractiveness of the liquid detergent category among the three promotional methods. Brands can increase their attractiveness most by opting for display ads. We also used the Solver function in excel to estimate the impact of the price cut method on both retailer & manufacturer profitability. We discovered that increased sales volume does not always mean maximized profitability for both the retailer and the manufacturers. This led us to re-emphasize the importance of setting optimal pricing for a brand and the effectiveness of choosing the promotional method strategically.

Introduction and Background

Liquid Laundry Detergent is one of the top-selling household items of ABC Super retail store, and ABC is trying to increase the profitability of this category. The top-selling four brands of this category belong to renowned 2 CPG manufacturers, Unilever & P&G. These brands are certainly an asset for ABC Super to drive the store traffic to the name category. However, not all brands are equal when it comes to profit maximization. Our team was hired to figure out a way for ABC Super by using the scanner-pannel data on how they can 1) Prioritize manufacturer brands to maximize category profit; 2) Efficiently utilize different methods of sales promotion for a category, and 3) Determine optimal pass-through rates that will maximize category and also 4) Keep the manufacturers satisfied so that they consider ABC Super as a valuable channel partner.

Data and Methodology

A pre-processed scanner panel dataset provided by Information Resources, Inc. (IRI) has been used for this analysis. It consists of liquid laundry detergent purchase data by 178 households collected from 4 chain shops of ABC Super within the timeline of 135-week. There are 2 data files; one contains 19157 observations with information on household purchase incidence, brand choice, purchase quantity, and price and promotion for each brand in a given week. This file has been used to analyze the liquid laundry detergent **category's average performance.** (Table 1) The latter has specific data on the respective category and contains detail on category choice occasions consisting of 3124 observations. This dataset has been utilized to estimate the category's brands' performance (Table 2). Mean table (Table3) also provides how many customers chose to purchase the detergent products. A mean & frequency table (Table4-5) was used to analyze the purchase volume per brand and brand share. The models were created using SAS, and the estimations collected from the models were analyzed using Microsoft Excel.

Firstly, the research team ran a binary logit regression model to analyze the effect on the purchase incidence from the liquid laundry detergent category when a sales promotion (Price-cut/Display Advertising/Feature Advertising) is run. This specific model helped us understand which sales promotion method is the most effective in increasing the probability of buying from the respective category. This model has implications for the retailer on how they can improve the category attractiveness. Secondly, a multinomial logit model was run to estimate the purchase probability of each of the four detergent brands by an individual household from the liquid laundry detergent category, given that a purchase was made from that category. This model helped us to understand each household's choice of brands and how that choice is affected by the different promotional methods. This model has implications for manufacturers of the brands on how they can increase the attractiveness of their name brands to purchasers. Finally, a semi-log model was run to estimate the purchased quantity of each of the brands by the households, given there has been a category purchase, and a particular brand was chosen. This model was useful to estimate how the purchased quantity was affected by a chosen method of promotion. This specific model has implications for both ABC Super & the manufacturers (P&G, Unilever) as it directly impacts the gross profit of both parties, precisely when 'Price Cut' is used as the primary promotional tool.

Key Findings

Overview of Detergent and Choice Dataset:

- **Regular Price: Tide** has the highest regular price, and **All** has the lowest price among the four brands (Table1 and Table2).
- **Price Cut: Wisk** applied the most significant price cut, and **Cheer** did the least (Table1 and Table2).
- **Display and Feature Advertising in household purchase: Wisk** did the most display and feature advertising among the four brands. **Cheer** conducted the least display and feature advertising in four brands (Table1).
- **Display and Feature Advertising in detergent purchase:** These advertisements worked relatively well on **Tide** and poorly on **Cheer** (Table2).
- Only **4.08%** of the household purchase incidence represents detergent purchases, and Tide gained the most market share (Table3 and Table4).
- **Volume: All** has the most significant one-time purchasing volume and highest average volume (Table5).

Effects of Promotional Tools toward Purchase Incidence: A binary logit model is run to estimate the effects of different promotion tools on the purchase incidence (Table6: Model 1). According to parameter estimates (Table7), average regular price and customers' previous purchases on promotions negatively influence the category's attractiveness. Firstly, the result suggests that when the average regular price is raised by one dollar and when customers' previous purchase was on promotions, the odds of liquid laundry detergent purchase drop by 53.37% and 40.79%, respectively (Table7). Secondly, average price cut (avg_pc), category display advertising, and category feature advertising positively influence the attractiveness of the category. The odds of category purchase increased by 190.35%, 63.17%, and 74.49%. Accordingly, when average price-cut increases one dollar, category display advertising is shown or category feature advertising is applied. Apart from the price cut effect, the probability of purchasing products in different promotion scenarios is produced (Table8-13). The comparison table of each scenario probability (Table14) uncovers that when feature advertising is applied and no matter which brands conduct the feature advertising, the probability of purchasing products is increased by 0.55%. Also, the probability of purchase incidence is increased by 0.47% if the display promotion is created. Overall, **Tide** demonstrates the best promotional effect (increases by 0.22%) when doing the price cut, which performs better than Wisk (0.15%), All (0.18%) and Clear (0.14%) do. Moreover, compared among the 3 promotional approaches, **feature advertising** is the most effective when triggering customers' category purchase decisions, followed by display advertising, and price cut is the least effective promotion method.

Effects of Promotional Tools toward Brand choice: The multinomial model is built to evaluate the effectiveness of promotional tools on four brand choices (Table15-16; Model 2). After computing (Table17), price cut, display advertising, and feature advertising increase the odds of brand choice by 103.77%, 269.66%, and 47.79%. Thus, customers' brand choice decisions can be augmented mostly by display advertising. Next, the probability of choosing a specific brand is calculated (Table18-29). The comparison of the increased probability of each promotional method within four brands is generated (Table30). This table shows that when a specific brand deploys any one of the promotions, the probability of choosing that brand increases accordingly; meanwhile Tide's probability of being chosen increases mostly compared with other brands.

Estimate of Conditional Purchase Quantity: In order to know the purchase quantity of a particular chosen brand, the semi-log model is created (Table31; Model 3). The result shows that no promotional tools significantly affect the purchase quantity (Table32), so for brand1 to brand 4, the purchase quantity remains the same with the given promotion. Each brand's purchase quantity can be calculated by putting average volume into each brand's linear predictor and computing e to the power of each brand's linear predictor (Table33). Brand Wisk's purchase quantities are 81.3 ounces, brand All's purchase quantities are 168.4 ounces, brand Tide's purchase quantities are 92.3 ounces, and brand Cheer's purchase quantities are 69.4 ounces.

Influences of Promotional Tools on Four Brands: Based on the above three models, the effectiveness of promotional tools of four brands on expected sales can be estimated (Table34-45). Compared with the expected quantity of each brand when different promotions are applied, the result demonstrates that for the price cut promotion (Table46), Tide's sales (by 88.29%) increased the most. (Wisk: by 80.13%, All: by 87.34%, Cheer: by 65.46%). Under the price cut promotion, the greatest increased quantity percentage (by 36.62%) in total sales is when All does the price cut promotion. For display advertising, sales on Wisk (by 324.29%) increased the most within four brands (All: by 256.82%, Tide: by 200.19%, Cheer: by 265.82%). If the store uses display advertising on a specific brand, total sales of each brand grow the most when All conducts display advertising (by 102.42%). Feature advertising grows Wisk's sales (by 138.88%) greatest in each brand (All: by 130.28%, Tide: by 117.84%, Cheer: by 130.28%). In total sales, comparing sales outcome of using the feature advertising on a particular brand, the store would gain greatest sales (by 84.69%) when All deploys the feature advertising.

Effect of price cut on the gross profit of the retailer: To evaluate the impact of price cuts, we compare the retailer's gross profit with and without price cuts (Table48). We assumed that the retail margin = 20% and the manufacturer margin = 45%. If we change the price cut for each brand at a time, the gross profit of Wisk, All, Tide, and Cheer will increase by 19.5% (Wisk), 28.6%(All), 31.5%(Tide), and 14.7%(Cheers). According to this result, the retailers' gross profit is increased most when the brand "Tide" opts for price cuts.

Effect of price cut on the gross profit of the manufacturer: We also evaluate the price cut effect from the manufacturers' perspective (Table49). For Unilever, after the price cut, Wisk increased 31.4% more profit than without any promotion; however, All's gross profit declined 5.6% from the benchmark (without promotion) profit, which is counter-intuitive. This shows that price cut promotion does not go well from the manufacturer's viewpoint with this specific brand. On the other hand, P&G's two brands' gross profit, Tide and Cheer, increased 18.7% and 19.8%, respectively. The two brands from P&G benefit both ABC Super and P&G, the manufacturer.

Effect of pass-through rate: In many cases, the retailer may pocket part of the price cut and pass through less than 100% to consumers, so we wanted to assess the effect when the pass-through rate is lower than 100%. In the table (Table 50-51), we assume that ABC super has a 70% pass-through. In this scenario, ABC super earns even greater profit in the category; however, on the manufacturer side, the gross profit of each brand decreases substantially. Take brand "All" for example; when ABC super has a 70% pass-through rate, ABC super's gross profit grows from $216.1 to $251.2 while the manufacturer's gross profit decreased from $83.11 to $48.02, which is 45.5% lower than All's the benchmark (without promotion) gross profit. With a 70% pass-through, the profit from Tide's manufacturer also significantly drops 11.1%.

Conclusions and Recommendations

1. Tide is the only brand that brings an increased gross profit for ABC Super (compared to benchmark profit), regardless of which brand does the price-cut promotion. (Table 48) So, we can infer that Tide customers are more loyal. If other brands want to maximize the effectiveness of price cut promotion, they should launch loyalty campaigns. Also, when Tide does the price cut, it increases the whole category's gross profit. So in general Tide is the most profitable brand for ABC Super for the said category. But ABC needs to be careful regarding the pass-through rate as any rate below 80% will negatively impact the manufacturers' gross profit. (Table: 51-52)
2. Wisk & Cheer, these two brands are the only brands that will provide the manufacturers gross profit above the benchmark even after ABC imposes a 70% pass-through rate. (Table51) So, ABC can consider earning more from these two brands with 70% pass-through without having to fear losing the manufacturers.
3. Since only one promotional method at a time is permitted, ABC super should make its promotion decision based on its primary goal. If the goal is profitability, then Tide should have a price cut to maximize the profit (Table 49). If the goal is increasing category attractiveness (Category incidence) then having feature ads (any brand feature ad will suffice) is the most effective. For individual brands, display advertisements are most effective to increase their probability of getting purchased, and the sales quantity also increases significantly. (Table 48).
4. Unilever should reconsider its pricing strategy and branding for both of its brands. For one, when Wisk opts for any of the promotional methods (price cut/feature/display) it increases the sales of competitors' brands too (Table 46). And, when **All** has a price cut, it benefits ABC super only by increasing the category profitability, not Unilever itself. Also, All as a brand even without price-cut does not gain profit for the manufacturer at all. This indicates Unilever should strategize the marketing planning for All as a whole (Table 49).

Limitation:

Even when ABC super has a 100% pass-through rate, the manufacturer of All does not make profits for price-cut (Table 49). To avoid losing All's manufacturer, ABC super should try to use display or feature ads since the sales of All is greater than that of All doing price cut. Compared to the price cut promotion, both feature and display advertising increase the overall category sales more(Table 46). However, the costs of feature and display advertising are unknown, so figuring the profitability portion for these tools was a confining factor.

Appendices: Tables, Exhibits, Figures

- **Table1: Mean Table of Key Variable in Detergent Dataset**

The MEANS Procedure

Variable	N	Mean	Std Dev	Minimum	Maximum
regpr1	19157	7.1818259	0.3085522	6.7470000	7.7690000
regpr2	19157	4.5918611	0.3323986	4.1200000	5.0280000
regpr3	19157	7.2852565	0.3518476	6.8520000	7.8030000
regpr4	19157	6.5377189	0.2910547	5.7100000	6.7900000
pcut1	19157	0.1553111	0.2605256	0	1.2170000
pcut2	19157	0.0576519	0.1151700	0	0.5420000
pcut3	19157	0.0360955	0.1396495	0	1.2050000
pcut4	19157	0.0228914	0.1249738	0	1.0220000
disp1	19157	0.4170277	0.4930804	0	1.0000000
disp2	19157	0.3398758	0.4736792	0	1.0000000
disp3	19157	0.2928955	0.4551028	0	1.0000000
disp4	19157	0.0887404	0.2843761	0	1.0000000
feat1	19157	0.2391293	0.4265630	0	1.0000000
feat2	19157	0.2221120	0.4156769	0	1.0000000
feat3	19157	0.2321345	0.4222054	0	1.0000000
feat4	19157	0.0588819	0.2354096	0	1.0000000
avg_rp	19157	6.3991656	0.2767827	5.9780000	6.8475000
avg_pc	19157	0.0679875	0.0894214	0	0.4497500
cat_disp	19157	0.8157854	0.3876693	0	1.0000000
cat_feat	19157	0.6718693	0.4695449	0	1.0000000

- **Table2: Mean Table of Key Variable in Choice Dataset**

The MEANS Procedure

brand	N Obs	Variable	N	Mean	Std Dev	Minimum	Maximum
1	781	regpr	781	7.1399949	0.2654270	6.7470000	7.7690000
		pcut	781	0.1739027	0.2882366	0	1.2170000
		disp	781	0.4391805	0.4966052	0	1.0000000
		feat	781	0.2240717	0.4172367	0	1.0000000
2	781	regpr	781	4.5510102	0.3285551	4.1200000	5.0280000
		pcut	781	0.0612983	0.1215267	0	0.5420000
		disp	781	0.3124200	0.4637770	0	1.0000000
		feat	781	0.2355954	0.4246423	0	1.0000000
3	781	regpr	781	7.2286159	0.3334287	6.8520000	7.8030000
		pcut	781	0.0526300	0.1737425	0	1.2050000
		disp	781	0.4494238	0.4977542	0	1.0000000
		feat	781	0.3367478	0.4729007	0	1.0000000
4	781	regpr	781	6.5036082	0.3046405	5.7100000	6.7900000
		pcut	781	0.0332830	0.1671830	0	1.0220000
		disp	781	0.1254802	0.3314748	0	1.0000000
		feat	781	0.1011524	0.3017236	0	1.0000000

- **Table3: Frequency Table of Incidence in Detergent Dataset**

The FREQ Procedure

incid	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	18376	95.92	18376	95.92
1	781	4.08	19157	100.00

- **Table4: Frequency Table of Choice and Incidence in Detergent Dataset**

The FREQ Procedure

Frequency Percent Row Pct Col Pct	Table of choice by incid		
	incid		
choice	0	1	Total
0	18376 95.92 100.00 100.00	0 0.00 0.00 0.00	18376 95.92
1	0 0.00 0.00 0.00	164 0.86 100.00 21.00	164 0.86
2	0 0.00 0.00 0.00	172 0.90 100.00 22.02	172 0.90
3	0 0.00 0.00 0.00	324 1.69 100.00 41.49	324 1.69
4	0 0.00 0.00 0.00	121 0.63 100.00 15.49	121 0.63
Total	18376 95.92	781 4.08	19157 100.00

- **Table5: Mean Table of Volume in Detergent Dataset**

The MEANS Procedure

Analysis Variable : volume						
choice	N Obs	N	Mean	Std Dev	Minimum	Maximum
0	18376	18376	0	0	0	0
1	164	164	111.2804878	38.8982547	50.0000000	200.0000000
2	172	172	128.7906977	59.2252349	50.0000000	512.0000000
3	324	324	119.1481481	44.5166991	50.0000000	400.0000000
4	121	121	105.6198347	23.5192319	90.0000000	200.0000000

- **Table6: Binary Logit Model**

```
proc genmod data=deterg descending;
     model incid = avg_rp avg_pc cat_disp cat_feat lbpromot /
           dist=binomial link=logit;
     title 'Binary Logit Model for Category Purchase Incidence = 1';
run;
```

- **Table7: Parameter Estimates, odds and Percentage Changes of odds of Purchase Incidence Model**

Incidence Model: Estimates		exp(b)	changes
Intercept	0	1	0.00%
avg_rp	-0.7629	0.466312159	-53.37%
avg_pc	1.0659	2.903450914	190.35%
cat_disp	0.4896	1.631663424	63.17%
cat_feat	0.5567	1.744904803	74.49%
lbpromot	-0.524	0.592147216	-40.79%

- **Table8: Probability of Purchase Incidence When Wisk Has the Price Cut**

Category Purchase Incidence:		
avg_rp	6.400	6.400
avg_pc	0.000	0.175
avg_disp	0.000	0.000
avg_feat	0.000	0.000
lbpromot	0.000	0.000
V	-4.883	-4.696
exp(V)	0.008	0.009
Pr(I=1)	**0.752%**	**0.905%**
Increasing Percentage		0.153%

- **Table9: Probability of Purchase Incidence When All Has the Price Cut**

Category Purchase Incidence:		
avg_rp	6.400	6.400
avg_pc	0.000	0.205
avg_disp	0.000	0.000
avg_feat	0.000	0.000
lbpromot	0.000	0.000
V	-4.883	-4.664
exp(V)	0.008	0.009
Pr(I=1)	**0.752%**	**0.934%**
Increasing Percentage		0.182%

- **Table10: Probability of Purchase Incidence When Tide Has the Price Cut**

Category Purchase Incidence:		
avg_rp	6.400	6.400
avg_pc	0.000	0.243
avg_disp	0.000	0.000
avg_feat	0.000	0.000
lbpromot	0.000	0.000
V	-4.883	-4.624
exp(V)	0.008	0.010
Pr(I=1)	**0.752%**	**0.972%**
Increasing Percentage		0.220%

- **Table11: Probability of Purchase Incidence When Cheer Has the Price Cut**

Category Purchase Incidence:		
avg_rp	6.400	6.400
avg_pc	0.000	0.163
avg_disp	0.000	0.000
avg_feat	0.000	0.000
lbpromot	0.000	0.000
V	-4.883	-4.709
exp(V)	0.008	0.009
Pr(I=1)	**0.752%**	**0.893%**
Increasing Percentage		0.141%

- **Table12: Probability of Purchase Incidence When At least One of Brands Has the Display Advertising**

Category Purchase Incidence:		
avg_rp	6.400	6.400
avg_pc	0.000	0.000
avg_disp	0.000	1.000
avg_feat	0.000	0.000
lbpromot	0.000	0.000
V	-4.883	-4.393
exp(V)	0.008	0.012
Pr(I=1)	**0.752%**	**1.221%**
Increasing Percentage		0.469%

- **Table13: Probability of Purchase Incidence When At least One of Brands Has the Feature Advertising**

Category Purchase Incidence:		
avg_rp	6.400	6.400
avg_pc	0.000	0.000
avg_disp	0.000	0.000
avg_feat	0.000	1.000
lbpromot	0.000	0.000
V	-4.883	-4.326
exp(V)	0.008	0.013
Pr(I=1)	**0.752%**	**1.305%**
Increasing Percentage		0.553%

- **Table14: Comparison Table of Probability of Each Purchase Incidence Scenario**

	probability of purchace incidence	changes of probability of purchase incidence
no pro	**0.752%**	
pc1	**0.905%**	0.153%
pc2	**0.934%**	0.182%
pc3	**0.972%**	0.220%
pc4	**0.893%**	0.141%
dis	**1.221%**	0.469%
feature	**1.305%**	0.553%

- **Table15: Multinomial Logit Model for Brand Choice**

```
proc mdc data=choice;
   model decision = intcpt1 intcpt2 intcpt3 regpr pcut disp feat /type=clogit
         choice=(brand 1 2 3 4);
   id caseid;
   title 'Multinomial Logit Model for Brand Choice';
run;
```

- **Table16: Parameter Estimates of Multinomial Logit Model for Brand Choice**

Multinomial Logit Model for Brand Choice

The MDC Procedure

Conditional Logit Estimates

Parameter Estimates

Parameter	DF	Estimate	Standard Error	t Value	Approx Pr > |t|
intcpt1	1	-0.4351	0.2210	-1.97	0.0490
intcpt2	1	0.0160	0.5124	0.03	0.9751
intcpt3	1	0.4445	0.2179	2.04	0.0414
regpr	1	0.0628	0.2531	0.25	0.8039
pcut	1	0.7118	0.2368	3.01	0.0026
disp	1	1.3074	0.1212	10.78	<.0001
feat	1	0.3906	0.1121	3.48	0.0005

Choice Model: Estimates	
intcpt1	-0.4351
intcpt2	0.0000
intcpt3	0.4445
regpr	0.0000
pcut	0.7118
disp	1.3074
feat	0.3906

- **Table17: Parameter Estimates, odds and Percentage Changes of odds of Purchase Incidence Model**

Choice Model: Estimates		exp(b)	changes
intcpt1	-0.4351	0.647199944	-35.28%
intcpt2	0.0000	1	0.00%
intcpt3	0.4445	1.559710146	55.97%
regpr	0.0000	1	0.00%
pcut	0.7118	2.03765574	103.77%
disp	1.3074	3.696550177	269.66%
feat	0.3906	1.477867248	47.79%

- **Table18: Probability of Brand Choice When Brand Wisk Had Price Cut**

Brand Choice:		
U1	-0.435	0.063
U2	0.000	0.000
U3	0.445	0.445
U4	0.000	0.000
exp(U1)	0.647	1.065
exp(U2)	1.000	1.000
exp(U3)	1.560	1.560
exp(U4)	1.000	1.000
sum	4.207	4.625
Pr(B1=1)	**15.4%**	**23.0%**
Pr(B2=1)	**23.8%**	**21.6%**
Pr(B3=1)	**37.1%**	**33.7%**
Pr(B4=1)	**23.8%**	**21.6%**

- **Table19: Probability of Brand Choice When Brand Wisk Had Display Advertising**

Brand Choice:		
U1	-0.435	0.872
U2	0.000	0.000
U3	0.445	0.445
U4	0.000	0.000
exp(U1)	0.647	2.392
exp(U2)	1.000	1.000
exp(U3)	1.560	1.560
exp(U4)	1.000	1.000
sum	4.207	5.952
Pr(B1=1)	**15.4%**	**40.2%**
Pr(B2=1)	**23.8%**	**16.8%**
Pr(B3=1)	**37.1%**	**26.2%**
Pr(B4=1)	**23.8%**	**16.8%**

- **Table20: Probability of Brand Choice When Brand Wisk Had Feature Advertising**

Brand Choice:		
U1	-0.435	-0.045
U2	0.000	0.000
U3	0.445	0.445
U4	0.000	0.000
exp(U1)	0.647	0.956
exp(U2)	1.000	1.000
exp(U3)	1.560	1.560
exp(U4)	1.000	1.000
sum	4.207	4.516
Pr(B1=1)	**15.4%**	**21.2%**
Pr(B2=1)	**23.8%**	**22.1%**
Pr(B3=1)	**37.1%**	**34.5%**
Pr(B4=1)	**23.8%**	**22.1%**

- **Table21: Probability of Brand Choice When Brand All Had Price Cut**

Brand Choice:		
U1	-0.435	-0.435
U2	0.000	0.584
U3	0.445	0.445
U4	0.000	0.000
exp(U1)	0.647	0.647
exp(U2)	1.000	1.793
exp(U3)	1.560	1.560
exp(U4)	1.000	1.000
sum	4.207	5.000
Pr(B1=1)	**15.4%**	**12.9%**
Pr(B2=1)	**23.8%**	**35.9%**
Pr(B3=1)	**37.1%**	**31.2%**
Pr(B4=1)	**23.8%**	**20.0%**

- **Table22: Probability of Brand Choice When Brand All Had Display Advertising**

Brand Choice:		
U1	-0.435	-0.435
U2	0.000	1.307
U3	0.445	0.445
U4	0.000	0.000
exp(U1)	0.647	0.647
exp(U2)	1.000	3.697
exp(U3)	1.560	1.560
exp(U4)	1.000	1.000
sum	4.207	6.903
Pr(B1=1)	**15.4%**	**9.4%**
Pr(B2=1)	**23.8%**	**53.5%**
Pr(B3=1)	**37.1%**	**22.6%**
Pr(B4=1)	**23.8%**	**14.5%**

- **Table23: Probability of Brand Choice When Brand All Had Feature Advertising**

Brand Choice:		
U1	-0.435	-0.435
U2	0.000	0.391
U3	0.445	0.445
U4	0.000	0.000
exp(U1)	0.647	0.647
exp(U2)	1.000	1.478
exp(U3)	1.560	1.560
exp(U4)	1.000	1.000
sum	4.207	4.685
Pr(B1=1)	**15.4%**	**13.8%**
Pr(B2=1)	**23.8%**	**31.5%**
Pr(B3=1)	**37.1%**	**33.3%**
Pr(B4=1)	**23.8%**	**21.3%**

- **Table24: Probability of Brand Choice When Brand Tide Had Price Cut**

Brand Choice:		
U1	-0.435	-0.435
U2	0.000	0.000
U3	0.445	1.135
U4	0.000	0.000
exp(U1)	0.647	0.647
exp(U2)	1.000	1.000
exp(U3)	1.560	3.111
exp(U4)	1.000	1.000
sum	4.207	5.758
Pr(B1=1)	**15.4%**	**11.2%**
Pr(B2=1)	**23.8%**	**17.4%**
Pr(B3=1)	**37.1%**	**54.0%**
Pr(B4=1)	**23.8%**	**17.4%**

- **Table25: Probability of Brand Choice When Brand Tide Had Display Advertising**

Brand Choice:		
U1	-0.435	-0.435
U2	0.000	0.000
U3	0.445	1.752
U4	0.000	0.000
exp(U1)	0.647	0.647
exp(U2)	1.000	1.000
exp(U3)	1.560	5.766
exp(U4)	1.000	1.000
sum	4.207	8.413
Pr(B1=1)	**15.4%**	**7.7%**
Pr(B2=1)	**23.8%**	**11.9%**
Pr(B3=1)	**37.1%**	**68.5%**
Pr(B4=1)	**23.8%**	**11.9%**

- **Table26: Probability of Brand Choice When Brand Tide Had Feature Advertising**

Brand Choice:		
U1	-0.435	-0.435
U2	0.000	0.000
U3	0.445	0.835
U4	0.000	0.000
exp(U1)	0.647	0.647
exp(U2)	1.000	1.000
exp(U3)	1.560	2.305
exp(U4)	1.000	1.000
sum	4.207	4.952
Pr(B1=1)	**15.4%**	**13.1%**
Pr(B2=1)	**23.8%**	**20.2%**
Pr(B3=1)	**37.1%**	**46.5%**
Pr(B4=1)	**23.8%**	**20.2%**

- **Table27: Probability of Brand Choice When Brand Cheer Had Price Cut**

Brand Choice:		
U1	-0.435	-0.435
U2	0.000	0.000
U3	0.445	0.445
U4	0.000	0.463
exp(U1)	0.647	0.647
exp(U2)	1.000	1.000
exp(U3)	1.560	1.560
exp(U4)	1.000	1.588
sum	4.207	4.795
Pr(B1=1)	**15.4%**	**13.5%**
Pr(B2=1)	**23.8%**	**20.9%**
Pr(B3=1)	**37.1%**	**32.5%**
Pr(B4=1)	**23.8%**	**33.1%**

- **Table28: Probability of Brand Choice When Brand Cheer Had Display Advertising**

Brand Choice:		
U1	-0.435	-0.435
U2	0.000	0.000
U3	0.445	0.445
U4	0.000	1.307
exp(U1)	0.647	0.647
exp(U2)	1.000	1.000
exp(U3)	1.560	1.560
exp(U4)	1.000	3.697
sum	4.207	6.903
Pr(B1=1)	**15.4%**	**9.4%**
Pr(B2=1)	**23.8%**	**14.5%**
Pr(B3=1)	**37.1%**	**22.6%**
Pr(B4=1)	**23.8%**	**53.5%**

- **Table29: Probability of Brand Choice When Brand Cheer Had Feature Advertising**

Brand Choice:		
U1	-0.435	-0.435
U2	0.000	0.000
U3	0.445	0.445
U4	0.000	0.391
exp(U1)	0.647	0.647
exp(U2)	1.000	1.000
exp(U3)	1.560	1.560
exp(U4)	1.000	1.478
sum	4.207	4.685
Pr(B1=1)	**15.4%**	**13.8%**
Pr(B2=1)	**23.8%**	**21.3%**
Pr(B3=1)	**37.1%**	**33.3%**
Pr(B4=1)	**23.8%**	**31.5%**

- **Table30: Comparison Table of Probability of Brand Choice Scenario with Each Promotion Scenarios**

Brand Choice	no promotion	price cut 1	price cut 2	pct 3	pct4
1	15.38%	23.03%	12.95%	11.24%	13.50%
2	23.77%	21.62%	35.86%	17.37%	20.85%
3	37.07%	33.72%	31.20%	54.03%	32.53%
4	23.77%	21.62%	20.00%	17.37%	33.12%
Improvement Percentage		7.65%	12.09%	16.95%	9.35%
Brand Choice	no promotion	display1	display2	display3	display4
1	15.38%	40.20%	9.38%	7.69%	9.4%
2	23.77%	16.80%	53.55%	11.89%	14.5%
3	37.07%	26.20%	22.59%	68.53%	22.6%
4	23.77%	16.80%	14.49%	11.89%	53.5%
Improvement Percentage		24.82%	29.78%	31.46%	29.73%
Brand Choice	no promotion	feature1	feature2	feature3	feature4
1	15.38%	**21.2%**	13.81%	13.07%	13.81%
2	23.77%	**22.1%**	31.55%	20.19%	21.35%
3	37.07%	**34.5%**	33.29%	46.55%	33.29%
4	23.77%	**22.1%**	21.35%	20.19%	31.55%
Improvement Percentage		5.82%	7.78%	9.47%	7.78%

- **Table31: Semi-log Model**

```
data temp1;
set deterg;
if choice=1;   /* keep only those observations when brand 1 was chosen */
logvol1=log(volume);
proc reg;
model logvol1 = avol regpr1 pcut1 lbpromot;
*model logvol1 = avol regpr1 pcut1 disp1 feat1 lbpromot;
title 'Semi-log (conditional) purchase quantity model for brand 1';
run;

data temp2;
set deterg;
if choice=2;   /* keep only those observations when brand 2 was chosen */
logvol2=log(volume);
proc reg;
model logvol2=avol regpr2 pcut2 lbpromot;
*model logvol2 = avol regpr2 pcut2 disp2 feat2 lbpromot;
title 'Semi-log (conditional) purchase quantity model for brand 2';
run;

data temp3;
set deterg;
if choice=3;   /* keep only those observations when brand 3 was chosen */
logvol3=log(volume);
proc reg;
model logvol3=avol regpr3 pcut3 lbpromot;
*model logvol3 = avol regpr3 pcut3 disp3 feat3 lbpromot;
title 'Semi-log (conditional) purchase quantity model for brand 3';
run;

data temp4;
set deterg;
if choice=4;   /* keep only those observations when brand 4 was chosen */
logvol4=log(volume);
proc reg;
model logvol4=avol regpr4 pcut4 lbpromot;
*model logvol4 = avol regpr4 pcut4 disp4 feat4 lbpromot;
title 'Semi-log (conditional) purchase quantity model for brand 4';
run;
```

- **Table32: Estimates of Purchase Quantity Models**

Semi-log (Conditional) Purchase Quantity Models: Estimates				
	brand 1	**brand 2**	**brand 3**	**brand 4**
Intercept	3.5458	4.29652	3.69781	3.87265
avol	0.00689	0.00671	0.00669	0.00297
regpr	0.0000	0.0000	0.0000	0.0000
pcut	0.0000	0.0000	0.0000	0.0000
lbpromot	0	0.0000	0.0000	0.0000
disp	0.0000	0.0000	0.0000	0.0000
feat	0.0000	0.0000	0.0000	0.0000

- **Table33: Purchase Quantities**

Purchase Quantities: (ounces)					
		Conditional Purchase Quantities			
	AVOL	CQ1	CQ2	CQ3	CQ4
Average AVOL:	123.7	81.3	168.4	92.3	69.4

Conditional Purchase Quantities with Given Promotions			
CQ1	CQ2	CQ3	CQ4
81.3	168.4	92.3	69.4

- **Table34: Expected Purchase Quantities When Brand Wisk Had Price Cut**

Expected Purchase Quantities with Given Promotion			
EQ1	EQ2	EQ3	EQ4
29.989	58.330	49.871	24.037

- **Table35: Expected Purchase Quantities When Brand Wisk Had the Display Advertising**

Expected Purchase Quantities with Given Promotion			
EQ1	EQ2	EQ3	EQ4
70.637	61.173	52.301	25.209

- **Table36: Expected Purchase Quantities When Brand Wisk Had the Feature Advertising**

Expected Purchase Quantities with Given Promotion			
EQ1	EQ2	EQ3	EQ4
39.769	86.145	73.652	35.500

- **Table37: Expected Purchase Quantities When Brand All Had Price Cut**

Expected Purchase Quantities with Given Promotion			
EQ1	EQ2	EQ3	EQ4
17.398	99.843	47.619	22.952

- **Table38: Expected Purchase Quantities When Brand All Had the Display Advertising**

Expected Purchase Quantities with Given Promotion			
EQ1	EQ2	EQ3	EQ4
16.475	194.966	45.094	21.735

- **Table39: Expected Purchase Quantities When Brand All Had the Feature Advertising**

Expected Purchase Quantities with Given Promotion			
EQ1	EQ2	EQ3	EQ4
25.941	122.730	71.001	34.222

- **Table40: Expected Purchase Quantities When Brand Tide Had Price Cut**

Expected Purchase Quantities with Given Promotion			
EQ1	EQ2	EQ3	EQ4
15.716	50.311	85.797	20.733

- **Table41: Expected Purchase Quantities When Brand Tide Had the Display Advertising**

Expected Purchase Quantities with Given Promotion			
EQ1	EQ2	EQ3	EQ4
13.520	43.280	136.786	17.836

- **Table42: Expected Purchase Quantities When Brand Tide Had the Feature Advertising**

Expected Purchase Quantities with Given Promotion			
EQ1	EQ2	EQ3	EQ4
24.540	78.560	99.263	32.374

- **Table43: Expected Purchase Quantities When Brand Cheer Had Price Cut**

Expected Purchase Quantities with Given Promotion			
EQ1	EQ2	EQ3	EQ4
17.343	55.521	47.469	36.340

- **Table44: Expected Purchase Quantities When Brand Cheer Had the Display Advertising**

Expected Purchase Quantities with Given Promotion			
EQ1	EQ2	EQ3	EQ4
16.475	52.743	45.094	80.344

- **Table45: Expected Purchase Quantities When Brand Cheer Had the Feature Advertising**

Expected Purchase Quantities with Given Promotion			
EQ1	EQ2	EQ3	EQ4
25.941	83.045	71.001	50.576

- **Table46: Comparison Table of Brand's Expected Purchase Quantities of Each Promotions Scenario**

Expected qauntity	no promotion	price cut 1	price cut 2	pct 3	pct4
1	16.6482528	29.9889459	17.3981709	15.715897	17.3432224
2	53.2958931	58.3303676	99.8426135	50.3111514	55.5206927
3	45.5666129	49.8709587	47.6191543	85.797404	47.4687591
4	21.9628255	24.0374936	22.9521378	20.7328365	36.3399538
Increase Quantity for specific brand		13.3406931	46.5467204	40.2307911	14.3771283
Total quantity	137.473584	162.227766	187.812076	172.557289	156.672628
Increase quantity percentage for specific brand		80.13%	87.34%	88.29%	65.46%
Increased total quantity percentage		18.01%	36.62%	25.52%	13.97%
Expected qauntity	no promotion	display1	display2	display3	display4
1	16.6482528	70.636533	16.4754549	13.5196805	16.4754549
2	53.2958931	61.1727284	194.966099	43.2804244	52.7427168
3	45.5666129	52.3011038	45.0936615	136.785833	45.0936615
4	21.9628255	25.2088085	21.7348659	17.8355283	80.3440222
Increase Quantity for specific brand		53.9882802	141.670206	91.21922	58.3811967
Total quantity	137.473584	209.319174	278.270081	211.421466	194.655855
Increase quantity percentage for specific brand		324.29%	265.82%	200.19%	265.82%
Increased total quantity percentage		52.26%	102.42%	53.79%	41.60%
Expected qauntity	no promotion	feature1	feature2	feature3	feature4
1	16.6482528	39.7686706	25.9411061	24.5400457	25.9411061
2	53.2958931	86.14513	122.729509	78.5598145	83.0450159
3	45.5666129	73.6518626	71.001345	99.2633385	71.001345
4	21.9628255	35.4997421	34.222209	32.3738923	50.5758819
Increase Quantity for specific brand		23.1204178	69.433616	53.6967256	28.6130564
Total quantity	137.473584	235.065405	253.894169	234.737091	230.563349
Increase quantity percentage for specific brand		138.88%	130.28%	117.84%	130.28%
Increased total quantity percentage		70.99%	84.69%	70.75%	67.71%

- **Table47:Attractiveness of each brand given it's chosen**

Attractiveness of each brand given it's chosen

Brand Name	Attractiveness (No promo) exp(U)	Probability of buying (No Promo)	Feat1 (Pr)	Feat2 (Pr)	Feat3 (Pr)	Feat4 (Pr)	disp1 (Pr)	disp2 (Pr)	disp3 (Pr)	disp4 (Pr)	Pcut1 (Pr)	Pcut2 (Pr)	Pcut3 (Pr)	Pcut4 (Pr)
Wisk (U1)	0.64720	**15.4%**	**21.2%**	13.8%	13.1%	13.8%	**40.2%**	9.4%	7.7%	9.4%	**23.0%**	12.9%	11.2%	13.5%
All (U2)	1.00000	**23.8%**	22.1%	**31.5%**	20.2%	21.3%	16.8%	**53.5%**	11.9%	14.5%	21.6%	**35.9%**	17.4%	20.9%
Tide (U3)	1.55971	**37.1%**	34.5%	33.3%	**46.5%**	33.3%	26.2%	22.6%	**68.5%**	22.6%	33.7%	31.2%	**54.0%**	32.5%
Cheers (U4)	1.00000	**23.8%**	22.1%	21.3%	20.2%	**31.5%**	16.8%	14.5%	11.9%	**53.5%**	21.6%	20.0%	17.4%	**33.1%**

7.6

Wisk , All & cheere same 8% increase for feature ad
If tide does feat ad pr increases more than 13%
All 9% increase

Wisk & All, disp, pr increases 24.8% & 29.7% than without pr
For tide, pr increases 31.4% than without promo
For Cheers pr increases 29.7 % than without promo

For price cut, wisk pr increases 7.6%, All's pr by 12.1%
Tide's pr to buy increaes by 17% &
Cheers incrases by 9.3%

- **Table48:retailer gross profit of having price cut (100% pass through rate)**

Benchmark: no promotions	Wisk	All	Tide	Cheer	category total
retailer gross profit	23.91	48.92	66.44	28.73	168.00
mfr gross profit	43.03	88.06	119.59	51.71	

retailer gross profit:	Wisk	All	Tide	Cheer	category total	***% change in total gross profit***
pc1>0	**43.1**	53.5	72.7	31.4	200.8	**19.5%**
pc2>0	25.0	**91.7**	69.4	30.0	216.1	**28.6%**
pc3>0	22.6	46.2	**125.1**	27.1	221.0	**31.5%**
pc4>0	24.9	51.0	69.2	**47.5**	192.6	**14.7%**

- **Table49:manufacturer gross profit of having price cut (100% pass-through rate)**

Mfr gross profit:	Wisk	All	Tide	Cheer
pc1>0	**56.52316**			
pc2>0		**83.10732**		
pc3>0			**141.9432**	
pc4>0				**61.93781**
% change over benchmark	**31.4%**	**-5.6%**	**18.7%**	**19.8%**

- **Table50:retailer gross profit of having price cut (70% pass-through rate)**

retailer gross profit:	Wisk	All	Tide	Cheer	category total	*% change in total gross profit*
pc1>0	**52.1**	53.5	72.7	31.4	209.8	**24.9%**
pc2>0	25.0	**126.7**	69.4	30.0	251.2	**49.5%**
pc3>0	22.6	46.2	**160.8**	27.1	256.6	**52.8%**
pc4>0	24.9	51.0	69.2	**57.7**	202.7	**20.7%**

- **Table51:manufacturer gross profit of having price cut (70% pass-through rate)**

Mfr gross profit:	Wisk	All	Tide	Cheer
pc1>0	**47.52648**			
pc2>0		**48.02048**		
pc3>0			**106.2760**	
pc4>0				**51.81454**
% change over benchmark	**10.4%**	**-45.5%**	**-11.1%**	**0.2%**

- **Table52:manufacturer gross profit of having price cut (80% pass-through rate)**

Mfr gross profit:	Wisk	All	Tide	Cheer
pc1>0	**51.28**			
pc2>0		**62.64**		
pc3>0			**121.14**	
pc4>0				**56.03**
% change over benchmark	**19.2%**	**-28.9%**	**1.3%**	**8.4%**

Model 1: Purchase Incidence Model

$V = -0.76(avg\ rp) + 1.07(avg\ pc) + 0.49(cat\ disp) + 0.56(cat\ feat) - 0.52(lbpromot)$

Model 2: Brand Choice Model

$Uk = -0.44 + 0.44 + 0.71(pcut) + 1.31(disp) + 0.39(feat)$

$U1 = -0.44 + 0.71(pcut) + 1.31(disp) + 0.39(feat)$

$U2 = 0.71(pcut) + 1.31(disp) + 0.39(feat)$

$U3 = 0.44 + 0.71(pcut) + 1.31(disp) + 0.39(feat)$

$U4 = 0.71(pcut) + 1.31(disp) + 0.39(feat)$

Model 3: Purchase Quantity Model

$Wisk: \ln(S) = 3.55 + 0.01(avol)$

$All: \ln(S) = 4.3 + 0.01(avol)$

$Tide: \ln(S) = 3.7 + 0.01(avol)$

$Cheer: \ln(S) = 3.87 + 0.003(avol)$