Pricing Decisions for Tropicana Orange Juice

Group Member Names:
Caroline Keller, Aly Rasmussen, Lauren Naclerio, José Jiménez Vivaldi, Jiacheng Liu

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Executive Summary

This memo reviews our key findings and recommendations in relation to Tropicana 64oz sold at Nick’s, a 15 store midwest regional grocery retailer. Fluctuations in orange juice sales make it challenging to predict and improve category profitability. Retail price is inconsistent across each store and frequent promotions have been introduced- proving the dynamic nature of pricing in this category. Our team reviewed weekly sales volume, retail price, and promotions for the item during a two-year period. Our analysis using a semi-log pricing model revealed considerable differences across stores, inconsistent price sensitivity, and a seasonality effect on sales, resulting in a $2.99 SRP recommendation for Tropicana 64oz.

Introduction and Background

Nick's tasked our team to recommend an optimal retail price for Tropicana 64oz, the largest item in Nick’s orange juice category. Currently, the final list pricing decision is left to each store manager leading to customer confusion and inconsistencies chain wide. The retailer would like to standardize pricing across their locations.

In order to determine the optimal price, we explored the performance of each individual store location, looked at quarterly data to account for seasonality, and reviewed in-store displays/ advertising in order to ensure all pertinent factors were considered. This memo reviews the three pricing models explored, key trends, and the best fit model’s optimal price and profit implications.

Data and Methodology

Nick’s provided weekly sales data for each of its 15 stores from January 2009 to December 2010 in the *tropic* dataset. Using SAS, we observed notable patterns in quantity and price. Across all 1,560 observations, the mean quantity sold was 40,914.54 oz/week (SD=49,216.14oz). The mean price ($3.60) had a standard deviation of $0.35. The prices for orange juice ranged $2.74-$4.18. Store 2 only sold 27,819 oz/week on average, while store 137 sold roughly triple that amount. Store 71 had the greatest variation and managers should be mindful of its extreme sales.

Various pricing models were explored in which price is the independent variable and quantity sold is the dependent, considering other relevant variables.[1] We tested linear models as well as the constant price elasticity assumed in log-log models. Finally, we tested semi-log models which more realistically allow for price sensitivity to change across price points. Our best fitting semi-log model looked as follows: model log(quantity) = price end9 deal qrt1-qrt3 store1-store14 interaction.[2]

Through Profit Analysis, we tested the optimal retail price by using a semi-log model to estimate the maximum expected gross profit by Week 105. In order to express comparative

[1] See appendix 1 for more details on the variables available in the dataset.

[2] See appendix 2 for more details on the final linear, log-log, and semi-log models tested.

results, the store population average of price based on Weeks 1-104 was also tested with the same model. Since fixed costs($2.57) do not vary with price, we can simply maximize the gross profit $\pi_t=S_t(P_t-C_t)$[3] with respect to P_t.

Key Findings

Linear models proved to be a poor fit for orange juice, only explaining about 20% of the variation in sales (e.g., adjusted R^2 of .2125). In practice, price sensitivity for CPG products is not consistent at different price points. Indeed, log-log models underperformed semi-log models with respect to explaining sales. We ultimately chose the semi-log model using the same parameters described as above. This model returned the greatest adjusted R^2 of .4960, explaining nearly half of the variation in sales. The p-values of deal and 'end9' are nominal; these are very small indicating that they have a highly significant effect on sales. Pearson correlation coefficients confirmed these correlations. According to our model, sales decreased when items were on promotion, even though the Pearson coefficients contradicted this relationship between the two variables. This disparity is due to the interaction effect between Price and Deal that was included in the model, so the relationship between deals and sales cannot be interpreted with the model's regression coefficients.

The optimal price for a unit of Tropicana 64oz is $3.00, but we recommend pricing it at $2.99, since the model shows that when a price ended in 9 there was an increase in sales. From estimating the expected gross profit of Week 105 of all stores, the result is $14,784, increasing over 89.7% compared to the average price of each store in Week 1-104.[4]

Conclusions and Recommendations

As mentioned in previous sections, each store should price its units of Tropicana 64oz bottles at $2.99. The rise in sales is not the highest that can be achieved, but balanced with a profit margin of $0.42 per bottle, each store can reach maximum profitability with that price. This sales increase is also supported by the positive impact of ending a price with 9.

Promotions should be used scarcely now that the product's price is fully optimized. The Pearson coefficient for the correlation between deal and sales was positive, but it was so low that it indicated a weak relationship between deals and sales increases. In a model the same as the chosen one, but without the interaction of price and deal, the coefficient of deal is 0.04216, which indicates a positive impact on sales in cases when the product is on promotion. However, this is smaller than the impact of ending the price with a 9 in that model (0.131) as well as the chosen one, which indicates a minimal impact in either model. Given that the nearest price below $2.99 that ends in 9 is $2.89, the rise in sales would not be large enough to account for the profit loss from cutting the margin, and if Nick's priced the item higher it would lose the sales increase due to the price ending in 9. An optimal promotion could be a '2 for $5.89' deal, therefore

[3] The equation used to determine the optimal price for the Tropicana 64oz bottles was **Cost – (1/b)**.

[4] See appendix 3 for more details on the gross profit projections for week 105.

discounting the cost of the individual unit without losing the psychological effect of a price ending in 9 and not having to lower the margin too much.

Appendices: Tables, Exhibits, Figures

Appendix 1: Dataset structure and descriptive statistics.

Variables	Descriptions
STORE	Unique identifier for each of the 15 stores
WEEK	Week number since January 1, 2009
QUANT	Sales volume, measured in ounces
PRICE	Retail price for Tropicana 64oz, measured in $/bottle
DEAL	Dummy variable for in-store display or feature advertising
INTERACTION	Derived by multiplying price and deal
QRT1 - QRT3	Dummy variables derived from week counts to group weeks by season
STORE1 - STORE 14	Dummy variables derived from STORE to isolate each store
END9	Dummy variable derived from PRICE to flag prices that ended in “9”

Store Metrics		**Price Mean 40914.54; Std Dev 49216.14**				**Quantity Mean 3.60; Std Dev 0.35**			
store*	**N Obs**	**Mean**	**Std Dev**	**Min**	**Max**	**Mean**	**Std Dev**	**Min**	**Max**
1	104	3.58	0.34	2.79	4.13	27818.79	21659.02	5,440	161,024
2	104	3.65	0.37	2.74	4.18	31783.38	22349.88	2,304	129,152
3	104	3.61	0.35	2.74	4.13	46072.62	37474.19	11,264	241,920
4	104	3.63	0.35	2.74	4.13	38584.09	28021.35	8,704	153,472
5	104	3.61	0.35	2.74	4.13	33152.66	19671.72	10,304	96,192
6	104	3.62	0.35	2.74	4.13	34583.60	29465.33	6,080	186,368
7	104	3.56	0.36	2.82	4.13	54601.24	125736.49	2,112	1,186,496
8	104	3.61	0.35	2.74	4.13	37563.69	32008.22	8,320	199,744
9	104	3.66	0.36	2.74	4.18	35760.27	37676.50	7,552	309,696
10	104	3.62	0.35	2.74	4.13	29345.85	31458.89	4,608	223,424
11	104	3.57	0.35	2.85	4.13	51078.77	63980.04	3,648	371,200
12	104	3.59	0.34	2.86	4.13	46139.08	45463.95	6,400	280,448
13	104	3.61	0.35	2.89	4.18	35575.38	33062.36	3,648	216,704
14	104	3.54	0.35	2.76	4.13	46978.69	49490.24	4,032	290,560
15	104	3.56	0.35	2.77	4.13	64680.00	42209.46	13,632	216,256

*Note: stores were assigned dummy varies in ascending order (e.g., store# 2 is store1).

Appendix 2: Models tested: linear, log-log, and semi-log model examples.

	Linear model		**Log-log model**		**Semi-log model**	
	Adj R-Sq 0.2125		**Adj R-Sq 0.4804**		**Adj R-Sq 0.4804**	
Variable	**Parameter Est.**	**p-value**	**Parameter Est.**	**p-value**	**Parameter Est.**	**p-value**
Intercept	401149.00	<.0001	21.01	<.0001	19.07	<.0001
price*	-93872.00	<.0001	-8.03	<.0001	-2.31	<.0001
end9	4639.40	0.08	0.12	0.00	0.13	0.00

deal	-216071.00	<.0001	-3.75	<.0001	-3.86	<.0001
qrt1	17559.00	<.0001	0.12	0.01	0.16	0.00
qrt2	9186.74	0.00	0.15	0.00	0.19	<.0001
qrt3	5431.91	0.09	0.13	0.00	0.15	0.00
store1*	-36387.00	<.0001	-0.84	<.0001	-0.84	<.0001
store2	-27282.00	<.0001	-0.59	<.0001	-0.58	<.0001
store3	-15878.00	0.01	-0.32	0.00	-0.32	0.00
store4	-21893.00	0.00	-0.43	<.0001	-0.43	<.0001
store5	-28918.00	<.0001	-0.54	<.0001	-0.54	<.0001
store6	-27652.00	<.0001	-0.64	<.0001	-0.64	<.0001
store7	-10660.00	0.08	-0.69	<.0001	-0.69	<.0001
store8	-24387.00	<.0001	-0.55	<.0001	-0.55	<.0001
store9	-23159.00	0.00	-0.54	<.0001	-0.53	<.0001
store10	-31881.00	<.0001	-0.90	<.0001	-0.90	<.0001
store11	-12639.00	0.04	-0.62	<.0001	-0.62	<.0001
store12	-16110.00	0.01	-0.47	<.0001	-0.47	<.0001
store13	-25258.00	<.0001	-0.65	<.0001	-0.65	<.0001
store14	-19459.00	0.00	-0.64	<.0001	-0.64	<.0001
interaction	57321.00	<.0001	1.03	<.0001	1.05	<.0001

*Note: price was either included as-is or in its log form.

Appendix 3: Expected gross profit per store in week 105.

Store	Unit Sales at P = 2.99	Unit Sales at Avg.Price of Week1-104
1	725.1	392.46
2	939.46	462.58
3	1223.3	636.16
4	1101.37	557.42
5	980.74	510.02
6	890.08	456.65
7	847.51	470.89
8	971.95	505.45
9	994.57	482.97
10	686.98	352.46
11	910.78	499.49
12	1056.07	564.09
13	882.98	459.18
14	888.3	506.44
15	1684.64	936.01
Total	**$14,784**	**$7,792**