




Verifying the Credibility of Demand Estimates based on Regression Analysis

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Abstract: We conduct pre-test research to analyze the credibility of the demand estimates, marketing expenses and price of K-Pack in the future. In order to set up the experimental conditions, three prices 50 cents, 60 cents, 70 cents, and two advertising levels \$3 million introduction plan and a \$3.5 million plan have been introduced. Further, two store locations, L1: K-Pack in the bakery section and L2 K-Pack in the breakfast food section were used to collect data. A 4P marketing principle has been used to describe product, price, place and promotion. ANOVA, F-test and regression analysis have been used to test the research hypothesis and to examine the relationship among the research variables. It is identified from the study outcomes that price and/or store volume will affect monthly average sales for the first month. Furthermore, the coefficient value indicates that store volume positively predicts average sales, while price negatively predicts average sales, indicating that price has a statistically significant effect on average sales while the store volume does not have a statistically significant impact on average sales. Moreover, according to the results of the second month, price and store volume are insignificant to explain the variation in average sales. Similarly, price and sales are found to be insignificant in explaining variation in average sales of K-Pack. It is identified from 4P marketing analysis that the company need to focus on product quality, affordable prices, store locations, and promotional strategy to increase its sales in future. Overall, these results shed light on credibility of demand estimates.


1 INTRODUCTION


The 4P theory came into the United States in the 1960s with the marketing mix theory (E Jerome McCarthy EIL, H. BORDEN 1960). In 1953, Neil Borden coined the term “Marketing mix” in his inaugural address to the American Institute of Marketing, which means that market demand is more or less influenced to some extent by so-called “Marketing variables” or “Marketing elements”. In order to seek a certain market response, enterprises should combine these elements effectively to meet market demand and obtain maximum profits.


The Marketing mix actually consists of dozens of elements (Borden’s proposed Marketing mix originally consists of 12 elements), which were

generally summarized by Jerome McCarthy in his 1960 book Basic Marketing into four categories: Product, Price, Place and Promotion (also known as 4Ps) (NEIL, H. BORDEN 1953). In 1967, Philip Kotler, in the first edition of his best-selling book Marketing Management: Analysis, Planning and Control, further confirmed the marketing mix method with 4Ps as the core:

- Product: one should pay attention to the functions of development, require products to have unique selling points, and put the functional demands of products in the first place.
- Price: according to different market positioning, develop different Price strategies, product pricing is based on the brand strategy

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of the enterprise, pay attention to the gold content of the brand.

- Distribution (Place): enterprises do not directly face consumers, but focus on the cultivation of distributors and the establishment of sales networks. The contact between enterprises and consumers is carried out through distributors.
- Promotion: Enterprises concentrate on the change of sales behavior to stimulate consumers, promote consumption growth by short-term behavior (e.g., discount, buy one get one free, marketing atmosphere, etc.), attract consumers of other brands or lead to advanced consumption to promote sales growth.

Moreover, regression analysis method, based on the analysis of the market with the relationship between independent variable and dependent variable, establishes a regression equation between variables. The regression equation is also known as the prediction model, which can change to estimate the dependent variable relationship characterized by correlation according to the number of independent variables in the prediction period. As a consequence, the regression analysis prediction method is a kind of important market forecasting methods (R.A Fisher 2005). When we forecast the future development status and level of market phenomena, if one can find the main factors affecting the market forecast objects and obtain their quantitative data, it is feasible to construct a high accuracy regression analysis and prediction method to forecast. It is a concrete, effective and practical method of market prediction.

The 4P marketing mix strategy is frequently applied in numerous real lives start-up business plans. For example, McDonald’s Corporation’s marketing mix (4Ps) involves various approaches that meet business concerns in different fast food restaurant markets around the world, the company’s corporate standards for productivity are implemented in the management of each company-owned and franchised location. In this article, we will review the progress made in the last few years (George S. Spasis, Konstantinos Z. Vasileiou. 2006, Muhammad Hasbullah Hadi Bahador 2019, Baker, Saren, M. eds., 2016, Resnick, Cheng, Simpson, Lourenço, 2016, Ferrell, Hartline, 2012, GbolagadeAdewale, Oyewale, 2013, Lamb, Hair, McDaniel, 2011, Eason, Noble, Sneddon 1955, J. Clerk Maxwell 1892, Jacobs Bean 1963, Yorozu, Hirano, Oka, Tagawa 1982, Young 1989).

The rest part of the paper is organized as follows. The Sec. 2 will introduce the data origination and

processing as well as regression models. The Sec. 3 presents the results of the regressions for four months separately. Subsequently, the Sec. 4 demonstrates the explanation of results as well as lists the limitations. Eventually, a brief summary is given in Sec. 5.

2 DATA & METHOD

This data here is collected by Mary, the marketing director of SMARTFOOD during a four-month test market study at 24 grocery stores in four different cities. The data consisted of average sale per month for 4 months (24 each) from store audits of the stores in each city. The mean average sales of each of the four months at the time of data collection were 161, 255, 278, 280, respectively.

The original data obtained from the market study were already treated for missing values and screened for outliers. In the current study, the descriptive statistics for all the variables were examined to make sure they fell within acceptable range and skewness is one such statistic that was carefully looked at. Histograms were obtained for all the variables whose skewness statistic was greater than 1 to have a pictorial view of the distribution of the variables. Information about the independent variables and how they were measured is provided in Table 1.

Table 1: Summary of the independent variables with sample means and standard deviation.

Variables	Scale	M	SD
Price		60	8.34
Advertising			
3 million	0		
3.5 million	1		
Location			
Backery	1		
Breakfast	0		
Store Volume		49	5.61

The dependent variable in this study was Average Sales per Month and it was measured by a four-month market study test. Sales of K-Pack were measured using store audits from a panel of stores in each city. The independent variables were price and store volume. The dummy variables considered in the present study are advertising, location of K-Pack within each store, and city index. These variables that

were based on recommendations from previous research were selected for use in this study. Marketing mix variables were: price, advertising, and location of K-Pack within each store. The price, measured the price of a single piece of K-Pack. The variable, advertising, measured the money that spend on advertising. Store location measured the place that K-Pack put in the store. To be specific, there are three prices: 50 cents, 60 cents, 70 cents; two levels of advertising: a simulation of a \$3 million introduction plan and a \$3.5 million plan; and two store locations: K-Pack in the bakery section versus K-Pack in the breakfast food section. Location measured as 1 if K-Pack in the bakery section, 0 if K-Pack in the breakfast food section. Prices and location were to be varied across stores within a city while advertising was varied across cities. Advertising was in the form of spot TV ads. Advertisement levels were selected that would simulate on a local basis the impact of national ads at the level of \$3 million and \$3.5 million. Advertising measured as 1 if the impact of national ads at the level of \$3.5 million, 0 if the impact of national ads at the level of \$3 million.

3 RESULTS

To investigate if price and volume interact with each other in determining sales, the following results are presented accordingly. In detail, the multiple linear

regression model is applied to address the issues with the p-values for the regression weights. In other words, a regression model is to be developed for predicting sales. This regression model is then to be used for determining the right marketing mix. The price should be treated using dummy variables, which are advertising and location. The results of the first month regression statistics and analysis are displayed.

Table 2: Regression statistics.

Regression Statistics	
Multiple R	0.577
R Square	0.333
Adjusted R Square	0.270
Standard Error	52.244
Observations	24

Table 3: ANOVA result.

ANOVA	df	SS	MS	F	Significant F
Regression Analysis	2	28670.5	14335.25	5.252	0.014
Residual	21	57319.13	2729.482		
Total	23	85989.63			

Table 4: Regression analysis output.

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	254.232	106.739	2.38	0.026	32.255	476.21	70.560	437.903
Price	-4.413	1.391	-3.172	0.004	-7.305	-1.520	-6.806	-2.019
Store Volume	3.541	2.068	1.713	0.101	-0.7586	7.8414	-0.0166	7.099

In the Tables 2-4, the regression statistics, standard errors and p-values for all the predictors are given. The results of the first month shows that 27% of the variance in average sales can be accounted for by price and store volume, $F(2,21) = 5.252$. The probability that the null hypothesis in our regression model cannot be rejected is 1.4%. Looking at the first month unique individual contributions of the predictors, store volume ($t=1.713$, $p=0.101$) positively predicts average sales, while price ($t=-3.172$, $p=0.004$) negatively predicts average sales. This suggests that price has a statistically significant

effect on average sales. Besides, unlike what we hypothesized, store volume does not contribute to average sales. The results of the second month regression statistics and analysis are displayed in the following.

Table 5: Regression statistics.

Regression Statistics	
Multiple R	0.101
R Square	0.0102
Adjusted R Square	-0.084
Standard Error	59.553
Observations	24

Table 6: ANOVA Results.

ANOVA	df	SS	MS	F	Significance F
Regression Analysis	2	764.112	382.056	0.107	0.898
Residual	21	74478.846	3546.611		
Total	23	75242.95			

Table 7: Regression Analysis Output.

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	199.662	121.672	1.641	0.115	-53.369	452.693	-9.704	409.029
Price	0.217	1.585	0.137	0.892	-3.079	3.514	-2.511	2.945
Store Volume	0.87	2.357	0.369	0.715	-4.0313	5.772	-3.185	4.926

In the Tables 5-7, the results of the second month shows that the explanation towards response is pretty low or negligible, which means insignificance of price and store volume, $F(2,21)=0.107$. The probability that the null hypothesis in our regression model cannot be rejected is 89.8%. The results of the second month unique individual contributions of the predictors shows that both price ($t=0.137$, $p=0.892$) and store volume ($t=0.369$, $p=0.715$) positively predicts average sales. This suggests that unlike what we hypothesized, both price and store volume do not have a statistically significant contribution to average

sales. The results of the second month regression statistics and analysis are displayed.

Table 8: Regression statistics.

Regression Statistics	
Multiple R	0.381
R Square	0.146
Adjusted R Square	0.065
Standard Error	62.283
Observations	24

Table 9: ANOVA Results.

ANOVA	df	SS	MS	F	Significance F
Regression Analysis	2	13914.542	6957.271	1.793	0.191
Residual	21	81463.082	3879.194		
Total	23	95377.625			

Table 10: Regression analysis output.

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	222.179	127.249	1.746	0.095	-42.451	486.808	3.215	441.142
Price	-2.370	1.658	-1.429	0.168	-5.819	1.078	-5.223	0.483
Store Volume	4.087	2.465	1.658	0.112	-1.038	9.213	-0.154	8.239

In the Tables 8-10, the results of the third month shows that 6.5% of the variance in average sales can be accounted for by price and store volume, $F(2,21)=1.793$. The probability that the null hypothesis in our regression model cannot be rejected is 19.1%. According to the third month unique individual contributions of the predictors, store volume ($t=1.658$, $p=0.112$) positively predicts average sales, while price ($t=-1.429$, $p=0.168$) negatively predicts average sales. This suggests that unlike what we hypothesized, both price and store volume do not have a statistically significant contribution to average sales. The results of the

second month regression statistics and analysis are displayed.

Table 11: Regression statistics.

Regression Statistics	
Multiple R	0.321
R Square	0.103
Adjusted R Square	0.0179
Standard Error	62.661
Observations	24

Table 12: ANOVA results.

ANOVA	df	SS	MS	F	Significance F
Regression Analysis	2	9502.837	4751.418	1.210	0.318
Residual	21	82454.121	3926.386		
Total	23	91956.958			

Table 13: Regression analysis output.

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	306.232	128.021	2.392	0.026	39.998	572.466	85.941	526.523
Price	-2.441	1.668	1.463	0.158	-5.911	1.028	-5.312	0.429
Store Volume	2.476	2.479	0.998	0.329	-2.681	7.634	-1.791	6.744

In the Tables 11-13, the results of the fourth month shows that 1.79% of the variance in average sales can be accounted for by price and store volume, $F(2,21)=1.21$. The probability that the null hypothesis in our regression model cannot be rejected is 31.8%. The results of the fourth month unique individual contributions of the predictors shows that store volume ($t=0.998$, $p=0.329$) positively predicts average sales, while price ($t=1.463$, $p=0.158$) negatively predicts average sales. In this case, different from what we hypothesized, both price and store volume do not have a statistically significant contribution to average sales.

4 DISCUSSION

A multiple linear regression analysis has been used in the study to predict monthly average sales, by using the price and store volume of K-Pack. It was hypothesized based on secondary research that price and store volume significantly affect average sales. In this regard, four regression models have been performed for four different months. It is identified from the results that the first regression model was significant at a 10% significance level as the p-value associated with the F-statistic is less than 0.05. The

R-square value indicates that price and store volume explained only 27% variation in the average sales of K-Pack and 73% of the variation remained unexplained. Hence, there may be other factors (e.g., physical environment, store location, promotional expenses, the attitude of staff, and number of alternatives) that might explain variation in average sales of K-Packs and all these factors ought to be taken into consideration for a good regression model. Further, the coefficient value indicates that store volume positively affects the average sales, while price negatively predicts average sales. It implies that increasing the price of K-Pack would decrease its sales while increasing the store volume increase its sales. This p-value corresponding to price is less than 0.10, while it is greater than 0.10 for store volume, hence it can be inferred price has a statistically significant effect on average sales, while store volume does not contribute to average sales.

With regard to the second month's data and analysis, it is identified that price and store volume does not explain a significant proportion of variation in the average sales of K-Pack. Further, the significant F-value is also greater than 0.10, hence the regression model is insignificant at a 10% significance level. The coefficient values of the second-month price and store volume are found out to be positive, which means that increasing the price and store volume in the second month led to an increase in the sales of K-Pack. However, the p-values indicated that both the variables are insignificant at a 10% significance level as the p-value of both the coefficient is greater than 0.10.

The value of the third month's estimate shows that price and store volume explain only a 6.45% variation in the average sales of K-Packs, while both of the variables are statistically insignificant to predict the average sales of K-Packs as the p-value for the corresponding coefficients is greater than 0.10. Similarly, it is also found for the fourth month's estimate that both price and store volume does not statistically significant to explain variation in average sales as the p-value for the model and coefficients is greater than 0.10. The reason may be small sample size, due to which it does not represent the characteristics of population accurately.

In the case of advantages by using marketing-mix, the 4P Marketing mix analysis does simplify and combine the 4P into one, which makes the marketing easier to operate and control. Moreover, the marketing mix strategy allows the company to implement its marketing plan based on its current resources and its customer needs.

Nevertheless, the marketing-mix strategy does not count the qualitative issue, such as employee's behavior and contingency can be occurred, e.g., accidentally adding too much carbohydrate due to a machine breaking down. Last but not least, it is time-consuming and requires a lot of funds to invest in the short run, in order to plan a proper strategy design, analysis and efficient innovative bakery machines for producing low-carbohydrate food.

Back-of-envelope calculation uses estimated or rounded numbers to develop a ballpark figure quickly. The 4P marketing-mix method is definitely more accurate compared to back-of-envelope calculation, whereas it required a much longer time for planning.

Lastly, in the case of qualitative issues, one can ask the customers to do a simple and straightforward online survey with coupons provided for SMART FOOD's product, in order to collect customers' comments and thus develop another method to avoid these problems.

5 CONCLUSIONS

In summary, to predict monthly average sales based on the price and store volume of K-Pack, the credibility of the demand estimates, marketing expenses and price of K-Pack in the future. According to the findings, price and store volume significantly affect the monthly average sales. It is also identified that store volume positively affects the average sales, while price negatively predicts average sales. It implies that the CEO of the SMARTFOOD company should make K-Pack affordable prices by setting reasonable prices. In addition, the CEO of the company also need to think about expanding the store price in order to increase the average sales of the company. However, the study results also reflected that only price is found out to be a significant predictor of the average sales for the first month. For the other three months, price and store volume does not affect the average sales. Nevertheless, the results of the study may be affected by several random causes and external factors, e.g., salesman attitude, discounts, number of alternatives, which might have impacts on the average sales of the company. The findings of the research also reflected that the CEO of the SMARTFOOD company needs to focus on improving the product quality, promotional strategy, price, and store locations to increase its sales in future. In brief, these results offer a guideline for marketing director of SMARTFOOD company to test the credibility of the demand estimates of K-Packs.

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