Modeling Effect Of Sales Due To Price Discounts
A Study With Special Reference To Cosmetic Consumers In Vellore City

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Abstract
The Buyers of cosmetics products in Vellore City, Tamilnadu, India formed the basis of consumer behavioral study. The cosmetics brand preference of 555 consumers were studied in 4 zones of the Vellore city. As part of the study, the top reasons for switching from top brand to other brands were analyzed. It was found that price discounts offered by other brand, Recommendations of friends, relatives and others who are using other brands, Unavailability of the regular brand in the stores, Allergic reactions to brand used at present, Desire to try different brands, Effective and attractive advertising of other brands, Sales promotion of other brands, Effective and attractive in-store displays of other brands and Ineffectiveness of the currently used cosmetic brand were the reasons for switch over to other brands. To understand the sales dynamics and to derive Probability Distribution Function (PDF) to predict sales trend due to price discounts, the change in sales of top brand Lakme due to price discount offered by close competitors was modeled and the probability distribution was derived. The PDF was found to be Lognormal with parameters \( \mu = 2.3941, \sigma = 1.2101 \).

Key Words: Buyer Behavior, Brand Switching, probabilities

I. Introduction
The research study by MRSS research agency and Assocham puts the Indian cosmetic industry’s current market size at US $6.5 billion. India's cosmetics and grooming industry market is expected to grow manifold to reach US $35 billion by 2035. In such a lucrative but competitive market, retaining customers and improving brand loyalty will pay dividends to the cosmetics company. Consumers often switch brands for various reasons. The probability of brand switching not only depends on the reasons. The top reasons for brand switching includes Price discounts offered by other brand, Recommendations of friends, relatives and others who are using other brands, Unavailability of the regular brand in the stores, Allergic reactions to brand used at present, Desire to try different brands, Effective and attractive advertising of other brands, Sales promotion of other brands, Effective and attractive in-store displays of other brands and Ineffectiveness of the currently used cosmetic brand. It is imperative to find the effect of top reason for brand switch on the number one ranked brand and its competitors. The derivation of probability distribution function will help in understanding the sales dynamics and help the brand managers to predict and react to sales fluctuations and counter the competition.

Literature Review
probabilistic model to test alternate market structures. Lattin and McAlister (1985) developed a model of consumer variety seeking behavior.

II. Objectives of the study:

- Determine the reasons for brand switching of cosmetic consumers and rank the reasons.
- Determine the probability of switching from top ranked brand due to the top reason.
- Model probability distribution function for brand switching due to the top reason.

III. Data Collection and Methodology:

Data Collection:

Primary data was collected using structured questionnaire. Stratified, Random sampling was used. Stratified sampling was used to select areas in Vellore district. The area was stratified into four zones - Zone 1 (Katpadi), Zone 2 (Sathuvachari), Zone 3 (Vellore Fort) and Zone 4 (Shenbakkam). Random sampling was used to select customers from the zones for study. Out of 560 Responses, 555 respondents were accepted after rejecting 5 responses for incomplete data.

Methodology Used:

As part of structured questionnaire, consumers were asked to select brands that they are currently using. They were free to choose more than one brand. They were also asked to rank the top reasons for switching over to competitor brands.

Reason for switching over from Current brand:

Frequency distribution was created and analyzed based on reasons nine reasons for brandswitching by consumers. The reasons were ranked based on frequency.

Probability Distribution:

The top reason for brand switch was found to be Price discount by competitors. To analyse this top reason in-depth, the sales of top brand (Lakme) and three competitor brands after sales discounts for first 60 days were analysed. The top brands and close competitors were found out in another related study. The probability Distribution due to Price Discount was found by subjecting the 60 days sales across 20 departmental stores to Kolmogorov Smirnov, Anderson Darling and Chi-Squared tests.

Kolmogorov-Smirnov Test - This test is used to decide if a sample comes from a hypothesized continuous distribution. It is based on the empirical cumulative distribution function (ECDF). Assume that we have a random sample x1, ..., xn from some distribution with CDF F(x). The empirical CDF is denoted by

\[ F_n(x) = \frac{1}{n} \cdot \left[ \text{Number of observations } \leq x \right] \]

Definition: The Kolmogorov-Smirnov statistic (D) is based on the largest vertical difference between the theoretical and the empirical cumulative distribution function:

\[ D = \max_{1 \leq i \leq n} \left( F(x_i) - \frac{i - 1}{n}, \frac{i}{n} - F(x_i) \right) \]

In order to determine whether the data follows a probability distribution, P-value is calculated based on the test statistic which denotes the threshold value of the significance level.

Anderson-Darling Test - The Anderson-Darling procedure is a general test to compare the fit of an observed cumulative distribution function to an expected cumulative distribution function. This test gives more weight to the tails than the Kolmogorov-Smirnov test.
Definition: The Anderson-Darling statistic ($A^2$) is defined as

$$A^2 = -n - \frac{1}{n} \sum_{i=1}^{n} (2i-1) \cdot [\ln F(X_i) + \ln(1-F(X_{n-i+1}))]$$

Chi-Square test: In the probability distribution calculation the test is used to determine if a sample comes from a population with a specific distribution. This test is applied to binned data. Although there is no optimal choice for the number of bins ($k$), there are several formulas which can be used to calculate this number based on the sample size ($N$). The formula used for binning is:

$$k = 1 + \log_2 N$$

The above three Goodness of fit test is carried out to determine the Probability Distribution of Sales after Sales discounts.

IV. Analysis and Results:
Reason for brand switching ranking:

Table 1 shows the results of the reasons for brand switching. Since the respondents can select more than one reason for brand switching, the total is more than the respondents.

<table>
<thead>
<tr>
<th>Brand Switch Factors</th>
<th>Score</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price discounts offered by other brand</td>
<td>2015</td>
<td>11.78%</td>
</tr>
<tr>
<td>Recommendations of friends, relatives and others who are using other brands</td>
<td>1994</td>
<td>11.66%</td>
</tr>
<tr>
<td>Unavailability of the brand I am regularly using in the store/s</td>
<td>1940</td>
<td>11.34%</td>
</tr>
<tr>
<td>Allergic reactions to brand used at present</td>
<td>1922</td>
<td>11.24%</td>
</tr>
<tr>
<td>Desire to try different brands</td>
<td>1905</td>
<td>11.14%</td>
</tr>
<tr>
<td>Effective and attractive advertising of other brand/s</td>
<td>1881</td>
<td>11.00%</td>
</tr>
<tr>
<td>Sales promotion of other brands</td>
<td>1837</td>
<td>10.74%</td>
</tr>
<tr>
<td>Effective and attractive In-store displays of other brands</td>
<td>1825</td>
<td>10.67%</td>
</tr>
<tr>
<td>Ineffectiveness of the brand I am using present</td>
<td>1786</td>
<td>10.44%</td>
</tr>
<tr>
<td>Total</td>
<td>17105</td>
<td>100%</td>
</tr>
</tbody>
</table>

From the table, it can be seen that the top three reasons for brand switching are Price discounts offered by other brand, Recommendations of friends, relatives and others who are using other brands and Unavailability of the brand I am regularly using in the store/s. Since the top reason for brand switching is Price discounts offered by other brand, this reason was taken up for in-depth analysis. The data is depicted as a bar chart in Figure 1.
Probability Distribution Of Sales: The 60 days mean sales of mean of top three competitors after price discount were analysed. The three Goodness of fit test was carried out to determine the Probability Distribution of Sales. The Goodness of fit of Sales is shown in Table 2.

The sales data is fitted on various probability distribution and the probability distribution fit is ranked. From table 2 data, based on the Kolmogorov Smirnov statistics rank, it is found that the Lognormal probability distribution is the best fit for the sales data. The Lognormal fit was with \( \mu = 1.2101 \). The probability distribution function is depicted in figure 2. Based on the distribution, the sales of competitor brand after price discount can be predicted. The general equation for lognormal can be represented by equation 1 below:

\[
\frac{e^{-\frac{(\ln x - \mu)^2}{2\sigma^2}}}{\sqrt{2\pi \sigma}} \quad \square > 0 \rightarrow \text{Equation 1}
\]
Based on the sales probability Lognormal distribution with parameters $\mu = 2.3941, \sigma = 1.2101$, the Mean and Median Sales after price discount is $22.79 \approx 23$ and $10.95 \approx 11$ respectively.

**Figure 2: Lognormal Probability Distribution Function**

The lognormal distribution can be used as a predictor of sales after price discount. Based on the peak sales and the decreasing trend indicated by the probability distribution, the brand managers can plan their marketing strategy. They can increase the brand advertisement and promotions based on the parameters of the Lognormal distribution. The figure below depicts the simulated parameters range from 2 to 4 in steps of 0.3.

**Figure 3: probability distribution with varying values of $\mu$**

**V. Limitations**

1. The results cannot be generalized to other states and countries as the reasons for consumer brand switch might differ.
2. The derived probability distribution cannot be extrapolated to other brands.
VI. Conclusion

The reasons for cosmetics brand switching in Vellore City, Tamilnadu, India was studied. The top reason for brand switching was found to be Price Discount. The probability distribution function for 60 day sales after price discount lead to the derivation of lognormal probability distribution with parameters $\mu = 2.3941, \sigma = 1.2101$. This parameter with variations can be used to simulate and study the price discount effect on the sales of brands. This will help brand managers to create counter strategies and help them retain customers. The study thus contributes to the brand loyalty literature and brings forth a uniquemethodology which will help brand managers and help in shaping the marketing strategy.

References: