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Multivariate Analysis of Advertising and Sales in Nigeria

ANALYSE MULTIDIMENSIONNELLE DE LA PUBLICITE ET DES VENTES AU NIGERIA

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Abstract

It is an established fact by marketing researchers that locally made products impact a lot on the economy of any nation, this they opined encouraged economic growth and expand job opportunities for the citizenry. Despite these benefits this products also suffer a great deal of setbacks to include poor channel of dissemination of information outside the shore of Nigeria. This handicap has been of great concern to the market researchers and many have even proposed the use of some forms of advertising techniques to achieve their goals. In this paper emphasis is placed on the use of selected advertising techniques, to achieve increase in the sales of some locally made products in Nigeria. A random sample of one hundred observations forms the target population. Multiple regression analysis and the tested hypothesis revealed that greater sales of locally made products are influenced by mode of advertising.

Key words: Multivariate; Advertising; Regression; Hypothesis

Résumé

Ceci est un fait établi par des chercheurs de marketing qui fait localement l'impact des produits beaucoup sur l'économie de toute nation, ce qu'ils émis l'opinion encouragé la croissance économique et accroître les possibilités d'emplois pour les citoyens. Malgré ces avantages présente les produits souffrent également beaucoup de reculs à inclure le canal pauvres de la diffusion d'informations en dehors de la côte du Nigeria. Ce handicap a été une grande préoccupation pour les chercheurs de marché et beaucoup ont même proposé l'utilisation de certaines formes de techniques de publicité pour atteindre leurs objectifs. Dans ce papier est l'accent mis sur l'utilisation des techniques de publicité choisie, pour atteindre augmentation des ventes de certains produits fabriqués localement au Nigeria. Un échantillon aléatoire d'une centaine de formes d'observations de la population cible. L'analyse de régression multiple et l'hypothèse testée a révélé que plus de la vente de produits fabriqués localement sont influencés par le mode de publicité.

Mots clés: Multivariété; Publicité; Régression; Hypothèse

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INTRODUCTION

Advertising is one of the communication or promotional tools employed by marketing oriented establishment, to reach their target markets. So many definitions have been advanced by many authors. According to Patti and Frazer (1988.4), advertising is a marketing communications element that is persuasive, non-personal, paid for by an identified sponsor, and disseminated through mass channels of communication to promote the adoption of goods, services, persons and ideas. Peter & Donnelly (2003.118) see advertising as a paid form of non-personal communication about an organization, its products or its activities that is transmitted through a mass medium to a target audience. The mass medium may be television, radio, newspaper, magazine, outdoor displays, car-cards or directories. Advertising generally could be said to be a

non-personal communication which is paid for and meant to affect a company or an individual's target audience or a market which will elicit acceptance of ideas, goods or services. Advertising stimulates demand, helps build brand success, develops and shapes buyer about product characteristics and availability and makes markets more competitive (Gilbraith, 1988: 81). In his view, Ebitu (2002:65) says some advertising if executed effectively, generates sales leads, communicates product advantages to prospective buyers and expands a company's marketing share and profitability.

Decision on what advertising message and channel to be chosen constitute a major part of the overall step of achieving advertising or promotional effectiveness, Danson (2004).this decision determines when the message will reach, and the medium itself influence the effectiveness of communication (Anderson and Vincze, 2004:409). In order to make a good choice, he opined that it is pertinent for a marketer to be acquainted with the characteristics of each media vehicle, their merits and demerits and finally, their reach, impact and frequency. Advertising objectives are the operational, measurable and achievable standards which organizations set and which have become a reference point for the operation and management of its marketing communication, Agatta (2004). Advertising objectives are derivable from the overall promotional objectives, although it is generally agreed that advertising seeks to inform, persuade and remind. (Ebitu 2002:67) Many authors have listed more specific and elaborate objective (Pride and Ferrel 2003).

A new form of advertising that is growing rapidly is electronic advertising. It is online advertising with a focus on social network sites, this is a relatively matured market because it has shown a lot of promise as advertisers is able to take advantage of the demographic information the users have provided to the social network site. Friendertising is a more precise advertising term in which people are able to direct advertising towards others directly using electronic advertising (Martin, 2006).

1. METHODOLOGY

This describes the methods adopted for the purpose of collecting information and sources from which the information used were collected. Research designs and methodology are typically classified according to the nature of the research objectives or type of research. However for this research a descriptive research design was used, first to portray the characteristics of the problem at hand and also determine the degree of which each advertising technique positively affects sales of some locally made products in Nigeria. It is necessary to mention here that questionnaires and personal interviews were used for data collection in this research, the two were used to collect the primary data for 10 locally made product in Nigeria. At each state, one hundred people were interviewed and the number of people who came by the product through the various form of advertisement is shown in Table 1 below.

Product	Radio advert	News paper	Electronic advert
Close Up	6	60	34
Eva soap	9	21	10
Eva wine	36	61	03
3 Crowns matches	39	31	30
Candle	90	7	03
Chalk	64	26	10
Klin detergent	81	17	02
Cheese balls	70	21	09
Bournvita	77	13	10
Plantain powder	90	08	02

Multivarate Linear Regression Model:

Let $Y=\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots.. \beta_r x_r + e$

The term linear refers to the fact that the mean is a linear function of the unknown parameters β_0, β_1, β_2……. β_r

The predictor variable may or may not enter the model as first order term with n independent observation on y as the associated values of x, the complete model becomes;

$$Y_1 = \beta_0 + \beta_1 x_{11} + \beta_2 x_{12} + \cdots \cdots \cdots + \beta_r x_r + e$$
$$Y_2 = \beta_0 + \beta_1 x_{21} + \beta_2 x_{22} + \cdots \cdots \cdots + \beta_r x_{2r} + e_2$$
$$Y_3 = \beta_0 + \beta_1 x_{31} + \beta_2 x_{32} + \cdots \cdots \cdots + \beta_r x_{3r} + e_3$$

$$Y_n = \beta_0 + \beta_{n1} x_{21} + \beta_2 x_{n2} + \cdots \cdots \cdots + \beta_r x_{nr} + e_n$$

Where the error terms are assumed to have the properties

$E(e_i) = 0$

$Var(e_i) = \sigma 2$

$Cov(e_i, e_k) = 0, i \neq j$

In matrix notation, we can write the above model as

$$\begin{bmatrix} Y_1 \\ Y_2 \\ \cdot \\ \cdot \\ Y_2 \end{bmatrix} = \begin{bmatrix} 1 & X_{11} & X_{12} & \cdots & X_{1r} \\ 1 & X_{21} & X_{22} & \cdots & X_{2r} \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ 1 & X_{n1} & X_{n2} & \cdots & X_{nr} \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \cdot \\ \cdot \\ \beta_n \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \\ \cdot \\ \cdot \\ e_n \end{bmatrix}$$

OR $Y = \beta x + e$ And the error property becomes

$E(e) = 0$

$Cov(e) = E(e\, e^1)\, \sigma^2 I$

Where β and σ are unknown

Now the regression equation of Y on X_1, X_2, X_3... is

$\bar{Y} = \beta_0 + \beta_1 \bar{x}_1 + \beta_2 \bar{x}_2 + \beta_3 \bar{x}_3$ equation (I)

The value of the coefficients βi, i = 0, … 3 can be obtained by solving the following normal equations:

$$\left.\begin{aligned} \sum Y &= n\beta_0 + \beta_1 \sum X_1 + \beta_2 \sum X_2 + \beta_3 \sum X_3 \\ \sum X1Y &= \beta_0 \sum X_1 + \beta_1 \sum X_1^2 + \beta 2 \sum X_1 X_2 + \beta_3 \sum X_1 X_3 \\ \sum X2Y &= \beta_0 \sum X_2 + \beta_1 \sum X_2 X_1 + \beta_2 \sum X_1^2 + \beta_3 \sum X_3 X_2 \\ \sum X3Y &= \beta_0 \sum X_3 + \beta_1 \sum X_2 X_1 + \beta_2 \sum X_3 X_2 + \beta_3 \sum X_3^2 \end{aligned}\right\}$$

equation (II)

The table below gives the required values:

	X_1	X_2	X_3	X_1X_2	X_1X_3	X_2X_3	X_1^2	X_2^2	X_3^3	X_1Y	X_2Y	X_3Y
2.5	6	30	16	180	360	1800	36	900	3600	555	2775	5550
3.3	8	33	63	264	205	2079	64	1089	3969	746.4	3078.9	5877.9
109.2	11	36	64	396	704	2304	121	1296	4096	1201.2	3931.2	6988.8
120.0	16	39	65	624	1040	2535	256	1521	4225	1920	4680	7800
118.6	19	43	67	817	1273	2881	361	1849	4489	2253.4	5099.8	7946.2
120.0	21	46	68	966	1428	3128	441	2116	4624	2520	5520	8160
133.0	25	49	69	1225	1725	3381	625	2401	4761	3325	6517	9177
136.5	26	53	70	1378	1820	3710	675	2809	4900	3549	7234.5	9555
134.0	27	55	73	1485	1971	4015	729	3025	5329	3618	7370	9782
140.0	29	57	75	1653	9175	4075	841	3249	5625	4060	7980	10500
1197.1	188	441	674	8988	13000	30108	4149	20245	45618	23748	54186.4	81336.9

This can be represented in matrix form as:

$$\begin{bmatrix} 10 & 188 & 441 & 674 \\ 188 & 4149 & 8988 & 13000 \\ 441 & 8988 & 20255 & 30108 \\ 674 & 13000 & 30108 & 45618 \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \beta_3 \end{bmatrix} = \begin{bmatrix} 1197.7 \\ 23748 \\ 54186.4 \\ 81336.9 \end{bmatrix}$$

Putting in augmented form, we have:

$$\begin{bmatrix} 10 & 188 & 441 & 674 & \cdots & 1197.7 \\ 188 & 4149 & 8988 & 13000 & \cdots & 23748 \\ 441 & 8988 & 20255 & 30108 & \cdots & 54186.4 \\ 674 & 13000 & 30108 & 45618 & \cdots & 81336.9 \end{bmatrix}$$

Subtracting $\frac{188}{10}$ times first row from second row; $\frac{441}{10}$ times first row from third row; $\frac{674}{10}$ times first row from fourth row; finally we subtract $\frac{11.6}{16}$ time 3rd row from 4th row to have

$$\begin{bmatrix} 10 & 188 & 441 & 674 & \cdots & 1197.7 \\ 0 & 614.4 & 697.2 & 328.8 & \cdots & 1231.2 \\ 0 & 0 & 16.0 & 11.6 & \cdots & 28.9 \\ 0 & 0 & 0 & 6.1 & \cdots & 25.9 \end{bmatrix}$$

Detaching the right hand column back to its original place, we have

$$\begin{bmatrix} 10 & 188 & 441 & 674 \\ 0 & 614.4 & 697.2 & 328.8 \\ 0 & 0 & 16.0 & 11.6 \\ 0 & 0 & 0 & 6.1 \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \beta_3 \end{bmatrix} = \begin{bmatrix} 1197.7 \\ 1231.2 \\ 28.9 \\ 25.9 \end{bmatrix}$$

Then by backhand substitution starting from the last row, we have

$6.1\beta_3 = 25.9$

$\beta_3 = 4.25$

$16\beta_2 + 16\beta_3 = 28.9$

$16\beta_2 = 28.9\ (11.6 \times 4.25)$

$\beta_2 = -1.28$

$614.4\beta_1 + 697.2\beta_2 + 16\beta_3 = 1231.2$

$614.4\beta_1 = 1231.2 - (697.2 \times [-1.28] + 328.8 \times 4.25)$

$= 1231.2 - (-892.42 + 1397.4)$

$= 1231.2 - 504.98$

$\beta_1 = 1.18$

$10\beta_0 + 188\beta_1 + 441\beta_2 + 674\beta_3 = 1197.7$

$10\beta_0 = 1197.7 - (188 \times 1.18 + 441 \times (-1.28) \times 674 \times 4.25)$

$= 1197.7 - (221.84 - 564.48 + 28645)$

$= 1197.7 - 2521.86$

$= -1324.16$

$\beta_0 = -132.48$

We now have,

$$\begin{bmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \beta_3 \end{bmatrix} = \begin{bmatrix} -132.42 \\ 1.18 \\ -1.28 \\ 4.5 \end{bmatrix}$$

Substituting with the regression equation, we have

$\overline{Y} = -132.42 + 1.18\overline{x}_1 - 1.28\overline{x}_2 + 4.25\overline{x}_3$

The above equation is the required regression equation of the effect of the advertising technique on the sales of some locally made products in Nigeria. While drawing statistical inference using multiple regressions, it should be noted that the regression coefficient for highly inter-correlated independent variables tend to be unreliable, this is because in highly inter-correlated independent variables, it is extremely difficult to separate the individual influence of each variable. There is a great deal of concern in fields such as econometrics and applied statistics with the problem of inter-correlation among independent variables, often referred to as multi-co linearity, as suggested by Morris Hamburg (2009) that one of the solutions to this problem is to merely discard one of the variables.

2. Hypothesis Testing

Having given a careful analysis of the response, the null and alternative hypothesis related to this work can now be formulated and tested using the likelihood ratio test for the regression parameters.

H0: $U_1 = U_2 = U_3 = 0$; the greater number of sales of these locally made products is influenced by mode of advertising.

H1: $U_1 \neq U_2 \neq U_3 \neq 0$; the greater number of sales of

these locally made products is not influenced by mode of advertising.

ANOVA TABLE

SOURCE OF VARIATION	SUM OF SQUARES	DEGREE OF FREEDOM	MEAN SQUARE
Between samples	11818.7	2	5909.35
Within samples	1612.9	27	59.74
Total	13431.6	29	

The confidence interval for this research is given at α = 99% since 100 questionnaire were distributed and 99 persons returned on record.

The 99 responses represent 99% response rate while the unreturned one represent 1% non-response rate; hence the decision to accept or reject the null hypothesis shall be based on the F – ratio test (F_{α}).

Therefore, $F(2, 27)\alpha = 5.49$

Our rejection rule is to reject H0 if $F_{cal} > F_{tab}$

$F_{cal} = 98.92$

$F_{tab} = 5.49$

We observe that $F_{cal} > F_{tab}$ which falls within the rejection region. Hence we do not have enough statistical evidence to accept H0, so we accept H1 and draw conclusion that the greater sales of these locally made product is influences by mode of advertising.

CONCLUSION

It can be deduced from our findings that the mode of advertising of these products actually influence the number of sales of the products. This could be traced to the fact that the coefficient of regression in radio advertising is higher than that of newspaper and electronic advertising.

The analysis of variance and the statistical hypothesis also confirm this assertion.

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