RESPONSE OF EGG SALES TO NEWSPAPER PROMOTION

by

Erwin Avery Sholts

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1964
STATEMENT BY AUTHOR

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SIGNED: [Signature]

APPROVAL BY THESIS DIRECTOR

This thesis has been approved on the date shown below:

[Signature]  Dec 2, 1963
Robert C. Angus  Date
Assistant Agricultural Professor
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ABSTRACT OF THESIS

RESPONSE OF EGG SALES
TO NEWSPAPER PROMOTION

by

Erwin Avery Sholts

It was the object of this investigation to determine the possibility of altering the quantity of egg sales through the use of newspaper promotion. The nature of the egg advertised, price of the advertised egg, size of the egg advertisement, and the seasonal price index were chosen as factors which might affect consumer purchases of eggs.

Models were developed with egg sales as a function of various combinations of the independent variables. Hypotheses were made concerning the expected relationships between variations in egg sales and each independent variable. The data were fitted to the models and subjected to stepwise multiple regression analysis to estimate the statistical association between variations in the dependent and independent variables.

The regression coefficients produced were generally insignificant. Regression coefficient signs computed were often inconsistent with hypothesized relationships. The
coefficients of multiple determination were small indicating that only a minor part of the variations in egg sales were statistically associated with the independent variables included in the analysis.

Statistical analysis of these data failed to establish the hypothesized relationships. The study did not provide information of sufficient reliability to be used as a basis for modifying egg advertising programs.
CHAPTER I

INTRODUCTION

Retail firms allocate portions of their annual budgets to advertising in an attempt to maintain or extend the level of consumer demand for their products. Knowledge of the effectiveness of advertising and promotion, together with a knowledge of the factors that contribute to making a promotional program effective, could help an industry. This study is an attempt to provide information about consumer response to newspaper advertising of eggs. It is an investigation into promotional activities of a firm and its competitors.

This study is concerned with evaluating the effectiveness of newspaper advertising of eggs. The overall objective of the study is to investigate the sales response to newspaper advertising. A second objective is to suggest ways in which the firm's advertising program might be improved. It is hoped this study might provide information useful to firms involved in egg merchandising and research personnel interested in this problem.

The general problem is embodied in declining per capita egg consumption, \(^1\) and the inelastic demand relationships

\(^1\)Per capita egg consumption for 1961 was estimated at 325. This was a 17 per cent decline from 1951 per capita consumption of 390 (16).
for eggs.\textsuperscript{2} The retail firm is confronted with the problem of decreasing revenue from egg sales as declining per capita consumption is reflected in decreasing consumer demand.

The retail firm must present its products to the consumer in order to effect a transfer. Product promotion or presentation to entice the consumer to buy is often employed. Methods such as point-of-sale promotion, spacious, convenient establishments, rapid, courteous service and branded products are all used to influence the consumer at the point of purchase. Newspaper advertising and retail circulars are frequently used to influence the consumer's point of purchase.

\textsuperscript{2}The price elasticity of demand for eggs as estimated by Brandow was \(-.3\) (15).
CHAPTER II

REVIEW OF LITERATURE

This chapter is a review of the literature reporting research on egg merchandising practices. The scope of this review is directed towards newspaper advertising and its effect on consumer response. No information was discovered concerning the sales response to newspaper advertising of eggs specifically. The review was divided into three major areas: (1) egg promotion, (2) problems in promotion, and (3) problems in evaluating promotional activities.

Egg Promotion

Product Promotion

A basis for promotional activity was set down by E. H. Chamberlain (3) who stated:

A general class of product is differentiated if any significant basis exists for distinguishing the goods (or services) of one seller from another. Such a difference may be real or fancied, so long as it is of any importance whatever to the buyer, and leads to a preference for one variety of product over another. Whenever such differentiation exists, buyers will be paired with sellers, not by chance and at random (as under pure competition) but according to their preference.
The United States Department of Agriculture conducted an investigation into homemakers' use and opinions about eggs in 1958 (2). The results indicated that the homemaker primarily associated the egg with the breakfast meal. The investigators proposed that efforts to increase egg consumption must be geared to efforts to increase the consumers' appreciation of the importance of a good breakfast. They also suggested that eggs need to be promoted as a regular breakfast item in those groups for whom economic factors are less of a barrier to increase consumption. These families live in larger communities and have higher socio-economic status in terms of income and educational levels. This suggestion was based on the finding that the per capita consumption of eggs appeared to decline as the economic status of a consuming unit rose.

Sales Promotion

Kantner (4) believed that, at the very least, prospective customers must be reminded that the product exists before they will consider it as an alternative to some other item. He divided sales promotion into four major categories: advertising, brands, display, and pricing. Some merchants advertise frequently and others not at all. Some sell only brand name products, others promote and advertise unbranded merchandise. In 1949 Kantner reported that only 6 per cent of the stores surveyed in the New York area were doing newspaper advertising
of eggs, and only 4 per cent were using in-store advertising. In 1950 Cray (5) reported that only 15.4 per cent of the independent stores in the Cleveland area used advertising to promote the sale of eggs. In this survey managers of 1500 stores were interviewed and information was secured from 1200 of these stores which sold eggs. Similar data were secured from chain organizations operating 379 individual stores in Cleveland. In this group all the stores used advertising to promote the sale of eggs. Newspapers were one media used by all stores in this group.

Bivins (6) questioned whether advertising could increase sales of food products either as a category or as a brand within a category. Advertising, he felt, has two objectives: (1) to increase consumption of some commodity at a given price and (2) to increase a commodity's share of a particular market. Bivins indicated that large promotional expenditures were encountered in competitive rivalry with particular product categories, and that production efficiencies may be offset by costly promotional activities of this type.

Baker and Bylund (7) conducted a study to determine the effectiveness of promotion for a better breakfast and cited the importance of newspapers as an advertising media. A concentrated program was undertaken to focus consumer attention on eggs as a healthful food. Newspaper articles,
School demonstrations, television, and point-of-sale advertising were all employed in disseminating the information. Following the program 243 persons were interviewed and 91 per cent appeared to be aware of the program. Newspaper advertising accounted for 58 per cent of the ascertained source of information. Egg consumption in the study area increased 36 per cent during the program. A 4 per cent increase was indicated in another city with no promotional program.

Problems in Promotion

Psychological Problems in Promotion

Bayton (8) calls attention to seven aspects of psychological problems involved in the promotion of farm products. These problem areas exist for the promotion of any commodity. The aspects to be discussed include the role of context, discriminating cues and cue-expectancies, the habit purchase, barrier profiles, sociometric patterns in purchase decisions, psychological factors in consumer behavior as a function of market segments, and psychological problems within the distribution channel.

In a concentrated effort to promote a given product an error may be made in forgetting a fundamental psychological principle. This principle is that response to a particular stimulus may be a function of the context within which
this stimulus exists. For some people specific food products are associated with a specific meal. For others specific food products are associated with different attributes such as taste and nutritive value. Still others may hold specific food products within a time factor context relative to the time for a given meal. A better understanding of the context within which consumers hold a given product may help to promote the product more effectively.

Discriminating cues and cue-expectancies refer to those attributes of a product that set it apart from other products, insofar as the consumers' perception is concerned. The problem here is determining which cue or cues are most critical in the decision-making process of the consumer. Another problem is the determination of which cue-expectancies are most critical in differentiation of one product from another. Two products may be different but many consumers might expect much the same things from two different products, such as vitamins, minerals, and pleasant taste. This is the psychological basis which may permit substitution of one product for another when the ends sought are the same. Other problems pointed out were the relevance and validity of cue-expectancies envisioned by consumers. It was pointed out that one of the key difficulties in the promotion of agriculture fibers as against synthetic fibers is that consumers are confused as to what are the valid cues.
There are purchases that are based upon practically no decision-making activity. This refers to the habit purchase concept. The problem is how to promote a product when consumers are using a competitive product on a habit-bound basis.

The problem of barrier profiles was discussed by Bayton (8). This refers to consumer adherence to one product and rejection of competing products. The question is why consumers choose particular products and why they reject others. A better understanding of this area through investigation might provide a firmer foundation for developing product promotion.

In research on barrier profiles Bayton found that in many instances family objection was a strong barrier to the use of a food product. He termed this a sociometric problem and indicated that when individuals other than the purchaser influence purchase decisions there is a need for investigation of the influencing unit.

In discussing psychological factors in consumer behavior as a function of market segments Bayton raised the question as to whether the factors discussed operated in the same way across socio-economic lines. He also suggested that the problem might exist in terms of segmenting the market by region such as urban, rural, or suburban. Knowledge of how the factors vary across socio-economic
lines and vary between regions may reveal the extent to which a promotional program has to be tailored to particular market segments.

Bayton also discussed distribution channels. He points out that whenever people take part in a process, their behavior must be taken into consideration. Decisions made by individuals involved in processing, product developing, promoting, wholesaling and retailing will all have an effect upon what the consumer will find available. It would appear that better knowledge of the decision-making process and the factors influencing it within the distribution channel would aid in the promotion of farm products.

**Extent of Promotion**

For many years advertising and promotion have been basic tools in aiding production and distribution. Indications are that these tools have become more important in recent years. This is attested to by the growth in expenditures for advertising and promotion. In 1960 11.9 billion was spent for promotion, a 6 per cent increase over 1959 and double the amount of ten years earlier (11).

**Problems in Developing a Promotional Program**

Hoofnagle (11) indicates some of the problems management faces in the use of advertising and promotion. In formulating a promotional program management must wrestle
with the following problems: should we advertise, how should we advertise, to what market segment or segments should promotion be directed, and what form should the promotion take. In many cases the firm must rely upon individual judgment in arriving at decisions. A program developed upon individual judgment may or may not produce the most effective results. So long as this situation exists advertising and promotion, except by chance, may never realize their maximum potential.

Problems in Evaluating Promotion Activities

Weber (10) says that it is impossible to quantify objectively the effectiveness of promotion because it is not a separate entity and cannot be considered by itself. He further states that even if it could be assumed a separate entity it would be impossible to measure effectively because of the unmeasurable and unpredictable known and unknown factors. He says that it is naive to think that through research we can conclude that an investment of x dollars can be expected to produce Y-units of sales. In his article Weber discusses some of the factors involved and the problems associated with them.
General Economic Conditions

The individual's economic condition may be a factor. The problem then arises as to how to handle this factor statistically. Handling the problem on an individual basis would be meaningless. Handling this problem on a local or national basis would also be impractical because one may not be representative of the other. Even if a valid indicator could be developed it might not provide for an increased response to promotion in general, more especially in the short run. After economic recovery from a recession has taken place the populous may be required to channel its surplus income into recovering from losses, repaying deferred debts, and replenishing depleted bank deposits. The effects on promotion after recovery for different products need not be in the same direction or of the same intensity as the indicator. Food promotion may be more effective in the immediate post recovery period because people may be first interested in enhancing their diets. A promotion on clothing may be less effective as consumers are catching up on necessities, while in a later period promotion on clothing may prove quite effective.

Market Conditions

In attempting to set up a control situation to investigate the effectiveness of a given firm's promotional
activities changes may occur within the market area or another assessable market area which negate the results. Competing firms may respond quickly and in different degrees of vigor to a competitor's promotional efforts. New firms may enter the market and old firms may change their size and scope of operation thereby changing the competitive relationship of the competing firms.

Factors Within the Firm

Changes in management personnel or policy and changes in sales personnel during an investigation may have an effect on the sales. Changes such as these introduce an unmeasurable factor in the researcher's point of view. However, Weber (10) feels that even in the face of such problems research into the effectiveness of advertising in expanding the market for agricultural products should be attempted.

He feels that the economist's approach to this problem should not be as the physical scientist does, in terms of segregation and quantification of the factors, but as the social scientist does, realizing that he's dealing with human beings with a free choice. Weber suggests the question by agricultural economists should not be is promotion effective, but rather what factors go into promotion and how can we improve them.
CHAPTER III

PROCEDURE

The study was undertaken to investigate sales response to newspaper advertising in the major population centers of Arizona. Phoenix, Tucson, Yuma, and Flagstaff were included. These cities represent approximately 85 per cent of Arizona's population. A firm was selected which operated retail outlets in all these areas and which carried on a program of newspaper advertising. The firm's entire network of retail outlets obtained eggs from a centrally located distributor.

It was hypothesized that the quantity of eggs sold was a function of the following:

1. Price of the firm's sale egg
2. Price of the competitor's sale egg
3. Quantity of firm advertising
4. Quantity of competitor advertising
5. Seasonal price movements

Data were obtained from four sources: the supplier, the firm, daily newspapers, and statistical bulletins.

A seasonal price index for eggs was developed to establish an independent variable representing seasonal
price variation. Price data were not available for the Arizona egg market. Los Angeles, California, price quotations were used because a major percentage of the eggs supplied to the firm originated in southern California (14). Several alternative price quotations were available. The price per dozen eggs when sold in carton lots was selected because the firm purchased all eggs in this way. A six-year moving average was used in the computations because Los Angeles price data were incomplete for all years prior to 1957. The Foote and Fox computational method was used to determine the seasonal price variation (13).

The total quantity of eggs sold by the firm under consideration was also obtained and represents a delivery minus returns figure. This information was obtained for the total quantity of each grade and size of egg sold within the firm's entire retail system on a weekly basis.

Information regarding the retail price, size, and quality of the advertised egg were obtained for the firm under consideration and for all competing firms advertising eggs on the same day. These data were obtained for each area from the daily newspapers for 1961 and 1962. The firm under consideration advertised consistently on a bi-weekly basis. Its competitors generally followed the same procedure. Data taken from newspaper advertisements
included the size of advertisement,\textsuperscript{1} quantity of advertisement allotted to eggs,\textsuperscript{2} type of advertisement,\textsuperscript{3} and total number of items in the advertisement.\textsuperscript{4} The data, therefore, represented quantitative measurements of egg advertising by the firm and its competitors.

A problem of determining the quantity of sales for the advertised egg was encountered. Firm records did not include sales by grade in each area. The data provided the total quantity of all eggs moving through each area per week. However the weekly quantities of each size and grade of egg moving through the entire system was available. The supplier indicated that each area received approximately the same mix of eggs. Thus the percentage of the sale egg sold in each area was approximately the same as the percentage sold throughout the system. The percentages were applied to corresponding weekly total egg sales in each area producing an estimate of eggs sold by size and grade.

\textsuperscript{1}Recorded in code form using 1, 2, 3, referring to full page, three-quarter page, and half page advertisements respectively.

\textsuperscript{2}Size of ad allotted to eggs estimated in square inches.

\textsuperscript{3}Recorded in code form using 1, 2, 3, referring to plain newsprint; picture and newsprint; and picture, newsprint, and color respectively.

\textsuperscript{4}Recorded in code form 1, 2, 3, referring to 0-20 items, 20-30 items, and 30 or over items respectively.
Prices of competitors' eggs by size and grade were generally obtainable from the newspapers. The problem of how to combine these prices was handled arbitrarily. No single price was representative of competitors' egg price because more than one size and quality were offered at different prices by competitors. Observation of the data indicated that approximately 95 per cent of the eggs advertised by competitors were of the same size and quality or of higher quality than the firm's advertised egg. The arithmetic mean for eggs of the same size and of higher quality was used to represent competing egg prices.

The firm indicated that three sizes of eggs were used in its newspaper advertising program. It also indicated that egg quality remained constant at the grade A level when the size of the egg promoted varied. The three sizes of eggs advertised were large, medium, and small, all of the same brand. The large grade A egg appeared in approximately 94 per cent of the firm's weekday advertisements and 99 per cent of weekend advertisements. The large grade A was dominant in the advertising and was selected to represent the firm's sale egg.

One of the assumptions associated with multiple regression analysis is a lack of correlation between independent variables. Graphic comparisons were made to examine the independence of independent variables and to discover the relationships between the dependent and independent variables.
The price of the advertised egg and quantity of space allotted to the egg in the overall advertisement were graphed in an attempt to establish a relationship. The data were plotted for each area for 1962. A cluster pattern was observed in each case with no linear relationship evident (Figures 1-4). This indicates that a change in price is not necessarily associated with a change in quantity of advertising by the firm.

Several series were plotted against time to discover interrelated movements with respect to time. The items plotted included the seasonal price index, total quantity of all eggs sold, size of the firm's egg advertisement, quantity of sale eggs sold, price of the firm's sale egg, and the wholesale price of eggs to the firm. The time series were plotted weekly because all data, except the seasonal price index, were calculated on a weekly basis. The seasonal price index was plotted with each entry centered on the month it represented (Figures 5-6). The graphs showed relatively little correlation between the factors, taken three at a time, with the exception of the relationship between wholesale prices and the price of sale eggs. This relationship, between the wholesale prices and the price of the firm's sale egg, results from the firm's pricing policies. A 25 per cent mark-up on sale eggs over the wholesale price was the general policy.
Figure 1

Firm sale egg price plotted against quantity of firm advertising for Phoenix area data
Figure 2

Firm sale egg price plotted against quantity of firm advertising for Tucson area data
Figure 3

Firm sale egg price plotted against quantity of firm advertising for Yuma area data
Figure 4

Firm sale egg price plotted against quantity of firm advertising for Flagstaff area data
Comparison of variations over time between Quantity of sale eggs sold, Quantity of firm advertising, and Price of the firm's sale egg. Phoenix area data were used which represented 80 percent of the firm's egg sales.
Figure 6:
Comparison of variations over time between Total quantity of eggs sold, Wholesale price of the firm's sale egg, and Seasonal price movements. Data used are representative of the firms entire retail system.
The graphic analysis showed little correlation between the factors. It was decided that statistical techniques should be applied to the data in hope of obtaining more comprehensive analysis.

Models were developed in an attempt to provide meaningful hypotheses about the effectiveness of newspaper advertising of eggs. The data for each model were subjected to stepwise multiple regression analysis. The models were constructed with quantity sold by the firm as the dependent variable expressed as a function of several independent variables. The statistical procedures give quantitative measurements of the associations between the dependent and independent variables as well as measures of the reliability of the associations. It was hoped that these models would yield reliable information with which to evaluate the advertising program.
CHAPTER IV
MODELS TESTED AND RESULTS

Statistical models were developed to determine the sales response to newspaper advertising of eggs. This chapter will be devoted to a description and discussion of the various models used.

Model No. I

\[ Y = F(C + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5) \]

C = constant

Y = quantity of 30 dozen cases of eggs sold by the firm

X_1 = price per dozen of firm's sale egg

X_2 = seasonal price index

X_3 = quantity of firm's egg advertisement in square inches

X_4 = total quantity of all competing egg advertising in square inches

X_5 = price per dozen of competitor's advertised egg

The hypotheses concerning this model are as follows:

1. The quantity of eggs sold by the firm varies inversely with the price of the firm's sale egg, the seasonal price index, and the total quantity of competitors' advertising producing negative regression coefficients.
2. The quantity of eggs sold varies directly with the price of competitors' advertised egg and the quantity of the firm's own advertisement producing positive regression coefficients.

Model No. I was tested for each area and for the composite of all areas. The results will be discussed in the aggregate and then for each individual area.

The following estimates were produced for Model No. I when the aggregate data were subjected to stepwise regression analysis.

| TABLE I.--Model No. I Statistics for Aggregate Data |
|------------------|------------------|------------------|------------------|------------------|
|                  | \( b_1 \)         | \( b_2 \)         | \( b_3 \)         | \( b_4 \)         | \( b_5 \)         |
| b1               | -9.5048           | 9.1507            | 31.3575           | -1.4090           | .9764             |
| Sb1              | 20.1254           | 10.9477           | 8.3629            | 2.4838            | .4238             |
| F                | .22               | .70               | 14.06*            | .32               | 5.32*             |
| \( R^2 = .1053 \); Sy. X = 632.1952; D. F. = 187; F = 4.40 | |
| C                | 607.4177          | \( \bar{Y} = 469 \) |

*Indicates significance at the 5 per cent level.

The F values computed for quantity of the firm's advertisement and price of competitors' advertised egg exceeded the tabular value required for significance at the 5 per cent level, implying that the regression coefficients of these two independent variables were significantly
different from zero. The regression coefficients for the remaining three independent variables were not significant. The regression coefficient for the seasonal price index was inconsistent with the hypotheses because the positive sign produced implies a positive relationship between the price index and quantity sold. The other regression coefficient signs were consistent with the hypotheses.

The coefficient of multiple determination was not large indicating that only a small part of variation in egg sales can be statistically associated with the independent variables included in the analysis.

The model produced the following estimates when the data for the Tucson area were subjected to stepwise multiple regression analysis.

TABLE 2.--Model No. I Statistics for Tucson Area Data.

<table>
<thead>
<tr>
<th></th>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$X_3$</th>
<th>$X_4$</th>
<th>$X_5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b_i$</td>
<td>2.3417</td>
<td>-1.1227</td>
<td>.2103</td>
<td>.3321</td>
<td>.0801</td>
</tr>
<tr>
<td>$Sb_i$</td>
<td>2.6594</td>
<td>1.5067</td>
<td>.9859</td>
<td>.4477</td>
<td>.0923</td>
</tr>
<tr>
<td>$F$</td>
<td>.78</td>
<td>.56</td>
<td>.05</td>
<td>.55</td>
<td>.75</td>
</tr>
</tbody>
</table>

$R^2 = .0817; \text{Sy. } X = 37.7048; \text{D. F. } = 45; F = .80$

$C = 102.3622; \overline{Y} = 140$
The F values computed for this area were all smaller than the tabular value required for significance at the 5 per cent level. This reflects small regression coefficients relative to their standard errors. Several regression coefficients were inconsistent with the hypotheses because the signs were not as expected. Inverse relationships were hypothesized for price of the firm's sale egg and quantity of competitors' advertisement but the signs computed were positive. This implies that a rise in the firm's sale egg price and an increase in competitor advertising were associated with an increase in quantity sold; however the regression coefficient signs were not as anticipated. The signs for the regression coefficients of the remaining three independent variables were consistent with hypothesized relationships.

A small coefficient of multiple determination coupled with the lack of significant regression coefficients and inconsistent signs presents a situation where little can be concluded about associations between the dependent and independent variables.

The estimates for Phoenix were larger than those produced in Tucson. The following estimates were obtained:
TABLE 3.--Model No. I Statistics for Phoenix Area Data.

<table>
<thead>
<tr>
<th></th>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$X_3$</th>
<th>$X_4$</th>
<th>$X_5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b_1$</td>
<td>36.3290</td>
<td>-18.7588</td>
<td>9.6752</td>
<td>5.1945</td>
<td>.4537</td>
</tr>
<tr>
<td>S$b_1$</td>
<td>13.6431</td>
<td>7.9208</td>
<td>4.6618</td>
<td>1.8203</td>
<td>.3643</td>
</tr>
<tr>
<td>$F$</td>
<td>7.09*</td>
<td>5.61*</td>
<td>4.31</td>
<td>8.14*</td>
<td>1.55</td>
</tr>
</tbody>
</table>

$R^2 = .4057; \text{Sy. } X = 209.6000; \text{D. F. } = 44; F = 6.01$

$C = 1382.0621; \overline{Y} = 1656$

*Indicates significance at the 5 per cent level.

The $F$ values computed for the price of competitors' advertised egg and quantity of the firm's advertisement were below the tabular value required for significance at the 5 per cent level, again reflecting small regression coefficients relative to their standard errors. The $F$ values computed for the three other independent variables exceeded the value indicating significance. Two of the regression coefficients were again inconsistent with the hypotheses concerning signs. Negative relationships between egg sales and price of the firm's sale egg and quantity of competitor advertising were hypothesized. The regression coefficients for these variables were significant and had positive signs. This implies that a rise in price of the firm's sale egg and an increase in competitor advertising are associated with increased egg sales. The regression coefficient signs of the remaining three variables were as hypothesized.
The coefficient of multiple determination was the largest one found (.4057), implying that variations in the independent variables were associated with approximately 41 per cent of the variation in egg sales. The associations found were in some cases conflicting with those proposed.

The model produced the following estimates when data for the Yuma area were processed.

TABLE 4.--Model No. I Statistics for Yuma Area Data.

<table>
<thead>
<tr>
<th></th>
<th>( X_1 )</th>
<th>( X_2 )</th>
<th>( X_3 )</th>
<th>( X_4 )</th>
<th>( X_5 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( b_1 )</td>
<td>.8982</td>
<td>-.2076</td>
<td>-.3905</td>
<td>-.2562</td>
<td>.0543</td>
</tr>
<tr>
<td>( Sb_1 )</td>
<td>.8024</td>
<td>.4243</td>
<td>.7194</td>
<td>.1003</td>
<td>.0612</td>
</tr>
<tr>
<td>( F )</td>
<td>1.25</td>
<td>.24</td>
<td>.29</td>
<td>6.53*</td>
<td>11.19*</td>
</tr>
</tbody>
</table>

\[ R^2 = .3749; \text{Sy. } X = 13.3753; \text{D. F. } = 44; \text{F } = 5.28 \]
\[ G = 10.2753; \bar{Y} = 60.3 \]

*Indicates significance at the 5 per cent level.

F values computed for price of the firm's sale egg, quantity of firm advertising, and the seasonal price index were all below the tabular figure required for significance at the 5 per cent level. F values computed for the quantity of competitor advertising and the price of competitors' sale egg were significant implying large regression coefficients relative to their standard errors; however the signs of the regression coefficients were inconsistent with those
hypothesized. The anticipated signs for the price of the firm's sale egg and quantity of competitors' advertising were negative and those computed were positive. The quantity of competitors' advertising, with a positive sign and a significant regression coefficient, implies a direct relationship between egg sales and competitor advertising. This relationship contradicts the hypotheses. The only independent variable with a significant regression coefficient and a sign in agreement with the hypotheses was the price of competitors' sale egg.

The coefficient of multiple determination was small indicating that only a small proportion of the variation in egg sales was associated with variations in the independent variables.

Model No. I yielded the following estimates when data for the Flagstaff area were subjected to stepwise multiple regression analysis.

**TABLE 5.--Model No. I Statistics for Flagstaff Area Data.**

<table>
<thead>
<tr>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$X_3$</th>
<th>$X_4$</th>
<th>$X_5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b_1$</td>
<td>-1.12924</td>
<td>.1768</td>
<td>-.4637</td>
<td>.1842</td>
</tr>
<tr>
<td>$Sb_1$</td>
<td>1.1153</td>
<td>.5961</td>
<td>.6507</td>
<td>.1546</td>
</tr>
<tr>
<td>$F$</td>
<td>1.34</td>
<td>.09</td>
<td>.51</td>
<td>1.42</td>
</tr>
</tbody>
</table>

$R^2 = .1373; \ Sy. X = 15.0759; \ D. F. = 36; \ F = 1.15;$

$C = 93.8508; \ \overline{Y} = 58.5$
The F values computed for all five independent variables were well below the tabular value (4.46), implying very small regression coefficients relative to their standard errors. The regression coefficient sign for the price of the firm's sale egg agreed with the hypotheses. Regression coefficient signs for the remaining four independent variables were not as hypothesized. Implications of these signs will not be discussed because the regression coefficients were not significantly different from zero.

A small coefficient of multiple determination and insignificant regression coefficients again present a situation where little can be concluded about associations between the dependent and independent variables.

Model No. I was developed to evaluate the effectiveness of newspaper advertising of eggs. It was hoped that this model would yield reliable information with which to evaluate the firm's advertising program. The data failed to establish any significant relationship between advertising and quantity of egg sales. The results produced were generally not significant and often inconsistent with the hypotheses.

Model No. II

\[ Y = F(C + b_1X_1 + b_2X_2 + b_3X_3) \]

\[ C = \text{constant} \]

\[ Y = \text{quantity of 30 dozen cases of eggs sold by firm} \]
The problem of determining sales response to newspaper advertising was reconsidered. It was hypothesized that sales might depend upon price differences between eggs advertised by the firm and its competitors. A measure of the relative quantities of advertising by the firm and its competitors was proposed as the second independent variables. The other variable used in this model represents seasonal price movements.

The hypotheses concerning this model are as follows:

1. The quantity of eggs sold by the firm will be inversely related to the price of the firm's sale egg minus the price of competitors' sale egg.

2. The quantity of eggs sold by the firm will be directly related to the ratio of advertising quantities producing positive regression coefficients.

3. The quantity of eggs sold by the firm will be inversely related to the seasonal price index producing negative regression coefficients.

This model was tested for the Tucson, Phoenix, and Yuma areas in aggregate and for each area individually. The Flagstaff data were not included in this test.

Model No. II produced the following estimates when the aggregate data were subjected to stepwise multiple regression analysis.
TABLE 6.--Model No. II Statistics for Aggregate Data.

<table>
<thead>
<tr>
<th></th>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$X_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>bi</td>
<td>123.9501</td>
<td>-3.7038</td>
<td>153.5580</td>
</tr>
<tr>
<td>Sbi</td>
<td>70.7583</td>
<td>26.4488</td>
<td>89.5548</td>
</tr>
<tr>
<td>F</td>
<td>3.07</td>
<td>.02</td>
<td>2.94</td>
</tr>
</tbody>
</table>

$R^2 = .0517; \text{Sy. } X = 2321.0468; \text{D. F.} = 180; F = 2.22$
$C = 2172.5329; \bar{Y} = 469.00$

The $F$ values computed all were below the tabular value (8.62) required for significance at the 5 per cent level, implying small regression coefficients relative to their standard errors. The regression coefficient signs were all in disagreement with the hypotheses.

The coefficient of multiple determination was small indicating little or no statistical association between the dependent and independent variables.

The model produced the following results when data for the Tucson area were subjected to stepwise multiple regression analysis.

TABLE 7.--Model No. II Statistics for Tucson Area Data.

<table>
<thead>
<tr>
<th></th>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$X_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>bi</td>
<td>-2.0254</td>
<td>.1459</td>
<td>-11.0562</td>
</tr>
<tr>
<td>Sbi</td>
<td>19.6055</td>
<td>7.1873</td>
<td>35.8282</td>
</tr>
<tr>
<td>F</td>
<td>.01</td>
<td>.00</td>
<td>.10</td>
</tr>
</tbody>
</table>

$R^2 = .0022; \text{Sy. } X = 388.9879; \text{D. F.} = 45; F = .45$
$C = 1362.1924; \bar{Y} = 140$
The F values computed were all below the tabular figure indicating significance at the 5 percent level reflecting small regression coefficients relative to their standard errors. The regression coefficient signs were all in agreement with the hypotheses.

The coefficient of multiple determination was very small. These results reflect a failure to find statistical association between the dependent and independent variables for the Tucson area.

The model produced the following estimates when data for the Phoenix area were subjected to the process.

**TABLE 8.**—Model No. II Statistics for Phoenix Area Data.

<table>
<thead>
<tr>
<th></th>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$X_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b_i$</td>
<td>95.9568</td>
<td>-2.7149</td>
<td>-284.7548</td>
</tr>
<tr>
<td>S$b_i$</td>
<td>102.7668</td>
<td>42.1213</td>
<td>117.0962</td>
</tr>
<tr>
<td>$F$</td>
<td>.87</td>
<td>.00</td>
<td>5.91</td>
</tr>
</tbody>
</table>

$R^2 = .1559$; $\text{Sy. X} = 2022.3968$; D. F. 38; $F = 2.35$

$C = 6292.7426$; $\overline{Y} = 1656.00$

The F values computed were all below the tabular value required for significance at the 5 percent level, implying small regression coefficients relative to their standard errors. Two regression coefficients were inconsistent with
the hypotheses because the signs were not as anticipated. The expected sign for the price difference was negative, the computed sign was positive. The expected sign for the ratio of advertising was positive, the computed sign was negative. The implications of these signs will not be discussed because the regression coefficients produced were not significantly different from zero. The regression coefficient for the seasonal price index was in agreement with the hypotheses.

The coefficient of multiple determination computed was not large implying that only a small part of variation in egg sales can be statistically associated with the independent variables included in the analysis.

The model produced the following estimates when data for the Yuma area were subjected to this process.

**TABLE 9.--Model No. II Statistics for Yuma Area Data.**

<table>
<thead>
<tr>
<th></th>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$X_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>bi</td>
<td>18.3575</td>
<td>2.2101</td>
<td>-14.7564</td>
</tr>
<tr>
<td>Sbi</td>
<td>11.3233</td>
<td>3.2779</td>
<td>14.7736</td>
</tr>
<tr>
<td>F</td>
<td>2.63</td>
<td>.45</td>
<td>1.00</td>
</tr>
</tbody>
</table>

$R^2 = .0859; \text{Sy. } X = 157.6950; \text{D. F. } = 35; F = 1.10$

$C = 413.8879; \bar{Y} = 60.3$
The F values computed again were all below tabular value required for significance. The regression coefficient for the price difference was inconsistent with the hypotheses because the sign was not as expected. The regression coefficients for the remaining two variables were in agreement with the hypotheses.

The coefficient of multiple determination was again small indicating that only a small part of variation in the dependent variable can be statistically associated with the independent variables included in the analysis.

Model No. II produced results paralleling the results produced by Model No. I. The data again failed to establish any significant relationship between advertising and quantity of egg sales. The estimates were generally not significant and often inconsistent with the hypotheses. The decision was made to develop a third model in an attempt to provide significant and consistent estimates.

**Model No. III**

\[ Y = F(C + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4) \]

- \( Y \) = quantity of 30 dozen cases of sale eggs sold by the firm
- \( X_1 \) = price per dozen of firm's sale egg
- \( X_2 \) = quantity of firm's advertisement in square inches
- \( X_3 \) = quantity of all competing advertising in square inches
- \( X_4 \) = price per dozen of competitors' advertised egg
The data and the previous two models were reviewed. The decision was made to drop the seasonal price index variable and to change the dependent variable from total eggs sold to sale eggs sold. The hypothesis was that quantity of sale eggs sold might be more closely associated with advertising than total quantity of egg sales. The decision to drop the seasonal price index was based upon the fact that it was generally not significant and a feeling of doubt about its overall importance.

The hypotheses concerning this model are as follows:

1. The price of the firm's sale egg and quantity of competitor advertising varies inversely with the quantity of sale eggs sold by the firm.

2. The price of competitors' sale egg and quantity of the firm's advertising varies directly with quantity of sale eggs sold by the firm.

This model was tested for the four areas as a composite and for each area individually.

The model produced the following estimates when the aggregate data were subjected to stepwise multiple regression analysis.

### TABLE 10.--Model No. III Statistics for Aggregate Data.

<table>
<thead>
<tr>
<th>X₁</th>
<th>X₂</th>
<th>X₃</th>
<th>X₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>bi</td>
<td>14.3392</td>
<td>.7107</td>
<td>-1.17653</td>
</tr>
<tr>
<td>Sbi</td>
<td>6.4139</td>
<td>9.4171</td>
<td>1.9317</td>
</tr>
<tr>
<td>F</td>
<td>5.07</td>
<td>.01</td>
<td>.84</td>
</tr>
</tbody>
</table>

\[ R^2 = .0956; \text{Sy. } X = 497.8942; \text{D. F. } = 180; F = 4.73 \]
\[ C = 69.1456; \bar{Y} = 392 \]
The F values computed for this area were all smaller than the tabular value (5.72) required for significance at the 5 per cent level, implying small regression coefficients relative to their standard errors. The computed regression coefficient for price of the firm's sale egg was inconsistent with the hypotheses because the sign was not as expected. The regression coefficients produced for the remaining three independent variables were in agreement with the hypotheses.

The coefficient of multiple determination was small indicating that only a minor portion of variation in egg sales can be statistically associated with the independent variables included in the analysis.

The model produced the following estimates when data for the Tucson area were subjected to stepwise multiple regression analysis.

TABLE 11.--Model No. III Statistics for Tucson Area Data.

<table>
<thead>
<tr>
<th></th>
<th>X₁</th>
<th>X₂</th>
<th>X₃</th>
<th>X₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>bi</td>
<td>.3208</td>
<td>-.0199</td>
<td>.3907</td>
<td>.0974</td>
</tr>
<tr>
<td>Sbi</td>
<td>.7672</td>
<td>1.3082</td>
<td>.3325</td>
<td>.0750</td>
</tr>
<tr>
<td>F</td>
<td>.17</td>
<td>.00</td>
<td>1.38</td>
<td>1.69</td>
</tr>
</tbody>
</table>

\[ R^2 = .0813; \text{Sy. X} = 30.7891; \text{D. F.} = 46; F = 1.02 \]
\[ C = 55.1844; \bar{Y} = 112 \]
The F values computed were all well below the tabular value required for significance at the 5 per cent level, implying small regression coefficients relative to their standard errors. The regression coefficient signs computed for the price of the firm's sale egg, quantity of firm advertising, and quantity of competitors' advertising were all inconsistent with the hypotheses. The computed regression coefficient sign for price of competitors' sale egg was positive as expected.

The coefficient of multiple determination was small. These results again imply small statistical associations between the dependent and independent variables included in the analysis.

The model produced the following estimates when data for the Phoenix area were subjected to the process.

**TABLE 12.--Model No. III Statistics for Phoenix Area Data.**

<table>
<thead>
<tr>
<th></th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
</tr>
</thead>
<tbody>
<tr>
<td>bi</td>
<td>9.8669</td>
<td>6.9610</td>
<td>2.7025</td>
<td>.1215</td>
</tr>
<tr>
<td>Sbi</td>
<td>4.4549</td>
<td>8.2615</td>
<td>1.8141</td>
<td>.5936</td>
</tr>
<tr>
<td>F</td>
<td>4.91</td>
<td>.71</td>
<td>2.22</td>
<td>.04</td>
</tr>
</tbody>
</table>

R^2 = .1774; Sy. X = 211.3771; D. F. = 45; F = 2.44

C = 655.1933; \( \bar{Y} = 1250.75 \)
The F values produced were again all smaller than the tabular value required for significance at the 5 per cent level, implying small regression coefficients relative to their standard errors. The regression coefficient computed for price of the firm's sale egg and quantity of competitors' advertising were inconsistent with the hypotheses because the signs were not as anticipated. The expected signs were negative but the computed signs were positive. The signs produced for the remaining variables were in agreement with the hypotheses.

The coefficient of multiple determination was small implying that only a small part of variations in egg sales can be statistically associated with the independent variables.

The model produced the following results when data for the Yuma area were subjected to the process.

**TABLE 13.--Model No. III Statistics for Yuma Area Data.**

<table>
<thead>
<tr>
<th></th>
<th>X₁</th>
<th>X₂</th>
<th>X₃</th>
<th>X₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>bi</td>
<td>-.3886</td>
<td>.4393</td>
<td>.2839</td>
<td>.1234</td>
</tr>
<tr>
<td>Sbi</td>
<td>.6250</td>
<td>.5606</td>
<td>.1001</td>
<td>.0435</td>
</tr>
<tr>
<td>F</td>
<td>.39</td>
<td>.61</td>
<td>8.05*</td>
<td>8.02*</td>
</tr>
</tbody>
</table>

\[ R^2 = 2356; \ Sy. X = 11.9486; \ D. F. = 43; \ F = 3.31 \]

\[ C = 2.5114; \ \bar{Y} = 49.70 \]

*Indicating significance at the 5 per cent level.
The F values computed for price of the firm's sale egg and quantity of the firm's advertising were below the tabular value indicating significance at the 5 per cent level, implying small regression coefficients relative to standard errors. F values produced for price of competitors' sale egg and quantity of competitor advertising exceeded the tabular value (5.73) required for significance. The computed regression coefficient sign for quantity of competitors' advertising was inconsistent with the hypotheses. The expected sign was negative but the computed sign was positive. The signs produced for the remaining three independent variables were as expected. The regression coefficients for price of competitors' sale egg and quantity of competitor advertising are significantly associated with variations in the dependent variable. The positive signs of these two variables indicate that they vary directly with the dependent variable.

The coefficient of multiple determination was not large indicating that only a small part of the total variation in egg sales can be statistically associated with the independent variables involved.

The model produced the following estimates when data for the Flagstaff area were subjected to the process.
**TABLE 14.**—Model No. III Statistics for Flagstaff Area Data.

<table>
<thead>
<tr>
<th></th>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$X_3$</th>
<th>$X_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b_i$</td>
<td>-.4566</td>
<td>.3499</td>
<td>.0182</td>
<td>-.0381</td>
</tr>
<tr>
<td>Sbi</td>
<td>.5380</td>
<td>.8028</td>
<td>.1486</td>
<td>.0892</td>
</tr>
<tr>
<td>F</td>
<td>.72</td>
<td>.91</td>
<td>.02</td>
<td>.18</td>
</tr>
</tbody>
</table>

$R^2 = .0451$; $Sy_X = 12.5011$; D. F. = 26; $F = .31$

$C = 38.5612$; $\bar{Y} = 40.24$

The F values computed were all below the tabular level required for significance at the 5 per cent level, indicating small regression coefficients relative to their standard errors. The only regression coefficient sign in agreement with the hypotheses was the sign computed for price of the firm's sale egg.

The coefficient of multiple determination was very small indicating little or no statistical association between variations in the dependent and independent variables included in the analysis.

The estimates produced by the data when subjected to this model parallel the results of Model I and II. Generally the regression coefficients computed were not significantly different from zero. The regression coefficient signs were often in conflict with the hypotheses and the coefficients of multiple determination were all small.
CHAPTER V

SUMMARY AND CONCLUSIONS

This study was undertaken to investigate sales response to newspaper advertising. It was hypothesized that egg sales were a function of several independent variables associated with newspaper advertising and seasonal price movements. The independent variables included in the analysis were price per dozen of the firm's sale egg, price per dozen of competitively advertised egg, the quantity of firm advertising, the quantity competitor advertising, and the seasonal price index for eggs. Models were developed with egg sales as a function of various combinations of these variables.

The data were fitted to the models and tested by stepwise multiple regression analysis. The tests were designed to indicate the statistical association between variations in egg sales and the independent variables. Hypotheses were made concerning the direction of associations between variations in the dependent variable and each independent variable. Large statistical associations between variations in egg sales and the independent variables would indicate that a large part of variations in egg sales could
be associated with variations in the independent variables.

The regression coefficients produced in testing the data were generally not significant, implying a small statistical association between variations in the dependent and independent variables. The regression coefficients computed were often inconsistent with the hypotheses because the relationships were not as expected.

The regression coefficients computed for the Tucson area when the data were fitted to the three models were all insignificant. The regression coefficient signs computed for Tucson area data were often inconsistent with those expected. These results coupled with very small coefficients of multiple determination reflect failure to find large associations between variations in egg sales and the independent variables.

The estimates obtained when Flagstaff area data were fitted to the various models and tested by the process paralleled those of the Tucson area. The regression coefficients were generally insignificant and the regression coefficient signs computed were often conflicting with those hypothesized. The coefficients of multiple determination were very small.

The estimates obtained for the Phoenix and Yuma areas were larger than those for the other two areas, but still not sufficient to indicate a large statistical association between
be associated with variations in the independent variables.

The regression coefficients produced in testing the data were generally not significant, implying a small statistical association between variations in the dependent and independent variables. The regression coefficients computed were often inconsistent with the hypotheses because the relationships were not as expected.

The regression coefficients computed for the Tucson area when the data were fitted to the three models were all insignificant. The regression coefficient signs computed for Tucson area data were often inconsistent with those expected. These results coupled with very small coefficients of multiple determination reflect failure to find large associations between variations in egg sales and the independent variables.

The estimates obtained when Flagstaff area data were fitted to the various models and tested by the process paralleled those of the Tucson area. The regression coefficients were generally insignificant and the regression coefficient signs computed were often conflicting with those hypothesized. The coefficients of multiple determination were very small.

The estimates obtained for the Phoenix and Yuma areas were larger than those for the other two areas, but still not sufficient to indicate a large statistical association between
variations in egg sales and variations in the independent variables.

Several of the regression coefficients computed for these two areas were significant at the 5 per cent level when the data were fitted to the various models; however the regression coefficient signs were again often conflicting with those hypothesized. The coefficients of multiple determination, for both areas, were again small indicating that little of the variations in egg sales can be statistically associated with variations in the independent variables included in the analysis.

The investigation failed to find evidence that newspaper advertising does affect egg sales. This, however, does not definitely mean that newspaper advertising is not associated with egg sales. It merely indicates that the data obtained and methods used in this study failed to support the inferences concerning newspaper advertising and egg sales.

The failure to find a large statistical association between variations in egg sales and the independent variables may be explained in several ways. The study may not have included all major variables; therefore, the total relationships produced might not be descriptive of the total situation. The relationships explained may not even represent a reliable partial explanation because the independent variables not
included in the analysis could have varied. The results may be due in part to the manner in which the data were generated. Errors involved in measurement of the data may be reflected in the results. For example, sales by grade of egg for each area represented total shipments not total sales. The problem of carry-over was not considered. These deficiencies do not destroy the value of the analysis but point ways to change the analysis and improve the results in the future.

Investigation into the effectiveness of a consistent program of egg promotion might provide better results. A controlled experiment with advertising in one period and not in another might yield more information. Investigation of the association between egg promotional programs and total store sales would provide a basis for analyzing the value of egg advertising as a method of increasing store traffic and overall sales. The author wishes to suggest that the above areas be considered for future investigation.
BIBLIOGRAPHY


