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DEVELOPING MODELS TO FORECAST SALES OF NATURAL CHRISTMAS TREES

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ABSTRACT

A study of practices for marketing Christmas trees in Winston-Salem, North Carolina, and Denver, Colorado, revealed that such factors as retail lot competition, tree price, consumer traffic, and consumer income were very important in determining a particular retailer's sales. Analyses of 4 years of market data were used in developing regression models for predicting sales of cut trees from retail lots.

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INTRODUCTION

BECAUSE OF THE SHORT selling season and the perishability of his product, the retailer of natural Christmas trees finds that a good sales forecast is his most important planning tool. Losses sustained by an established retailer or a new one can be substantial if he has little knowledge of his potential sales. If the established retailer errs in his sales forecast and stocks too many trees, he will have trees left unsold on Christmas day and may even depress the market price. If he stocks too few trees, potential sales will be lost.

Unlike most other businessmen, the retailer of natural Christmas trees cannot correct errors in sales forecasts by inventorying surplus merchandise, recouping lost sales, or changing locations. He must study the various potential retail locations in the marketplace and estimate his expected sales performance at each. Once his decision about location and volume has been made, he is virtually locked into it for the short market period of 2 to 3 weeks.

The sales forecasting records of retailers of natural Christmas trees have not been outstanding. Studies in several metropolitan areas show that 10 to 20 percent of all trees available for sale at the retail level remain unsold,[1] *(Pendleton and Garrett 1973, Troxell 1970).* Certain retailers in these markets have been known to discard two trees for every three they sell. In addition, it is not uncommon to find markets in which as many as one-third of the retailers leave the market after only 1 year *(Pendleton and Garrett 1973).* A retailer can easily lose a substantial investment if he fails to know his market potential at a given retail location.

To provide retailers with more knowledge about potential sales in a given market area, we undertook to develop a forecasting tool for estimating sales of natural Christmas trees. The tool or model relates tree sales by a single retailer of Christmas trees to those variables that are the most important determinants of his sales. These relationships can be expressed as a predicting equation with the general form:

$$Y = a + bX_1 + cX_2 + \ldots$$

where Y is the estimated number of trees that will be sold by a given retailer; the X's are those variables that can affect tree sales, such as price of the tree, merchandising techniques, consumer income, and number of households in the market area. The constants (a, b, c, . . .) measure the relationships between the sales determinants (X's) and the number of trees sold (Y). Such a predicting equation can assist both established and prospective retailers in determining how many trees to stock and where to locate their lots.

This paper describes how the predicting model was developed and tested. It also identifies those marketing factors that strongly influence the success of retailers of Christmas trees.

RESEARCH APPROACH

Sales Determinants

The basic hypothesis of the model is that the number of sales for each retailer of Christmas trees is determined by a set of economic and demographic variables. The economic variables are those that characterize the particular retailer—tree prices, lot location, type of lot, degree of competition, and merchandising methods. The demographic variables characterize the consumers who live in the market area, and include income, number of households, education, number of children and occupation.

A total of 105 economic and demographic variables was analyzed in the study. The data for both sets of variables were collected in Winston-Salem, North Carolina. The data for 48 economic variables were collected in a survey of all retailers of natural Christmas trees in Winston-Salem over a 3-year period, 1967 to 1969. The data for 57 demographic variables were taken from the United States Census of Population and Housing Report for the

[1] P. V. Ellefson: The 1964 Twin Cities retail Christmas tree market. Unpub. Rep., Schl. For., Univ. MN, 1965.

Winston-Salem Standard Metropolitan Statistical Area *(1960)*.

It was necessary to reduce the large number of variables that were identified as possible determinants of tree sales. This reduction was easily accomplished, because many of the 105 variables are interrelated. For example, total income provides a good measure of an individual's ability to obtain such consumer goods as Christmas trees. Yet, purchase of Christmas trees may also be influenced by other variables, such as family size, value of home, net disposable income, education, and number of rooms in a housing unit, all of which are related to total income. Taken together, these variables provide a more complete picture of a consumer's ability to purchase Christmas trees, but it is not necessary to analyze every one of them. One or two of these variables can represent the entire group.

Factor analysis was used to reduce the 105 variables to a smaller number. The model identified variables that were interrelated and grouped them into factors. Two or three variables were selected from each group to represent the factor. Stepwise regression analysis was then used to select a subset of variables that served as predictors of sales of Christmas trees.

Factor Analysis

Analysis of the 105 variables yielded 19 factors. Table 1 lists one factor and the seven principal variables that the factor model identified as being interrelated. The most important variables from this factor were selected to represent all the variables. The screening of all 19 factors resulted in the selection of 43 of the original 105 variables for subsequent regression analysis.

Table 1.—*Details of seven principal variables interrelated in one selected factor characterized as "Inferior Marketing Practices"*

Description
1. Type of lot—discount store
2. No trees purchased last year
3. Fewer trees sold this year
4. No advertising
5. Little marketing experience
6. Poor tree quality
7. Poor lot quality

Regression Analysis

Regression analysis is a method for describing a relationship between a dependent variable (sales of natural Christmas trees) and a set of independent variables (sales determinants). The "regression" itself is the equation developed to explain this relationship. Stepwise regression was used to develop an equation relating sales of natural Christmas trees to the most *significant* of the 43 sales determinants.

STUDY RESULTS

Using the Models

Predicting equations were developed for each of the three study years—1967, 1968, and 1969. The variables included in each of the three equations, or models, are listed in Table 2. Some of the variables listed represent more than one variable in the actual equation. Model I, developed from the 1967 data, utilized 20 variables as significant determinants of tree sales. Models II and III utilized 18 and 15 variables, respectively. Statistical measures for each of the three models are presented in Table 3.

Of the three models, Model I is the most efficient in describing the data base from which it was created. It explains 89 percent of the variation in sales of trees in retail lots in 1967 and has the smallest standard error of the three models. Model II explains 88 percent of the variance in 1968 sales, but has a larger standard error. Model III is least effective; it explains only 71 percent of sales variation, and has a large standard error.

The variables in the three models reveal those marketing forces that are important to the retailer of Christmas trees. The type of retail outlet and the location of the lot are critical variables. Merchandising, competition among lots, and consumer traffic are important in insuring exposure of the merchandise to potential customers. Tree price and quality, properly paired with the consumer's ability and willingness to pay, set the stage not only for good sales, but for repeat sales to satisfied customers. Good indicators of a consumer's

Table 2.—*Variables comprising predictive equations for sales of natural Christmas trees in Winston-Salem, North Carolina*

Model I	Model II	Model III
Lot type	Lot type	Lot type
Lot location	Lot location	Lot location
Level of merchandising	Interaction of lot type and lot location	Interaction of lot type and lot location
Interaction of merchandising and lot type	Interaction of merchandizing and lot location	Interaction of merchandizing and lot type
Interaction of lot location and lot type	Competition among retail lots	Competition among retail lots
Competition among retail lots	Population in group quarters	Tree price
Consumer traffic	Median family income	Population in group quarters
Tree price	Number of households	College enrollees
Occupation	College enrollees	
Persons per household	Median school years completed	
College enrolees	Value of housing units	

Table 3.—*Statistics of Models I, II, and III*

Model	Number of observations	Number of variables	Variations in tree sales explained (R^2)	Standard error
I	53	20	89	111.9
II	46	18	88	175.3
III	53	15	71	239.4

ability and willingness to pay are his education, the monetary value of his home, his occupation, and his income. All three models included these variables in one way or another in making estimates of a retailer's sales potential. The following examples illustrate how the models utilize the above relationships to predict relative performances of "good" and "poor" retail lots.

An actual retailer in Winston-Salem—who will be given the fictitious name Mr. Fir—sold 20 trees in 1967. He was located in a small business area in a low-income section of the city. Two other lots were within four blocks of his retail lot. Of all retailers studied, the street on which his lot was located had the lowest traffic recorded: 1,000 cars per day. His trees were priced at an average of $2, and were of low quality. He did not merchandise or advertise his trees. It was to be expected that his sales would be low, and the predicting equation painted an even dimmer picture for this lot. Model I predicted Mr. Fir's sales as minus 73 trees!

A second retailer, Mr. Spruce, took an entirely different approach. Mr. Spruce located his lot at a shopping center that had the highest traffic count in the city. There were two other lots close by, but he advertised and merchandised his trees and lot location and kept good-quality trees. As a consequence, he sold 523 trees at the highest average tree price in the city: $5.48. Model I predicted his sales at 545 trees.

In the above examples, the 1967 model predicted sales that differed from actual sales. Although the model is not precise in its estimates, it accurately reflects the effects of "good" and "poor" marketing strategies and lot locations. Predictions of 1968 and 1969 retail lot sales with the 1968 and 1969 models provided results that were similar, although less accurate.

These examples reveal only how well the models predict relationships from data that were, in fact, used to create them. How effective would they be in predicting sales in the same city for a new retailer? And, even more important, could they be used to predict a retailer's sales in another city in another year?

Testing the Models

To test the three Winston-Salem models, each of the equations was used to predict sales for the two other years for which market data were available. In addition, to test predictions made by the model for an entirely different market, an analysis was made of the Denver, Colorado, market.

A 1965 survey of 152 retailers of natural Christmas trees in Denver, Colorado, yielded sales data about the area's market for such trees *(Troxell 1970)*. These data were used to develop a new model similar to those developed in Winston-Salem.

The two metropolitan areas differed significantly, both in demographics and in retail sales of natural Christmas trees. Denver had four times as many households as did Winston-Salem, and a greater average household income. Also, 11 times as many trees were sold in Denver as in Winston-Salem. Ninety-two percent of households purchased trees, of which more than 60 percent were plantation grown.

As expected, each model is most accurate when predicting sales from the market data used in its development. This accuracy can be statistically evaluated by examining residuals (Table 4). Residuals are the differences between what is actually observed in the market, and what is predicted by the model or equation.

The minimum average square residual for the 1967 data set resulted from use of the 1967 model, Model I (Table 4). Similar results were obtained for the 1968 and 1969 Winston-Salem models, and the 1965 Denver Model.

The average square residual for Winston-Salem models was always much larger when predicting sales in the Denver market. Average square residuals of Model I tested on 1968 and 1969 market data were only one-tenth of those created from the Denver data. Also, the Denver model was less effective in predicting Winston-Salem tree sales than Denver tree sales. The average square residuals on the three sets of Winston-Salem market data were three to seven times as large as those occurring from use of the Denver model on Denver sales.

All the models were less accurate in predicting sales from data sets different from the one used to develop them. As expected, the greater the difference in the data sets, the larger the error. The Winston-Salem models were least effective on Denver market data, and the Denver model was least effective on Winston-Salem market data.

CONCLUSIONS

First and foremost, forecasting models do not and cannot guarantee a successful Christmas tree business. Consumer behavior remains somewhat unpredictable. The buyers of Christmas trees undergo changes in attitudes and expectations that cause them to alter their spending habits from one year to the next. These psychological factors cannot easily be quantified and included in predicting equations. Second, the three Winston-Salem models were first attempts to develop methods of forecasting sales of natural Christmas trees; further testing of the methods is necessary.

The predicting equations that have been developed demonstrate the importance of retail lot market strategies, such as merchandising

Table 4.—*Average square residuals from the use of four predicting models on four different sets of Christmas tree market data*

Model	1967 Winston-Salem	1968 Winston-Salem	1969 Winston-Salem	1965 Denver
Model I	**7,567**	65,717	95,028	837,306
Model II	121,913	**18,043**	90,750	776,512
Model III	47,035	60,346	**40,004**	798,621
Denver	1,424,811	1,085,028	2,140,043	**364,399**
Number of Observations	53	46	53	152

Bold type indicates data from which the model was constructed.

and advertising, for increasing sales of trees at the retail level. Further, they establish definite relationships among tree quality, consumer traffic, and competition, and demonstrate how these factors influence both the price received and the number of trees sold.

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