Analysis of Market Factors Associated with Sales of Cut Natural Christmas Trees

by
Lawrence D. Garrett

USDA FOREST SERVICE RESEARCH PAPER NE-364
1977

FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE
NORTHEASTERN FOREST EXPERIMENT STATION
6816 MARKET STREET, UPPER DARBY, PA. 19082

The Author

LAWRENCE D. GARRETT received his B.S. degree in forestry from Southern Illinois University, and his M.S. and Ph.D. degrees in forest economics from Michigan State University. He joined the Northeastern Forest Experiment Station in 1965 at the Forest Products Marketing Laboratory in Princeton, West Virginia. He is presently project leader of maple products marketing research, and Chief of Laboratory of the George D. Aiken Sugar Maple Laboratory, So. Burlington, Vermont.

MANUSCRIPT RECEIVED FOR PUBLICATION 14 JUNE 1976

Abstract

A study of the market performance of natural Christmas tree retailers in Winston-Salem, North-Carolina, revealed that success was strongly related to location in active retail shopping areas. Christmas tree retailers in shopping centers or areas high in retail sales sold more trees, received a higher average price, and had fewer trees left unsold than retailers in suburban or residential areas. Market factors that contributed to the success of these lots were better merchandising practices, better quality trees, ample parking space, high customer traffic, and better advertising. Consumer mobility was found to be high in the purchase of natural Christmas trees. In all market areas of the city, consumers traveled an average distance greater than the distance to the next retail lot and, in many cases, twice the distance to the nearest retail lot.

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CONTENTS

INTRODUCTION

ANNUALLY, millions of cut natural Christmas trees move to market in the United States. In a 2-month period, these trees flow through a complex market system from thousands of tree plantations and wildlands across the North American continent. Because of the short market period and the geographic dispersion of supply and demand points, market performance is often less than desirable. One basic problem appears to be the inability to determine demand at the retail level.

Losses to the retailer can be substantial if he has little knowledge of his potential sales. If he has too few trees, potential sales may not be realized and, if he carries too many trees, he may depress the market price and have trees left unsold.

THE RESEARCH APPROACH

The intent of this study was to develop information that would provide retailers with more knowledge about sales in a given market area. The study was also designed to relate tree sales for a single Christmas tree retailer to certain variables that are the most important determinants of his sales. Those relationships are expressed as predicting equations, which take the following form:

$$Y = a + bX + cX + \ldots + kX ,$$

where Y is the number of trees sold by a given retailer, and X's are variables associated with tree sales, such as price of tree, consumer income, distance from consumer's home to retailer's lot, etc.

Winston-Salem, North Carolina, was chosen as the study area. The city is a Standard Metropolitan Statistical Area (SMSA), for which detailed population and housing information is available by census tract and city block.

A total of 105 economic and demographic variables was analyzed in the study. A survey of Christmas tree retailers was conducted over a 3-year period 1967, to 69, to generate data on 48 economic variables for each retailer and his particular market environment. Also, information on 57 demographic variables was taken from census tract data to characterize the consumers buying trees. In addition, to determine consumer mobility, 1,017 households in Winston-Salem were personally interviewed concerning tree-buying behavior.

An analytical technique, Principal Factor Analysis, was used to identify which of the 105 variables studied were related to a common factor. Once this had been determined, many variables could be dropped, keeping only those that best described a market factor. Regression analysis was used for further screening of the data and for the development of predicting equations.

MARKET RELATIONSHIPS

Retailer Concentration

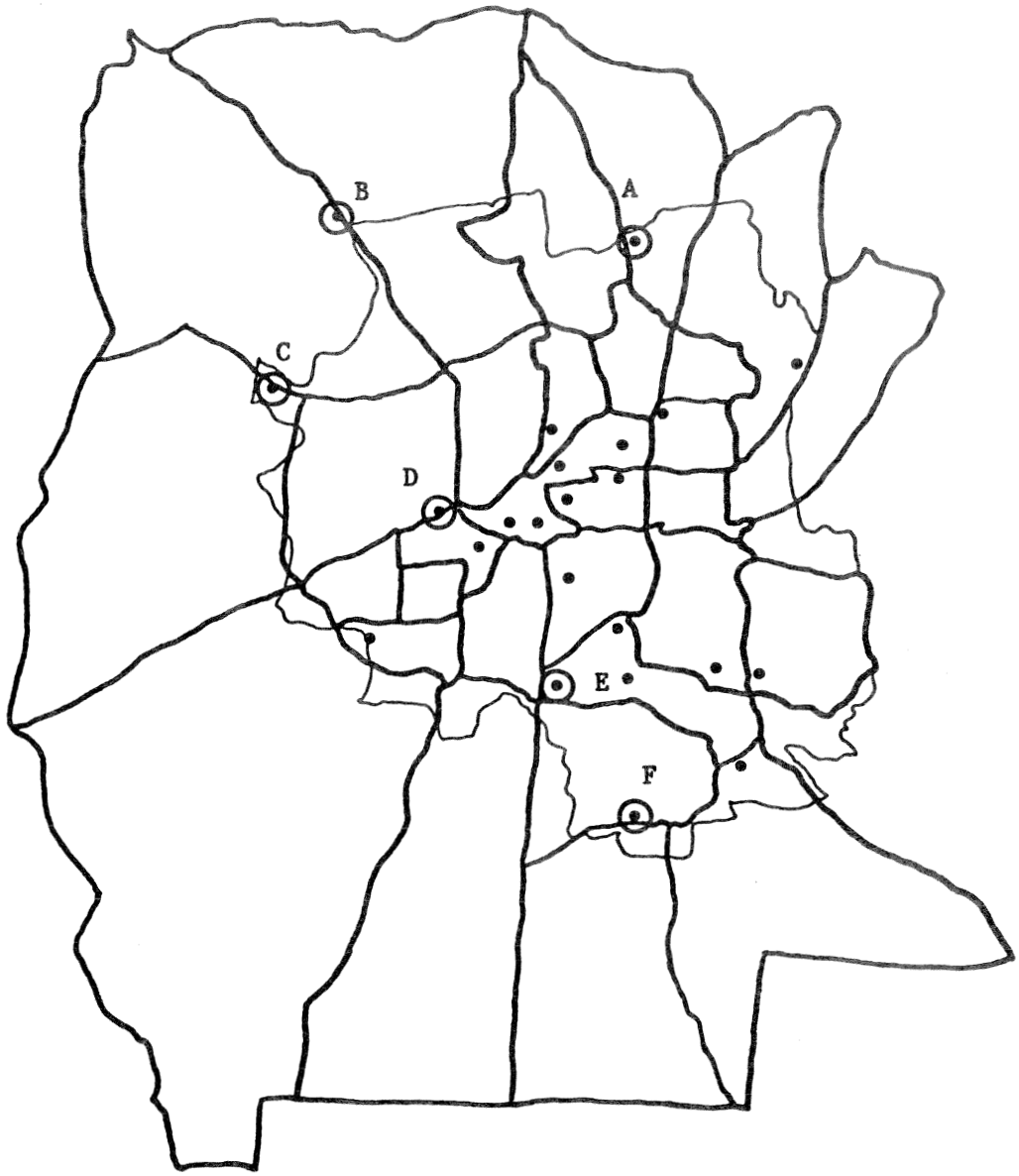
Winston-Salem is like most American cities in its adoption of planned suburban shopping center complexes. The center city still maintains an active retail trade, but significant retail activity has been transferred to the suburbs. Six areas in Winston-Salem were designated as shopping centers or centers of concentrated retail activity (A-F, fig. 1). The principal centers were located at B, D, and E.

Many Christmas tree retailers have, through casual observations or by trial and error, keyed on the transfer of retail activity to the shopping centers. For example, the largest concentrations of Christmas tree retailers in Winston-Salem in 1969 were located at or adjacent to areas D, E, and B in figure 1. The number of retailers located at each was nine, eight, and five, respectively. Further, the two largest retailers in the city were located in area D, the next largest in area E, and the fourth largest in area B. Forty-one percent of the Christmas tree retailers were located in these three retail areas, no larger than 10 city blocks.

Retailers located in or adjacent to shopping centers accounted for 74 percent of the city's total sales of natural Christmas trees. Each tree retailer at these locations held an average of 3 percent of the market, whereas, in the remaining market areas, individual retailers held an average of only 1 percent of the market.

Why are the retailers at these locations? Because these are the most viable Christmas

Figure 1.—Concentrations of Winston-Salem retailers of natural Christmas trees.



Singular Retail Locations •

City Limits ——

Census Tract Boundaries ——

Multiple Retail Locations
(Major & Minor Retail Areas) ◎

Mile Scale

0 ½ 1

tree market areas in the city. There are well-defined market associations that show why this is true.

Population, Income, and Distance Traveled

Population has long been cited by economists as a critical factor in the retail sales potential of an area; in fact, it was critical to the Christmas tree retailers' sales in Winston-Salem. This fact does not mean that the retailer should locate in the center of a suburban housing development. However, he should have a location that gains access to an area of potential retail sales.

In figure 1, areas A, B, C, D, E, and F are located on the fringes of the city, defined as suburban by the Census Bureau. Each is approximately 2 miles distant from the others. Areas D, E, B, and A are large multistore shopping complexes, offering services (banking, hair styling, insurance etc.), as well as consumer goods. Areas C and F are central shopping areas with several stores offering mainly consumer goods.

If we define the above areas as separate primary market areas, their potential sales population can be defined as indicated in table 1. We see how critical population can be with the two leading sales areas, D and E. Percentage of market held coincides with population. However, area B provides an excellent example of why demand is not predicated on one or two variables alone, but on a combination of several interacting variables.

Retail area B actually serves more population than is indicated in table 1. Two factors—the type of road system serving this area and the demographic characteristics of the consumer—contribute to making area B a more viable area for tree sales than is indicated by the population count alone. For example, area B is serviced by a major traffic artery, with an average daily traffic count slightly less than that of area E. All the traffic moving northwest from the city passes the area. A second factor contributing to high sales in area B is the predominance of middle- to upper-middle-income families. Higher incomes put more consumer goods, such as Christmas trees, within reach of these households. Also, it gives these consumers more market mobility when they shop.

The greater mobility of middle-income families is indicated by the distance traveled to purchase trees (table 1). Because middle-income families traveled farther, area B, with a 2.5-mile average purchase radius, was obtaining customers from census tracts 4, 25 and 12 (fig. 2). These tracts were not included in the population count because they were assumed to be more closely associated with retail areas C and D.

A counterargument could be presented for area A. It has a very large population in its retail area (23,600) and is serviced by a major traffic artery (15,000 vehicles daily). Yet, area A, with seven retailers, held only 8 percent of the market. The prime limiting factor here is income. Low-income areas were not viable Christmas tree market areas in Winston-Salem. This is true even though these families have many children, a factor that was positive for sales among upper-middle-income families.

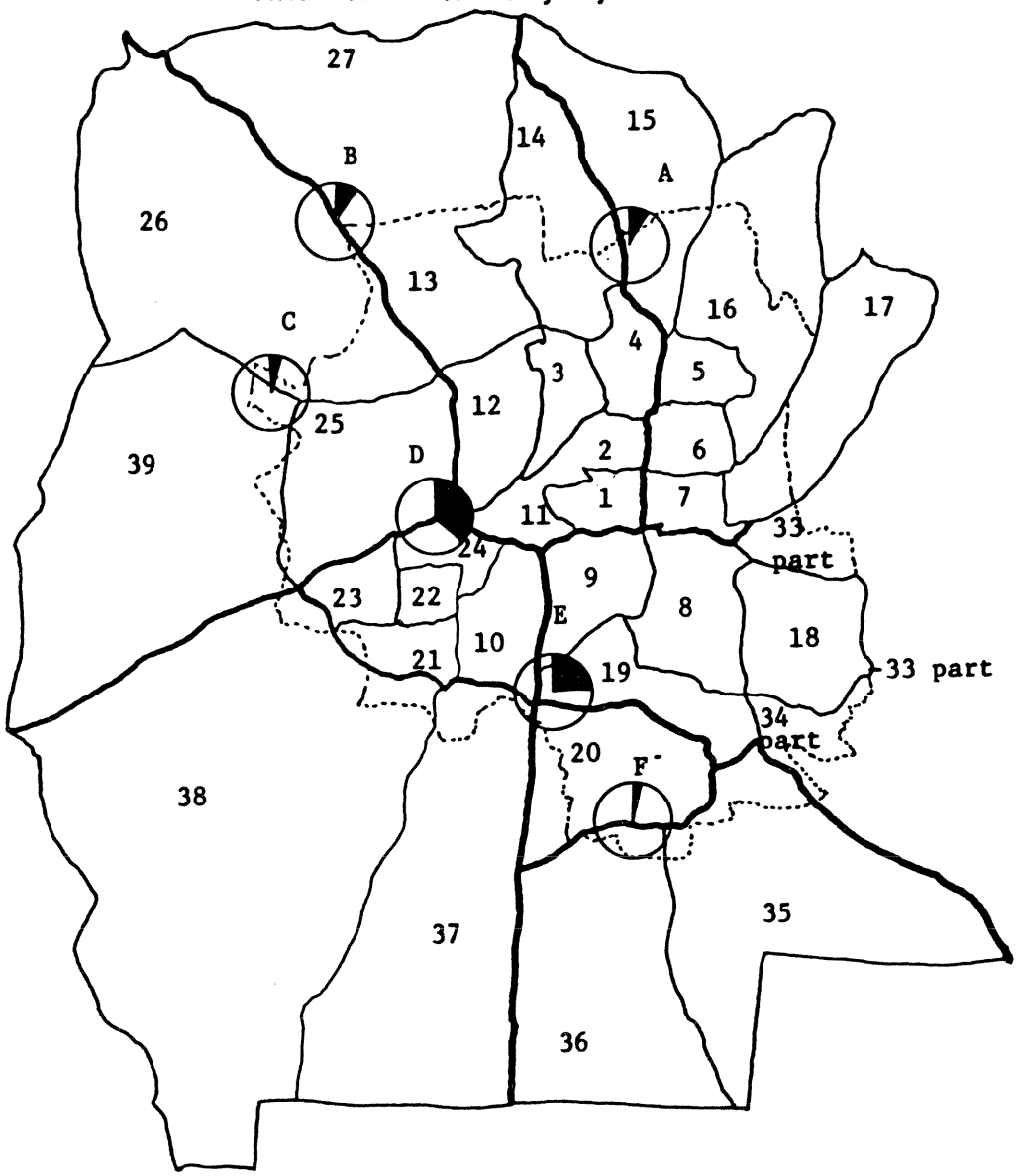
The above observation is further supported by

Table 1.—Christmas tree market relationships: Winston-Salem, NC.[1]

Market area	Distance consumer traveled to purchase tree (miles)	Number of retailers	Population in market area	Average income	Average daily vehicle traffic	Percentage of total market held
A*	2.0	7	23,600	4,700	15,000	8
B*	2.5	5	4,000	8,600	12,000	14
C°	2.0	2	7,300	12,600	7,000	3
D*	2.8	9	31,000	7,600	25,000	37
E*	2.5	8	33,000	6,100	15,000	23
F°	2.5	3	8,000	6,200	7,000	2
G	2.0	17	68,000	4,600	3,000	13

[1] Table based on 1969 retail, consumer, and traffic count data, and 1960 census tract data.
* Major retail area
° Minor retail area

Figure 2.—Winston-Salem major traffic arteries, and the natural tree market held by major and minor retail areas.



retail sales in the diffuse area (G), which also has a high population count. Here 17 retailers, located 6 to 7 blocks apart, each averaged only 0.76 percent of total sales. In area G, two factors were critical; traffic arteries were minor, 3,000 vehicles daily, and income level was the lowest for the city.

We can observe from the preceding analysis that road systems and average income are both associated with the distance that consumers travel to purchase a natural tree. The consumer departs very little from his normal purchasing pattern when buying a Christmas tree. He does not mind traveling to acquire his tree. In fact, he often travels 2 miles to purchase it. Neither does he strive to minimize the effort involved in this purchase. Retailers observed that consumers may shop two or more lots before deciding on a tree and take 10 to 15 minutes to decide on a particular tree.

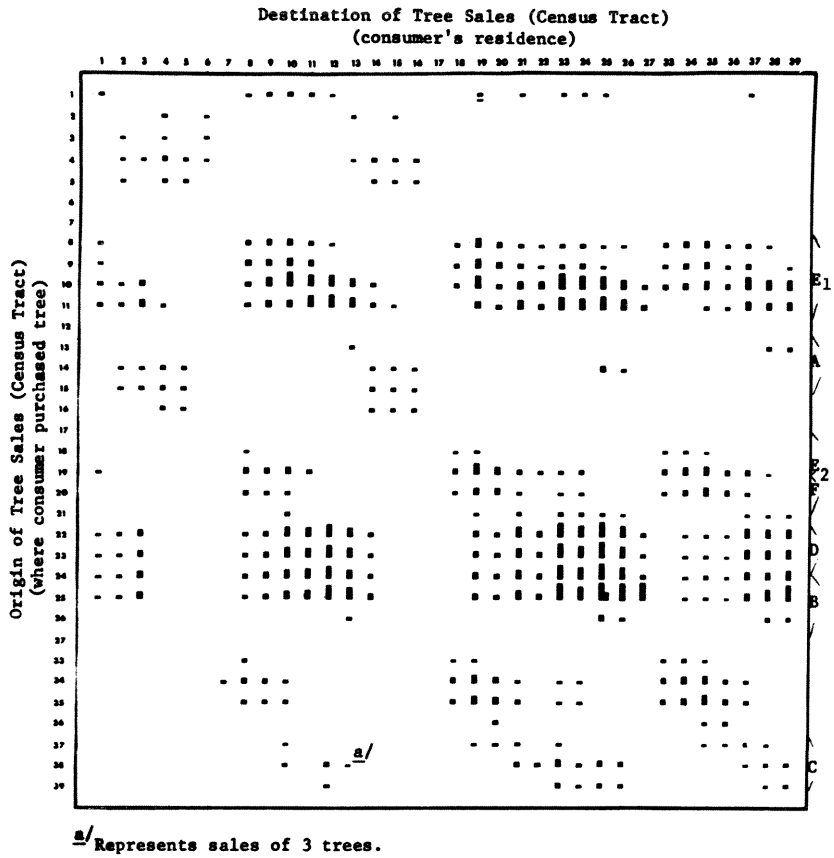
Consumer Mobility

One factor disclosed concerning consumer mobility was a definite relationship between the distance traveled to purchase a Christmas tree and the income of the buyer (table 2). As income increases, people tend to purchase trees farther from their places of residence. For example, householders with incomes less than $3,999 traveled an average of 1.8 miles to buy a tree.

Table 2.—Association between income class and distance traveled to purchase a natural tree.

Income class	Average miles traveled
$< 3,999	1.8
4,000 - 6,999	2.5
7,000 - 9,999	2.8
10,000 +	2.0

Figure 3.—Natural Christmas tree purchase patterns by census tract: Winston-Salem, N.C., 1969.



a/ Represents sales of 3 trees.

Householders with incomes between $4,000 and $10,000, traveled between 2.5 and 2.8 miles to buy a tree. Mobility decreased, however, at high incomes, primarily because shopping centers are closer to areas of high purchasing power.

Consumer migration data were developed to assess the origins of sales at a particular location. From these data, a grid showing sales movement was developed to illustrate consumer mobility in selected areas of the city (fig. 3). The figure is constructed to be read from both axes, permitting an evaluation of where tree-buyers lived and to what census tract they traveled to make their purchases.

If all purchases had been made where the consumer lived, the matrix would have all sales recorded on the diagonal, running from the upper left to the lower right. A significant number of tree purchases did occur within the census tract, as depicted by the sales grouped along the diagonal. However, considerable off-diagonal sales appear in the form of horizontal bands. These represent sales at one of the major or minor retail areas.

Persons in low-income census tracts 1-9 purchased their trees from the diffuse retail area and from areas A, D, and E (fig. 1). This is corroborated by the finding that these persons traveled about 1.8 miles to buy a tree, which is only slightly more than the distance across two census tracts in the eastern side of the city. To have gotten out to market areas B, C, or F would have meant traveling 3 miles or farther.

Study of the bands of sales running horizontally across the matrix reveals the origin of tree sales for each market area. For example, area E is composed of pattern E_1 and E^2, located on the corners of census tracts 19, 9, and 10. Those lots sold trees to persons in census tracts 9 to 11 and 19 to 22, all of which bound census tracts 19 and 9 on the north, west, and south. Two major traffic arteries service the area (fig. 2).

Area D, located both in tract 24 and tract 25, was serviced by an interstate expressway and two boulevards, all high-volume traffic roads. The bulk of this area's sales went to census tracts 9 to 12, which are immediately adjacent on the east and northeast; tracts 21 to 26, which are directly adjacent on the south, west, and northwest; and tracts 37 to 39, which surround the general sales area on the south and west.

Further elaboration would only serve to strengthen the argument that consumers do travel considerable distances to select and purchase natural Christmas trees. Also, the percentage that do so is high, approaching 50 percent in most income classes.

At this point in our discussion, we have at least clarified one fact. High retail sales of natural trees are associated with locating the retail lot in or near major retail sales areas. However, acquiring a prime location does not necessarily mean high sales performance. As we have shown, there are many market associations that may contribute to or detract from sales performance. We cannot analyze these associations fully without analytical models.

ANALYSIS OF VARIABLE INTERACTION: FACTOR ANALYSIS

The basic intent of using factor analysis in this study was to condense information contained in our original 105 variables into a smaller number of independent factors (*Harman 1967*). An example will clarify our intent.

Total income provides a good measure of an individual's ability to obtain consumer goods, such as Christmas trees. Yet, purchase of Christmas trees may also be influenced by other related variables, such as family size, value of home, net disposable income, and number of rooms in a housing unit, all of which can be related to total income (*Drysdale and Mansedas 1970, Moore and Box 1970, Thatch and McDonald 1970, Troxell 1969*). Taken together, they provide a more complete picture of a consumer's ability to purchase consumer goods other than necessities. That is, total income reduced by taxes is net disposable income, which when reduced by housing, food, medical care, and other necessities, provides a potential income for purchasing so-called luxury goods and services. Therefore, each variable is partially related to the consumer's ability to buy.

Factor analysis reveals such relationships through correlation analysis rather than mental reasoning. It groups those variables that are associated with a common factor, and analytically determines the amount of variation in that factor that is accounted for by each variable related to it, hence, factor analysis or analysis of factors.

Using the Factors

Our analysis of the 105 variables yielded 19 factors. Each factor can be labeled with a word or term derived from the variables that appear on the factor, e.g., marketing practices. Factors are always given a numbering or ranking sequence, because they are developed by the model in descending order of importance. In our study, Factor II (the primary variables that comprise it) explains more of the variation in all our data collected (105 variables) than does Factor III. Factor IV explains more variation than does Factor V, and so on.

Table 3 lists Factor IV and the top 11 variables that the factor model says are associated; together, they describe a market activity that should be obvious to us.

To interpret the factor, two criteria must be followed:

1. (+) scoring variables are related in a positive manner to the factor, and (−) scoring variables are related in a negative manner;
2. The higher the factor score, the more closely is the variable associated with the factor.

Taking the positive variables first, they describe retailers who were new (no trees last year) or ones who sold fewer trees this year than in the previous year. Also, the retailers didn't advertise, some used discount-store locations and, generally speaking, they had poor-quality lots, i.e., trees on the ground, no signs or lights, etc.

Most retailers would agree that these variables contribute to poor sales performance. In effect, they describe poor market strategies, bad retail practices or low retail performance. Basically, they describe what a retailer shouldn't do if he wishes to be successful.

If the positive scores are associated with poor marketing practices, negative loadings should describe the opposite. In fact, they do just that. They describe retailers in business more than 1 year, advertising in newspapers and with signs, and selling more trees. Thus, Factor IV can be called "marketing practices."

Table 3.—Description of the 11 highest loading variables on Factor IV[1] (Marketing Practices)

Variable score	Description of variable
.89	Relationship of trees purchased this year to last year (no trees)
.89	Relationship of trees sold this year to last year (fewer)
-.70	Advertisement - yes
.70	Advertisement - no
.40	Type of establishment - discount store
-.38	Number of years retailed Christmas trees
-.33	Advertisement - signs
.33	Tree quality - poor
-.31	Advertisement - newspaper
.30	Lot quality - poor
-.28	Relationship of trees sold this year to last year (more)

[1]Factor analysis of 105-variable matrix. Analysis type R-mode, using principal factor solution; number of observations = 53; eigenvalue cut off at 1.00.

Number of Factors

Nineteen principal factors were developed from the 105 variables. The total variance explained for each variable ranged from 0.90 to 0.95. For 105 variables, the total explained variance was 97.81, giving an average of 93 percent explained for each variable. Each of these factors is assumed to be independent (0 correlation) and each, in turn, provides a description of a different source of variance.

Screening the Factors

Our primary reason for creating the factors was to select a smaller number of variables for further analysis. To do this, we selected two or three of the highest-ranking variables on each factor. The screening process resulted in the selection of 43 of the original 105 variables for subsequent regression analysis.

Our effort to describe the Winston-Salem Christmas tree market was intended, in part, to illustrate the complexity of interaction that exists, but is not always apparent. Also, we wished to illustrate that these market relationships can be meaningfully analyzed with models, as in factor analysis. The next, and final, step is to determine if we can predict what will happen in a Christmas tree market based on what we have learned. To accomplish this, we did the following:

- Data on the screened 43 variables were tabulated for all Winston-Salem retailers from 1967-69.
- By use of regression models, predicting equations were developed from these data for each of the 3 study years.

- Using the 1967-69 models, we estimated each retailer's sales for each year, i.e., the 1967 model (Model I) was used to predict sales for every retailer listed in 1967, 1968, and 1969. The same was accomplished for the 1968 and 1969 models.
- Finally, each of the three models was used to estimate tree sales for all retailers in a different market year (1965) and for a different market area (Denver, Colorado).

The Three Predicting Models

The statistics of regression analysis permit us to decide which equations best describe the data from which they are taken. Variables included in the models resulting from our first two steps are presented in table 4. In table 5 are statistical measures of the three predicting models.

Of the three models, Model I is most efficient in describing the data base from which it was

Table 4.—Variables used in predicting equations for sales of natural Christmas trees in Winston-Salem, North Carolina, 1967-69.

1967
MODEL I

$$Y_{ijk} = \mu + \alpha_i + T_j + r_k + \alpha T_{ij} + \alpha r_{ik} + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots$$
(tree sales)

Where

Y_{ijk}	=	tree sales on i^{th} lot type at the j^{th} location with k merchandising
μ	=	general mean
α_i	=	effect of lot location
T_j	=	effect of lot type
r_k	=	effect of merchandising
$T\alpha_{ji}$	=	lot type x lot location interaction
Tr_{jk}	=	lot type x merchandising interaction
X_1	=	competition among retail lots
X_2	=	consumer traffic
X_3	=	tree price
X_4	=	occupation - laborers
X_5	=	persons per household
X_6	=	college enrollees

1968 MODEL II	1969 MODEL III
Lot type	Lot type
Lot location	Lot location
Interaction of lot type and lot location	Interaction of lot type and lot location
Interaction of merchandising and lot location	Interaction of merchandising and lot type
Competition among retail lots	Competition among retail lots
Population in group quarters	Tree prices
Median family income	Population in group quarters
Number of households	College enrollees
College enrollees	
Median school years completed	
Value of housing units	

Table 5.—Statistical comparison of predicting Models I, II, and III.

Model	Number of observations (retailers)	Number of variables in equation	Percentage of variation 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

created. It explains 89 percent of the variation in retail lot tree sales in 1967, with the lowest error of estimate for all three models, 111.9. Although Model II explains a similar percentage of total variance in 1968 retail tree sales, it does so with a much higher standard error, 175.3. Model III was much less effective in characterizing variation in 1969 retail tree sales; only 71 percent of sales variation was explained, with a high standard error, 239.4.

A review of the variables in the three models reveals those marketing factors that are important to the Christmas tree retailer. Retail outlet and lot location have been identified as important. Merchandising, competition among lots, and consumer traffic determine exposure to potential sales. Product 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 from satisfied customers. Good indicators of a consumer's ability and willingness to pay are education, value of the home, occupation, and income. All three models included these variables in making estimates of a retailer's sales potential.

How the Models Work

A non-fictitious retailer in Winston-Salem, to whom we will give the fictitious name Mr. Fir, actually 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 4 blocks of his retail lot. Of all retailers studied, his lot had the lowest traffic recorded, 1000 cars. His trees were priced at $2, and were of low quality. He did not merchandise or advertise his trees. It is apparent that his sales should be low, and the predicting equation painted an even dimmer picture for this lot. Using Model I, Mr. Fir's expected tree sales, as indicated below, would be minus (−) 73 trees:

$$\text{Tree sales (Y)} = -765.41479 + (-188.99060)(X_6) + (120.62463)(X_7) + (-269.23779)(X_8) + (-151.87868)(X_9) + (67.08125)(X_{17}) + (21.89651)(X_{18}) + (9.91129)(X_{19}) + (106.99033)(X_{20}) + (81.26111)(X_{25}) + (9.07497)(X_{27}) + (-40.59557)(X_{30});$$

entering the various variable values,

$$Y = -765.41479 + (-188.99060)(1) + (120.62463)(-1) + (-269.23779)(-1) + (-151.87868)(-1) + 67.08125(2) + (21.89651)(6) + (9.91129)(1.000) + (106.99033)(2.00) + (81.26111)(.69) + (9.07497)(26) + (-40.59557)(4.96) = -73.$$

A second retailer, Mr. Spruce, took an entirely different approach. Mr. Spruce located at a shopping center with the highest traffic count in the city. Although he was close to two competing lots, he advertised and merchandised his trees and lot location and kept good quality trees. As a consequence, he sold 525 trees at the highest average tree price in the city, $5.48. Predicting his sales with Model I gives the following:

$$(Y) = -765.41479 + (120.62463)(1) + (-151.87868)(1) + (-76.27829)(1) + (187.25530)(1) + (67.08125)(2) + (9.91129)(13.1) + (106.99033)(5.48) + (81.26111)(.04) + (9.07497)(35) + (-40.59557)(.03)$$

$$Y = 545.$$

In the above examples, the 1967 model predicted sales that differed from actual sales. Although it is not precise in its estimates, it accurately characterizes, through its predictability, the effects of "good" and "poor" marketing strategies. Predicting 1968 and 1969 retail lot sales with the 1968 and 1969 (II and III) models was less effective than the 1967 example. However, both were effective in demonstrating the effects of marketing strategies.

The above examples serve only to reveal how well the models predict relationships from data that were, in fact, used to create them. To determine their effectiveness as a marketing tool, they must be tested on a different set of market data. We cannot assume that Model I is the best predictor in a different market environment just because it is an effective predictor for 1967 Winston-Salem market data. It will be effective only if model parameters in the new market are nearly identical to the 1967 Winston-Salem market parameters.

A Test of Model Effectiveness

A 1965 survey of 152 natural tree retailers in Denver, Colorado yielded sales data on that area's natural Christmas tree market (*Troxell 1969*). These data were used to develop variables similar to those we used in the Winston-Salem models and a predicting equation for Denver. Also, the data were used to test the predicting efficiency of the three Winston-Salem models.

The two metropolitan areas differed significantly, both in population demographics and in natural Christmas tree retail sales activity. Denver had four times the number of households and a greater average household income. Eleven times as many trees were sold in Denver as in Winston-Salem. A total of 92 percent of households purchased trees, more than 60 percent of which were plantation grown.

Our comparisons of all four models in all four markets gave the expected results. Their accuracy had been expected to decrease over time in the same market, and such a decrease is suggested. The models had been expected to perform more poorly in a new market, and such a result seems obvious from tests of the Winston-Salem models on Denver data.

Table 6 was developed from a statistical analysis of the difference between actual retailer sales in a market and the sales predicted by the model. The analysis of these differences, defined as average squared residuals, provides a measure of accuracy for each model on each set of market data.

Table 6.—Average squared residuals of predicted Christmas tree sales in four markets

Model	Data sets			
	Winston-Salem			Denver
	1967	1968	1969	1965
I	**7,567**	65,717	95,028	837,306
II	121,903	**18,043**	90,750	776,512
III	47,035	60,346	**40,004**	798,621
Denver	1,424,811	1,085,028	2,140,043	**364,399**

The model developed from a specific data set was always the most accurate predictor of actual market sales represented by that data set. This is indicated by the fact that the diagonal values in table 6 are the lowest for each column. Each data set is different, and so is each model. For Model I to have equal predicting accuracy on 1967 and 1968 data sets would require the data and, therefore, the models to be identical. Sales data did differ over the 3 years in Winston-Salem. Further, the Winston-Salem and Denver data have extreme differences.

A second supposition, using the above argument, would be that the Denver model should have lower accuracy on Winston-Salem data sets than on the Denver data. This fact is demonstrated in table 7, in which the performance of each model is ranked for each data set. The Denver model was ineffective in predicting Winston-Salem tree sales. By contrast, the Winston-Salem Models were much more effective in the Denver market. Also, all three models produced similar squared residuals (table 6).

Table 7.—Relative accuracy of four predicting equations on four sets of Christmas tree retail sales data

Model	Data sets			
	Winston-Salem			Denver
	1967	1968	1969	1965
I	**I**	III	III	IV
II	III	**I**	II	II
III	II	II	**I**	III
Denver	IV	IV	IV	**I**

Table 8.—Model error in predicting actual tree sales for the average retailer in four markets (trees per lot)

Model	Data sets			
	Winston-Salem			Denver
	1967	1968	1969	1965
I	87	256	308	915
II	349	134	301	881
III	217	246	200	894
Denver	1193	1041	1463	604

Although the models are effective in describing the characteristics of markets for natural Christmas trees, their utility for direct application in market management is restricted. The models do not effectively predict sales at the retail level. Table 8 presents the average error each model incurred in predicting the average retailer's tree sales in a given market. Model I errs in its estimate of the average retailer's sales by 87 trees per lot. Model II errs by 349 trees, and the Denver Model errs by twice the actual sales. A similar pattern exists in all markets.

Analyzing Residual Plots

Although much can be gained from the statistical tests of the models in table 6, certain inferences are lacking. To obtain a more in-depth look at the performance of the models, it is necessary to look at the residual plots, more specifically $(Yi-\hat{Y}i)^2/\hat{Y}i$.

The plots support the statistical analysis of the residuals. The pattern of residuals for Model III fully characterizes a large variance, which is not constant (fig. 7). In fact, the assumption of constant variance appears to be violated at both high and low values of Y. Further, it is more severe in Model III than in any other model.

A fact not indicated by the foregoing analysis of residuals is that estimates of Denver sales yield a somewhat constant variance over lot size. In fact, residual variance created from each model's estimates of Denver retail sales has the greatest uniformity of all residuals analyzed (figs. 4 and 5). Conversely, residuals created from use of the Denver Model to predict sales on 1967-69 Winston-Salem retail data reveal greater variances for larger retail lots (fig. 6).

Model I had the least variation in the residuals, although there is evidence of a need for weighted least squares or variable transformation (fig. 4). Yet, the probabilities of improvement are minimal when Model I is compared with the Denver Model.

The Denver Model reveals the greatest potential for improvement. It is the most effective estimator on lot sizes up to 1,000 trees; at that point, the variance increases radically. Model II has plots similar to Model III, revealing a change in residual variance from small to large lots (figs. 5 and 7).

CONCLUSIONS AND RECOMMENDATIONS

Several conclusions can be drawn from this research. Based on these conclusions, recommendations can be made that will not only provide greater meaning to these investigations, but should also be valuable to future research.

Conclusions

Competition did exist in the Winston-Salem retail market for natural Christmas trees. Although there was obvious concentration of seller activity, there were no controls imposed on market activity by this concentration. Perfect competition, however, could hardly be expected with the limited information system available to retailers.

Consumer mobility in the purchase of cut natural Christmas trees was high. Low-income buyers residing in areas where single lots were less than 1 mile apart traveled an average of 1.8 miles to purchase their trees. Median-income families traveled the greatest distance (2.8 miles), while residing in areas where concentrations of retailers averaged 1.2 miles from the consumer. In all sectors of the market, consumers traveled an average distance that exceeded the average distance to the nearest retail lot.

The greatest retail sales activity occurred in areas of concentrated retail sales for other products. About half of the cut natural tree retailers were located there, and they held approximately 70 percent of total market sales. Other products and services offered at these centers are important to the sales of natural trees. They afford convenience to the consumer, with large parking areas, sufficient area for product display, and access to other stores for

Figure 4.—Squared residual plots of estimated Denver retail sales with Model I.

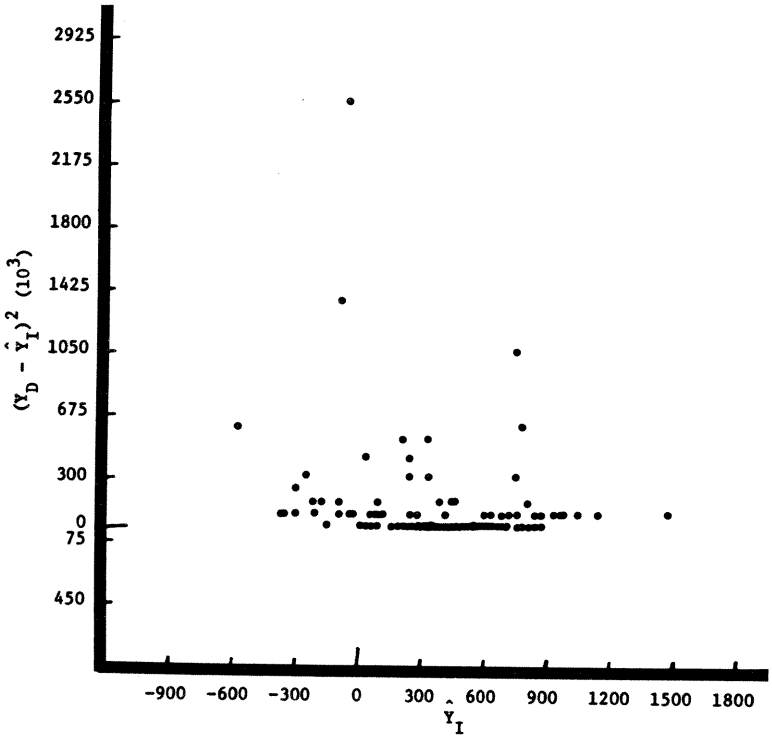


Figure 5.—Squared residual plots of estimated Denver sales with Model II.

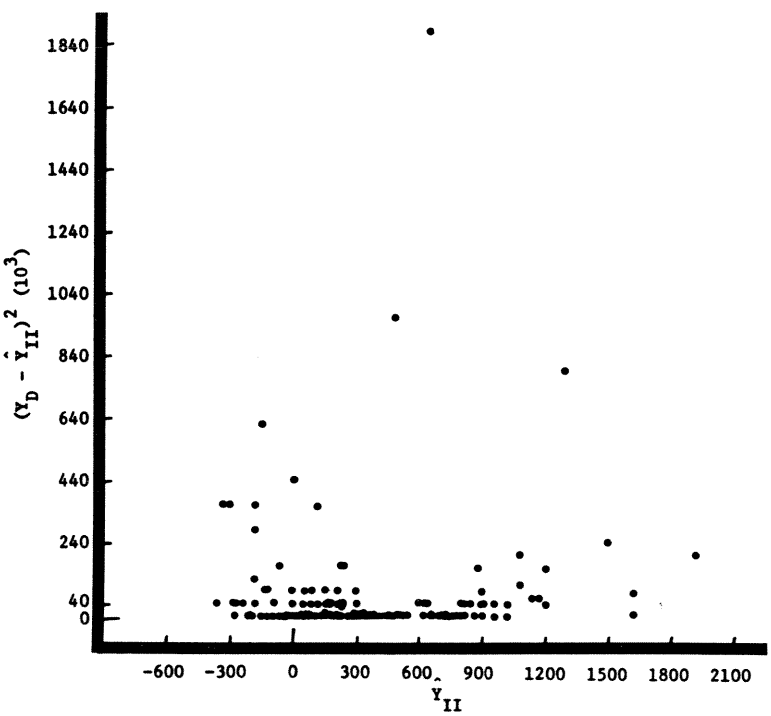


Figure 6.—Squared residual plots of estimated 1967 Winston-Salem retail sales with the Denver Model.

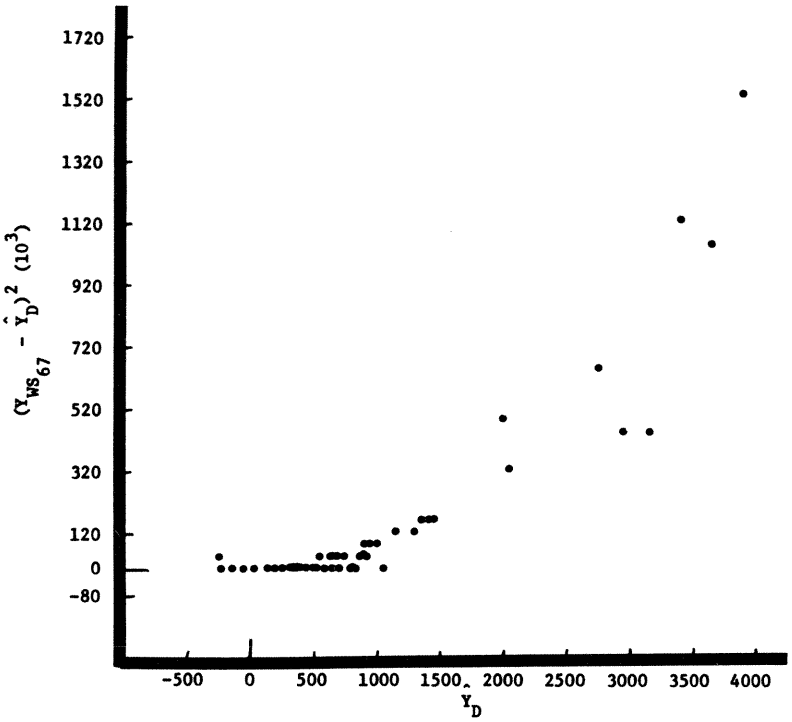
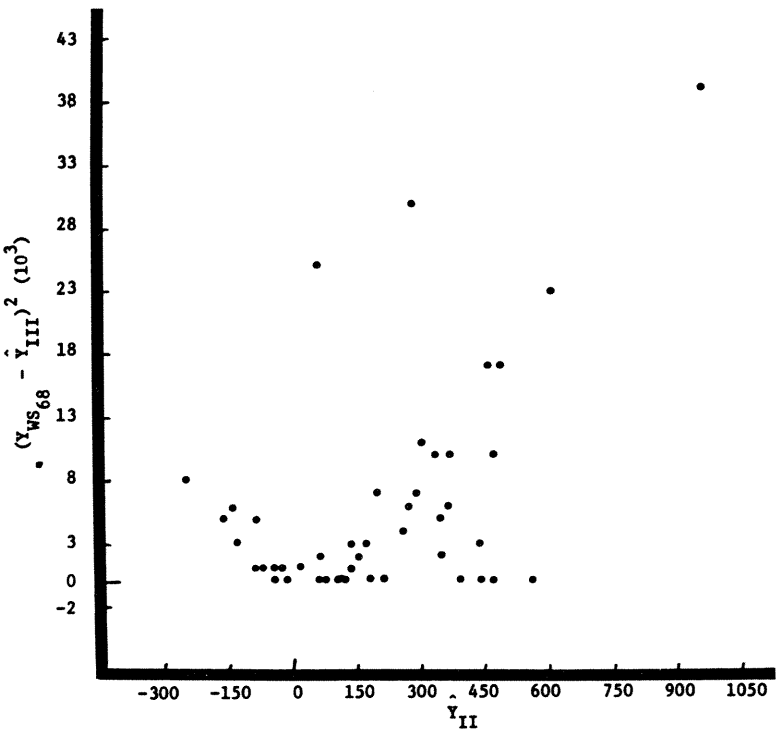


Figure 7.—Squared residual plots of estimated 1968 Winston-Salem retail sales with Model III.



normal shopping activity. Also, such market activities as advertising and merchandising are greatly facilitated at these locations. Therefore these centers represent prime locations for retailing Christmas trees in metropolitan areas.

Factor analysis was effective in delineating independent spheres of influence from variables used in the analysis. However, factor and regression analysis, like other analytical tools, depend on good empirical data. Creation of the predicting equations was hampered by limitations on availability of current and reliable census data and our inability to quantify certain variables correctly. Yet the models did effectively characterize the market relationships observed.

The use of predicting equations as developed herein has restricted application to direct market management. The models are structured around marketing factors that are exceedingly dynamic; they are ever-changing, and often occur in differing proportions. Further, variance was not concentrated in one variable but in many, making it difficult to monitor the changes.

The equations developed demonstrate statistical significance and are effective in identifying market associations. Yet, their accuracy at the retail level is insufficient for them to stand alone as a management tool. They are effective in characterizing market strategies being used at the retail lot level. Further, the models do differentiate the market effect of "good" versus "poor" market strategies.

Recommendations

This research has demonstrated that a myriad of marketing and economic factors affect the sales performance of a given retail lot. Although some factors are more important than others, several must be included to have an acceptable estimator. From one lot to another, within the same market, these factors will change in level of importance to the dependent variable (sales). More importantly, changes in market conditions with time, geography, or both will likely cause even greater variability.

This sensitivity at the retail lot level limits the effectiveness of the models. The potential for predicting error is too great to permit dependence solely on the model for decision-making. Instead, the model could and should be used for market analysis. If the retailer studies a cross-section of potential lot locations, he can rank the areas by estimated sales performance. Patterns similar to those in Denver and Winston-Salem should become apparent. These evaluations could then be used for selecting the best lot locations.

Future research should concentrate on defining interrelationships among the variables studied. This research was directed at obtaining effective estimators, with limited attention being paid to assessment of individual variables. Extensive descriptive studies have been made, focusing attention on many factors that are important to retail sales. More definitive work is necessary to determine the exact impact these variables have on sales and on each other.

Once analytical relationships have been established for important variables, attempts should be made to develop regional models. Systematic aggregation of retail outlets to larger, more homogeneous groups, either a priori or via empirical evidence would be a natural extension of the work presented here. It should incorporate time as a variable, to allow for the effects of changes in and competition from other products.

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☆U.S. GOVERNMENT PRINTING OFFICE: 1977-703-078/28