ANALYSIS OF MARKET FACTORS ASSOCIATED WITH CUT NATURAL CHRISTMAS TREE RETAIL SALES IN URBAN AREAS

Dissertation for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY

LAWRENCE DAVID GARRETT

1976

This is to certify that the

thesis entitled

Analysis of Market Factors Associated with Cut Natural Christmas Tree Retail Sales in Urban Areas

presented by

Lawrence David Garrett

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Forestry

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Major professor

Date January 23, 1976

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ABSTRACT

ANALYSIS OF MARKET FACTORS ASSOCIATED WITH CUT NATURAL CHRISTMAS TREE RETAIL SALES IN URBAN AREAS

By

Lawrence David Garrett

Annually, forty million natural Christmas trees move from plantations and wild lands throughout the United States and Canada, through various market intermediaries, and finally to retail sales lots. The market effort culminates with the sale of millions of natural Christmas trees to consumers in three short weeks in December. In many areas the retail marketing period is even shorter. The market mechanisms are sophisticated and the marketing functions quite complex. Yet, each year hundreds of thousands of Christmas trees are left unsold on Christmas day in metropolitan areas, while in other metropolitan areas insufficient numbers of trees are available for the consumers. The market system reacts by fewer retailers coming into the market the following year in one area and more in other areas. The significant problem faced by these retailers is that insufficient market knowledge is available. An in

depth research effort was made to explain those factors which associate greatest with natural Christmas tree sales and to statistically model these factors to predict individual retail lot tree sales potential.

The study identified various Christmas tree marketing attributes of the Winston-Salem market. The area absorbed an increasing number of natural Christmas trees over the 3 years of study; in 1967, 9,227 trees were sold, whereas in 1969, 11,941 trees were sold. A variety of trees were available, including Balsam fir and Scotch pine from Canada; plantation Fraser fir and wild cedar from North Carolina; and Douglas fir from the West Coast. Average price increased over the 3 years of study, and the percentage of unsold trees vacillated from 14 to 17 percent. Retailer mobility was high, with 31 retail lots moving in and out of the market over the 3 years of study.

The study related associations between retail lot market characteristics, consumers' demographic characteristics, and lot locations. Analysis of marketing factors revealed that successful retail lots had better trees, located in areas of high retail sales activity, on heavily traveled roads, and had ample parking facilities. These lots sold more trees, obtained better prices, and had fewer unsold trees at the end of the marketing period.

The study also disclosed that the consumer travels considerable distances to purchase natural Christmas trees. The research evaluates the various market associations and

presents interpretations as to their combined effects on the spatial location and performance of natural Christmas tree retail outlets in Winston-Salem.

Using principal factor analysis and regression analysis, the market associations observed in the Winston-Salem natural tree market were statistically modeled. The research identified independent spheres of influence or factors, which were used in subjective evaluations of market variable associations. Associating variables were further utilized in developing predicting equations to estimate tree sales for individual retail outlets in Winston-Salem and Denver, Colorado.

Each predicting equation developed was tested for its accuracy in predicting sales with market data different from which it was developed. Interpretations were made as to each model's efficiency and utility.

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By

Lawrence David Garrett

A DISSERTATION

Submitted to
Michigan State University
in partial fullfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Forestry

1976

ACKNOWLEDGEMENTS

I am indebted to many individuals for the completion of this research effort. It represents the culmination of a relatively small dream in this hemisphere of high ideas and worldly accomplishments. However, the academic accomplishment which this paper transmits to the author transcends this. It began with a high school principal who instilled an appreciation for knowledge, through professors who were much more humanitarian than given credit, and ended with a wife who understood the frustration, yet urged me to carry the project to completion.

Having made the necessary hurdles in the academic world, many of my concepts of that world have changed, however, one has not. This system, in spite of its failings, still instills the desire to learn and understand. For that fact, I thank the learning institutions I have attended, and the many people with whom I was associated. To my major professor I must express my gratitude for a conviction which will no doubt follow me the remainder of my professional life: "Because things are not completely to our satisfaction, it does not necessarily mean they are of no value, and not deserving of our consideration."

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INTRODUCTION

Christmas tree marketing in the United States annually involves the sale of approximately 40 million natural trees valued at nearly $140 million (Sowder 1965). Future sales are likely to be even larger. By 1976, expanding annual consumption should reach 45 million trees (U.S. Department of Commerce 1965). This will represent a market with a total retail value of at least $160 million annually. In addition, some 20 million pounds of decorative material --wreaths, roping, and yule logs-- are sold each year for more than $600,000 (Sowder 1965).

A market of this magnitude for a product as perishable as a natural Christmas tree requires an effective market information system. However, there are definite indications that the performance of complex marketing methods and channels now being used in the industry is less than desirable. One basic problem appears to be the industry's inability to accurately predict consumer demand[1/]. This is illustrated by:

1/ Ellefson, P.V., and T.H. Pendleton. 1969. Problem analysis of Christmas tree marketing in the eastern U.S. Unpublished report. U.S. Dep. Agric. For. Serv., For. Prod. Mktg. Lab., Princeton, W.VA.

1. Excess and deficit supplies of trees at the retail level.

2. The year-to-year turnover of retailers.

Reliable estimates of the magnitude of excess and deficit supplies of trees are varied. While certain areas appear to have an abundance of trees on retail lots, others face dire shortages of quality trees. For example, studies in the St. Paul - Minneapolis metropolitan area have shown that approximately 15 percent of the total trees available for sale at the retail level remain unsold[1/]. Certain retailers in that market have been known to discard two trees for every three sold. Other studies have found similarly high figures (U.S. Department of Agriculture 1961), (Troxell 1970), (Drysdale and Nausedas 1970).

On the other hand, certain areas face critical shortages of quality trees and trees of certain species[2/], (Sullivan 1963). It is not uncommon for a consumer to be forced to purchase a particular species which was not his original choice[3/]. Nor is it uncommon for a consumer to

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1/ Ellefson, P.V. 1965. The 1964 Twin Cities retail Christmas tree markets. Unpublished report. Minnesota University, School of Forestry, St. Paul, MN.

2/ Fuller, K.B. 1964. A study of consumer preference for Christmas trees in a mature market area. Unpublished Masters Thesis, Pennsylvania State University, School of Forestry, University Park, PA.

3/ Ellefson, P.V., and T.H. Pendleton. 1969. Problem analysis of Christmas tree marketing in the eastern U.S. Unpublished report. U.S. Dept. Agric. For. Serv., For. Prod. Mktg. Lab., Princeton, W.VA.

purchase an artificial tree, or perhaps none at all, because there were no quality natural trees available (Black 1962), (Drysdale and Nausedas 1970).

It is obvious that losses to the retailer will be substantial if he is unable to sell his supply of trees by Christmas day. But equally significant, he is also financially affected if he cannot supply the quantity and type of trees desired by consumers. In this case, potential sales may be permanently lost and profits reduced.

In a like manner, both the wholesaler and grower face possible losses from failing to satisfactorily estimate the size of their markets. A wholesaler who incorrectly estimates sales either in total or by species will find himself with a supply of unsaleable trees or else unable to fill an order. If the grower fails to accurately forecast consumer sales either in total or by species, he is faced with supply-demand imbalances which he must live with for several years.

Year-to-year inconsistency in retailers is the second chief indication that inadequate market knowledge is one of the major problems facing the Christmas tree industry. In some markets, only six out of ten retailers return to sell trees the following year. And, of the new total, around one-third are inexperienced retailers new to the trade (Skok and Miles 1963), (Troxell 1970).

While these figures may not be representative of all areas, they are sufficiently typical to indicate the

rather volatile and inconsistent nature of the natural Christmas tree retail market (Conklin 1962), (Nelson 1961). This erratic market entry and exit may well be due to a lack of market knowledge of consumer demand. Instead of attempting to estimate his potential sales, and then deciding whether to enter the trade, the retailer all too frequently makes his decision based upon the number of retailers in the market during the preceding year and the seemingly high profits they earned. The result is too many retailers in certain years and too few in others. Such inconsistency results in two major problems for the industry:

1. Growers and wholesalers are often faced with inefficient and unreliable market outlets.
2. Retailers frequently suffer economic losses because they lack marketing experience.

One solution to excess and deficit supplies of trees, retailer inconsistency, and increased consumer satisfaction is to increase knowledge of those market factors associated with natural Christmas tree sales. Accurate estimates of market demand and subsequent coordination of supply and retail sales can significantly reduce losses now occurring in this industry.

PURPOSE OF STUDY

The major objective of this study is to identify and analyze market factors associated with cut natural Christmas tree sales in urban areas. Further, to develop forecasting models which will assist Christmas tree retailers in estimating their potential sales in a given market area. The research will attempt to relate retail tree sales for a single retailer to those variables which are found to be the most important determinants of his sales.

In order to achieve this objective, two subobjectives must be met:

1. Predicting models developed in this report attach considerable weight to the natural tree being purchased in close proximity to place of residence[1/,2/] (Brundage, Nicewander, and Kohly 1955), (Brundage 1958), (Roth and Brummel 1971). Should the assumption be false,

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1/ Fuller, K.B. 1964. A study of consumer preference for Christmas trees in a mature market area. Unpublished Masters Thesis, Pennsylvania State University, School of Forestry, University Park, PA

2/ Schweitzer, D.L. 1963. The retail Christmas tree market in the Twin Cities. Unpublished report. Minnesota University, School of Forestry, St. Paul, MN.

that is, people buy trees distant from their place of residence, the model would be improperly specified (Thompson 1964). Therefore, a secondary objective is to determine the validity of this assumption.

2. Because there are so many variables which can conceivably influence tree sales, it is necessary to screen a large set of economic and demographic variables to obtain a smaller subset having maximum explanatory power (Green and Tull 1970). Once this subset is identified, it can be entered into a predicting model as a set of independent variables. The model then identifies the relative significance of those variables having association with Christmas tree sales.

Accomplishment of these objectives will result in workable information that can be used by the retailer in effective decision-making activities. That is, identification of those economic and demographic variables which associate with or influence tree sales, greatly increases the retailer's market knowledge. Not only is he better equipped to make decisions on lot location, merchandising, and advertising, but given a certain mix of these variables, he can determine his probable sales performance at a given location.

A Structural Model

To fully understand the market relationships between buyers and sellers of Christmas trees requires analysis of such market factors as product characteristics and price, consumer demographic characteristics and preferences, market characteristics, attributes of related products, etc. That is, the model should incorporate all factors related to the product, the buyer and seller, and the market place.

It is normally impossible to include each and every conceivable variable affecting a product in a market environment. Yet, in characterizing a structural model, it is important to identify through observation, empirical analysis, or a priori evidence those factors felt to be important. A consumer demand or sales model for cut natural Christmas trees would, therefore, reflect the following relationship:

Demand = some function of production and market factors.

The above model must be partitioned to be meaningful and, depending upon the objectives sought and constraints imposed, the list of individual variables to represent these factors may vary widely. Generally, however, the analyst attempts to include the most influential variables even with the most abstract model. Such a partitioning would likely include the following list:

Sales for cut Christmas trees = a function of

tree price, quality, type; substitute product price, quality, type; complementary products; supply of natural tree, complements and substitutes; consumer characteristics and preference; number, size, quality, and type of retail outlets.

The sales for natural Christmas trees is predicated on available supplies of the product. It was beyond the scope of this research to study supply relationships; therefore, the apparent interactions between sellers, growers, wholesalers, brokers, etc., are not analyzed. However, to obtain a clear perspective of the demand relationships presented, it is important to have an intuitive understanding of the natural Christmas tree supply function and its *a priori* relationship to demand.

Natural Christmas Tree Supply

Natural Christmas trees are a perishable, nondurable, consumer good. They are perishable in a biological sense because they physically deteriorate. In an economic sense they are also perishable. That is, cut natural Christmas trees have zero market value on December 26, regardless of their biological condition, and consequently, a demand ceases to exist. In contrast, the artificial Christmas tree is nonperishable and is a durable good. In fact, post December 25 sales of artificial trees at reduced prices have become quite popular in metropolitan areas.

The natural Christmas tree market period, or the period of direct interaction between supply and demand, is generally initiated the last week of November or the first week in December, assuming no artificial market constraints. This is not to be confused with the production period required for the product, which averages 8 - 10 years.

The market supply function depends a great deal on the time interval separating markets and supply points. For metropolitan areas, the time interval is generally too short to negotiate significant adjustments in supply during the market period. Producers and wholesalers are aware of this problem and, therefore, harvest and handle fixed product volumes based on orders placed 6 to 12 months in advance. Opportunity for competitive bidding of additional supply is severely limited.

Because of these factors, the supply of cut natural trees is virtually inelastic during the market period. The degree of inelasticity exhibited within a given market place depends on many factors. Examples of these factors are as follows.

Size of market: Large metropolitan markets are generally supplied by distant growers, wholesalers, or brokers who deal in large volumes. As indicated in Figure 1, if the market structure is not responsive (i.e., no trading within the market or between like outlets in nearby markets), the retailer supply function is extremely inelastic - By contrast, smaller markets are supplied by more

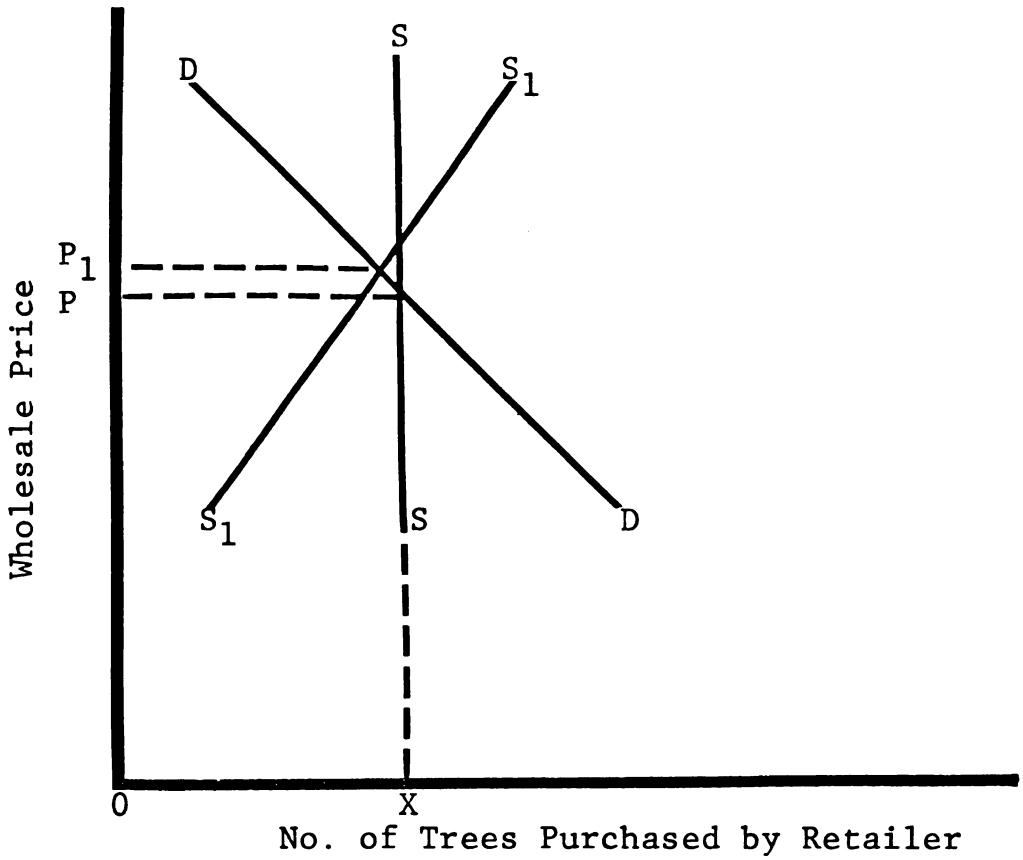


Figure 1.--The natural Christmas tree supply function during the retail market period.

local grown or wild trees from smaller growers or producers. The supply is normally more expensive, but can be more elastic (S_1S_1).

Proximity of competing demand points: Several market areas (cities) in close proximity can have elastic supply functions. For example, chain store retailers have multiple sales outlets in competing markets. Since market information is readily exchanged, supply can be shifted from where demand and/or prices are low to a market where demand is strong and/or prices are high.

Market structure: The market structure of the

natural Christmas tree industry can affect the supply function. If several market areas in close proximity are serviced primarily by different suppliers, the supply function to each is more inelastic than if one supplier is servicing all areas. Primarily this is due to shorter time for market feedback and reduced transfer and handling costs. These transfers are usually arranged to minimize losses to the retailer relinquishing ownership of a tree shipment.

The above relationships regarding supply refer to the retail market period or the very short run. Regressing backward from December, the greater the time interval, the more elastic the function. For example, if we were to expand our treatment of supply to the 9-month period, April - December, we would observe a transitory supply function. In Figure 2, the period April - July is represented by S_1; the period August - October S_2; and November - December, S_3.

The greatest grower volume commitments are made in period one at a lower average wholesale price, p_1. As the procurement period shortens, the grower or wholesaler demands a higher price to cover both real carrying costs and those imputed costs associated with risk and uncertainty. Faced with a much shorter interval for disposing of their product, the growers' supply function becomes more inelastic.

In the last period (within or immediately preceeding the market period) the grower becomes virtually

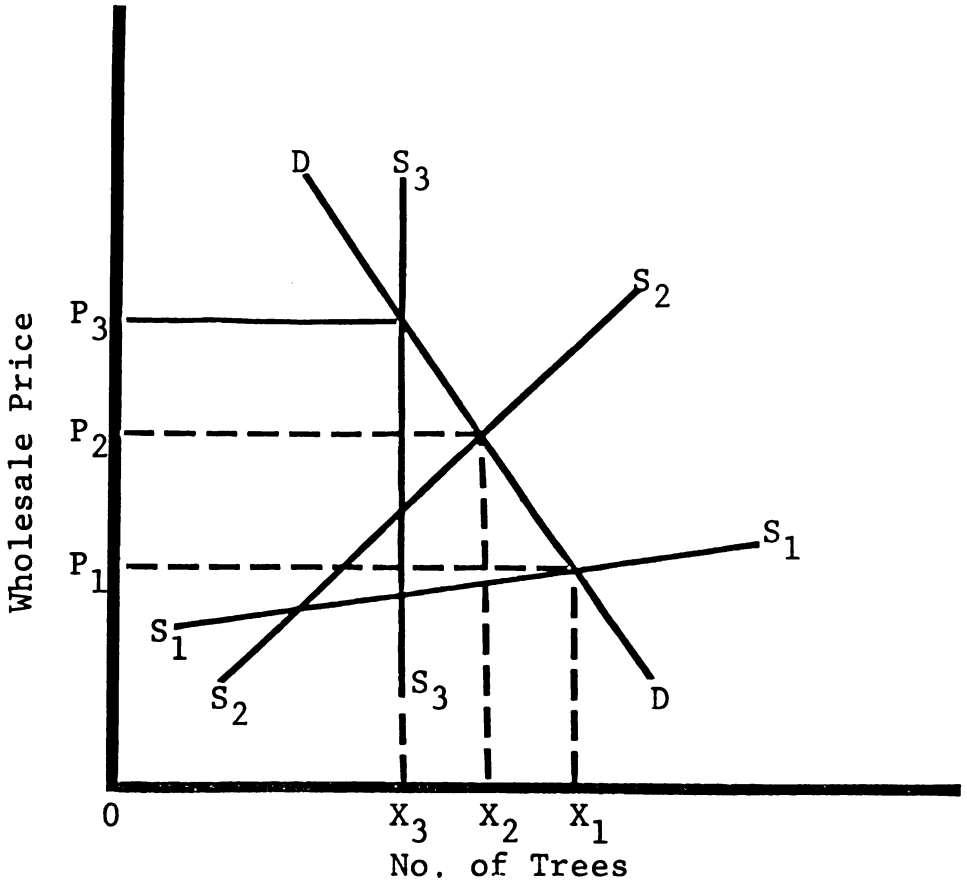


Figure 2.--The transitory natural Christmas tree supply function.

inflexible. Regardless of the price offered by the dealer, he can only release a fixed amount to the market. If he had used normal marketing procedures, he would have little, if any, product left for that market period. To make relatively small quantities of additional product available, the grower would have to incur high unit costs. Even if he could charge exorbitant prices, a small sale would yield insufficient profit to create the incentive. If the potential sale was large, he would be faced with a more serious consideration. He would have to deplete his inventory, which has planned allocation to established future

markets -- markets that could be lost if not supplied.

Both of the above supply functions are important. First, and most important, within the retail market period, supply is virtually fixed. Second, although the transitory supply functions directly affect the price which the retailer must pay for his trees, this price does not completely determine the retail price of trees in the market place. Retail market price is determined from the direct interaction of market supply and consumer demand.

Retail sales of cut natural trees are constrained at least at the upper limits by the fixed supply schedule. In our study, we assumed the existence of a fairly rigid inelastic supply schedule during the retail market period. Demand and price relationships are, therefore, not affected by a changing supply schedule. Supply is fixed, as well as the incurred cost for its offering. It remains only to treat the demand relationships which guide transfer of this fixed supply from retailer to consumer. Consumer demand is influenced by these factors:

1. Christmas tree prices.
2. Consumer taste and preference.
3. Market size.
4. Consumer income.
5. Price and market characteristics of related products.
6. The range of goods available to the consumer.

Market prices for Christmas trees are, no doubt, initially dependent on wholesale costs, which are determined via the transitory supply schedules previously discussed. Since the retailer is faced with a fixed supply, to maximize profits his market strategy should be to shift the demand function upward at all price levels. However, he is thwarted in these efforts as the market period wanes.

Consumers' preference and taste are demand shifters. That is, if a consumer suddenly prefers a different species of trees, the demand for that tree shifts upwards at all price levels, and downward shifts occur for species being abandoned. It is possible to attract some sales back if the retailer can ascertain the reasons for the change in preference, and successfully implement corrective market strategies.

Consumer preferences and tastes are shaped by many variables; religion, cultural background, ethnic grouping, peer grouping, social status, education, etc. However, they are not inflexible, and do change over time.

Market size strictly represents the potential market. That is, ostensibly, the larger the population, the larger the sales of the product in question. This is, of course, not necessarily true. For shoes, raw population counts may be correct, but one does not wear a Christmas tree. Market size for Christmas trees is best represented by housing units. And, if number of housing units increases, other things being equal, more trees will be supplied at all

price levels, or demand is shifted upward.

Income is a gross measure of the economic ability to absorb goods and services. However, the consumer's income is constrained by necessary purchases of government goods and services (taxes) and private goods and services (i.e., necessities; food, housing, clothing, transportation). Remaining are those monies which can be expended for such items as Christmas trees. Increases or decreases can affect the total number of trees purchased.

Price and market characteristics of related products, whether they are substitutes or complements, are important to sales of cut natural Christmas trees. Balled trees, cut wild trees, cut natural trees, and artificial trees have certain levels of substitutability in the market place. Wreaths, lights, tinsel, tree stands, etc., are, in most cases, complementary goods to the above products. Changing the price of any one type of tree may well change the position of the demand function for all substitutes. It would also shift demand for complements. That is, if people save money buying their trees, they may buy more tinsel at existing prices.

The range of goods available to the consumer affects demand for the product. Intuitively, the wider the range, the greater the individuals' needs are satisfied and, therefore, the greater the sales. It is infeasible in the supply sector to create a wide range of trees, and yet some adjustments must be made. Quality, appearance,

species, price, packaging, etc., are all varied to conform to different consumer preferences and needs.

An intensive analysis of two natural tree markets and related specification of Christmas tree sales predicting models required treatment of most of these factors. Some were of lesser importance than others, and some were more difficult to incorporate due to the type of analysis utilized. These elements of demand are treated herein as factors relating to retail sales and, therefore, will be referred to as tree sales.

RESEARCH PROCEDURE

The basic hypothesis of this market analysis is that tree sales for a given retail lot are a function of economic variables associated with the product, the retail lot, its market location, and demographic characteristics of consumers in the census tract where the lot is located. Further, the hypothesis to be tested is that equations can be developed to accurately predict individual tree lots sales via estimation of these variables.

Testing the equations for accuracy requires a hypothesis which will test the difference between sales in a given market area (Y), and the predicted sales ($\hat{Y}$) obtained from the developed equations. Stated specifically:

$$H_N: \quad \Sigma (\hat{Y} - Y) = 0$$

If the equations are found to be statistically significant, further analysis will be completed to determine their practical utility as a management tool. The primary criterion for the acceptance will be the capability of the equations to estimate actual tree sales within the average market spoilage level, or 15 percent.

Development of this research progressed through several stages, each having separate procedural elements,

but dependent on other stages at some point of the research process. The research procedure used is best represented by the following four stages, which will be discussed in order of their formulation (Figure 3).

Stage A: Study area, variables, scope of study, and methods of data collection and analysis.

Stage B: Screening variable set for redundancy.

Stage C: Final reduction of variable set, determination of coefficients for socio-economic variables, and deriving the predicting equations.

Stage D: Testing the models.

Selecting Study Area, Variables, and Data Collection Techniques

Study Area

Winston-Salem, North Carolina was chosen as the study area. Since approximately two-thirds of all natural trees are sold in metropolitan areas[1/], it was felt that a study of a metropolitan area would result in greater benefits to the industry.

Development of the forecasting model was dependent upon the Bureau of Census information system, i.e., census tract data. Winston-Salem is a Standard Metropolitan

1/ This estimate is based upon the fact that over 70 percent of the U.S. population resides in metropolitan areas.

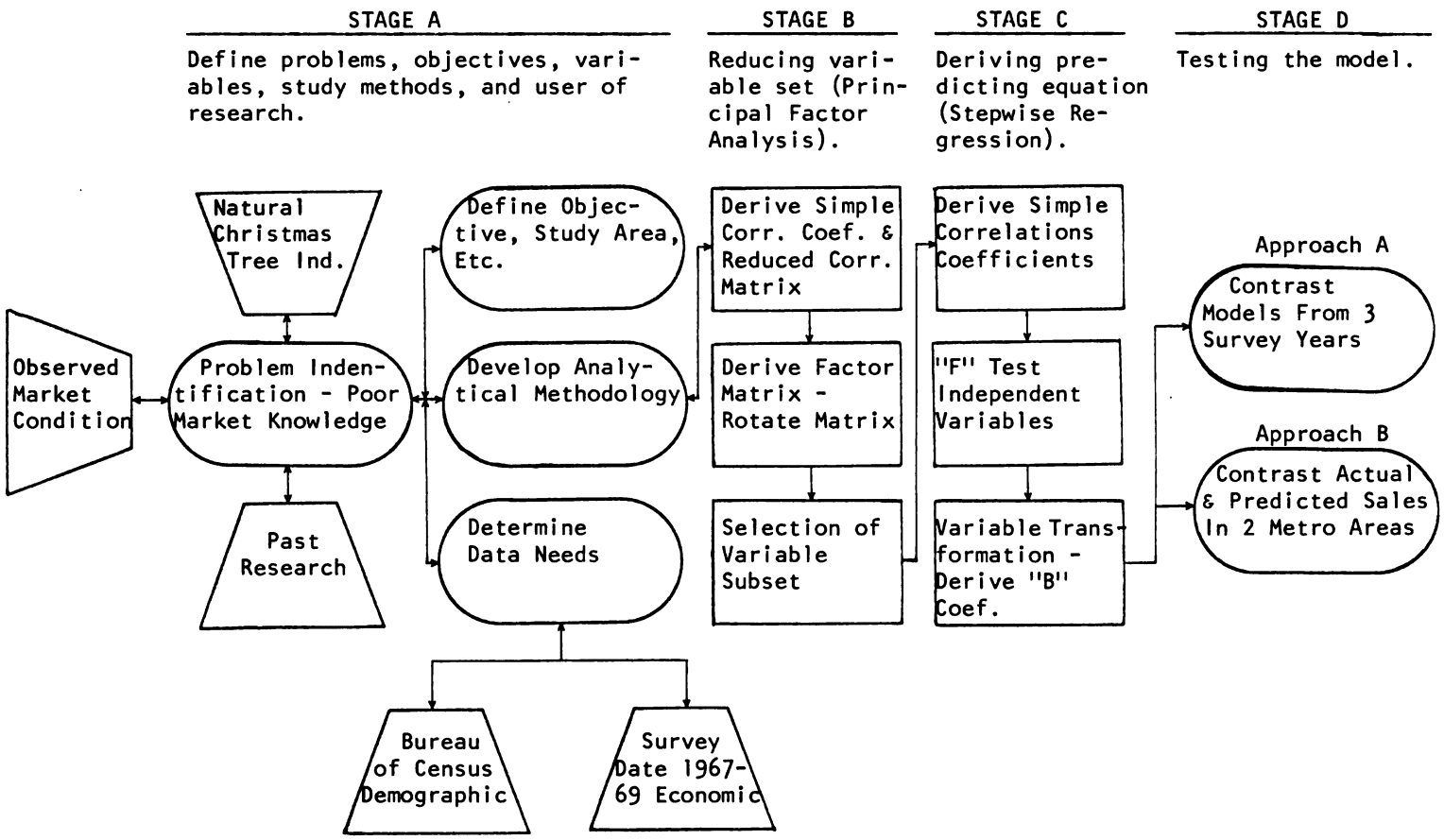


Figure 3.--A general study model to analyze natural Christmas tree sales in urban areas.

Statistical Area (SMSA) for which detailed demographic information is available by census tract and city block.

Also, all Christmas tree retailers in Winston-Salem are required by city ordinance to purchase a retail license. As a result, the universe of retailers was readily available. Only 6 of 35 other SMSA's surveyed in the East and Southeast had such a city ordinance.

Winston-Salem SMSA had an estimated 1968 population of 150,000 people. The population is divided into white (60 percent) and negro (33 percent) racial groups, with segregated areas of residence significantly reflected in census tract statistics. Average income varies by census tracts beginning at $3,000 and exceeding $20,000 at the upper level.

Winston-Salem is recognized as a major consumer market area in the North Carolina Piedmont Plateau. This is evidenced by the fact that the Winston-Salem - High Point - Greensboro area is one of the most rapidly expanding market areas in the Southeast (Sales Management 1966).

The suitability of Winston-Salem as a test area of consumer response to market goods is supported by the fact that four major market testing firms have consumer panels in the city[1/].

1/ Source: Margaret Ernstes Market Interviewing Service, Winston-Salem, NC. Market Testing Firms: Home Testing Institit., Family Opinion Poll, Speedata Inc., and Marketest, Inc.

Selecting the Variable Set

Two general classes of variables are assumed to be associated with sales of natural Christmas trees:

1. Demographic variables characterizing the population buying trees, and
2. Economic variables characterizing retail outlets from which trees are purchased.

Certain associations, such as changes in taste, were not evaluated due to limitations of the cross section analysis.

Demographic variables

The 1960 United States Census of Population and Housing Report PH(1)-174 for Winston-Salem, North Carolina, SMSA was used to develop census tract data for the study. Census tract data provided a complete set of demographic characteristics of consumers, and these data are readily available at minimum cost.

Variables 48 through 104 represent the demographic variables used in the study (Table 1, Appendix B). The 56 variables can be categorized into 10 general types or groups as illustrated. Several measures of the same variable were selected, and the most important of these were isolated using factor analysis (Harmon 1967).

Economic variables

Marketing research has firmly established that certain marketing practices are instrumental in effecting retail sales of consumer goods. These practices, when

quantified, can be studied with the intent of identifying those having greatest influence on sales. Because there is definite interaction between economic variables and the demographic variables mentioned above, their combined effect on sales was studied.

Variables 1 through 47 and variable 105 (Table 1, Appendix B) are the economic variables used in the study. As with the demographic variables, an attempt was made to identify specific variables which would best represent the general group.

Economic variables were obtained from several sources. Variables 7 through 47 were obtained from observations recorded at the retail lot and personal interviews with retail lot owners (Schedule I, Appendix A). Variables 1 through 6 were created by plotting lot locations on a Winston-Salem block map and noting street distances among these various retail lots. These distances served as a proxy variable for determining competition among retail lots.

Data for variable 105 was obtained from 1967-69 annual average daily traffic volume (AADV) maps[1/]. A major traffic artery carried an AADV of traffic exceeding 10,000 vehicle units. It was usually a 4-lane expressway, or limited access road. Two-lane roads with an AADV

1/ North Carolina State Road Commission, Traffic Division. 1967, 1968, and 1969. Annual average daily 24-hour traffic volume maps (AADV). Raleigh, NC.

greater than 10,000 were improved (widened) 2-lane roads with asphalt berms.

The AADV variable acts as a direct measure of potential customer traffic. The traffic volume for a given retailer was determined by the AADV for the road adjacent to the lot.

Data Collection

As noted previously, all data on demographic variables were extracted from the 1960 Bureau of the Census publication PHC(1)-174. Data on economic variables were taken from four surveys in Winston-Salem during the Christmas holiday periods of 1967, 1968, and 1969. Two schedules were used in these surveys, a retail lot owner interview schedule (Schedule I, Appendix A) and a consumer survey schedule (Schedule II, Appendix A).

Retail lot owner survey

The two-part retail lot owner schedule was used to obtain information on economic variables which affect a retail Christmas tree lot's sales performance. Part I was used to record observations by the researcher on the retail lot, such as conditions of trees, lot appearance, parking space, etc. Marketing data were taken on Part II via a personal interview with the lot owner or operator. The survey was conducted for a three-year period; 1967, 1968, and 1969.

Retail lots were located through the Winston-Salem

retail licensing bureau. All observations and interviews were conducted by forest economists from the Forest Products Marketing Laboratory at Princeton, West Virginia. Retail lot observations (Part I) were made on December 17 - 21 for each of the three study years. Interviews with retailers (Part II) were conducted in January and February with the majority of the interviews completed in January.

The total number of observations (retail lots) varied from 53 in 1967 and 1969 to 46 in 1968. This was due to entry and exit of retailers and not to nonrespondents. All lot owners within the city limits were contacted and 100 percent response was recorded on Parts I and II of Schedule I for each of the three survey years.

Consumer survey

As indicated previously, past research has revealed that consumers prefer to travel only short distances to purchase natural Christmas trees. However, this hypothesis needs further evaluation as it poses a critical assumption to the model being used in this study.

To determine if Christmas trees are purchased near the consumer's residence[1/], and also to obtain information on artificial tree purchases, and consumers who did not purchase any trees, a survey of Christmas tree consumption

1/ "Near the consumer's residence" as defined for this study, is an area encompassing the census tract in which the consumer resides, plus directly adjoining census tracts.

patterns was conducted in Winston-Salem.

A private research organization conducted the survey via house-to-house personal interviews, using Schedule II, Appendix A. In total, 1,017 responses were recorded.

A stratified sample of Winston-Salem consumers was constructed, using 1960 census block listings. The samples within each census tract were weighed by the 1960 population of the census tract.

No callbacks were taken on nonrespondents, however, replacement interviews were taken. In a nonresponse, the interviewer would take the next highest house number as a replacement. If this respondent was already in the sample, the next highest house number was used and so forth.

Questions 1 and 2 of the schedule were used to resolve proximity of purchase of trees to the consumer's house. Questions 3, 4, and 5 were used to establish the market segment held by artificial trees. Questions 6 and 7 were used to determine the market segment which presently does not purchase any type Christmas tree. Questions 8 - 11 were used in correlating survey data to census block data.

Reduction of Original Variable Set: Factor Analysis

Two general analytical models were used for data analysis. Factor analysis (Harman 1967) was used to reduce the original variable set (Table 1, Appendix B) to a smaller subset. Stepwise regression analysis was used for further data screening, derivation of partial regression

coefficients, and development of predicting equations.

To current day statisticians and mathematicians, the term "factor analysis" has varied meaning. The term represents a group of techniques that are used to analyze the intercorrelations within a set of variables. Its primary purpose is to find a way of summarizing the information contained in a number of original variables into a smaller set of new variables or factors, with a minimum loss of information -- that is, to remove the redundancy in the original measurements.

Generally speaking, the method can incorporate four different analytical methodologies. These are briefly described by Massy (1963) as:

1. Separation and analysis of distinct dimensions that are latent in a larger set of variables.
2. Separation and analysis of differing groups which exist in a larger population.
3. Identification of certain likely variables for subsequent regression or discriminant analysis from among a much larger set of potential independent variables.
4. Summarization of the common parts of a set of explanatory variables into a smaller number of new variables which can be used in regression or discriminant analysis.

Approaches 1 and 2 use the smaller number of conceptual variables for factors as ends in themselves; that is, the listing of factor[1/] scores on each independent factor is the ultimate goal and the scores are used only to subjectively identify the factors. Method 3 also uses factor scores, but uses the scores for identifying variables to use in subsequent analysis. Method 4 requires that quantified estimates of the factors be obtained. These estimates are then used in subsequent regression or discriminant analysis.

Method 3 was used in this study to screen the original 105 variable set to the smaller variable subset used in the final regression analysis.

This use of factor analysis as strictly a data reduction tool departs from the classical use of factor analysis (1 above) as proposed by Thurstone (1931).

Much of the criticism of the use of factor analysis in marketing research centers around its use in the classical approach (Ehrenberg 1962), (Rothman 1968). It is purported that little is gained with factor analysis because of the subjective manner in which factors are identified. That is, the final goal sought is a list of subjectively identified orthogonal factors (zero correlations).

1/ The grouping of a linerally independent set of original variables defines a factor. The extent to which each variable is correlated to the factor is represented by its "factor score."

Using factor analysis for strictly variable reduction is an attempt to make the method more useful in marketing research[1/]. That is, by identifying and eliminating redundancy and linear dependence in data sets, we gain greater efficiency in subsequent regression or discrimant analysis (Harman 1967), (Green and Tull 1970).

Deriving the Predicting Equations: Regression Analysis

Factor analysis is employed not only to reduce the original variable set, but to do it in such a manner to delete those variables having the greatest interdependence, which would cause serious multicolinearity in subsequent regression analysis.

The use of regression analysis on a variable subset which has been "screened" by factor analysis affords certain advantages. With the initial factor analysis, the manifold relationships between all variables can be studied at one time without running into the problems of multicolinearity that are so often encountered in regression analysis. Once a relatively "close" subset of independent variables is identified, the greater predictive power and hypothesis testing ability of multiple regression can be brought into play.

1/ For a thorough treatment of the analytical model used here, the author suggests Harman's text on Modern Factor Analysis. For applications in marketing see: Green and Tull, Research for Marketing Decisions.

Multiple regression is more widely known than factor analysis and its use in marketing and economic research requires little elaboration (Gatty 1966), (Draper and Smith 1966), (Salzman 1968). Basically, multiple regression is a method for describing a relationship between a dependent variable and a set of independent variables. The "regression" itself is an equation developed to "explain" this relationship.

Multiple regression in itself is not designed to assist in additional screening of variables which do not make a minimum contribution to the explanation of the regression. However, a refinement of multiple regression, stepwise regression, is designed to accomplish this objective.

To test the significance of a variable to determine if it should remain in the regression equation, a ratio of quantified added influence of the last introduced variable to the residual unexplained part of the regression is developed. This is compared with a ratio of minimal acceptance chosen by the analyst. For the models presented in this study, the minimal acceptance ratio was 0.01 and the minimal ratio for removal was 0.005. The specific multivariate computer program used in the analysis was BMD02R[1/].

1/ BMD02R. 1966. Stepwise regression. Version of May 2. Health Science Computing Facility, UCLA, CA.

The program also permits evaluation of dummy variables; i.e., those variables considered important but not easily quantified. For example, extreme difficulty was encountered in trying to quantify "level of merchandising" on a retail lot. Instead, this variable was entered as a dummy, or classification variable, which simply indicates whether or not the owner merchandised his product[1/]. The program gives all measures of significance on dummy variables as are recorded for continuous variables.

Testing the Model

It is difficult to define absolute criteria for use in assessing the usefulness of a predicting model. That is, how does one assess the utility of a model, or its ability to predict tree sales accurately? The attitude taken here is that two criteria should be satisfied.

1. Comparative Statistics of Models: Once a model was specified in one market from one year of cross section data, additional sets of data from the same market were obtained and models developed for the next two consecutive years. The standard errors of the three models were contrasted as well as the coefficients of multiple determination.

1/ "Merchandising Activities" relate not only "what product combinations are presented," i.e., grade, species, sizes, etc., but also "how they are presented," i.e., in stands, under lights, etc. It does not relate to product price.

2. Comparing Estimated and Actual Sales: After deriving the model in one market area, it was used to predict sales of retailers in another market area. Actual sales in the new market area were contrasted with estimated sales.

As three consecutive years of data (1967-69) were collected in Winston-Salem, it was possible to develop three predicting models. These three models were then contrasted as described above. The three models developed in Winston-Salem were used to estimate cut tree sales in Denver, Colorado. These estimates were then compared to actual sales for the Denver area. Also, a model developed from Denver market data was used to estimate sales from the four years of market data in Winston-Salem.

ANALYSIS AND DISCUSSION OF RESULTS

This chapter will be devoted to assessing the Winston-Salem natural Christmas tree market in several ways. First, the market situation will be described as it existed, showing both the retailer and the consumer factions and their resultant interactions. The market will then be mathematically modeled via principal factor analysis, to isolate independent spheres of influence. Once this has been accomplished, a statistical model of the market interactions will be developed, from which market performance can be predicted.

The Retail Market Structure for Natural Christmas Trees

The retail market structure refers to the organizational characteristics of a retail market that determine the relationship among sellers, among buyers, of sellers to buyers, and of established sellers to potential sellers (Greenwold, Douglas, and Associates 1965). In other words, retail market structure refers to those characteristics of a retail market that determine or influence the nature of competition within the market. The natural Christmas tree retail market structure can best be described by:

1. Characteristics of retailers in the market.

2. The extent to which the outputs of the retailers in the market are viewed as non-identical by buyers in the market.
3. The relative ease or difficulty with which new retailers may enter the market.

Tree Sales

Christmas tree retailers in Winston-Salem sold 9,227 natural trees in 1967, 10,152 in 1968, and 11,941 trees in 1969 (Table 2). Balsam fir was by far the biggest seller each year, accounting for over 40 percent of all trees sold. In 1967, the Eastern Red cedar and White pine were second and third in sales, respectively. From 1967 to 1969, sales of cedar trees fell almost 60 percent (767 trees) and had slipped to fifth in popularity. White pine became the second most popular tree in 1969, followed by Fraser fir and Scotch pine. The large decline in sales of cedars was attributed to a change in taste influenced by the supply of better quality pine and fir. This is supported by the fact that sales of Fraser fir increased over 100 percent (706 trees) between 1967 and 1969.

There were more unsold trees in 1969 than in either of the two earlier years. In 1969, 17.5 percent of the Christmas trees in stock were not sold compared with 14.7 percent in 1967 and only 9.7 percent in 1968. Eastern Red cedar led the list of unsold trees every year, with lot operators discarding about one-fifth of their cedars.

Table 2.--Christmas trees sold in Winston-Salem, NC, 1967-1969.

Type	1967		1968		1969	
	Number	% of Trees Available	Number	% of Trees Available	Number	% of Trees Available
Balsam fir	3,762	89.6	4,529	92.2	5,173	81.7
Fraser fir	615	82.4	848	96.4	1,382	83.7
Douglas fir	--[b/]	--	--	--	57	95.0
White pine	1,566	84.1	1,737	87.1	2,075	81.3
Scotch pine	976	95.2	1,305	93.2	1,304	87.1
Eastern Red cedar	1,686	77.3	1,097	81.4	900	78.5
Norway spruce	16	100.0	3	--	65	81.2
White spruce	35	70.0	--	--	--	--
Blue spruce	--	--	--	--	83	87.4
Arizona cypress	40	66.7	--	--	--	--
Halverson[a/]	531	77.8	633	95.6	902	85.5
Total	9,227		10,152		11,941	
% of Total		85.3		90.3		82.5
% of Total Available Left Unsold		14.7		9.7		17.5

[a/] A color-processed natural spruce.

[b/] Species not sold.

Generally, fewer Scotch pine Christmas trees had to be discarded than any other species.

Prices

The retail price of Christmas trees varied according to species (Table 3), but Fraser fir brought the highest price of all the major species each year, and it also enjoyed the greatest annual increase in sales. Prices of all species increased between 1967 and 1968. However, between 1968 and 1969, prices of the pines fell even below their 1967 level. This change in the price structure is partially accounted for by the influx of Canadian imported pines, mainly Scotch. These trees, marketed primarily by chain grocers, were purchased at slightly lower wholesale prices than local grown pines. Also, the large number of retail dropouts between 1968 and 1969 coupled with the high percentage of unsold trees in 1968 seemed to cause retailers to depress market prices in 1969.

The average retail markup of the five major species declined notably over the three years. The average markup was 118 percent in 1967, 98 percent in 1968, and only 91 percent in 1969. With the exception of Fraser fir, the average markup for each species fell between 1967 and 1969. The overall increase in wholesale tree prices coupled with seller resistance to raise prices in 1969 was responsible for the decline in markups.

Chain grocery stores and discount establishments

Table 3.--Average retail price[1/] of Christmas trees in Winston-Salem, NC, 1967-69.

Species	1967	1968	1969
Balsam fir	$2.84	$3.10	$3.34
Fraser fir	4.81	6.73	6.90
Douglas fir	a/	a/	7.00
White pine	4.44	4.69	4.19
Scotch pine	4.55	4.76	4.11
Eastern Red cedar	2.08	2.32	2.86
Norway spruce	3.25	a/	a/
White spruce	2.00	a/	a/
Blue spruce	a/	a/	4.00
Arizona cypress	1.10	a/	a/
Halvorson	2.00	2.32	2.08
Average	3.21	3.75	3.87

1/ Weighted by number trees sold.

a/ Species not sold.

sold Christmas trees at below average markups. However, this pricing policy was consistent with the normal pricing policies of chain stores. The practice of pricing Christmas trees as "loss-leaders" was not observed at any chain grocer's or discount stores.

Number and Type of Retail Lots

There were 53 natural Christmas tree retailers in Winston-Salem in both 1967 and 1969. Only 46 retailers sold Christmas trees in 1968.

A wide variety of retail outlets sold Christmas trees in Winston-Salem between 1967 and 1969 (Table 4).

Table 4.--Percent frequency of natural Christmas tree retail lot types: Winston-Salem, NC, 1967-69.

Type of Retail Establishment	1967	1968	1969
Chain grocery stores	32.1	37.0	36.0
Independent lots	28.3	19.5	18.8
Discount stores	13.2	13.0	13.2
Independent grocery stores	11.3	10.9	11.3
Nurseries and florists	7.5	10.9	9.4
Service stations	1.9	6.5	7.5
Other	5.7	2.2	3.8
Total	100.0	100.0	100.0

However, one-third of all Christmas tree retailers in each of the three years were chain grocery stores. Independent lots (including church and civic groups) accounted for about 28 percent of all retailers in 1967 and almost 20 percent in each of 1968 and 1969. Discount stores, independent grocers, nurseries and florists, service stations, and other dealers made up the remaining retail outlets.

Of the seven distinct types of natural Christmas tree retail lots in Winston-Salem, independent lots had the best overall market performance. A three-year average of 44 percent of total sales was held by this group, which constituted an average of only 22 percent of the total

retail lot types. Discount stores ranked second in performance with 15 percent of total sales while representing only 13 percent of the population of retailers. The poorest performing group was independent grocers. In this group only 3 percent of the market was held by 11 percent of the retail outlet population.

The three largest groups of retailers, chain grocery stores, independent lots, and discount stores, comprised 70 percent of the total retail population and held 85 percent of the market sales.

Retail Lot Size

Relative size in the market place is normally associated with power. With bigness comes the ability to dictate market conditions through actions. Large Christmas tree retailers did exist in the Winston-Salem market. In each of the three study years, 20 percent of the retailer population (10 retailers) held 60 percent of total market sales. The five largest retailers sold about 40 percent of all trees. As an indicator of market impact per retail lot; the ten largest retailers averaged 722 sales per lot, whereas the remaining lots averaged only 110 sales.

It is also significant to note that all ten large retailers were either a chain grocery store, independent lot, or a discount store.

Lot Location

Christmas tree retailers in Winston-Salem located where consumers went to spend money. In 1969, 81 percent of all tree retailers were located in business areas; only 19 percent were found in residential areas. Of greater significance, 66 percent of the retailers were located in the four major and two minor shopping areas of the city (Figure 4).

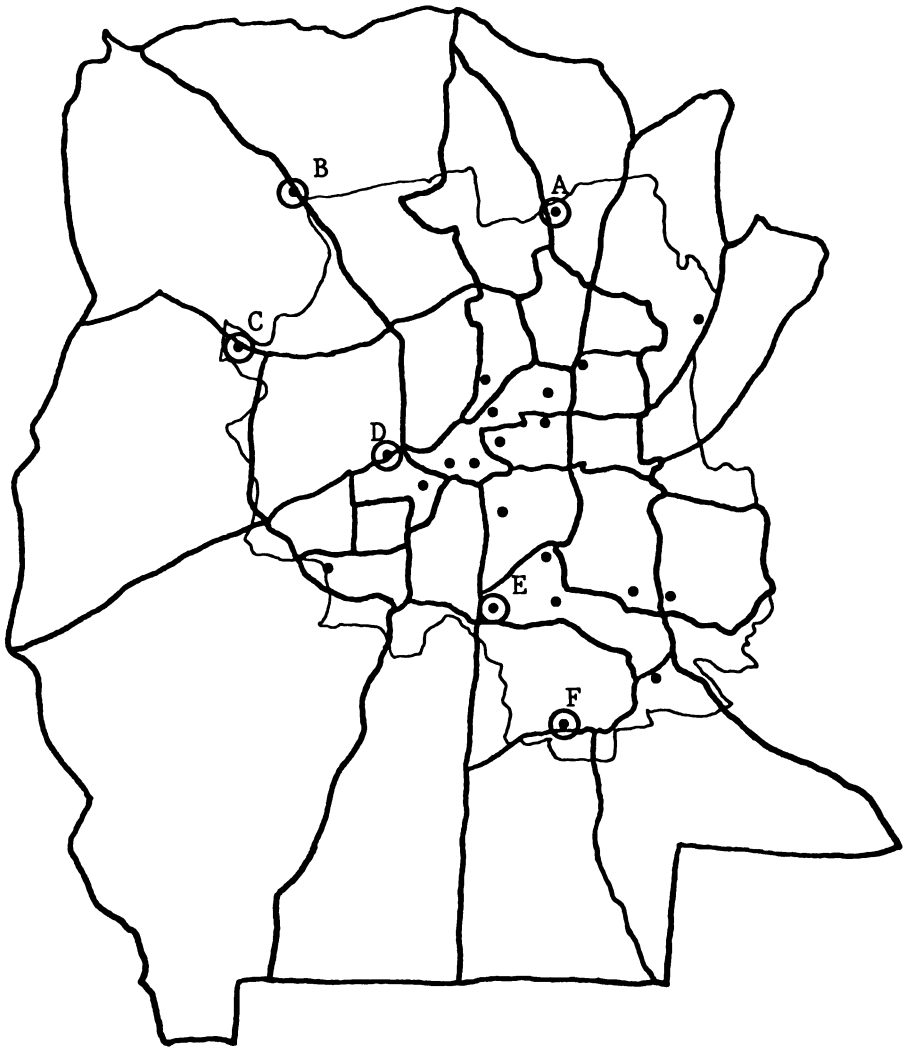
Christmas tree retailers who located in retail business areas sold more trees and discarded fewer each year than did those retailers in residential areas. In 1969, the average retailer in a business area sold 241 trees, but the average retailer on a residential street only sold 156 trees. The retailer in the business area also had fewer trees left over.

In addition to selling more trees, retailers in business areas received a higher price for their trees. In 1969, the average price of trees sold in business areas was $4.04; the price in residential areas was $3.76. The average price of trees in business areas in 1968 was over $1.00 more than the average price in residential areas.

Type of Street

About half of all Christmas tree retailers in Winston-Salem were located on major traffic arteries[1/].

1/ Average daily traffic volume of over 10,000 vehicles.



Singular Retail Locations

City Limits ———

Census Tract Boundaries ———

Mile Scale
0 ½ 1

Multiple Retail Locations ⊙
(Major & Minor Retail Areas)

Figure 4.--Concentrations of Winston-Salem natural Christmas tree retailers.

And these retailers sold more trees and received higher prices than retailers located on minor streets.

In 1969, each retailer in Winston-Salem sold an average of 225 trees. But the retailer located on a major street sold an average of 340 trees. The retailer located on a major street in 1968 sold an average of 351 trees, while the retailer on a minor traffic artery sold only 111 trees. In all three study years, retailers on major streets also discarded fewer trees.

Prices were also higher at tree lots located on major streets. In 1969, the average price of trees sold by retailers on major streets was $.87 higher than tree prices at lots on minor streets. The average price differences in 1967 and 1968 were $.51 and $1.12, respectively.

Over the three-year period, there was a gradual increase in the proportion of Christmas tree retailers located on major traffic arteries. This trend will undoubtedly continue as more and more retailers realize the importance of selling trees in areas of consumer purchasing activity.

Parking Facilities

Most Christmas tree retailers in Winston-Salem realized the importance of large and easily accessible parking facilities to their business. Each year, about 70 percent of the retail outlets had adequate parking facilities. The others had either small and cramped parking

lots -- 20 percent of all retailers -- or none at all.

Buyers of natural Christmas trees obviously prefer the convenience of large and easily accessible parking lots. Retailers providing adequate parking sold over twice as many trees as did other retailers, and they had fewer trees left over Christmas day. In 1969, for example, retailers with inadequate parking facilities had to discard two trees for every three sold.

Tree prices were also higher at locations with large parking areas. This illustrates the fact that buyers are willing to pay extra to shop where convenient parking facilities are available.

Merchandising

A product may be merchandised or promoted in several ways. Advertising and product display were the most widely used methods to merchandise trees at retail in Winston-Salem.

About one-half of all retailers advertised their Christmas trees each year. This advertising included newspaper, television, radio ads, handbills, trading stamp specials, special displays, and direct mail campaigns (Figure 5). Newspaper advertising was the most common. In 1967, about 40 percent of the retailers advertised in newspapers, and in each of 1968 and 1969, the number was almost 50 percent. Newspaper advertising was heavily used by chain grocery stores and discount establishments.

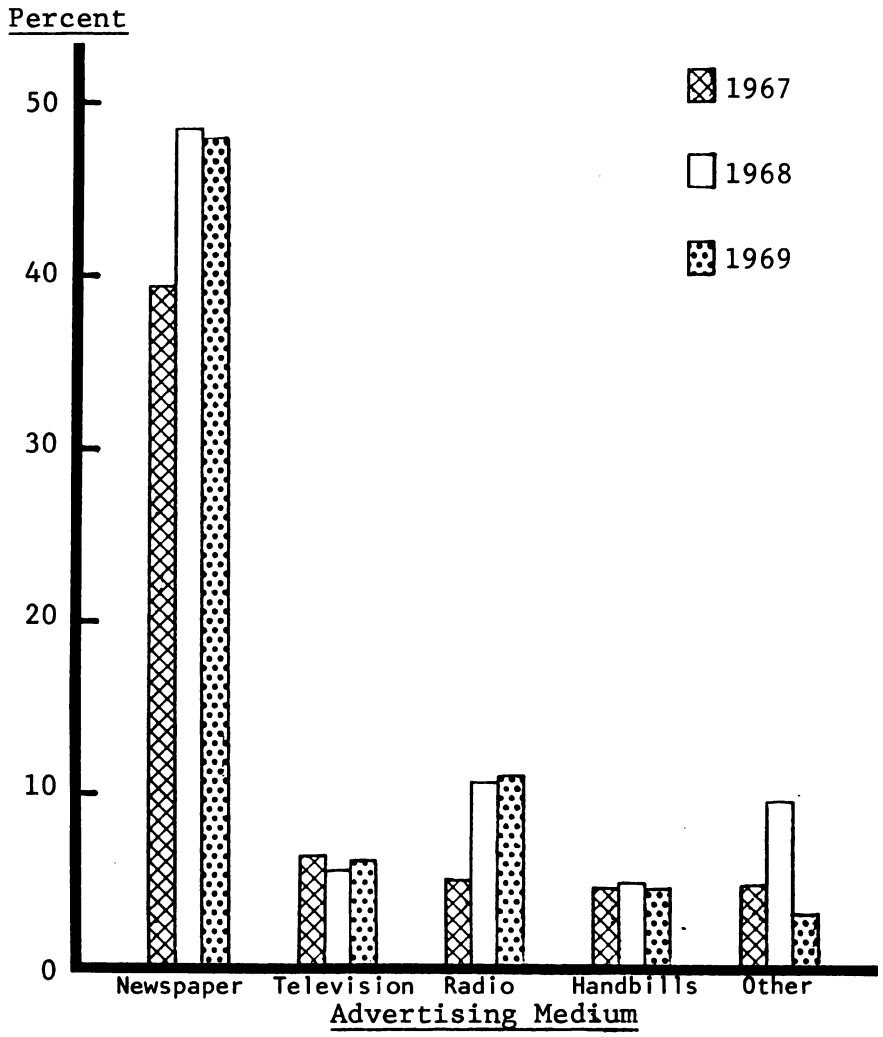


Figure 5.--Percentage of Christmas tree lots in Winston-Salem that advertised by various media, 1967 - 1969.

Christmas tree retailers made very little use of radio and television to reach the public. In 1969, only six retailers used either of these two media. Three of these retailers were independent lots and all were large outlets. In 1968, four of the five users of radio and television advertising were large independent lots.

Retailers who advertised sold more trees and had fewer unsold trees than those who did not advertise. In 1968, each retailer who advertised sold an average of 337 trees and had only 6.6 percent of his original supply of trees left over on Christmas day. The typical retailer who did not advertise, sold only 105 trees and had to dispose of almost one-fifth of his trees. The retailer who advertised in 1969 sold an average of 312 trees compared to an average of 225 trees for all retailers.

Christmas tree prices were generally higher on retail lots that advertised. In 1969, the average price received by retailers who advertised was $.19 above the average price received by those retailers who did not advertise. The average price differences in 1967 and 1968 were $.35 and $.64, respectively.

Like advertising, an attractive display of Christmas trees is a way to lure customers to retail lots and influence them to buy. However, Christmas tree retailers in the Winston-Salem market did not take full advantage of this merchandising technique. Many of them -- 41 percent

in 1969 -- simply leaned their trees against a building, stand, or rope. And over one-third of the retailers in 1969 piled most of their trees on the ground. Only one-fourth of the retailers displayed their trees standing upright and separately for ease of selection. In both 1967 and 1968, there were even fewer attractive and convenient displays.

The manner in which Christmas trees were displayed on the lot in the Winston-Salem area affected both tree sales and prices. A retailer whose trees stood upright and separately, sold over twice as many trees as a retailer who leaned his trees against a building or stacked them in piles on the ground. Retailers with good displays also received higher prices for their trees.

Product Differentiation

In the three years of study, no strong evidence of product differentiation existed in retailing natural Christmas trees in Winston-Salem.

Although several species and qualities of trees were sold in the market place, no attempt was made to differentiate among them. In fact, for the majority of trees offered, any attempt to differentiate would have been false advertising at best. Many trees supplied to this market were nonplantation Canadian Balsam fir and Scotch pine of low quality. These trees represented a fairly homogenous product to the consumer.

Brand differentiation was not used when, in fact, it could probably have been used effectively. For example, many consumers were aware of the poor quality associated with Canadian imported trees and would have reacted favorably to advertisements branding trees as "North Carolina fir" or "native pine." It would even have been feasible for long established independent lots to brand their trees with their own names. Two such lots were local nursery men and Christmas tree growers, who produced their own trees.

Tree quality was not explicitly used to differentiate trees sold. Not one lot in the three years of study sold any trees on grade. However, retailers did use the pricing mechanism to imply quality differences.

Slight quality differences were apparent both among the trees on a particular lot and among lots. Probably only two lots had significantly better trees, where advertising quality differences would have been effective. These lots carried predominately local-grown plantation Fraser fir and Scotch pine. However, the consumer would have had to purchase at the two lots in previous years, been informed by others, or visited several lots including these to have known of the quality differences. That is to say, that even the lots with the best trees in the city did not capitalize on their product differences.

Ease of Market Entry

Entry relates to the ease or difficulty a new Christmas tree retailer encounters in becoming a member of a group of competing natural Christmas tree retailers.

Barriers to entry in the natural Christmas tree retail trade in Winston-Salem did not act as a constraint to potential retailers. Ostensively, new retail lot owners in Winston-Salem overcame three factors of market entry that would appear critical to one entering this retail trade. These factors could be clasified as:

1. Information concerning short run profits and risks.
2. Access to a supply of natural Christmas trees.
3. Ability to overcome certain other natural or artificial barriers to entry (e.g., supply of trees, licensing, market outlet).

Probably the most influencing factor is information regarding short run profits. As there are no annual reports released locally on the profitability of the enterprise, information must be dispersed by word-of-mouth. And, since existing retailers are the major information source, they can partially control future attitude toward entry. This, no doubt, accounted in part for the fluctuating numbers of retail lots over the three-year period. In good years, retailers reflect optimism, influencing others to enter the market the following year. A depressed market the following year, due to too many retailers, causes

retailers to impart pessimistic views in discussions with potential future retailers. This, in effect, characterizes the market information system associated with the Winston-Salem market.

Once a potential retailer has made the decision to enter the retail market, he is confronted by few constraints. The element of risk is minimized due to the low investment required. Essentially, all that is required is a tree inventory, a leased lot, and a small labor input. For a small operator this means an initial outlay of $200 to $400. Because nearly all market control factors are internalized (i.e., the lot owner has complete freedom in the market arena), the risk is minimized even more.

During the three-year study period, availability of trees for sale did not act as a constraint to market entry. As tastes changed, and the Eastern Red cedar lost popularity, Canadian imported pines and fir were available for retailers. As with cedar, these trees could be purchased at a low unit price ($1.00 - $1.75). This not only afforded the new retailer an opportunity to maximize income (high markup per unit), but it also affords minimum loss (low investment risk).

Entry could be impeded by an insufficient supply of high quality natural trees in the future. The Winston-Salem market is going through a transformation in which the consumer has been given the opportunity to select between low price wild trees and high priced plantation trees, and

he has chosen the latter. Presently, there are insufficient numbers of plantation-grown trees to supply the Winston-Salem market. Because of the limited number of plantation growers in the area, and concentrated demand from other nearby cities such as Raleigh, High Point, and Charlotte, several retailers are already buying trees quite distant from the Winston-Salem market area. For example, the increasing demand for Fraser fir has caused retailers to procure trees from plantations in the mountainous regions of western North Carolina. This has also resulted in a high wholesale cost for this species, and a low markup relative to other species. Therefore, not only is the short run profit potential depressed, but risk is increased. This should become more important in future seasons as a natural constraint to entry for new retailers.

Other natural constraints on market entry are those costs associated with obtaining a retail license, renting a lot, and actual operation of the lot. Renting a lot either involved a direct rental agreement for a definite period of time, or profit sharing arrangements between retailer and land owner. Retail licenses were awarded quite freely for a $50 fee. Most retail outlets already involved in another retail trade, had a retailer's license to conform to their normal business requirements. However, the majority of retailers that entered the market over the three-year period did purchase a license as a prerequisite to entry. The former approach is common in residential

areas and the latter dominates business areas.

Land rent costs in Winston-Salem were not exorbitant, generally running less than 5 percent of gross sales. Labor costs, although cheap in absolute terms ($1.00/hour), are relatively expensive when considering cost per tree sold. Labor costs rank second to the costs of purchasing the trees. However, for small, independent lots, labor requirements are satisfied through the lot owner, posing little resistance to entry.

An artificial constraint to entry is a city ordinance restricting street vendors to within the city limits, and restrictions on the time trees can be displayed for sale. For example, lots could not open in 1969 until December 14. This automatically limits the retail season to 11 days.

Another set of constraints are normally imposed by existing retailers in the general market area. However, evidence of strong competitiveness between retailers was not present in the Winston-Salem market. The normal mania of roadside vendors was not observed, as is generally true of mellon and fruit stands in the midwest and pecan stands in the south. Retailers made little attempt to differentiate on price, selection, or quality. Strong price competition, which is a way of life with roadside vendors, appeared very weak in retailing Christmas trees.

To substantiate this lack of barriers in Winston-Salem, one needs only to observe the number of retailers

entering the market each year. In each of the 1967 and 1969 seasons, 53 retailers sold trees. Between 1967 and 1968, 13 retailers left and 6 entered. And, between 1968 and 1969, 11 retailers entered and 4 left. Of the 65 different retailers who sold trees between 1967 and 1969, 23 -- or 35 percent -- lasted just one year. Only 37 retailers -- 57 percent -- were in the tree business all three years. In total, 34 retailers either left or entered the business over the three-year period.

If we were to establish a cause for the number of "failures"[1/] in the natural tree retail trade, we would have to call it poor market information. All retailers entering and exiting the market were small, and most left the same year they entered. As we have shown, these small retailers exhibited extremely poor market knowledge.

Associating Retail Lot, Tree Sales, and Consumers

One short statement could relate the market associations in Winston-Salem during the study years; "high natural Christmas tree sales coincide with areas of high retail activity."

Areas of high retail activity in Winston-Salem had several characteristics in common.

1/ The term "failure" may be somewhat misleading. A small segment of retailers either planned to spend only one season in the market, or did not return the following year for personal or business reasons other than excessive financial losses.

1. Major retail areas (Wingate and Corbin 1956) were located on major traffic arteries (AADV 10,000). Minor retail areas were located on traffic arteries with an average daily traffic volume of 5,000 to 10,000[1/].
2. Both major and minor retail areas were within one mile of major medium and high population concentrations.
3. Four of the seven retail areas (the four major retail areas) were incorporated with a shopping center complex[2/]. One of the minor shopping areas was located near a small shopping center.
4. High retail sales areas were located nearer high income residential areas than lower income residential areas.

Thirty-four of the 53 retailers in 1969 were located in the major and minor retail areas of the city. Even more significant, 29, or 55 percent, of the 53 outlets were located at the four major shopping areas (Table 5).

Winston-Salem is not unlike most American cities in its adoption of planned suburban shopping center complexes. The "suburban sprawl" and "shopping center mania" of the

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1/ The distinction here between major and minor retail areas is predicated primarily on the existence of a shopping center complex at major retail areas.

2/ A shopping center complex is defined here as a planned retailing center housing a department store, chain grocery store, discount store, and associated speciality stores.

fifties and sixties has transferred the cities retail trade from the center city to several satellite retail areas located in the suburban fringe. The center city still maintains an active retail trade, however, shifts have occurred in types of goods offered and relative volumes sold.

Many Christmas tree retailers have, through casual observations or trial and error, keyed on this transfer of retail activity. For example, the largest major retail areas were D, E, and B in order of size (Table 5). The number of retailers located at each was 9, 8, and 5 respectfully, or 22 total. Further, the two largest retailers in the city located in or near area D (Figure 6). The next largest retailer was located in area E, the fourth largest retailer in area B, and the sixth largest in area C.

All retail operators selling over 500 trees annually located at a major or minor retail area, establishing a definite association between lot size and their location relative to retail sales potential. That is, it is not by chance that the largest retail concentration occurs at area D, and also that the two largest retailers located there, nor is it by chance that the second largest retailer concentration is at area E and also that the third largest retailer is located there. These two areas offered the maximum sales potential.

Retailer concentration is best illustrated by the fact that 41 percent of the retailers were located in three retail areas, no larger than six city blocks. But

Table 5.--Natural Christmas tree market relationships: Winston-Salem, NC.[1/]

Market Area	Miles Consumer Traveled To Purchase Tree	Census Tracts In Market Area	# of Retailers	Population	Average Consumer Income	Ave. Daily Traffic Volume	% of Market Held
A[a/]	2.0	3-4-5-15-16	7	23,600	4,700	15,000	8
B[a/]	2.5	13-26-27	5	4,000	8,600	12,000	14
C[b/]	2.0	26-25-39	2	7,300	12,600	7,000	3
D[a/]	2.8	12-11-9-10-21-24-22-23-24	9	31,000	7,600	25,000	37
E[a/]	2.5	21-10-22-9-8-19-20	8	33,000	6,100	15,000	23
F[b/]	2.5	20-36-35-37	3	8,000	6,200	7,000	2
G[c/]	2.0	11-2-1-0-19-8-7-6-5-16-17-33-34-18-3	17	68,000	4,600	2,000-4,000	13

[1/] Table based on 1969 retail, consumer, and traffic count data, and 1960 census tract data.

[a/] Major retail area.

[b/] Minor retail area.

[c/] Diffuse retail area.

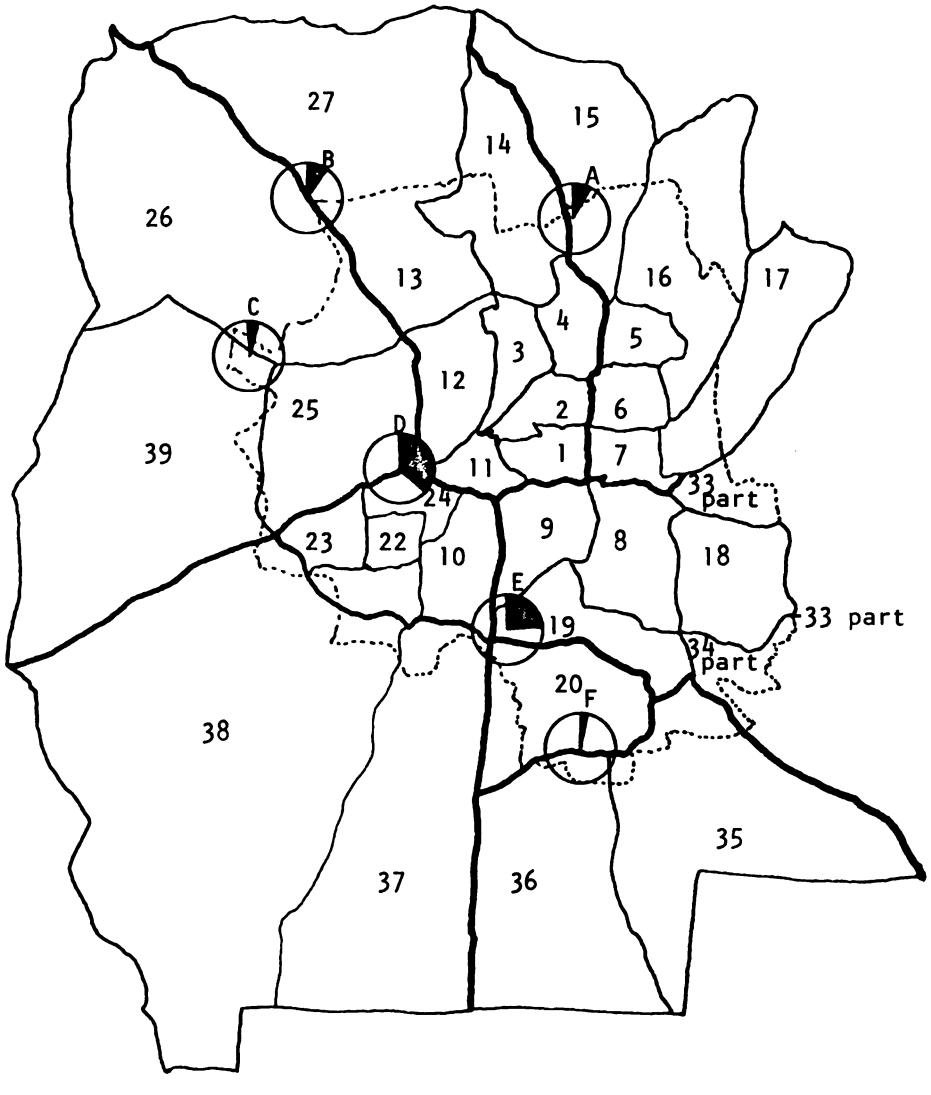


Figure 6.--Winston-Salem major traffic arteries and natural tree market held by major and minor retail areas.

this combined six-block area of intense retail activity supported 74 percent of the total natural Christmas tree market for the city.

And why are the retailers at these locations? Categorically, we would have to say that these are the most viable Christmas tree market areas in the city. Each retailer at these locations held an average of 3 percent of total market sales; whereas, in the remaining market areas, retailers enjoyed only an average of 1 percent of market sales. There are definite market associations which provide explanation for these observations.

Associating Market Factors with Tree Sales

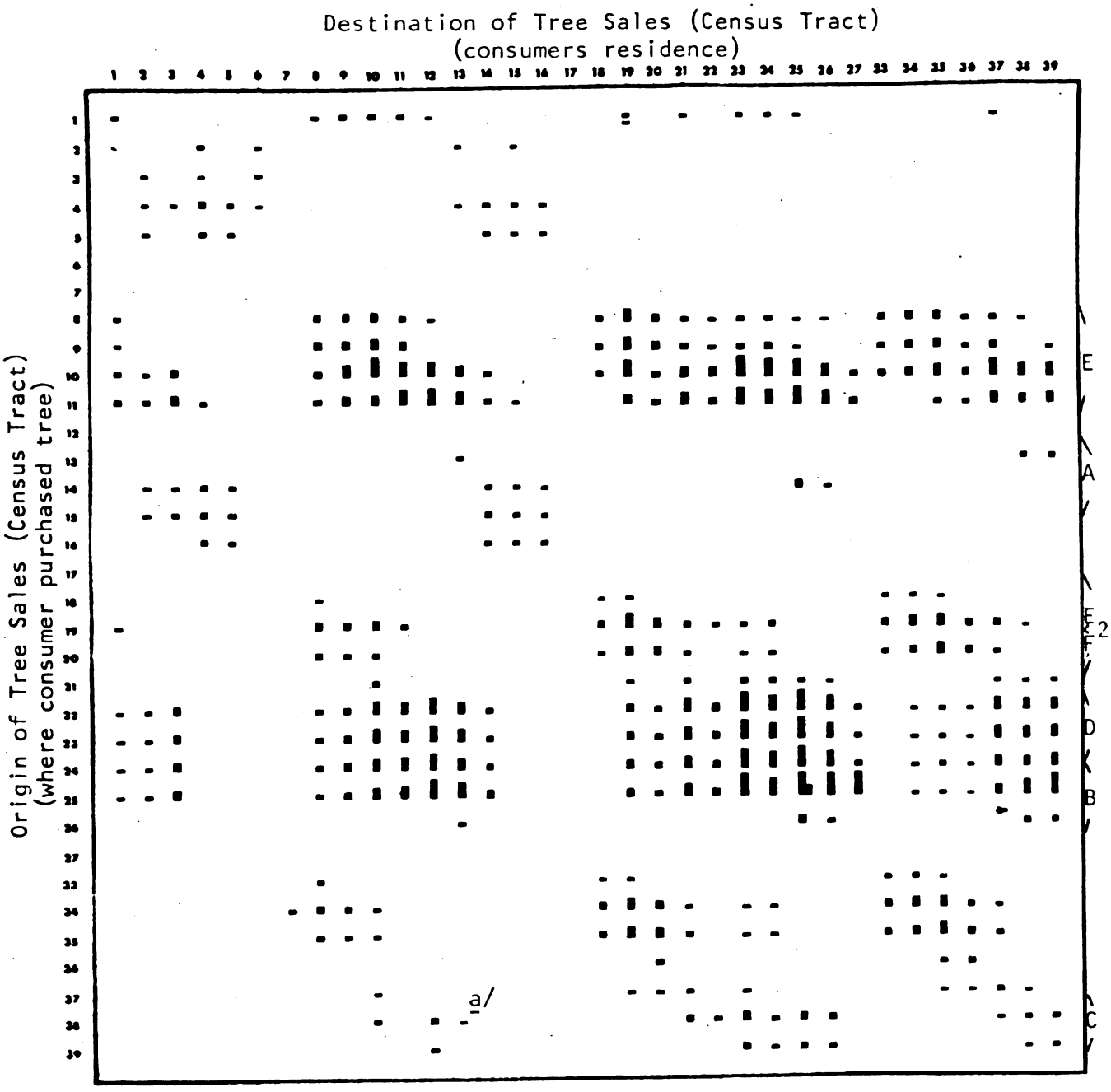
In evaluating the retail potential of a regional area, a metropolitan area, or segment of a city area, as is the case here, certain variables come to the forefront; population, purchasing power, and distance.

Population has long been cited as a critical factor in analyzing retail potential of an area (Thompson 1964). Some market analysts classify it as the primary factor upon which so many other factors depend. Contemporary market analysts argue that raw population counts are becoming more important as sales predictors due to greater homogenity in the consuming sector (Thompson 1964).

In the study area, population was critical to the Christmas tree retailers sales. However, this does not mean that the retailer should locate in the center of a

suburban housing development. Because if he does, he will, in effect, isolate himself from the majority of potential consumers. He should have a location that gains access to an area population of potential retail sales. In Figure 6 we see that areas A, B, C, D, and E are located on the fringes of the city, in areas the census bureau defines as suburban. Each is approximately two miles distant from the other. If we define these as primarily separate market areas, their potential sales population becomes as indicated in Table 5. We see how critical population can be with the two leading sales areas D and E. Percentage of market held coincides with population. But, what of the third largest retail area, area B, which has a representative population of only 4,000 in its market area. In fact, it affords 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 services more population than is indicated in Table 5. Two factors, type of road systems serving this area and the demographic characteristics of the consumers, contributed to making area B a more viable area for tree sales than is indicated by the raw population count. Area B is serviced by a major traffic artery with an AADV count only slightly less than that of area E. All of the traffic exiting northeast from the city passes the area.



a/ Represents sales of 3 trees.

Figure 7.--Natural Christmas tree purchase patterns by census tract: Winston-Salem, NC, 1969.

A second factor causing high sales at area B is the demographic characteristics of the population being served by the retail area. Buyers of natural trees in this area were medium middle income to upper middle income families. One of their basic market attributes is that they "shop" in the market place, rather than just "buy." Because they shop, they travel farther, as indicated in Table 5.

Because middle income families travel farther to purchase a tree, area B with a 2.5 mile average purchase radius was obtaining sales from census tracts 4, 25, and 12. These were not included in the population count because this market area was more closely controlled by retail areas C and D.

A counter-argument could then 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 AADV). Yet, area A held only 8 percent of the market with 7 retailers. The prime contributing factor here is income. Low income areas are not viable natural Christmas tree market areas (Troxell 1970) and (Drysdale and Nausedas 1970). This is true even though a high incidence of children occur in these families, which is a positive factor for sales when considering upper middle income families. This is further supported by retail sales in the diffuse area (G). Here 17 retailers locating at 6 - 7 blocks distance obtained on an individual basis only 0.7 percent of total sales. In this area two factors

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were critical; traffic arteries were minor, 2,000 - 4,000 AADV and income level was the lowest for the city. Population count was high but ineffective.

We can observe from the preceding analysis that road systems (AADV) and average income are both associated with distances consumers travel to purchase a natural tree and other consumer goods. Distance traveled to purchase a natural tree is obviously a factor affecting the sales performance of all retailers. Because it also affects crossover sales from one retailer (census tract) to another, it was given additional attention in this study.

Validity of the Crossover Assumption

One of the basic assumptions of this study was that the consumer buys his tree within the census tract where he resides, and, therefore, does not cross census tract boundaries to purchase trees. This hypothesis, that sales are a function of the demographic characteristics of only those persons residing in the same census tract where the lot is located, is unfounded.

As we have demonstrated, the consumer departs very little from his normal purchasing pattern when buying a Christmas tree. He doesn't mind traveling to acquire his tree. In fact, most often he travels two miles to purchase it. Neither does he strive to minimize the effort on this purchase. Retailers observed that consumers may shop two or more lots before deciding on a tree. And 15 minutes in

deciding on a particular tree purchase was commonplace.

One factor disclosed concerning consumer behavior was that a definite relationship exists between percent of crossover sales and buyer income (Table 6). Persons with higher incomes were more likely to purchase trees within the census tract where they lived, partly because these tracts were larger, and also because retail lots chose these tracts for a location. For example, 75 percent of the households with incomes less than $3,999 who bought a natural tree, purchased it out of the census tract which they lived[1/]. Fifty percent of the households with incomes between $4,000 and $10,000 and 34 percent with incomes over $10,000 also purchased trees out of the tracts where they resided. Obviously, tree sales within a given census tract are not entirely dependent on the demographic characteristics of the persons living in that tract. Also, in this study it is likely that a greater specification error occurs when low income tracts are considered than when high income tracts are considered.

Analysis of individual consumer behavior also disclosed that the consumer travels considerable distance to purchase his tree rather than to purchase it at a closer, more convenient location (Table 7). The study results verify this conclusion.

The average distance traveled to purchase a natural tree in Winston-Salem was 2.5 miles. This distance varied

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[1/] The census tract described here includes the census tract being studied, plus the immediately adjacent census tracts.

Table 6.--Association between income class and tree purchases out of census tract.

Income Class	Percent In Tract Purchase	Percent Out Tract Purchase
$ 3,999 -	25	75
4,000 - 6,999	49	51
7,000 - 9,999	48	52
10,000 +	66	34

Table 7.--Association between income class and miles traveled to purchase a natural tree.

Income Class	Average Miles Traveled	Number of Observations
$ 3,999 -	1.8	13
4,000 - 6,999	2.5	89
7,000 - 9,999	2.8	34
10,000 +	2.0	46

depending upon the buyers and sellers involved. Buyers with incomes under $4,000 traveled an average of 1.8 miles to get their trees, and buyers with incomes above $10,000 traveled 2.0 miles to make their purchases. The population making up the mass purchase power, those with incomes between $4,000 - $10,000, traveled an average of 2.8 miles.

Also, consumer migration data was developed to assess origin of sales at a particular location. From these data a grid showing sales movement was developed to illustrate high consumer mobility in selected areas of the city (Figure 7). The figure is constructed to be read from both axis, permitting an evaluation of where consumers lived, who purchased trees, and to what census tract they traveled to make their purchases.

For our original hypothesis to be correct, 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 grouped sales along the diagonal. However, considerable off-diagonal sales exist in the form of bands. These represent sales originating 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 areas A, D, and E. This is also verified by the fact that these persons traveled about 1.8 miles to buy a tree, which is only slightly over the distance across two census tracts in the eastern side of the city. To have gotten out to market areas B, C, and F would have meant traveling three 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 to persons in census tracts 9-11 and 19-22, all of which bound census tracts 19 and 9 on the north, west, and south. Two major traffic arteries, Silas and Petercreek Parkways, service the area.

Area D, located in both tracts 24 and 25, was serviced by an interstate expressway, Stratford Road, and Northeast Blvd., all high volume traffic roads (Figure 6). The bulk of this area's sales went to census tracts 9-12, which are immediately adjacent on the east and northeast; tracts 21-26, which are directly adjacent on the south, west, and northwest; and tracts 37-39, 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 a natural Christmas tree. Also, the percentage doing so is high, approaching 50 percent in most income classes.

This factor was extremely important in the distribution of natural trees in Winston-Salem. Its implication to the predicting models was also significant, as will be discussed later.

We have clarified one point. Success in retailing natural trees is associated with locating the retail lot in or near major retail sales areas. However, this does not just happen. As we have shown, there are many market associations which contribute to, detract from, or have a neutral

effect on sales performance. However, as is evident from preceding sections, we cannot fully analyze these associations without analytical models. To determine interactions among only three variables; income, distance, and population becomes an exercise in futility, without such analytical models. Granted, we can observe certain associations, but as we bring in more variables, we must develop analytical models to assess the interactions.

Principal Factor Analysis

The intent of this research is not to provide a definitive treatment of the principal factor model, nor to assess the general competence of the model as an acceptable analytical tool. Reference is made to Harman (1967) for a detailed discussion of the principal factor model and Green and Tull (1970) for its applicability to this analysis.

The term "factor analysis" represents a group of methods for analyzing intercorrelations within a set of variables. The basic intent for using the model in this study is to summarize information contained in our original 105 variable set into a smaller set of linear independent factors, with a minimum loss of information.

Factor analysis has had a wide array of applications, and, in fact, served effectively in all capacities. Its utility relative to other analytical tools, such as cross-classification, regression, discriminant analysis, etc., is one of complementarity and not competitiveness.

Principal factor analysis is closely related to principal component analysis. Principal component analysis of an original correlation matrix will produce a set of factors equal to the number of original variables analyzed. That is, the model attempts to explain all the variance associated with each variable.

Principal factor analysis does not ascribe entirely to the above approach. Here the attempt is to maximize the variance explained for each variable while minimizing the number of factors created. That is, although each variable is assumed to have a sample variance of one, we will only attempt to explain a major portion of this variance. This portion is determined by a method described in Harman and is dependent on the correlations of the respective variables. These percentages of total variance, which will be explained for each variable, are denoted as the communalities for each variable and will be represented by "h^2," where $0<h^2<1$.

The Variable Set

In Table 1, Appendix B, two lists of variables are presented; a list of specific variables for which data were recorded, and a list of general variables represented by one or more specific variables.

In developing the survey schedules and deriving the variable list, we purposely selected more than one specific variable to represent general variables such as

race, families, households, tree prices, competition, etc. These general variables are not to be confused with the factors sought. Although we will make association between the final factors created and these general variables, they were not developed for that purpose. They simply serve as a general reference or index to the specific variables.

Factor analysis of the independent variable set (105 variables) is accomplished independent of the dependent variable tree sales (Y_s). Therefore, no association or inference is made regarding the structuring of the factors and their influence on tree sales.

Creation of Factors

Nineteen principal factors were created from the original correlation matrix (105 x 105). The original communalities created to replace unities in the correlation matrix ranged between .90 and .95. That is, the model attempted to explain on the average somewhat less than 95 percent of the communality (variance) of each variable. For 105 variables, the total communality was 97.81, giving an average of 93 percent variance explained for each variable.

Creation of only 19 factors resulted from selection of an eigenvalue of 1.00 as a cutoff point. A partial factor matrix (14 x 19) with the resulting factor scores appears in Table 8, Appendix B. The model assumes that the 19 factors or dimensions are independent of one another

(zero correlation) and that each in turn provides a description of a different linerally independent variance source. Through inference of the highest loadings on each factor, we were able to subjectively identify these 19 factors.

Subjective Assessment of Factors

Most of the beginning work in factor analysis had as its end product the listing of variables and their respective scores on each linerally independent factor. Through interpretation of the variable factor scores appearing on each factor, researchers formulated a subjective description of the factor, i.e., what the factor purportedly represented. This introduction of subjectivity as a final result of the analytical model caused criticism of factor analysis. Yet, analysis of the output in this fashion appears extremely useful, as it forces the scientist to make associations between the analyzed data and the original field observations.

Using the factor model for screening, we selected the highest scoring variable on each factor, because theoretically these variables explain the largest percentage of total variance associated with each factor. Through careful study of the remaining variables we can see how and why they are linked to the factor and to the high scoring variables selected. To gain this inference requires some knowledge of the factors.

The principal factor method results in the

creation of two types of factors; General and Unique Factors. The General Factor, normally created first, has relatively high loadings for all variables, therefore, the interpretive power on the factor is usually low. Unique Factors generally have fewer variables with high loadings, and consequently, are more readily interpreted. However, some may occur with either all low loadings, or only one high loading (Rummel 1970). These factors are difficult to interpret, and will be referred to here as "Unique Low Load Factors." It is feasible that additional matrix rotation or a different rotation method might have been helpful in their interpretation.

To properly describe either a general or a unique factor we are entirely dependent on the factor scores. These scores simply relate the correlation between the variable and the factor, and can vary between -1.00 and 1.00. Scores of a magnitude less than 0.30 have been ignored by most researchers. A negative loading implies a negative reaction of the variable to its respective factor, and singular high loadings, whether positive or negative, are normally considered insignificant.

Based on model concepts, data presented, and field observations, the following descriptions are presented for the 19 factors. The variables and factor loadings are presented in Tables 9A - 9S, Appendix B.

Factor #1; Table 9A, App. B; General Factor: As is the case of many factor solutions, a general factor is somewhat difficult to interpret and relates little information. Over 50 percent of the variables loaded on this factor with a score exceeding 0.80.

Factor #2; Table 9B, App. B; Unique Factor: Retail Area Contrast: This factor contrasts two types of market areas in the city. Positive variables 60, 5, 100, and 1 describe the suburban areas serviced by shopping centers. Average population per household, and number of rooms per housing unit were higher. Competition was either between shopping centers or within them. Negative variables describe the less viable eastern and northeastern census tracts. The variables and their respective loadings describe a more transient, lower income, high rental area.

Factor #3; Table 9C, App. B; Unique Factor: White Racial Groups: Both negative and positive loadings identify this factor. Variables 49, 82, 83, and 97 identify the white population as precisely as variables 50, 95, 80, 98, 73, and 16 identify the negro population. As indicated by the high negative loadings, severe social and economic differences did exist between white and black racial groups. Whites are more wealthy and own their own homes. Blacks are less wealthy, typically laborers, rent instead of own, and are less educated.

Factor #4; Table 9D, App. B; Unique Factor: Inferior Sales or Market Performance: Variables 35, 39, 31, 13, 26, and 29 associate with poor sales performance, whereas variables 30, 47, 46, and 42 associate with good sales performance. That is, poor tree sales are definitely associated with poor lot quality (29), poor tree quality (26), no advertisement (31), and time in business (35).

Factor #5; Table 9E, App. B; Unique Factor: The Independent Retail Lot: There is definite correlation between the high loading descriptive variables on this factor and the independent lots located in Winston-Salem, especially the two largest independent retail lots. The largest independent lot was a multiple ownership (40) using handbills as the major means of advertisement (43). Lots were generally located 1/4 mile distance from each other (3 - 4 blocks).

Factor #6; Table 9F, App. B; Unique Factor: Good Tree Quality: The variable scores are more difficult to interpret here, but of the top 9 variables, 8 are definitely associated with good tree quality. That is, good trees received average to high price (10, 8). Lots selling good trees were higher quality, advertised, located in business areas, and the best quality trees in the city were at nurserys or florists (26, 42, 44, 18, 14).

Factor #7; Table 9G, App. B; Unique Factor: Major or Minor Retail Areas: Five of the top 6 variable scores characterize this factor as a high traffic retail

area. Traffic count is critical (105), and lots are close together (2). Shopping areas were in business areas (22), and the lots had average tree quality, not poor (25, 26). Because these areas were located around the city's fringe, many other seemingly conflicting variables fall in. For example, retail area A was in an older part of town and was the only retail area with little housing construction since 1940 (102). Area B was located near a college and consequently near the only high group quarters population in the city (59).

Factor #8; Table 9H, App. B; Unique Factor: Upper Income Areas: At the outset this factor appears to be a low load factor, however, if we support the top 4 variable loadings with the next 4 we see possible definition. That is, the first 4 (84, 103, 77, and 101) tell us income, school years completed, and value of home are important. The next 3 highest loadings are more definitive, i.e., high incomes (83), better educated (76), located in an area where lots are in close proximity (2). An appropriate area designation could be higher income suburban fringe.

Factor #9; Table 9I, App. B; Unique Low Load Factor: This factor is poorly defined by the variable scores. The first 7 variables describe several lot types in the city. For example, civic lots advertised with signs, and located in business areas. However, they did not have poor lot quality.

Factor #10; Table 9J, App. B; Unique Factor: Lot Types, Civic Organization: This factor describes variable 15, church or civic groups. Most such groups located in median income areas, where obviously the largest percentage of kindergarten enrollment occurs (69). And, because they obtain free radio time, these groups made wider use of radio than any other group.

Factor #11; Table 9K, App. B; Unique Low Load Factor: Certain factors created have no definite pattern in the relationship of factor scores. However, variables which have interpretive value on other factors do appear in these low load factors, such as the income variable (85).

Factor #12; Table 9L, App. B; Unique Factor: Lot Type, Discount Store: This factor, as will be the case of the remaining factors, is defined by only 2 or 3 variables. Variables 13 and 21 definitely relate to discount stores and their locations. Variable 69 lends partial support, however, one discount store was located near a census tract with high incidence of children in kindergarten.

Factor #13; Table 9M, App. B; Unique Factor: Group and Apartment Housing: This factor provides a description of a group housing area with variables 72 and 59. Families with high incomes correlate negatively (83), persons being out of the city prior to 1955 correlate positively (79), school enrollment for children and adults is high (68), and variables 89 and 67 also support the factor,

as well as multifamily housing.

Factor #14; Table 9N, App. B; Unique Low Load Factor: This factor has one element common to the preceding two low load factors; the appearance of variables on past and present tree purchases and sales.

Factor #15; Table 9O, App. B.; Unique Factor: Effective Market Strategies: This factor draws together several variables having high scores on other factors. From the top 5 variables an effective Christmas tree retail lot market strategy can be defined. For example, effective retail marketing requires good trees, attractive lot, high consumer traffic, etc. Note these variables are similar to the top negative loadings on factor 4.

Factors 16-19 were all difficult to interpret. High loading variables were nonexistent. Further, there were no clusters of variables showing definite patterns. As such, no interpretations are presented.

Screening the Variable Set

A second use of the factor matrix is to reduce the original variable set. The variables listed in Table 10, Appendix B, represent the reduced variable set taken from the factor matrix. Deriving the set from the original matrix (105 x 19), required selecting the 2 or 3 highest ranking variables on each factor. By doing this we follow the thesis of principal factor analysis to its conclusion. That is, the model presumes that the 19 factors or dimensions are independent (zero correlation) and they each in turn

provide a description of a different independent variance source. The variable loadings on each factor determine the degree of association between the variables and the factor, i.e., highest loadings reflect highest association. Therefore, by picking the highest loading for each factor we have effectively screened the data for intercorrelation and retained those variables explaining maximum variance.

One segment of the approach is to be questioned. The successive factors created by the principal factor method decrease in their ability to explain total variance. For the problem under study, the first factor explained 35 percent of the total eigenvalue (variance). The additional percent of total variance explained by factor 2 was 10 percent. Factor 20 was not created because it did not have an eigenvalue greater than 1.00. Should we then consider factor 1's highest loadings (variables) more important than the high loadings on factor 2 or 8?

From a purely factor theory point of view, factor 1 has greatest explanatory power, i.e., it accounts for the major portion of total variance. However, the goal here is to isolate the several major independent spheres of influence (Factors) and screen these to determine the variables of greatest association in these spheres. Of the total variable set, these are the most suited for regression analysis.

Twenty-two of the original 24 general variables are represented in the 49 specific variables taken from the final factor matrix (Table 10, Appendix B). Nearly all

of the specific economic variables had loadings above .50 on the principal factors. Only a small segment of the demographic variables had loadings above .50.

General variables deleted.--Two general variables deleted in the initial screening were knowledge of business (specific variable; number of years retailed Christmas trees) and population (specific variable; total population). The variable "number of years sold Christmas trees" (47) had a factor score of .45 on the 19th factor created. Its partial r^2 with tree sales (Y's) was low (-.150). Only 3 independent variables had a partial r^2 with X47 that exceeded .50. These were X12, X42, and X21, the two former of which also appeared on factor 19 but with higher scores than X47. Variable X12 was "type of establishment, chain grocery store." These stores advertised mainly in newspapers (X42) and they located at shopping centers (X21), the two other variables correlating with X47. Therefore, X47 could be excluded in favor of the more explanatory variable X12.

Total population (X48) provided little explanatory power. Its r^2 with tree sales (Y's) was .002. Its loading in the factor matrix occurred on factor 1, at the .96 level. However, three household variables loaded higher on factor 1 than did X48. The household variables are preferred due to direct association between housing unit and place of display for the tree. Also, high loadings of white and negro population variables on other factors

indicate that total population must be partitioned to be meaningful.

Specific variables deleted.--Although nearly all of the general variables survived the screening process, many specific variables were deleted. A closer look at a cross-section of the deleted variables supports the validity of the screening process.

The general economic variable "competition" was represented by six specific variables of which only three were retained. These three, competition between one and two blocks, two and three blocks, and four blocks to a mile are the location patterns identifiable in the city (Figure 5).

The general economic variable "retail price" is represented by average price, explaining why the major variance is associated with "average" and "average low price."

All three "tree quality" variables were retained, however, "good tree quality" accounted for greater variance than did "average" or "poor" tree quality. The same is true for the advertising variable. The variable "advertised yes" accounted for greater variance than did "advertising no." All three variables "good tree quality," "good lot quality," and advertised yes" were associated with larger, more progressive lots.

Similar relationships are also observed for the demographic variables, which were screened much more

heavily than the economic variables.

For example, three specific variables were used to represent effect of race in the study; white population, negro population, and total foreign stock. Only negro population was retained. Racial groups other than caucasians and negro represented less than 1 percent of the total population, and were grouped into total foreign stock. Negro population was not only large with respect to total population (33 percent of total), but was concentrated in the eastern section of the city. Predominantly negro tracts had lower incomes, greater number of persons per household, and fewer number of rooms per housing unit. As such, more variance is explained by this variable than the foreign stock variable.

Specific household variables were considered important, and at the outset it appeared the model selected poor variables; "population in group quarters" and "population per household." However, Winston-Salem college dominates a census tract in a prime retail area and depresses retail sales in the census tract significantly. It was felt that total number of households would be a more realistic variable in the model, but "population per household" was retained. It provides a direct measure of the variance associated with the number of children in a household. It is felt that different purchase patterns are evident for young couples, young families, and older couples with no family at home.

The Predicting Model

In pulling together the previous sections of this paper, it is obvious that the natural tree buyer is predictable in the market place. His purchase patterns are associated with market characteristics exhibited by the retail lot and also his own demographic characteristics and preferences. This section will be devoted to characterizing these associations in the form of predicting equations.

The Variable Set

The slightly altered variable set listed in Table 11, Appendix B represents the 41 final variables used in the stepwise multiple regression model. Variables 1-24 represent the economic variable set, 25-37 the demographic variable set, and variables 38-41 represent information on consumer preferences and behavior. These latter variables were not included in the principal factor model. However, due to the market held by artificial trees and definite buying behavior and preference associated with natural and artificial trees, it was necessary to include them in the regression model.

Most of the adjustments in variables between Tables 10 and 11 occurred in the economic variable set. Although some variables were deleted, most of the changes were due to combining variables and/or representing the original variables with "dummy" variables.

The model was easily adaptive to representing

some variables as dummy dichotomies or multichotomies. The new dummy variables are binary coded as zero, or one (Suits 1957), (Johnson 1963), (Tomeck 1963). Values for these variables are reflected in the computed intercept for the regression line, i.e., the direct effect of dummy variables is to shift the intercept value up or down. The mean value of the intercept takes on the value $B_0^1 = B_0 + B_{i-n}$ when it is made to represent the constant term (Bo) plus effects of the dummy variables (B_{i-n}).

The competition variables for 1-3 blocks were combined to form one variable "competition, 0-4 blocks." The area location variable "Business and shopping center" was dropped because of its high correlation with "Business area." The variable "Residential area and vacant lot" was combined with residential area.

A different set of variables were used to represent trees for sale and trees sold, because of the limited interpretive power of the original variables in Table 10, Appendix B.

Variables depicting multiownership of lots were deleted from the sets because of their high correlation with the variable "Enterprise types, chain grocery store." Seven of the nine multiple ownerships were accounted for by chain grocery stores.

Because of the weak data supporting some of the variables in "Type of advertisement," these variables were dropped and only one pseudo variable on advertisement was

retained.

Two demographic variables were removed and four were added. "Median family and unrelated individual income" was removed due to high correlation with "Median family income." The variable "Divorced persons over 14" was removed because of high correlation with the variables "Laborers" and "Negro population."

Total population was entered because of its traditional use in demand models. The variable "Children under 18 years of age of head of household" was added because of its selection in many studies as a determinant of natural tree sales[1/]. "Median number of persons per housing unit" was added as a proxy variable for the sales variance caused by group quarters and multiple dwelling housing units. "Number of households" was added to test the importance of the single dwelling housing unit.

Specification of the Model

The model purports that retail lot tree sales are a function of market characteristics of the retail lot, plus demographic characteristics of consumers within the census tract where the lot is located. This hypothesis can

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1/ Ellefson, P.V., and T.H. Pendleton. 1969. Problem analysis of Christmas tree marketing in the eastern U.S. Unpublished report. U.S. Dept. Agric. For. Serv., For. Prod. Mktg. Lab., Princeton, W.VA.

also be stated as:

$$Y(c_r) = Bo + Br_{i-n} \cdot Xr_{i-n} + Br_{j-n} \cdot Xr_{j-n} + Bc_{k-n} \cdot Xc_{k-n} + \mu$$

Where:

$Y(c_r)$ = Number of natural trees sold (Y) by retailer (r) in census tract (c)

Bo = Intercept or base value

Xr_{i-n} = Dummy economic variables, i.e., merchandising, advertising, etc., for retail lot (r). Variables running i-n.

Xr_{j-n} = Continuous economic variables associated with retail lot (r) in census tract (c). Variables running j-n.

Xc_{k-n} = Continuous demographic variables associated with persons in census tract (c). Variables running k-n.

μ = Random component with expectation zero and constant variance from observation to observation.

The model, although developed to a workable stage, is improperly specified. The specification error involves improper characterization of the demographic data since customers from census tracts other than "c" are not considered.

To correct the specification error would involve tabulating all sales by census tract origin, and weighing

the demographic data from each census tract by the relative percentage of total sales attributed to them. An attempt was made to do this using data from the consumer survey, but it proved futile.

Previous discussions have illustrated that buyers of natural Christmas trees in Winston-Salem purchased trees out of census tracts in which they resided. In fact, many purchases were made three miles distant from place of residence, or three census tracts away. Consequently, unexplained variance did occur in the predicting models as a result of the specification error.

Observation Error

Another error involves the use of 1960 census data to represent demographic characteristics of consumers residing in Winston-Salem for the study period 1967 - 1969. In effect, it could be said a different population occurred in the city for each of the three study years. However, at the time the study was conducted, only 1960 census data were available. As previously discussed, any change in demographic characteristics between 1960 and 1967 and the successive study years introduces errors of observation in the data. The extent of these errors were not evaluated in the study.

Empirical Models

Three empirical models were developed from the Winston-Salem data. To avoid confusion, the models will be

referred to as models I, II, and III, corresponding respectively to the years 1967, 1968, and 1969.

In developing the three models, many variables were dropped and new ones created to make the equations more efficient. However, most variables which appeared in one model also appeared in the remaining two models (Table 12, Appendix B). The final list of variables retained for use in all three Winston-Salem models is presented in Table 13, Appendix B. Initial computer runs clearly identified 13 variables which would not enter the models at the specified "F" levels. Referring to Table 11, Appendix B, these variables are: X_{16}, X_{18}, X_{19-21}, X_{23}, X_{24}, X_{30}, and X_{38-41}.

Two of the variables deleted, X_{16} (tree quality) and X_{18} (advertised), were felt to be important to the model. However, as previously mentioned, both variables could have been represented by better data sets. Variable X_{16} should have been a scalar variable, and X_{18} might have been represented better by "dollars expended for advertising."

Variables X_{38-40} represent the percentage of Winston-Salem consumers who purchased either a natural tree, artificial tree, or no tree. These data were well developed, but failed to have any association with the models. This is surprising indeed when one considers that over 35 percent of the consumers did not purchase a tree and 37 percent used artificial trees.

Variables X_{19-21} and X_{23-24} were found to be closely correlated with X_{22} (Y variable) and, consequently, were not included in any models.

Interaction variables X_{10-12} represented effects of location on independent lots and chain stores. The effect of an independent lot in a business area or shopping center is represented by X_{10}. The effect of an independent lot in a residential area is $-X_{10}$. Effect of business location on chain stores was X_{11}, and shopping center location X_{12}. Effect of residential location was computed from $-X_{11}$ $-X_{12}$.

Effects of interaction variable "Merchandising," interacting with three retail outlet types; Independent lot, Discount store, and Nursery, were determined as follows:

	Independent Lot	Discount Store	Nursery
Merchandised	X_{13}	X_{14}	$-X_{13}$ $-X_{14}$
Did not Merchandise	$-X_{13}$	$-X_{14}$	X_{13} $+X_{14}$

Likewise, "Effect of merchandising interacting with location" was determined similarly:

	Business	Shopping Center	Residential
Merchandised	X_{15}	X_{16}	$-X_{15}$ $-X_{16}$
Did not Merchandise	$-X_{15}$	$-X_{16}$	X_{15} $+X_{16}$

Evaluation of the
Winston-Salem Predicting Models

As indicated from the descriptive data in Table 14, all models were statistically significant at the 5 percent level. However, the models did differ as regards R^2, standard error, and computed "F" values.

All 3 Winston-Salem models (Tables 15-17, Appendix B) were developed on a fairly consistent sample size; 53, 46, 53, for models I, II, and III, respectively. Also, the 34 variables used in developing the 3 models were identical (Table 12, Appendix B). Yet, the statistics describing the 3 models and the variables entering each model differed.

Models I and II were most effective in representing the data from which they were created. The coefficients of determination for the 2 models were 0.80 and 0.79, respectively. Model III, although significant at the .05 level, offered explanation of only 51 percent of the variance associated with tree sales (Y). Further, models I and II had lower standard errors and higher "F" ratios than model III.

Table 14.--Comparative statistics on models I, II, and III.

Model	N	K	R^2	Std. Error	F	$F_{.05, k, n-k-1}$
I	53	20	0.8046	111.9521	6.586	1.91
II	46	18	0.7876	175.3309	5.563	2.01
III	53	15	0.5148	239.3306	2.617	1.95

The foregoing statistical inference would indicate that the 1967 equation has effectively modeled that year's market relationships. It does in fact provide good estimates of 1967 retailers' market performance in Winston-Salem. However, that was not our basic objective. Our objective was to develop a predicting model which would be useful in estimating sales from market information different from that which it was created.

Our empirical selection of variables, and successful model development from a given set of market information does not necessarily imply that the model will be successful in estimating sales, given different market information. In fact, another set of data might well reverse the order of importance of the several variables.

To provide a more explicit measure of effectiveness for the three models, they were used in predicting retail Christmas tree sales for retail lot owners located in Denver, Colorado, during the 1965 Christmas season.

The Denver Market

A 1965 survey of 186 natural tree retailers located in Denver, Colorado, yielded extensive economic sales data on the area's natural Christmas Tree market (Troxell 1970). These data were used to develop variables paralleling those used in the Winston-Salem models. Further, the data were used to test the predicting efficiency of models I, II, and III, and to create an independent

estimating equation for Denver.

Denver and Winston-Salem have had growth patterns similar to most metro areas. However, the two cities did differ in many respects. Following are examples of apparent differences in Winston-Salem and Denver demographic data:

- Denver had 185,000 households in 1960 as opposed to 32,213 in Winston-Salem.
- Total 1960 population for Denver was 458,117 as compared to 111,135 for Winston-Salem.
- Denver non-white racial groups accounted for only 9 percent of total population as compared to 33 percent for Winston-Salem.
- Although income distribution was similar for the two cities, the mean income for Denver was greater than for Winston-Salem.

Other demographic variables used in the models also differed, characterizing the two retail areas as having quite different demographic makeup.

Differences and similarities were noted for the product retailing methods and retail outlets. Approximately 115,000 trees were sold in Denver, compared to 10,000 in Winston-Salem. An estimated 92 percent of the Denver households had natural trees. Also, an estimated 61 percent of the trees marketed in Denver were plantation grown, as opposed to a much smaller percentage for Winston-Salem. Species composition was largely Douglas fir (38 percent) and Scotch pine (35 percent) in the Denver market, whereas

only a few Douglas fir were sold in Winston-Salem.

Retail outlets were similar for the two cities, with over half the outlets being either chain grocery stores or independent lots. Also, these outlets accounted for over 60 percent of total sales in each city. Average tree price of $4.77 for Denver was higher than Winston-Salem (1967 - $3.21).

Consumer purchase patterns were quite similar for the two cities, even though purchases per capita were higher for Denver. Denver consumers traveled up to three miles to purchase natural trees, and shopped more than one lot before selecting their tree.

The Denver Model

A predicting model was developed from the Denver data, conforming to the 33 independent variables used in creating the three Winston-Salem models.

The Denver model proved to be significant at the .05 level with an R^2 = .4679 and a large standard error (Table 18, Appendix B). However, the "F" test on the Denver model is computed on a sample size (n = 152), three times that used to create model I (n = 53).

The Denver model did incorporate many variables found in two or more of the Winston-Salem models, however, one variable (X_{23}) did not occur in any of the three previous models. In addition, variables X_{13}, X_{15-16}, X_{23-24}, and X_{29} occurred in only one of the Winston-Salem models (Table 12, Appendix B).

Evaluating the Predicting Equations

The foregoing predicting equations have close association to the data from which they were created; yet, they may have little utility when market conditions change. Although we have attempted to account for all variables affecting retail sales in Winston-Salem and Denver, the models presented are only abstractions. Further, they are static, characterizing market conditions for only those years for which data were collected.

The success of a predicting equation in estimating sales for different markets relates primarily to differences in market parameters. If market factors and their interrelationships remain precisely the same from one market to the next, a predicting equation will be highly successful. A similar conclusion is reached when the same market is considered, but at two different points in time.

Variables Represented

Thirty-three independent variables were used in developing the three Winston-Salem models. Yet, the models are not structured around identical variable sets. Although the models share a similar number of variables; K=20, 18, and 15 for models I, II, and III, respectively, the variables included in each differ slightly. Only 11 variables appear in all three Winston-Salem models. These represent type of retail establishment, area location, merchandising, and lot competition (Table 12, Appendix B). Seven

variables appeared in only two models and are represented by location, competition, tree price, and population. Eleven variables appeared in only one model, either Model I or II. These included household demographics, income, education, and retail traffic count.

Ten of the 11 variables that appear in all Winston-Salem models also appear in the Denver model (Table 18, Appendix B). However, the Denver model also included variables $X_{15, 16, \text{ and } 23}$, which did not occur in any other model. Their inclusion results from differing marketing conditions and population demographics in Denver. For example, merchandising of trees in business areas was more prominent in Denver. In addition, families were younger in Denver, the population per household was larger (X_{33}) and kindergarten enrollees (X_{29}) were higher. Also, these young families had purchasing power equivalent to older families in Winston-Salem.

It is of little meaning to cite 10 variables as being included in all models without characterizing the level of association these variables held to the dependent variable tree sales.

The 10 variables accounted for 33, 36, 27, and 27 percent of the variance in Models I, II, and III, and the Denver model, Respectively. Other variables which proved important to the models were prices of trees sold (X_{20}), competition 0-4 blocks (X_{17}), and merchandising (X_9).

Seven variables did not enter the Winston-Salem models; $X_{15, 16, 21, 23, 26, 27, \text{and } 33}$. Merchandising in business areas (X_{15}) was practically nonexistent in Winston-Salem. Negro population was concentrated in census tracts in the eastern sector of Winston-Salem. These tracts recorded the minimum sales incidence for the city, affording little explanation of variance in the models. Population per household (X_{23}) was better represented by persons per housing unit (X_{27}). Also, the general demographic population (X_{33}) was better represented by $X_{22, 27, 28, \text{and } 30}$, and variables X_{26} and X_{29} are best represented by variable X_{27}.

The variable coefficients revealed a similar low level of continuity across the models. The zero intercept, or B_o for each model did differ, but the regression coefficients did produce certain similarities. For example, of 11 variables occurring in each of the 3 models, only 3 entered with a negative value.

A much more in depth comparative analysis could be made of each equation; but it would not characterize the predictability of the models. The true test of the equations is their effectiveness in predicting sales for differing market conditions.

Analysis of Residuals

Our hypothesis states that predicting equations can be used to predict a retailer's sales in any given

market. Or, stated differently, within a given level of confidence there should be no statistical difference between the actual sales and predicted sales. To test the effectiveness of the predicting equations, each model was used to predict sales for retail lots different than those used to create the model. An analysis of residuals was used to evaluate each equation.

The stated null hypothesis is; for a given retail sales predicting model, $Y = B_o + B_1 X_1 + B_2 X_2 + \mu$, its $\hat{Y}_{i's}$ for a new market condition will equal the $Y_{i's}$ for that market. Specifically stated, using the 1967 Winston-Salem model (I) on the Denver market data;

$HN: \Sigma(\hat{Y}_{(I)DS} - Y_{DS}) = 0$ Where $\hat{Y}_{(I)DS}$ = estimates of Denver retail lot sales with model I and, Y_{DS} = Actual retail lot sales in Denver.

A similar set of hypothesis are developed for each model on each remaining set of market data. The level for rejecting the null hypothesis (Type I error) is .05.

If the models are assumed to be correct, the unexplained variances could be envisioned as the observed errors in the model. However, as previously noted, observation and specification errors exist in the models, restricting the identification of residuals to unexplained variances.

The question of model error prompted a visual, as well as statistical examination of the residuals. The

visual analysis of residual plots against estimated Y_i's for each model did reveal model error. The statistical analysis of residuals caused the null hypothesis for the 1969 Winston-Salem model (III) to be rejected at both the 99 and 95 percent confidence level (Table 19).

The 1969 estimating equation for Winston-Salem had a low R^2 and a high standard error. A computed "F" of 0.58 and 0.75 resulted from retail sales estimates of 1967 and 1968 sales data, respectively. However, estimates of Denver market sales yielded a larger computed "F," which resulted in the hypothesis not being rejected.

An overall comparison of computed "F's" for all models in all markets identifies model I as the most effective estimator (Table 19). Yet, statistical indicators, when taken alone, permit little inference. A direct comparison of computed "F" values assumes the residuals of each model are, in fact, its true errors. Yet, each of the models could have both observation and specification errors, and the level of these errors could differ. An examination of residual plots provided greater insight into these problems.

Residual Plots

Although several plots of the residuals were accomplished, only plots of $(\hat{Y}_i - Y_i)^2 / \hat{Y}_i$ were selected for discussion. Figures 8-19, Appendix B, present the observed patterns of residual plots for each model on 3 different sets of market data.

Table 19.--"F" tests of residuals from 4 predicting models tested on 4 different sets of market data.

Model	1967 Winston-Salem Data	1968 Winston-Salem Data	1969 Winston-Salem Data	1965 Denver Data
I	$\dagger\dagger 6.58_{53,32}$	$\dagger\dagger 3.33_{46,32}$	$\dagger\dagger 4.40_{53,32}$	$\dagger\dagger 31.18_{152,32}$ [c/]
II	$\dagger\dagger 2.27_{53,27}$	$\dagger\dagger 5.56_{46,27}$	$\dagger 1.83_{53,27}$	$\dagger\dagger 12.35_{152,27}$
III	$0.58_{53,37}$	$0.75_{46,37}$	$\dagger\dagger 2.617_{53,37}$	$\dagger 9.65_{152,37}$
Denver	$\dagger\dagger 2.22_{53,130}$	$\dagger\dagger 1.71_{46,130}$	$\dagger\dagger 3.24_{53,130}$	$\dagger\dagger 5.44_{152,130}$

$\dagger\dagger$Significant at .05 and .01 level.

$\dagger$ Significant at .05 level.

c/Degrees of freedom.

The plots do support the statistical analysis of the residuals. The pattern of residuals for model III fully characterize a large variance, which is not constant. 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 any other model.

A fact not indicated by the "computed F's" is that estimates of Denver sales yield a more constant variance over lot size than did the other models. In fact, residual variance created from each model's estimates of Denver retail sales have the greatest uniformity of all residuals analyzed. Conversely, residuals created from use

of the Denver model to predict sales on 1967-69 Winston-Salem retail data reveal greater variances as larger retail lots are encountered.

Sales estimates with model I exhibit the minimal variation in residuals, although there is evidence of a need for weighted least squares or variable transformation. Yet, the probabilities of improvement are minimal compared to models II and III.

The Denver model reveals the greatest potential for improvement. It is a very efficient estimator on lot sizes up to 1000 trees. At that point, the variance increases radically, making the model completely ineffectual for sales estimation on large lots.

Model II has similar plots to model III, revealing considerable change in residual variance from small to large lots. Its range of effectiveness is limited.

Accuracy of Estimators

Of the four models tested, only model III failed to produce statistically acceptable estimates of Christmas tree retail sales. Its estimates of 1967 and 1968 Winston-Salem retail sales resulted in more variance than was acceptable at either .01 or .05 level of confidence. In addition to the variance being too large, it was also heterscedastic. Further, this unequal or heteroscedastic variance occurred to a limited extent in all models.

A question raised by the foregoing discussion is, "What practical limitations does the unequal variance impose on the models?" The answer could be resolved by establishing confidence intervals such that the retailer could be 90 percent confident that the estimated sales ($\hat{Y}_i$) are within 15 percent of actual sales (Y_i). As approximately 15 percent of the trees at retail are left unsold, the models should have this level of accuracy to stand alone as a management tool.

An evaluation of each model would demonstrate that none has the level of accuracy to be effective as a complete decision tool for retailing Christmas trees. Model I, the most accurate estimator overall, sustained an average error of over 50 percent in its estimates of 1967 Winston-Salem sales for only 7 of the 53 retailers. Therefore, the models do have practical limitations. Further, although we can accept our original hypothesis of $\Sigma(\hat{Y}_i - Y_i)=0$, it should not be concluded that the models represent a complete information and decision system.

CONCLUSIONS AND RECOMMENDATIONS

Summary

Natural Christmas tree retailers in Winston-Salem sold 9,227, 10,152, and 11,941 trees in 1967, 1968, and 1969, respectively. The species mix was dominated each year by Balsam fir, accounting for 40 percent of all trees sold. Taste preferences for local plantation-grown trees caused a rapid decline in the sales of wild Eastern Red cedars, which dropped 60 percent in total sales over the three years. This void was filled by local plantation-grown firs, Scotch pine, and White pine.

Prices for trees sold varied significantly, with Fraser fir bringing the highest prices and Eastern Red cedar the lowest.

The number of retail lot outlets varied from 53 in 1967, to 46 in 1968, and 53 in 1969. Wholesale to retail mark-ups on Christmas trees declined over the 3-year period from 118 percent in 1967 to 91 percent in 1969. Trees left unsold were 14.7, 9.7, and 17.5 percent for 1967 through 1969, respectively.

Retail outlet types were dominated by chain grocery stores, which represented over one-third of the total lots each year. The second most predominant lot type was

independents. Together, the two types accounted for over 50 percent of all lot types. Tree sales volume was concentrated in a relatively small number of lots also. In each of the 3 years of study, 20 percent of the retailer population held 60 percent of market sales, and even more significant, the 5 largest retailers sold 40 percent of all trees.

Market Associations

Several retail market relationships were established from evaluations of Winston-Salem tree market data.

The best sales performance for Christmas tree retail lots occurred in areas of high retail activity for other consumer durable and nondurable goods. Retail lots located at shopping centers in four different areas of the city demonstrated higher retail sales activity relative to other retail lots. Retail lots located at these major retail market areas outsold their competitors in residential and downtown business areas three to one.

Factors which were demonstrative in increasing tree sales were also associated with shopping centers. Shopping centers were located on major traffic arteries, gaining them direct access to population moving to and from the city area. Also, shopping centers had larger and better parking facilities and provided extensive advertising, such as flyers, handbills, and radio ads. By associating themselves with these areas of high retail activity and practicing marketing strategies that have been demonstrated

effective in other retail goods, Christmas tree retail lot owners enjoyed greater tree sales, higher prices for their trees, and fewer trees left unsold at the end of the Christmas marketing season.

Distances traveled is associated with income, and most consumers are willing to travel over two miles to purchase a natural Christmas tree. In fact, many consumers in Winston-Salem traveled over three miles to select and purchase a natural Christmas tree. Based on these findings, the research would strongly suggest that retail owners locating in suburban areas not adjacent to roads bearing high traffic counts, and using little advertising, will severely limit their sales of natural Christmas trees.

Analysis and Inference

Many variables were revealed to have possible association with performance of natural Christmas tree retail outlets in Winston-Salem. Principal factor analysis was utilized in reducing a large number of variables which were felt to have some association with natural Christmas tree sales. The method proved useful in reducing the original number of variables to a more suitable subset for use in regression analysis. In effect, the model screened the data for intercorrelation among variables and identified independent sources of variance from several variables. By clustering these variables in the form of factors, and subjectively identifying these associations, definite spheres

of variance were identified. Among those defined were; white racial groups, inferior market performance, good tree or product quality, and major retail areas.

Predicting Models

A subset of variables defined through factor analysis was used as input to stepwise regression analysis. Four predicting models were created, one from each of the three years of data from Winston-Salem, and an additional model from 1965 tree sales data on Denver, Colorado. The models were created to predict expected sales for natural Christmas tree retail lot owners in metro areas.

Evaluation of regression coefficients and standard errors for the four models revealed model I, developed from 1967 Winston-Salem data, best described the market data from which it was created. The equation explained 89 percent of the variance associated with the 1967 data.

Each model was then used to estimate sales from market data different from which it was created. A statistical analysis of the residuals indicated the 1967 Winston-Salem model to be the most effective estimator, and the 1969 Winston-Salem model the least effective. However, analysis of residual plots revealed all models were limited due to unequal variance. Further, the Denver model proved to have the greatest accuracy up to lots handling 1000 trees. The 1967 Winston-Salem model had greatest accuracy on lots handling greater than 1000 trees.

Several conclusions can be drawn from this research. Based on these conclusions, recommendations can be made which 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. Retailer market entry and exit was not impeded either by natural or artificial constraints as witnessed by high retailer turnover during the three study years. A fairly homogeneous product was marketed, with little effort expended by retailers to differentiate the product. Although there was obvious concentration of seller activity, there were no explicit 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 lot locations averaged less than a mile apart, traveled an average of 2.5 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 exceeding the average distance to the nearest

retail lot or lots.

Location of the greatest retail sales activity occurred in areas of concentrated retail sales for other products. About half of the cut natural tree retailers located there and held approximately 70 percent of total market sales. Shopping centers grew out of the concept of concentrating buyer traffic and, therefore, high buyer activity. Market products and services offered at these centers are as important to the sales of natural trees as they are to other products. They afford convenience to the consumer, with large parking areas, sufficient area for product display, and access to other stores for normal shopping activity. Also, market activities such as advertising and merchandising are greatly facilitated at these locations. As such, these centers represent prime locations for retailing Christmas trees in metropolitan areas.

Although many retailers appeared astute in locating at or adjacent to shopping centers, they did not effectively utilize marketing strategies to better their independent position relative to others, or to afford overall expansion of natural tree sales in Winston-Salem. Price competition was implicit in the market (a range of prices existed), but retailers did not use the mechanism (promotion of price) to lure consumers from other lots. This was even true in the final weeks of the market period when retailers should have been making deliberate moves to minimize losses.

Retailers used minimal advertising and they did not grade their trees. This was true in 1969 after a decisive consumer taste change had occurred in favor of higher quality trees. Retailers reacted slow to the taste change, and, in fact, made a grave error in 1969 in oversupplying the market with low quality trees. Also, they mistakenly increased price. As a result, 23, 18, and 22 percent spoilage levels were recorded in 1967, 1968, and 1969 for low quality trees. During the same periods, high quality plantation fir and pine were enjoying good sales growth, and at significantly higher prices. But instead of concentrating on quality plantation trees in 1969, the market was supplied with an increased supply of wild balsam fir and pine from Canada. Even though the pines entered the market at a price below the 1967 average for pines, sales stagnated at the 1968 level.

Factor analysis was effective in deliniating independent spheres of influence from certain variables used in the analysis. However, the underlying concepts of factor and regression analysis, as is true of other analytical tools, are inherently dependent upon good empirical data. Creation of the predicting equations was hampered by lack of current and reliable census data and inability to correctly quantify certain variables. Yet, the author feels the models did effectively characterize the data from which they were created and the market relationships observed.

The use of predicting equations as developed herein will have moderate effectiveness within the market where they are developed, but only over the short-run. The models are structured around marketing factors that are exceedingly dynamic. They are ever-changing, and often in differing proportions. Further, variance was not concentrated in one variable, but many, making it difficult to monitor the changes.

The estimating equations, although developed to a reasonable stage, are ineffectual as estimators at the retail lot level. The demonstrate statistical significance and are important in identifying market associations. Yet, their accuracy at the retail level exceeds the allowable tolerance for a management tool. Many variables in the model have large variances. In combination they can produce a significant departure from the true lot situation; or the model could be representing the true capability of a lot which is not being realized due to poor management by the retailer. Speculation as to the cause of the unexplained variance does not remove it. What is critical is that it is too large for the models to be acceptable.

Recommendations

The most critical recommendation regarding this work is that the reader fully understands its limitation. Briefly, caution should be used in utilizing the models for predictive purposes at the retail lot level.

This research has demonstrated that a myriad of marketing and economic factors affect the sales performance of a given retail lot. Although some are more important than others, several must be included to have an acceptable estimator. From one lot to another, within the same market, these will change in level of importance to the response variable (Y). More importantly, changes in market conditions with time and/or geography 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 depend entirely 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 data could then be used for selecting the best lot location.

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

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

APPENDICES

APPENDIX A

SCHEDULE I

CHRISTMAS TREE RETAIL MARKETING QUESTIONNAIRE

To be read or explained to retailer by interviewer

The questions that are about to be asked of you are intended to provide us with the necessary information to develop a method of forecasting retail sales of natural Christmas trees. You, the Christmas tree retailer, will be the chief beneficiary of the results of this study and they will be made available to you as soon as possible. The information that you give us will be confidential. No one else will have access to this quationnaire or to the information contained therein.

Instructions to the interviewer

This questionnaire or data sheet is divided into two sections. The first consists of those questions that are to be asked of, and answered by the Christmas tree retailer. The second section consists of certain characteristics of each retailer to be observed and recorded. This last section does not include any questions to be asked.

Bureau of Budget No. 40S 69007
Expiration Date: March 31, 1969

CHRISTMAS TREE RETAIL MARKETING QUESTIONNAIRE

Name of Lot Owner or Firm _____

Address of Owner or Firm _____

Phone (Office) _____ (Home) _____

Lot Location _____

Identification Number _____

A. Retail Lot Characteristics (Visual Observations)

1. Number of other Christmas tree retailers within designated distances of this retailer. Identify by their identification number.

Distance	Number	Identification
1 block & under	_____	_____
Over 1 block - 2 blocks	_____	_____
Over 2 blocks - 3 blocks	_____	_____
Over 3 blocks - 4 blocks	_____	_____
Over 4 blocks - 1 mile	_____	_____
Over 1 mile - 2 miles	_____	_____

2. Type of retail establishment.

Independent lot /___/

Chain grocery store /___/

Discount store /___/

Nursery or florist /___/

Church or civic group /___/

Independent grocery store /___/

Service station /___/

Other (specify) _____ /___/

3. Type of area in which retail lot is located. (May check more than one.)

Business area /___/

Residential area /___/

Shopping center /___/

Vacant lot /___/

4. Is lot located on a principal traffic artery?

Yes /___/

No /___/

5. Parking facilities adjacent to lot.

Large parking area (>50 cars) /___/

Small parking area (<50 cars) /___/

Street parking only /___/

None available /___/

6. Quality of trees being sold at lot (ACTGA Grades).

Good /___/

Average /___/

Poor /___/

7. Nature of tree display at lot.

Good (Standing upright and well-lighted) /___/

Average (Leaning, few on stands, few lights) /___/

Poor (On ground, little or no lighting) /___/

B. Retail Lot Sales Data

1. How many trees of each of the species listed below did you have available to sell in the 1968 Christmas season? How many did you sell? (Do not include artificial trees.)

Species	# of Trees Available to Sell Total	0-3'	3'-5'	Over	# of Trees Sold Total	0-3'	3'-5'	Over
Pine								
White								
Scotch								
Red								
Virginia								
Total								
Fir								
Balsam								
Fraser								
Douglas								
White								
Total								
Spruce								
Norway								
White								
Black								
Total								
Eastern Red Cedar								
Arizona Cypress								
Other (specify) _____								
TOTAL								

2. What were the high, low, and median prices that you <u>received</u> for each of the species sold? (Do not include prices of artificial trees.)

Species	High Price dollars	Low Price dollars	Median Price dollars
Pine			
White	_____	_____	_____
Scotch	_____	_____	_____
Red	_____	_____	_____
Virginia	_____	_____	_____
Fir			
Balsam	_____	_____	_____
Fraser	_____	_____	_____
Douglas	_____	_____	_____
White	_____	_____	_____
Spruce			
Norway	_____	_____	_____
White	_____	_____	_____
Black	_____	_____	_____
Eastern Red Cedar	_____	_____	_____
Arizona Cypress	_____	_____	_____
Other (specify) _____	_____	_____	_____

3. What was the average price you paid for each of these species, and by what arrangements were the purchases made?

Species	Purchase Arrangements: Delivered	Picked Up At Distributor	Cut & Piled	On Stump	From Other Retailer	On Consignment
	-average price per tree-					
Pine						
White						
Scotch						
Red						
Virginia						
Fir						
Balsam						
Fraser						
Douglas						
White						
Spruce						
Norway						
White						
Black						
Eastern Red Cedar						
Arizona Cypress						
Other (specify) _____						

4. Did you advertise your trees this year?

   Yes /___/

   No /___/

5. If answer to Question 4 is yes, where did you advertise and how frequently?

   Newspapers (number of issues) /___/

   Magazines (number of issues) /___/

   Handbills or cards (number of bills) /___/

   Radio (number of spots) /___/

   Television (number of spots) /___/

   Display signs (number) /___/

   Other _____ /___/

6. How many years have you been selling trees? ____ years

7. How many trees did you purchase for sale at this lot for Christmas, 1967? _____ number purchased

8. How many trees did you sell at this lot for Christmas, 1967? _____ number sold

9. Do you operate any Christmas tree retail lots other than this one?

   Yes /___/

   No /___/

   If "yes," where it is located?

   _____

SCHEDULE II

CHRISTMAS TREE CONSUMER QUESTIONNAIRE

Interview Location Code: ____/____ C. T. - Int. #

BOB No.: 40-S69102

Approval Expires: 2/28/70

Hello, I represent the Margaret Ernstes Interviewing Service. I am conducting a survey for the Forest Service of the U.S.D.A. Could you please assist us in completing the following questionnaire on natural and artificial Christmas trees?

1. Do (did) you have a Christmas tree this year?

   Yes /___/ No /___/

2. How many trees do (did) you have? (COMPLETE A SCHEDULE FOR EACH TREE.)

   _____

3. Is (was) your tree natural or artificial? (IF NATURAL TREE, GO TO QUESTION 5.)

   Natural /___/ Artificial /___/

4. In what year did you purchase your artificial tree?

   _____

5. What species or type of tree is (was) it? (IF ARTIFICIAL TREE GO TO QUESTION 8.)

   Natural (species) _____

   Artificial (type) _____

6. How was your natural tree obtained?

   Purchased /___/ Other /___/

7. Where was it purchased? (GET NAME OF RETAIL ESTABLISHMENT OR OPERATOR AND STREET LOCATION.)

   _____

   _____

   _____

8. How old is the family member who selected the tree?

   Under 10 /___/ 10-14 /___/ 15-19 /___/ 20-24 /___/ Over 24 /___/

9. How many people live in your household? _____

10. Is your total family income:

Under $3,000	/___/	$ 9,000 - $11,999	/___/
$3,000 - $5,999	/___/	$12,000 - $14,999	/___/
$6,000 - $8,999	/___/	$15,000 and over	/___/

11. How many rooms do you have in your living quarters? (EXCLUDE BATHROOMS, UTILITY ROOMS, ENCLOSED PORCHES.)

    _____

APPENDIX B

Table 1.--Variables selected for initial factor analysis.

REDUCTION ROUTINE		
Variable number	General variables measured	Description of specific variables used
		Economic Variables
1	Competition	Proximity of competing retail lots - under 1 block
2	"	Proximity of competing retail lots - 1 to 2 blocks
3	"	Proximity of competing retail lots - 2 to 3 blocks
4	"	Proximity of competing retail lots - 3 to 4 blocks
5	"	Proximity of competing retail lots - 4 blocks to 1 mile
6	"	Proximity of competing retail lots - 1 to 2 miles
7	Trees available at lot	Trees for sale - sum
8	Retail prices at which trees offered	Average high price
9	" "	Average low price
10	" "	Average price
11	Type retail establishment	Type of establishment - independent lot
12	" "	Type of establishment - chain grocery store
13	" "	Type of establishment - discount store
14	" "	Type of establishment nursery or florist

Table 1.--(Cont'd.)

Variable number	REDUCTION ROUTINE: General variables measured	Description of specific variables used
		Economic Variables
15	Type retail establishment	Type of establishment - church or civic group
16	" "	Type of establishment - independent grocery store
17	" "	Type of establishment - other
18	Location of lot	Area location - business area
19	" " "	Area location - shopping center
20	" " "	Area location - residential area
21	" " "	Area location - business area and shopping center
22	" " "	Area location - business area and vacant lot
23	" " "	Area location - residential area and vacant lot
24	Tree quality	Tree quality - good
25	" "	Tree quality - average
26	" "	Tree quality - poor
27	Merchandising at lot	Lot quality - good
28	"	Lot quality - average
29	"	Lot quality - poor
30	Advertising for lot	Advertisement - yes
31	"	Advertisement - no

REDUCTION ROUTINE		
Variable number	General variables measured	Description of specific variables used
		Economic Variables
32	Sales performance	Relationship of trees purchased this year to last year - more
33	"	Relationship of trees purchased this year to last year - less
34	"	Relationship of trees purchased this year to last year - same
35	"	Relationship of trees purchased this year to last year - N.A. (purchased no trees last year)
36	"	Relationship of trees sold this year to last year - more
37	"	Relationship of trees sold this year to last year - less
38	"	Relationship of trees sold this year to last year - same
39	"	Relationship of trees sold this year to last year - N.A. (sold no trees last year)
40	Size of operation	Operates other retail lots - yes
41	" "	Operates other retail lots - no
42	Type of advertising	Advertisement - newspaper
43	" "	Advertisement - handbills
44	" "	Advertisement - radio
45	" "	Advertisement - TV
46	" "	Advertisement - signs

REDUCTION ROUTINE		
Variable number	General variables measured	Description of specific variables used
		Economic Variables
47	Knowledge of business	Number of years retailed Christmas trees
105	Potential customer traffic volume	Traffic count - AADV
		Demographic Variables
48	Population	Total population
49	Race	White population
50	"	Negro population
51	"	Total foreign stock
52	Households (families)	Population in households
53	"	Primary families
54	"	Primary individuals
55	"	Wives of head of household
56	"	Children under 18 years of age of head of household
57	"	Other relatives of head of household
58	"	Nonrelatives of head of household
59	"	Population in group quarters (nearest hundredth of a person)
60	"	Population per household
104	"	Households

REDUCTION ROUTINE		
Variable number	General variables measured	Description of specific variables used
		Demographic Variables
61	Families	Married couples
62	"	Married couples with own household
63	"	Married couples with own children under 6 years of age
64	"	Married couples with own children under 18 years of age
65	"	Married couples with husband under 45 years of age
66	"	Married couples with husband under 45 years of age and with own children under 18 years of age
78	"	Persons living in same house in 1960 as in 1955
67	Young adults, age, and group quarters	Unrelated individuals
72	" "	Enrolled in college
79	" "	Persons living outside Winston-Salem SMSA in 1955
88	" "	Persons over 18 years of age
68	Children, age	Total school enrollment, 4 to 34 years of age
69	" "	Enrolled in kindergarten (private and public)
70	" "	Enrolled in elementary (private and public)

REDUCTION ROUTINE		
Variable number	General variables measured	Description of specific variables used
		Demographic Variables
71	Children, age	Enrolled in high school (private and public)
86	" "	Persons under 6 years of age
87	" "	Persons between 6 and 18 years of age
73	Education	Persons 25 years old and over with no school years completed
74	"	Persons 25 years old and over with some elementary education
75	"	Persons 25 years old and over with some high school education
76	"	Persons 25 years old and over with some college education
77	"	Median school years completed (to nearest tenth of year)
80	Income	Families with income under $3,000
81	"	Families with income between $3,000 and $5,000
82	"	Families with income between $5,000 and $10,000
83	"	Families with income over $10,000
84	"	Median family income
85	"	Median family and unrelated individual income

REDUCTION ROUTINE		
Variable number	General variables measured	Description of specific variables used
		Demographic Variables
89	Marital status	Single persons over 14 years of age
90	" "	Married persons over 14 years of age
91	" "	Widowed persons over 14 years of age
92	" "	Divorced persons over 14 years of age
93	Occupation	Labor force (male and female)
94	"	Professional, skilled, and semi-skilled workers (male and female)
95	"	Laborers (male and female)
96	Type housing unit (group housing)	Housing units
97	" "	Owner occupied housing units
98	" "	Renter occupied units
99	" "	Sound housing units
100	" "	Median number of rooms per housing unit (to nearest tenth)
101	" "	Median number of persons per housing unit (to nearest tenth)
102	" "	Housing units built since 1940
103	" "	Median value of owner occupied housing unit

Table 8.--Highest 14 factor scores on 19 factors.[1/]

Factors									
1	2	3	4	5	6	7	8	9	10
Factor Score / Variable No.									
-.98 / 90	.86 / 60	-.83 / 50	.89 / 35	.91 / 40	.93 / 10	.89 / 105	.91 / 84	-.79 / 37	.85 / 15
-.98 / 53	.84 / 5	-.76 / 16	.89 / 39	-.91 / 41	.85 / 9	.50 / 2	.88 / 103	.76 / 36	.63 / 44
-.97 / 52	-.77 / 34	-.75 / 95	-.70 / 30	.81 / 43	.82 / 14	.47 / 23	.84 / 77	.42 / 46	-.34 / 12
-.97 / 61	-.77 / 67	-.65 / 3	.70 / 31	.43 / 4	.79 / 8	.47 / 22	.68 / 101	.35 / 29	.30 / 69
-.97 / 55	-.75 / 58	-.60 / 80	.40 / 13	.41 / 11	.56 / 42	.46 / 25	.60 / 83	.26 / 3	.19 / 2
-.97 / 62	-.72 / 79	.56 / 49	-.38 / 47	.36 / 23	.35 / 27	-.45 / 26	.51 / 2	.25 / 7	.19 / 100
-.96 / 48	-.71 / 51	-.44 / 98	-.33 / 46	-.30 / 47	.32 / 44	-.40 / 102	.39 / 44	.25 / 21	.18 / 23
-.95 / 64	-.67 / 6	.41 / 82	.33 / 26	.30 / 7	-.28 / 26	.36 / 59	.36 / 76	.23 / 69	.18 / 101
-.95 / 78	.64 / 100	-.39 / 73	-.31 / 42	.23 / 27	.28 / 18	.35 / 100	.26 / 51	-.23 / 28	.17 / 60
-.94 / 75	-.63 / 4	-.33 / 86	.30 / 29	.23 / 24	.27 / 25	-.31 / 101	-.25 / 46	.18 / 4	.17 / 58
-.94 / 71	-.59 / 98	.33 / 83	-.28 / 36	.20 / 79	-.24 / 28	.31 / 1	-.23 / 60	-.16 / 26	.17 / 37
-.94 / 87	-.54 / 72	-.32 / 70	-.27 / 12	-.19 / 42	.18 / 5	-.23 / 18	.23 / 85	-.16 / 22	-.16 / 77
-.94 / 88	.46 / 1	-.32 / 57	.24 / 100	-.18 / 69	-.17 / 46	.23 / 67	-.23 / 42	.13 / 15	.16 / 29
-.93 / 63	-.46 / 92	.31 / 97	-.24 / 25	-.18 / 12	.17 / 32	.21 / 72	.22 / 31	.13 / 17	-.16 / 11

[1/] Economic variables, 1967 retail lot surveys and traffic counts; 1960 Winston-Salem Census tract data. Analysis of 105 X 105 variable matrix. Analysis type-factor R-Mode, using principal factor solution. Number of observations = 53; Eigen value cut off at 1.00.

Table 8.--(Cont'd.)

Factors								
11	12	13	14	15	16	17	18	19
Factor Score / Variable No.								
.84 / 38	.70 / 13	.66 / 72	.89 / 33	.79 / 24	-.84 / 20	.87 / 19	-.84 / 17	-.65 / 12
.75 / 85	.47 / 21	.58 / 59	-.73 / 32	.68 / 27	-.33 / 25	.27 / 92	-.43 / 18	.63 / 11
.52 / 34	-.41 / 69	-.39 / 3	-.22 / 34	.63 / 7	.30 / 26	.27 / 38	.34 / 21	-.57 / 45
-.27 / 36	.38 / 34	-.38 / 28	.21 / 47	.51 / 22	-.28 / 102	-.27 / 26	-.24 / 26	-.54 / 42
.25 / 102	.36 / 7	-.35 / 83	-.21 / 45	.38 / 8	.24 / 21	.27 / 25	.23 / 46	-.45 / 47
-.24 / 45	-.25 / 23	.32 / 29	-.19 / 8	-.34 / 21	-.23 / 2	-.25 / 102	.23 / 23	-.40 / 18
.22 / 18	-.23 / 47	.31 / 34	.19 / 44	-.34 / 28	.21 / 34	-.24 / 60	.22 / 12	.37 / 22
.21 / 37	-.22 / 32	.29 / 79	.18 / 28	-.33 / 25	.19 / 45	.24 / 28	.18 / 1	.36 / 23
.19 / 33	.22 / 28	-.26 / 58	.14 / 18	-.29 / 29	.19 / 1	-.24 / 29	.15 / 13	.27 / 59
.19 / 32	-.21 / 27	.24 / 68	.14 / 59	-.28 / 26	-.18 / 32	.24 / 59	.14 / 102	.26 / 3
.18 / 5	-.20 / 11	.23 / 67	-.14 / 60	-.26 / 34	-.17 / 28	.23 / 4	.14 / 25	-.26 / 83
.17 / 12	-.19 / 18	.23 / 89	-.13 / 102	-.26 / 12	.17 / 29	.22 / 100	-.13 / 20	-.25 / 1
.16 / 23	-.19 / 85	.21 / 31	-.12 / 46	-.25 / 42	-.17 / 7	-.21 / 46	.13 / 9	-.23 / 76
.16 / 103	-.14 / 76	-.21 / 30	.12 / 72	.25 / 43	.16 / 16	-.21 / 18	-.13 / 2	.22 / 73

Table 9A.--Identification of top 14 variable loadings on 19 principal factors.

Factor #1		
Variable	Score	Description
90	-.98	Married persons over 14 years of age
53	-.98	Primary families
52	-.97	Population in household
55	-.97	Wives of head of household
62	-.97	Married couples with own household
48	-.96	Total population
64	-.95	Married couples with own children under 18 years of age
78	-.95	Persons living in same house in 1960 as in 1955
75	-.94	Persons 25 years old and over with some high school education
71	-.94	Enrolled in high school (private and public)
87	-.94	Persons between 6 and 18 years of age
88	-.94	Persons over 18 years of age
63	-.93	Married couples with own children under 6 years of age

Table 9B.--Identification of top 14 variable loadings on 19 principal factors.

Factor #2		
Variable	Score	Description
60	.86	Population per household
5	.84	Proximity of competing retail lots - 4 blocks to 1 mile
34	-.77	Relationship of trees purchased this year to last year
67	-.77	Unrelated individuals
58	-.75	Nonrelatives of head of household
79	-.72	Persons living outside Winston-Salem SMSA in 1955
51	-.71	Total foreign stock
6	-.67	Proximity of competing retail lots - 1 mile and over
100	.64	Median number of rooms per housing unit (to nearest tenth)
4	-.63	Proximity of competing retail lots - 3 to 4 blocks
98	-.59	Renter occupied units
72	-.54	Enrolled in college
1	.46	Proximity of competing retail lots - under 1 block
92	-.46	Divorced persons over 14 years of age

Table 9C.--Identification of top 14 variable loadings on 19 principal factors.

Factor #3		
Variable	Score	Description
50	-.83	Negro population
16	-.76	Type of establishment - independent grocery store
95	-.75	Laborers (male and female)
3	-.65	Proximity of competing retail lots - 2 to 3 blocks
80	-.60	Families with income under $3,000
49	.56	White population
98	-.44	Renter occupied units
82	.41	Families with income between $5,000 and $10,000
73	-.39	Persons 25 years old and over with no school years completed
86	-.33	Persons under 6 years of age
83	.33	Families with income over $10,000
70	-.32	Enrolled in elementary (private and public)
57	-.32	Other relatives of head of household
97	.31	Owner occupied housing units

Table 9D.--Identification of top 14 variable loadings on 19 principal factors.

Factor #4		
Variable	Score	Description
35	.89	Relationship of trees purchased this year to last year (no trees)
39	.89	Relationship of trees sold this year to last year (less)
30	-.70	Advertisement - yes
31	.70	Advertisement - no
13	.40	Type of establishment - discount store
47	-.38	Number of years retailed Christmas trees
46	-.33	Advertisement - signs
26	.33	Tree quality - poor
42	-.31	Advertisement - newspaper
29	.30	Lot quality - poor
36	-.28	Relationship of trees sold this year to last year (more)
12	-.27	Type of establishment - chain grocery store
100	.24	Median number of rooms per housing unit (to nearest tenth)
25	-.24	Tree quality - average

Table 9E.--Identification of top 14 variable loadings on 19 principal factors.

Factor #5		
Variable	Score	Description
40	.91	Operates other retail lots - yes
41	-.91	Operates other retail lots - no
43	.81	Advertisement - handbills
4	.43	Proximity of competing retail lots 3 to 4 blocks
11	.41	Type of establishment - independent lot
23	.36	Area location - residential area and vacant lot
47	-.30	Number of years retailed Christmas trees
7	.30	Trees for sale - sum
27	.23	Lot quality - good
24	.23	Tree quality - good
79	.20	Persons living outside Winston-Salem SMSA in 1955
42	-.19	Advertisement - newspaper
69	-.18	Enrolled in kindergarten (private and public)
12	-.18	Type of establishment - chain grocery store

Table 9F.--Identification of top 14 variable loadings on 19 principal factors.

Factor #6		
Variable	Score	Description
10	.93	Average price
9	.85	Average low price
14	.82	Type of establishment - nursery or florist
8	.79	Average high price
42	.56	Advertisement - newspaper
27	.35	Lot quality - good
44	.32	Advertisement - radio
26	-.28	Tree quality - poor
18	.28	Area location - business area
25	.27	Tree quality - average
28	-.24	Lot quality - average
5	.18	Proximity of competing retail lots - 4 blocks to 1 mile
46	-.17	Advertisement - signs
32	.17	Relationship of trees purchased this year to last year (more)

Table 9G.--Identification of top 14 variable loadings on 19 principal factors.

Factor #7		
Variable	Score	Description
105	.89	Traffic count - AADV
2	.50	Proximity of competing retail lots - 1 to 2 blocks
23	.47	Area location - residential area and vacant lot
22	.47	Area location - business area and vacant lot
25	.46	Tree quality - average
26	-.45	Tree quality - poor
102	-.40	Housing units built since 1940
59	.36	Population in group quarters (nearest hundredth of a person)
100	.35	Median number of rooms per housing unit (to nearest tenth)
101	-.31	Median number of persons per housing unit (to nearest tenth)
1	.31	Proximity of competing retail lots - under 1 block
18	-.23	Area location - business area
67	.23	Unrelated individuals
72	.21	Enrolled in college

Table 9H.--Identification of top 14 variable loadings on 19 principal factors.

Factor #8		
Variable	Score	Description
84	.91	Median family income
103	.88	Median value of owner occupied housing unit
77	.84	Median school years completed (to nearest tenth of year)
101	.68	Median number of persons per housing unit (to nearest tenth)
83	.60	Families with income over $10,000
2	.51	Proximity of competing retail lots - 1 to 2 blocks
44	.39	Advertisement - radio
76	.36	Persons 25 years old and over with some college education
51	.26	Total foreign stock
46	-.25	Advertisement - signs
60	-.23	Population per household
85	.23	Median family and unrelated individual income
42	-.23	Advertisement - newspaper
31	.22	Advertisement - no

Table 9I.--Identification of top 14 variable loadings on 19 principal factors.

Factor #9		
Variable	Score	Description
37	-.79	Relationship of trees sold this year to last year (less)
36	.76	Relationship of trees sold this year to last year (more)
46	.42	Advertisement - signs
29	.35	Lot quality - poor
3	.26	Proximity of competing retail lots - 2 to 3 blocks
7	.25	Trees for sale - sum
21	.25	Area location - business area and shopping center
69	.23	Enrolled in kindergarten (private and public)
28	-.23	Lot quality - average
4	.18	Proximity of competing retail lots - 3 to 4 blocks
26	-.16	Tree quality - poor
22	-.16	Area location - business area and vacant lot
15	.13	Type of establishment - church or civic group
17	.13	Type of establishment - other

Table 9J.--Identification of top 14 variable loadings on 19 principal factors.

Factor #10		
Variable	Score	Description
15	.85	Type of establishment - church or civic group
44	.63	Advertisement - radio
12	-.34	Type of establishment - chain grocery store
69	.30	Enrolled in kindergarten (private and public)
2	.19	Proximity of competing retail lots - 1 to 2 blocks
100	.19	Median number of rooms per housing unit (to nearest tenth)
23	.18	Area location - residential area and vacant lot
101	.18	Median number of persons per housing unit (to nearest tenth)
60	.17	Population per household
58	.17	Nonrelatives of head of household
37	.17	Relationship of trees sold this year to last year
77	-.16	Median school years completed (to nearest tenth of year)
29	.16	Lot quality - poor
11	-.16	Type of establishment - independent lot

Table 9K.--Identification of top 14 variable loadings on 19 principal factors.

Factor #11		
Variable	Score	Description
38	.84	Relationship of trees sold this year to last year (same)
85	.75	Median family and unrelated individual income
34	.52	Relationship of trees purchased this year to last year (same)
36	-.27	Relationship of trees sold this year to last year (More)
102	.25	Housing units built since 1940
45	-.24	Advertisement - TV
18	.22	Area location - business area
37	.21	Relationship of trees sold this year to last year (less)
33	.19	Relationship of trees purchased this year to last year (less)
32	.19	Relationship of trees purchased this year to last year (more)
5	.18	Proximity of competing retail lots - 4 blocks to 1 mile
12	.17	Type of establishment - chain grocery store
23	.16	Area location - residential area and vacant lot
103	.16	Median value of owner occupied housing unit

Table 9L.--Identification of top 14 variable loadings on 19 principal factors.

Factor #12		
Variable	Score	Description
13	.70	Type of establishment - discount store
21	.47	Area location - business area and shopping center
69	-.41	Enrolled in kindergarten (private and public)
34	.38	Relationship of trees purchased this year to last year (same)
7	.36	Trees for sale - sum
23	-.25	Area location - residential area and vacant lot
47	-.23	Number of years retailed Christmas trees
32	-.22	Relationship of trees purchased this year to last year (more)
28	.22	Lot quality - average
27	-.21	Lot quality - good
11	-.20	Type of establishment - independent lot
18	-.19	Area location - business area
85	-.19	Median family and unrelated individual income
76	-.14	Persons 25 years old and over with some college education

Table 9M.--Identification of top 14 variable loadings on 19 principal factors.

Factor #13		
Variable	Score	Description
72	.66	Enrolled in college
59	.58	Population in group quarters (nearest hundredth of a person)
3	-.39	Proximity of competing retail lots - 2 to 3 blocks
28	-.38	Lot quality - average
83	-.35	Families with income over $10,000
29	.32	Lot quality - poor
34	.31	Relationship of trees purchased this year to last year (same)
79	.29	Persons living outside Winston-Salem SMSA in 1955
58	-.26	Nonrelatives of head of household
68	.24	Total school enrollment, 4 to 34 years of age
67	.23	Unrelated individuals
89	.23	Single persons over 14 years of age
31	.21	Advertisement - no
30	-.21	Advertisement - yes

Table 9N.--Identification of top 14 variable loadings on 19 principal factors.

Factor #14		
Variable	Score	Description
33	.89	Relationship of trees purchased this year to last year (less)
32	-.73	Relationship of trees purchased this year to last year (more)
34	-.22	Relationship of trees purchased this year to last year (same)
47	.21	Number of years retailed Christmas trees
45	-.21	Advertisement - TV
8	-.19	Average high price
44	.19	Advertisement - radio
28	.18	Lot quality - average
18	.14	Area location - business area
59	.14	Population in group quarters (nearest hundredth of a person)
60	-.14	Population per household
102	-.13	Housing units built since 1940
46	-.12	Advertisement - signs
72	.12	Enrolled in college

Table 90.--Identification of top 14 variable loadings on 19 principal factors.

Factor #15		
Variable	Score	Description
24	.79	Tree quality - good
27	.68	Lot quality - good
7	.63	Trees for sale - sum
22	.51	Area location - business area and vacant lot
8	.38	Average high price
21	-.34	Area location - business area and shopping center
28	-.34	Lot quality - average
25	-.33	Tree quality - average
29	-.29	Lot quality - poor
26	-.28	Tree quality - poor
34	-.26	Relationship of trees purchased this year to last year (same)
12	-.26	Type of establishment - chain grocery store
42	-.25	Advertisement - newspaper
43	.25	Advertisement - handbills

Table 9P.--Identification of top 14 variable loadings on 19 principal factors.

Factor #16		
Variable	Score	Description
20	-.84	Area location - residential area
25	-.33	Tree quality - average
26	.30	Tree quality - poor
102	-.28	Housing units built since 1940
21	.24	Area location - business area and shopping center
2	-.23	Proximity of competing retail lots - 1 to 2 blocks
34	.21	Relationship of trees purchased this year to last year (same)
45	.19	Advertisement - TV
1	.19	Proximity of competing retail lots - under 1 block
32	-.18	Relationship of trees purchased this year to last year (more)
28	-.17	Lot quality - average
29	.17	Lot quality - poor
7	-.17	Trees for sale - sum
16	.16	Type of establishment - independent grocery store

Table 9Q.--Identification of top 14 variable loadings on 19 principal factors.

Factor #17		
Variable	Score	Description
19	.87	Area location - shopping center
92	.27	Divorced persons over 14 years of age
38	.27	Relationship of trees sold this year to last year (same)
26	-.27	Tree quality - poor
25	.27	Tree quality - average
102	-.25	Housing units built since 1940
60	-.24	Population per household
28	.24	Lot quality - average
29	-.24	Lot quality - poor
59	.24	Population in group quarters (nearest hundredth of a person)
4	.23	Proximity of competing retail lots - 3 to 4 blocks
100	.22	Median number of rooms per housing unit (to nearest tenth)
46	-.21	Advertisement - signs
18	-.21	Area location - business area

Table 9R.--Identification of top 14 variable loadings on 19 principal factors.

Factor #18		
Variable	Score	Description
17	-.84	Type of establishment - other
18	-.43	Area location - business area
21	.34	Area location - business area and shopping center
26	-.24	Tree quality - poor
46	.23	Advertisement - signs
23	.23	Area location - residential area and vacant lot
12	.22	Type of establishment - chain grocery store
1	.18	Proximity of competing retail lots - under 1 block
13	.15	Type of establishment - discount store
102	.14	Housing units built since 1940
25	.14	Tree quality - average
20	-.13	Area location - residential area
9	.13	Average low price
2	-.13	Proximity of competing retail lots - 1 to 2 blocks

Table 9S.--Identification of top 14 variable loadings on 19 principal factors.

Factor #19		
Variable	Score	Description
12	-.65	Type of establishment - chain grocery store
11	.63	Type of establishment - independent lot
45	-.57	Advertisement - TV
42	-.54	Advertisement - newspaper
47	-.45	Number of years retailed Christmas trees
18	-.40	Area location - business area
22	.37	Area location - business area and vacant lot
23	.36	Area location - residential area and vacant lot
59	.27	Population in group quarters (nearest hundredth of a person)
3	.26	Proximity of competing retail lots - 2 to 3 blocks
83	-.26	Families with income over $10,000
1	-.25	Proximity of competing retail lots - under 1 block
76	-.23	Persons 25 years old and over with some college education
73	.22	Persons 25 years old and over with no school years completed

Table 10.--Forty-nine highest scoring variables selected from 14 X 19 factor matrix.

Variable number	Score	Description
2	.50	Competition - 1-2 blocks
3	-.39	" - 2-3 blocks
5	.84	" - 4 blocks-1 mile
7	.63	Total trees for sale
9	.85	Average low price
10	.93	Average price
11	.63	Type enterprise - independent lot
12	-.65	" " - chain grocery
13	.70	" " - discount store
14	.82	" " - nursery or florist
15	.85	" " - church or civic group
16	-.76	" " - independent grocery
17	-.84	" " - other
18	-.43	Area location - business area
19	.87	" " - shopping center
20	-.84	" " - residential area
21	.47	" " - business & shopping center
23	.47	" " - residential area & vacant lot
24	.79	Tree quality - good
25	-.33	" " - average
26	.30	" " - poor
27	.68	Merchandising on lot - good

Table 10.--(Cont'd.)

Variable number	Score	Description	
30	-.70	Advertisement	- yes
32	-.73	Year to year tree purchases	- more
33	.89	" " " " "	- less
34	-.77	" " " " "	- same
35	.89	" " " " "	- NA
36	.76	Year to year tree sales	- more
37	-.79	" " " " "	- less
38	.84	" " " " "	- same
39	.89	" " " " "	- NA
40	.91	Number of lots operated	- 1
41	-.91	" " " "	- 1
43	.81	Where advertised	- handbills
44	.63	" "	- radio
45	-.57	" "	- television
46	.42	" "	- signs
50	-.83	Negro population	
59	.58	Population in group quarters	
60	.86	Population per household	
69	-.41	Enrolled in kindergarten	
72	.66	Enrolled in college	
77	.84	Median school years completed	
84	.91	Median family income	

Variable number	Score	Description
85	.75	Median family and unrelated individual income
92	.27	Divorced persons over 14
95	-.75	Laborers
103	.88	Median value of owner occupied housing units
105	.89	Traffic count AADV

Table 11.--List of 41 variables entered in stepwise regression models--Winston-Salem models; 1967, 1968, 1969.

Variable number	Description
	Economic Variables
1	Competition - 0-4 blocks
2	Competition - 4 blocks-1 mile
3	Traffic count (AADV)
4	Average low price
5	Average price trees sold
6	Type of enterprise - independent lot (dummy)
7	" " " - chain grocery store (dummy)
8	" " " - discount store (dummy)
9	" " " - nursery or florist (dummy)
10	" " " - church or civic group (dummy)
11	" " " - independent grocery store (dummy)
12	" " " - other (dummy)
13	Area location - business area (dummy)
14	" " - shopping center (dummy)
15	" " - residential area (dummy)
16	Tree quality (dummy) (1) have quality (0) don't have quality
17	Merchandising (dummy) (1) have merchandising (0) don't have merchandising
18	Advertised (dummy) (1) did (0) did not
19	Trees for sale this year (P)
20	Trees for sale last year (P-1)

Table 11.--(Cont'd.)

Variable number	Description
21	Ratio - trees for sale ($\frac{P}{P-1}$)
22	Trees sold this year (P)
23	Trees sold last year (P-1)
24	Ratio trees sold (P/P-1)
	Demographic Variables
25	Negro population
26	Population in group quarters
27	Population per household
28	Enrolled in kindergarten
29	Enrolled in college
30	Median school years completed
31	Median family income
32	Laborers
33	Median value of owner occupied housing units
34	Total population
35	Children under 18 years of age of head of household
36	Median number of persons per housing unit
37	Number of households
	Variables From Consumer Survey
38	Do not have a Christmas tree
39	Have an artificial Christmas tree
40	Have a purchased natural tree
41	Have a natural tree, not purchased

Table 12.--Variables appearing in predicting models I, II, and III; Winston-Salem, NC.

Found in all models	Description	Found in only two models	Description	Found in only one model	Description
X_1	Type lot; independent	X_{10}	Interaction variable; independent lot in business area	[1/] X_9(I)	Merchandising; did merchandise
X_2	Type lot; chain grocery	X_{14}	Interaction variable; merchandising with discount store	X_{12}(I)	Interaction variable; chain store lot in shopping center
X_3	Type lot; discount store	X_{18}	Competition; 4 blocks - 1 mile	[1/] X_{13}(I)	Interaction variable; merchandising with independent lot
X_4	Type lot; nursery or florist	X_{20}	Price of trees sold	X_{19}(I)	Traffic count (AADV)
X_5	Type lot; church or civic group	X_{22}	Population in group quarters	[1/] X_{24}(II)	Median family income
X_6	Type lot; independent grocery store				

[1/] Model in which variable appeared.

Table 12.--(Cont'd.)

Found in all models	Description	Found in only two models	Description	Found in only one model	Description
X_7	Lot location; business area			X_{25}(I)	Laborers
X_8	Lot location; shopping center			X_{27}(I)	Persons per housing unit
X_{11}	Interaction variable; chain store lot in business area			X_{28}(II)	Number of households
X_{17}	Competition; 0-4 blocks			[1/] X_{31}(II)	Median school years completed
X_{30}	College enrollees			X_{32}(II)	Value of housing units

[1/] Model in which variable appeared.

Table 13.--List of variables entered in final stepwise regression models--Winston-Salem models; 1967, 1968, 1969, and Denver model, 1965.

Variable number	Description
	Economic Variables
X_1	Type lot - independent
X_2	" " - chain grocery store
X_3	" " - discount store
X_4	" " - nursery or florist
X_5	" " - church or civic group
X_6	" " - independent grocery store
X_7	Lot location - business area
X_8	" " - shopping center
X_9	Merchandising - did merchandise
X_{10}	Interaction variable - independent lots located in business areas
X_{11}	" " - chain store lots located in business areas
X_{12}	" " - chain store lot located in shopping center
X_{13}	" " - merchandising with independent lot
X_{14}	" " - merchandising with discount store
X_{15}	" " - merchandising in business area
X_{16}	" " - merchandising in shopping center
X_{17}	Competition - 0-4 blocks
X_{18}	" - 4 blocks-1 mile

Table 13.--(Cont'd.)

Variable number	Description
X_{19}	Traffic count (AADV)
X_{20}	Prices of trees sold
	Demographic Variables
X_{21}	Negro population
X_{22}	Population in group quarters
X_{23}	Population per household
X_{24}	Median family income
X_{25}	Laborers
X_{26}	Children under 18
X_{27}	Persons per housing unit
X_{28}	Number of households
X_{29}	Kindergarten enrollees
X_{30}	College enrollees
X_{31}	Median school years completed
X_{32}	Value of housing units
X_{33}	Population
$X_{34}(Y)$	Trees sold

Table 15.--Description of model I: predicting model for natural Christmas tree sales; Winston-Salem, NC 1967. (Statistical characteristics: N = 53, K = 20, R = 0.8969, R^2 = 0.8046, Std. Error = 97.4912, F = 6.586.)

Variable number	Contribution to RSQ	Coefficient of correlation	Regression coefficient	Description
X_0			-765.41479	Constant
X_{34}				(Y) Dependent variable; trees sold
X_1	.1139	.337	60.84439	Lot type - independent
X_2	.0330	-.117	- 54.07054	Lot type - chain grocery store
X_3	.0217	.183	400.71216	Lot type - discount store
X_4	.0182	-.018	-374.85083	Lot type - nursery or florist
X_5	.0491	.246	246.65698	Lot type - church or civic group
X_6	.0429	-.090	-188.99060	Lot type - independent grocery store
X_7	.0109	.078	120.62463	Lot location - business area
X_8	.0083	.007	-269.23779	Lot location - shopping center
X_9	.0603	.196	-151.87868	Merchandising - did merchandise

Table 15.--(Cont'd.)

Variable number	Contribution to RSQ	Coefficient of correlation	Regression coefficient	Description
X_{10}	.0116	.184	- 76.27829	Interaction variable - independent lot in business area
X_{11}	.0342	-.160	-158.81769	Interaction variable - chain store lot in business area
X_{12}	.0230	-.163	171.53374	Interaction variable - chain store lot in shopping center
X_{13}	.0892	.177	187.25530	Interaction variable - merchandising with independent lot
X_{17}	.0622	.241	67.08125	Competition - 0-4 blocks
X_{18}	.0081	.077	21.89651	Competition - 4 blocks to 1 mile
X_{19}	.0185	.347	9.91129	Traffic count (AADV)
X_{20}	.1445	.318	106.99033	Price of trees sold
X_{25}	.0192	.065	81.26111	Laborers
X_{27}	.0233	.013	9.07497	Persons per housing unit
X_{30}	.0123	.148	- 40.59557	College enrollees

Table 16.--Description of model II: predicting model for natural Christmas tree sales; Winston-Salem, NC 1968. (Statistical characteristics: N = 46, K = 18, R = 0.8875, R^2 = 0.7876, Std. Error = 175.3309, F = 5.563.)

Variable number	Contribution to RSQ	Coefficient of correlation	Regression coefficient	Description
X_0			142.96655	Constant
X_{34}				(Y) Dependent variable - trees sold
X_1	0.774	.278	255.92163	Type lot - independent
X_2	.0443	-.112	-106.98358	Type lot - chain grocery store
X_3	.0042	.067	-102.53397	Type lot - discount store
X_4	.0455	-.013	- 42.08624	Type lot - nursery or florist
X_5	.0363	.237	271.24536	Type lot - church or civic group
X_6	.0257	-.110	-112.01918	Type lot - independent grocery store
X_7	.1113	.277	140.73718	Lot location - business area
X_8	.0061	.199	-125.84946	Lot location - shopping center
X_{10}	.1830	.450	277.47803	Interaction variable - independent lots in business area

Table 16.--(Cont'd.)

Variable number	Contribution to RSQ	Coefficient of correlation	Regression coefficient	Description
X_{11}	.0121	.027	-144.23497	Interaction variable - chain store lot in business area
X_{14}	.0302	-.050	-156.96634	Interaction variable - merchandising with discount store
X_{17}	.0497	.414	142.42615	Competition - 0-4 blocks
X_{22}	.2202	.032	787.23657	Population in group quarters
X_{24}	.0179	.223	142.92302	Median family income
X_{28}	.0138	-.028	19.32732	Number of households
X_{30}	.0142	.192	- 54.90912	College enrollees
X_{31}	.0377	.209	-791.70850	Median school years completed
X_{32}	.0313	.165	- 35.92450	Value of housing units

Table 17.--Description of model III: predicting model for natural Christmas tree sales; Winston-Salem, NC 1969. (Statistical characteristics: N = 53, K = 15, R = 0.7175, R^2 = 0.5148, Std. Error = 239.3806, F = 2.617.)

Variable number	Contribution to RSQ	Coefficient of correlation	Regression coefficient	Description
X_0			-121.69426	Constant
X_{34}				(Y) Dependent variable - trees sold
X_1	.1081	.329	235.96870	Type lot - independent
X_2	.0149	-.044	- 22.11629	Type lot - chain grocery store
X_3	.0002	.073	- 22.93744	Type lot - discount store
X_4	.0142	-.012	-269.41382	Type lot - nursery or florist
X_5	.0124	.136	266.47925	Type lot - church or civic group
X_6	.0834	-.065	-180.18784	Type lot - independent grocery store
X_7	.0160	.094	95.51788	Lot location - business area
X_8	.0036	.101	- 67.06488	Lot location - shopping center
X_{11}	.0141	.008	-167.95613	Interaction variable - chain store lot in business area

Table 17.--(Cont'd.)

Variable number	Contribution to RSQ	Coefficient of correlation	Regression coefficient	Description
X_{14}	.0232	.173	-106.62254	Interaction variable - merchandising with discount store
X_{17}	.0407	.235	66.35716	Competition - 0-4 blocks
X_{18}	.0357	.131	35.89357	Competition - 4 blocks to 1 mile
X_{20}	.0676	.211	35.88022	Prices of trees sold
X_{22}	.0233	-.076	-718.72217	Population in group quarters
X_{30}	.0148	.140	58.38811	College enrollees

Table 18.--Description of the Denver, CO model: predicting model for natural Christmas tree sales, 1965. (Statistical characteristics: N = 152, K = 20, R = 0.6841, R^2 = .4679, Std. Error = 603.6545, F = 5.447.)

Variable number	Contribution to RSQ	Coefficient of correlation	Regression coefficient	Description
X_0			1654.64453	Constant
X_{34}				(Y) Dependent variable - trees sold
X_1	.0466	.195	367.81543	Lot type - independent
X_2	.0579	-.165	-1128.11743	Lot type - chain grocery store
X_3	.0055	.158	- 64.46059	Lot type - discount store
X_4	.0530	.215	658.04297	Lot type - nursery or florist
X_5	.0009	.076	77.69997	Lot type - church or civic group
X_6	.0065	.039	110.05064	Lot type - independent grocery store
X_7	.0272	.152	- 377.84521	Lot location - business area
X_8	.0629	.251	849.02637	Lot location - shopping center
X_9	.0303	.027	- 362.59399	Merchandising - did merchandise

Table 18.--(Cont'd.)

Variable number	Contribution to RSQ	Coefficient of correlation	Regression coefficient	Description
X_{10}	.0092	.208	196.79907	Interaction variable - independent lot in business area
X_{11}	.0140	-.010	802.94141	Interaction variable - chain store lot in business area
X_{12}	.0209	.170	-1685.71680	Interaction variable - chain store lot in shopping center
X_{13}	.0127	-.082	- 322.45972	Interaction variable - merchandising with independent lot
X_{14}	.0135	-.061	491.91162	Interaction variable - merchandising with discount store
X_{15}	.0077	-.018	440.77100	Interaction variable - merchandising in business area
X_{16}	.0120	-.139	-1001.00098	Interaction variable - merchandising in shopping center
X_{22}	.0173	-.101	- 695.78784	Population in group quarters
X_{23}	.0158	-.177	- 363.20117	Population per household
X_{24}	.0068	.053	236.37401	Median family income
X_{29}	.0082	-.020	99.73190	Kindergarten enrollees

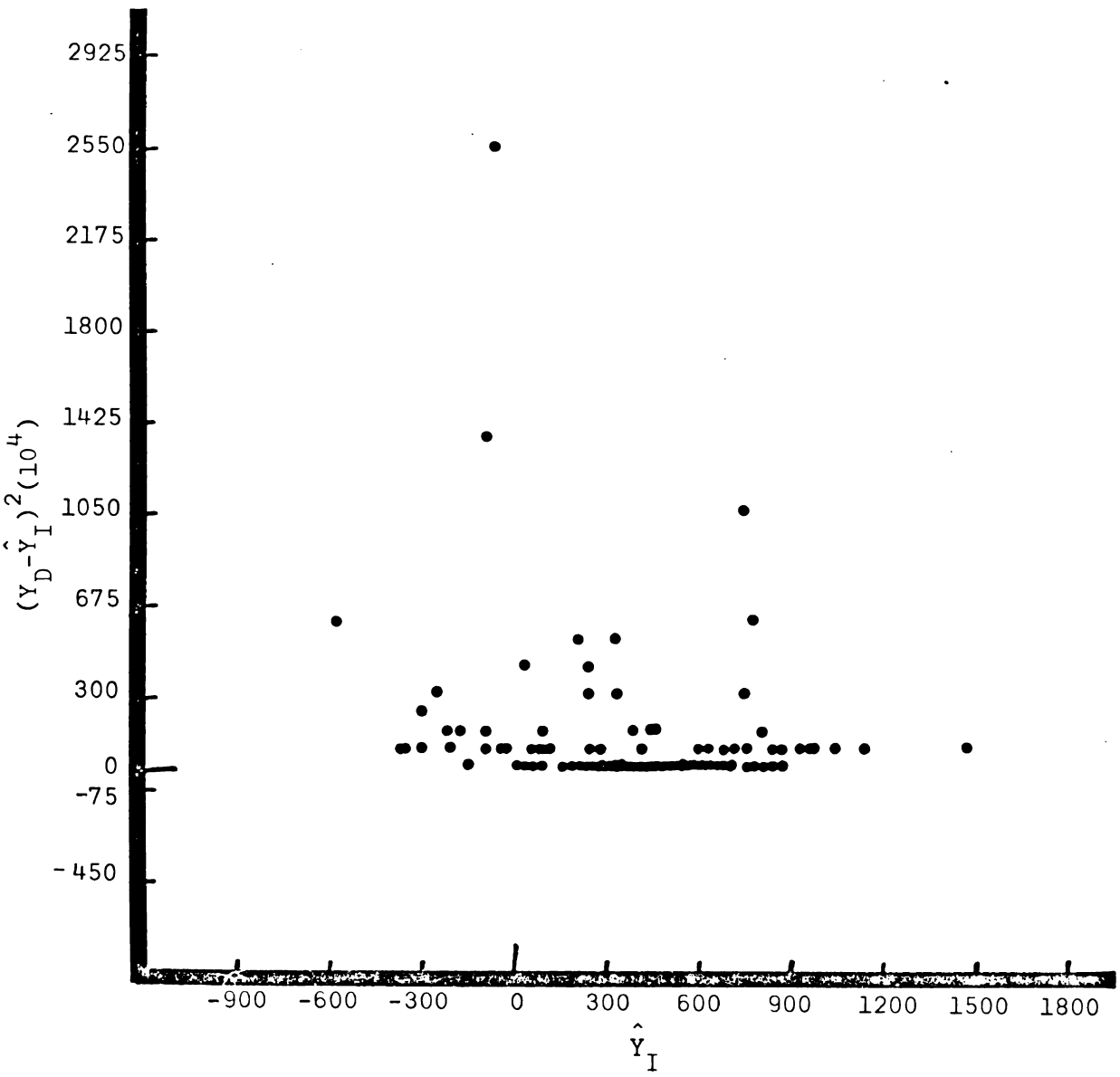

Figure 8.--Squared residual plots of estimated Denver retail sales with model I.

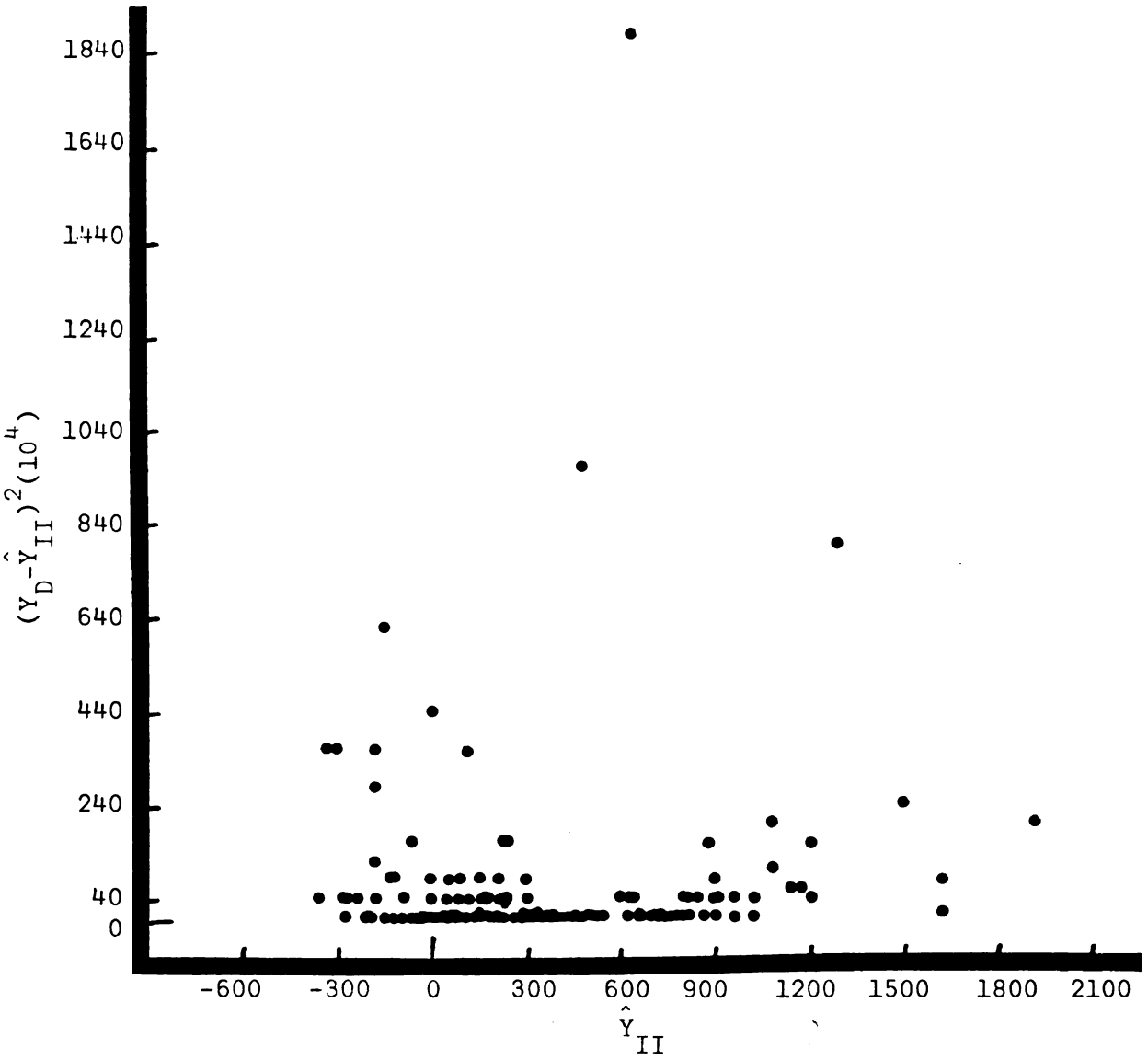

Figure 9.--Squared residual plots of estimated Denver sales with model II.

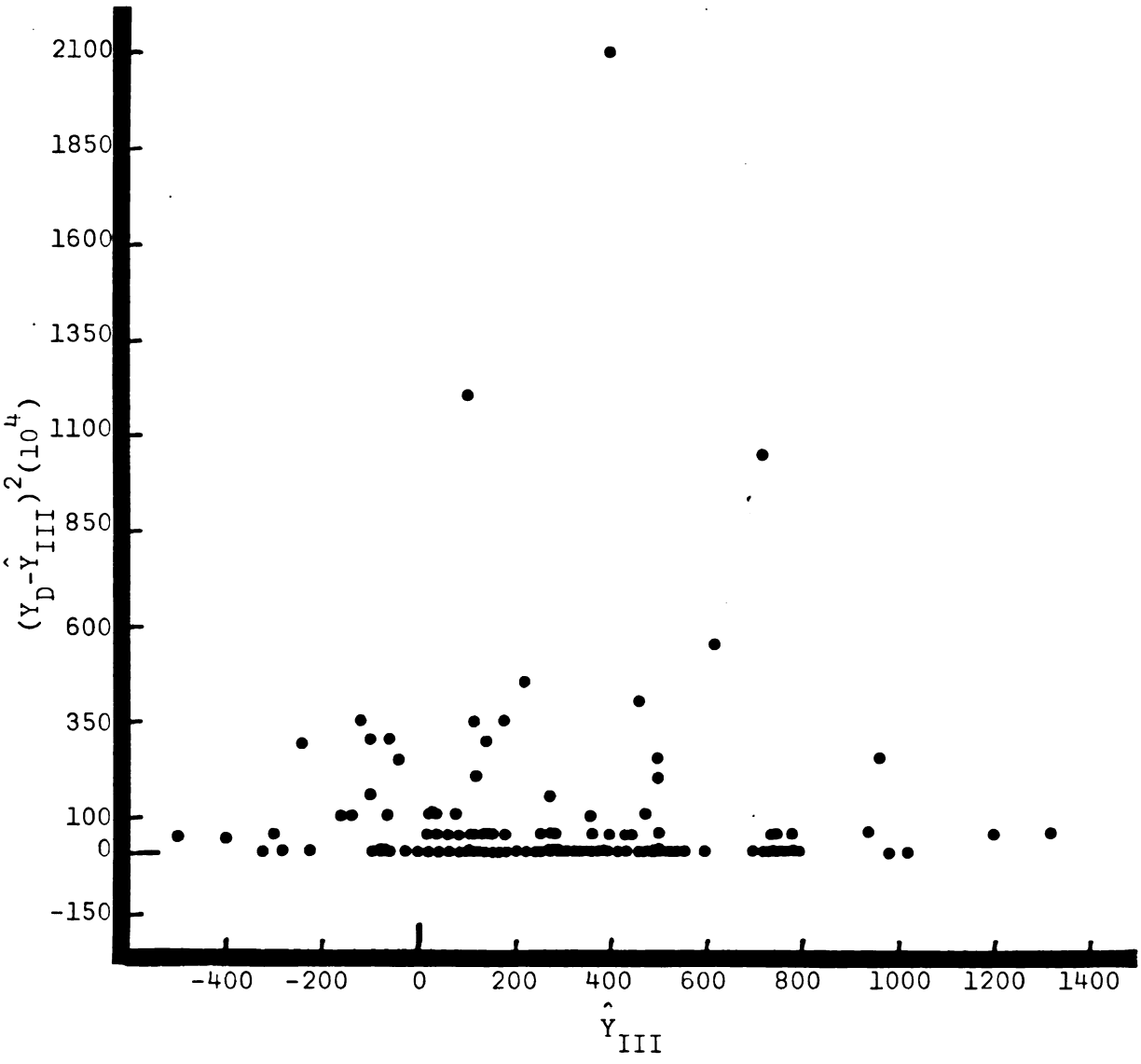

Figure 10.--Residual plots of estimated Denver retail sales with model III.

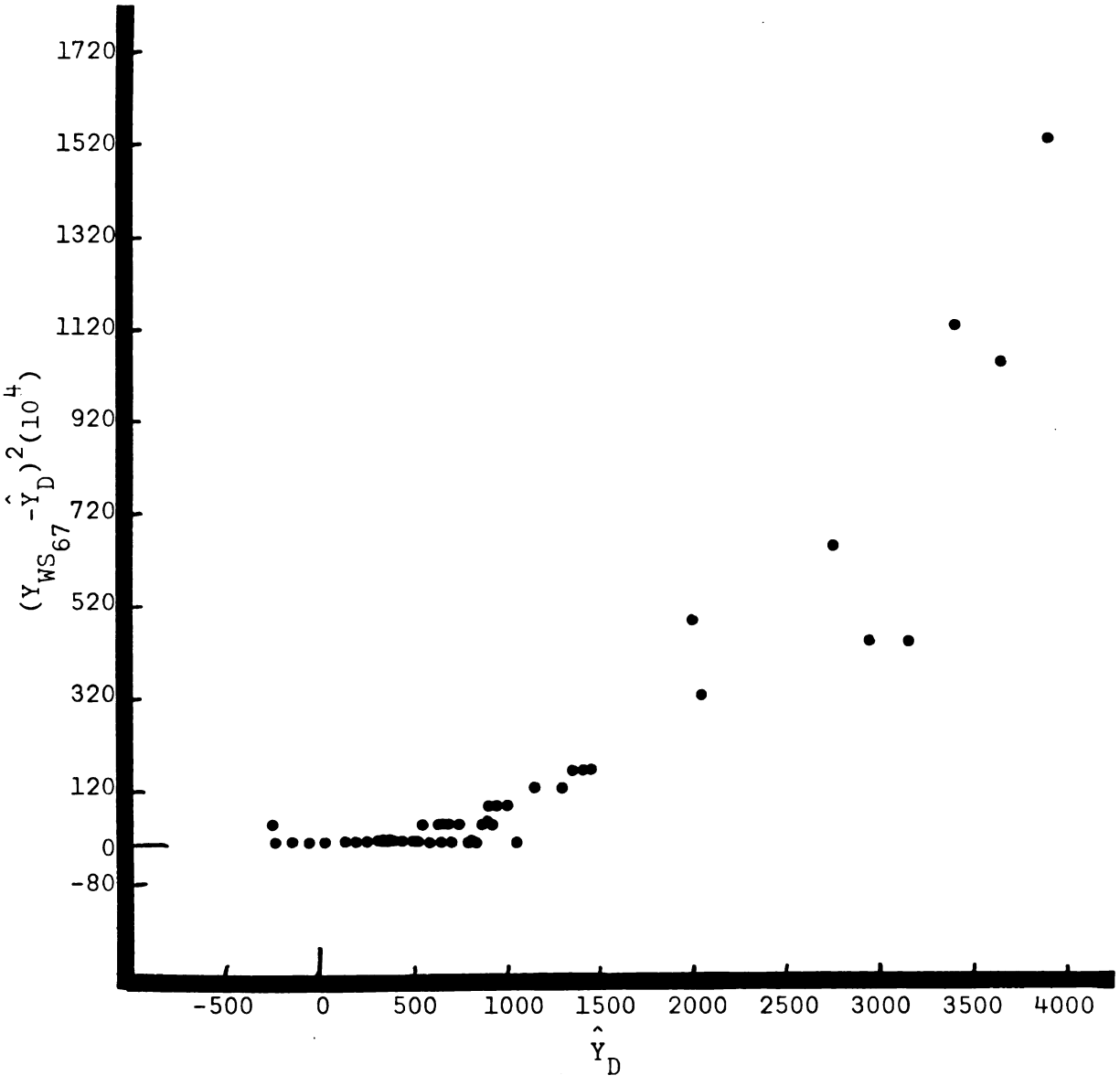

Figure 11.--Squared residual plots of estimated 1967 Winston-Salem retail sales with the Denver model.

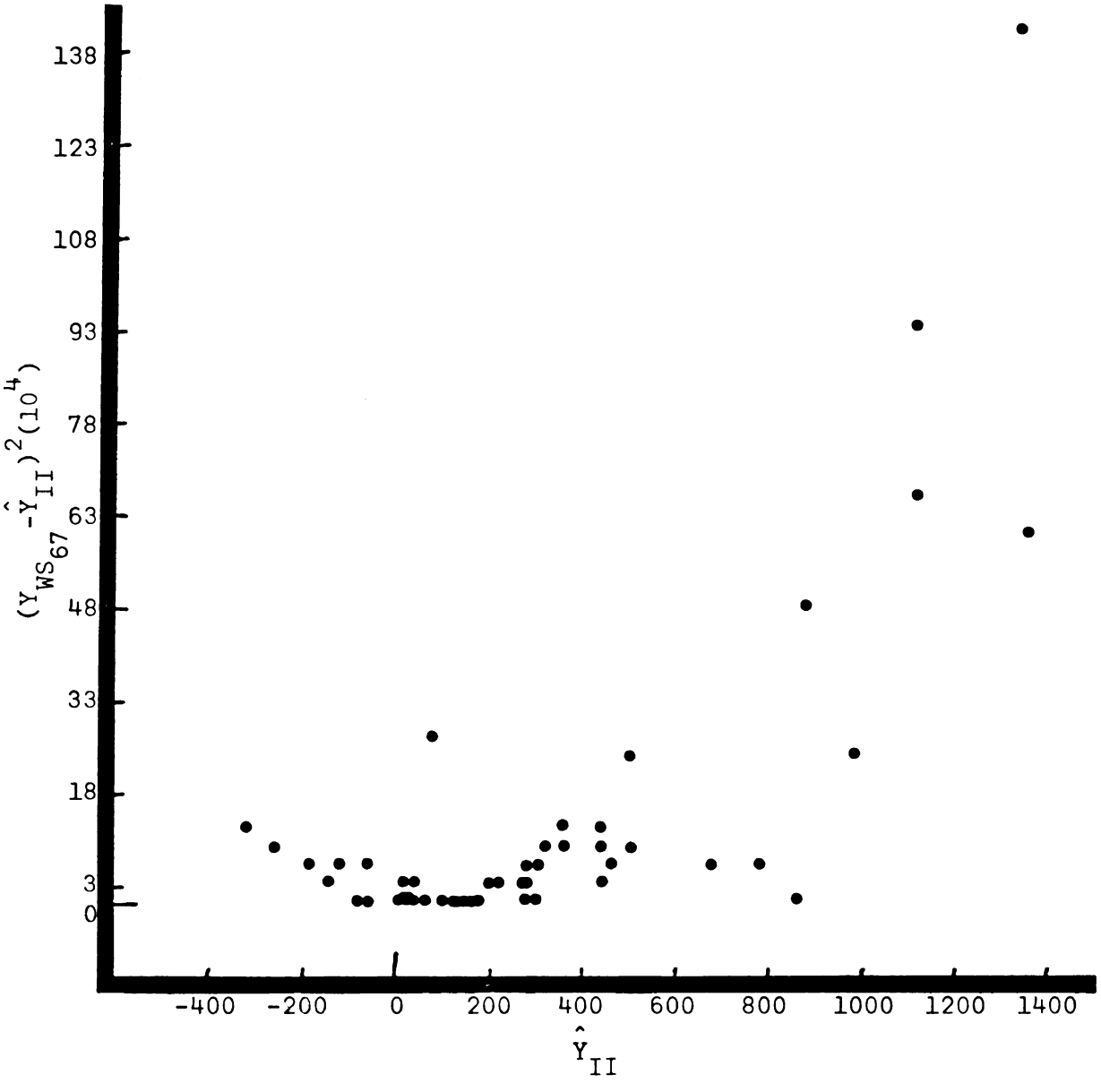

Figure 12.--Squared residual plots of estimated 1967 Winston-Salem retail sales with model II.

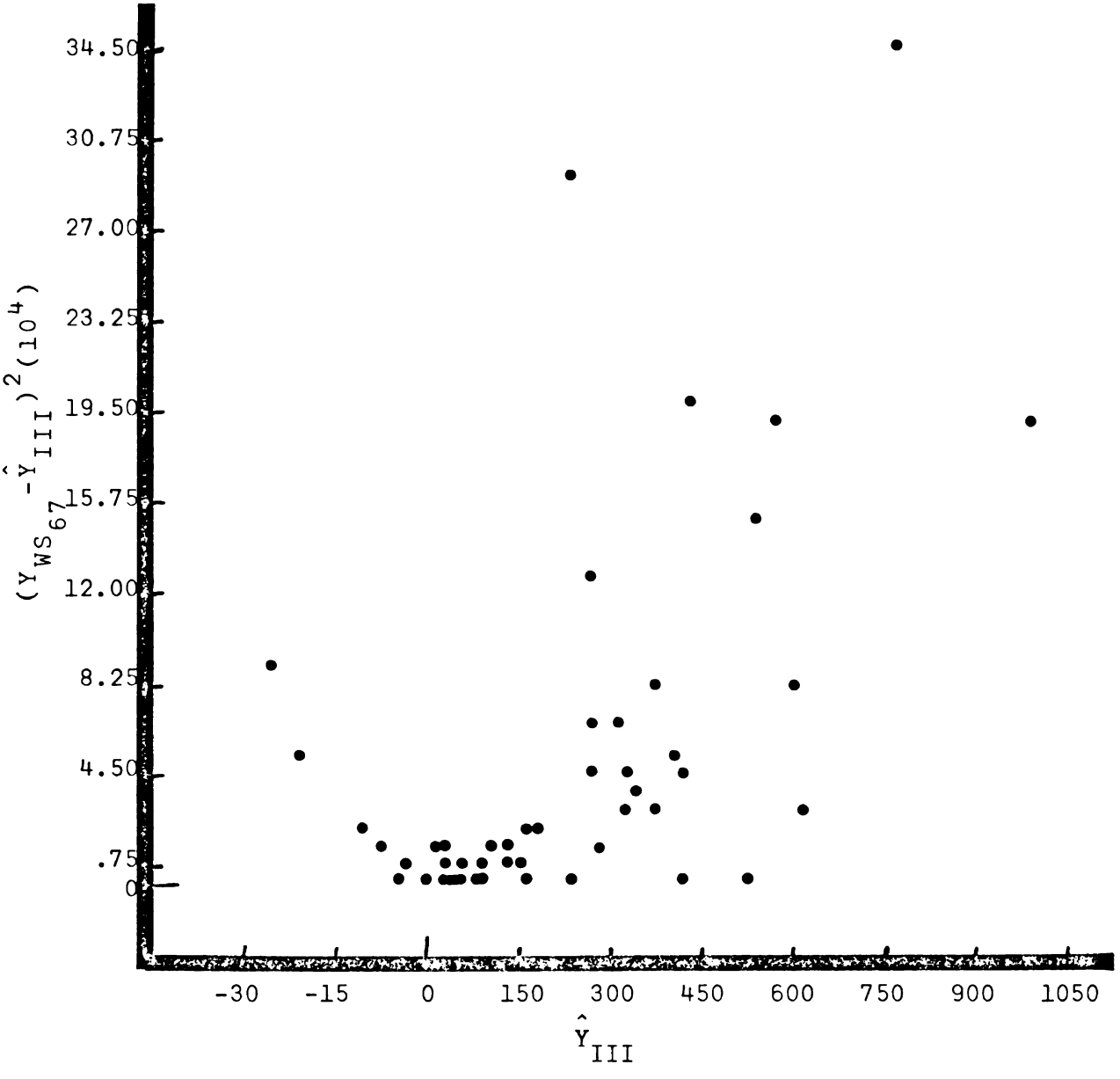

Figure 13.--Squared residual plots of estimated 1967 Winston-Salem retail sales with model III.

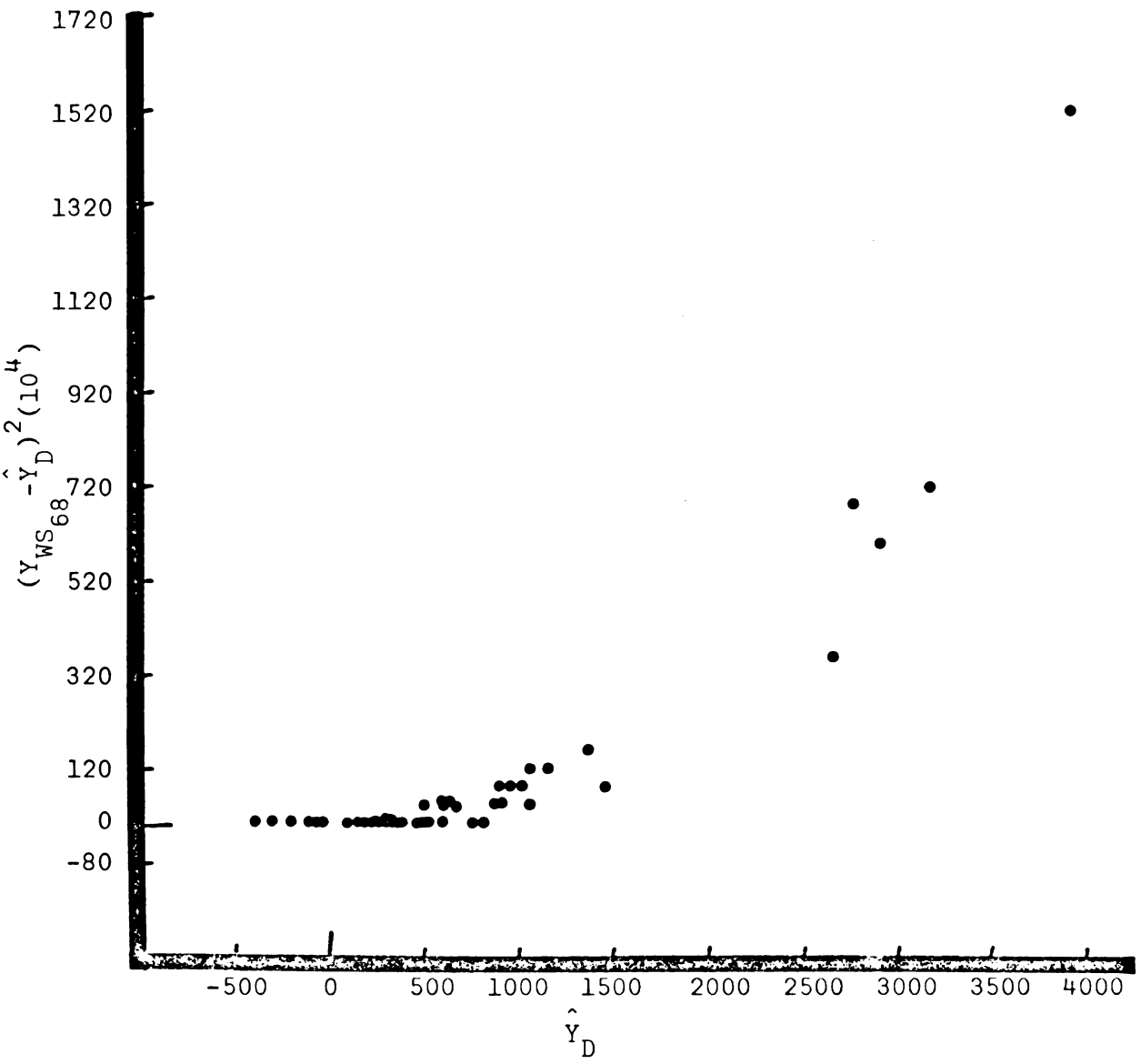

Figure 14.--Squared residual plots of estimated 1968 Winston-Salem retail sales with Denver model.

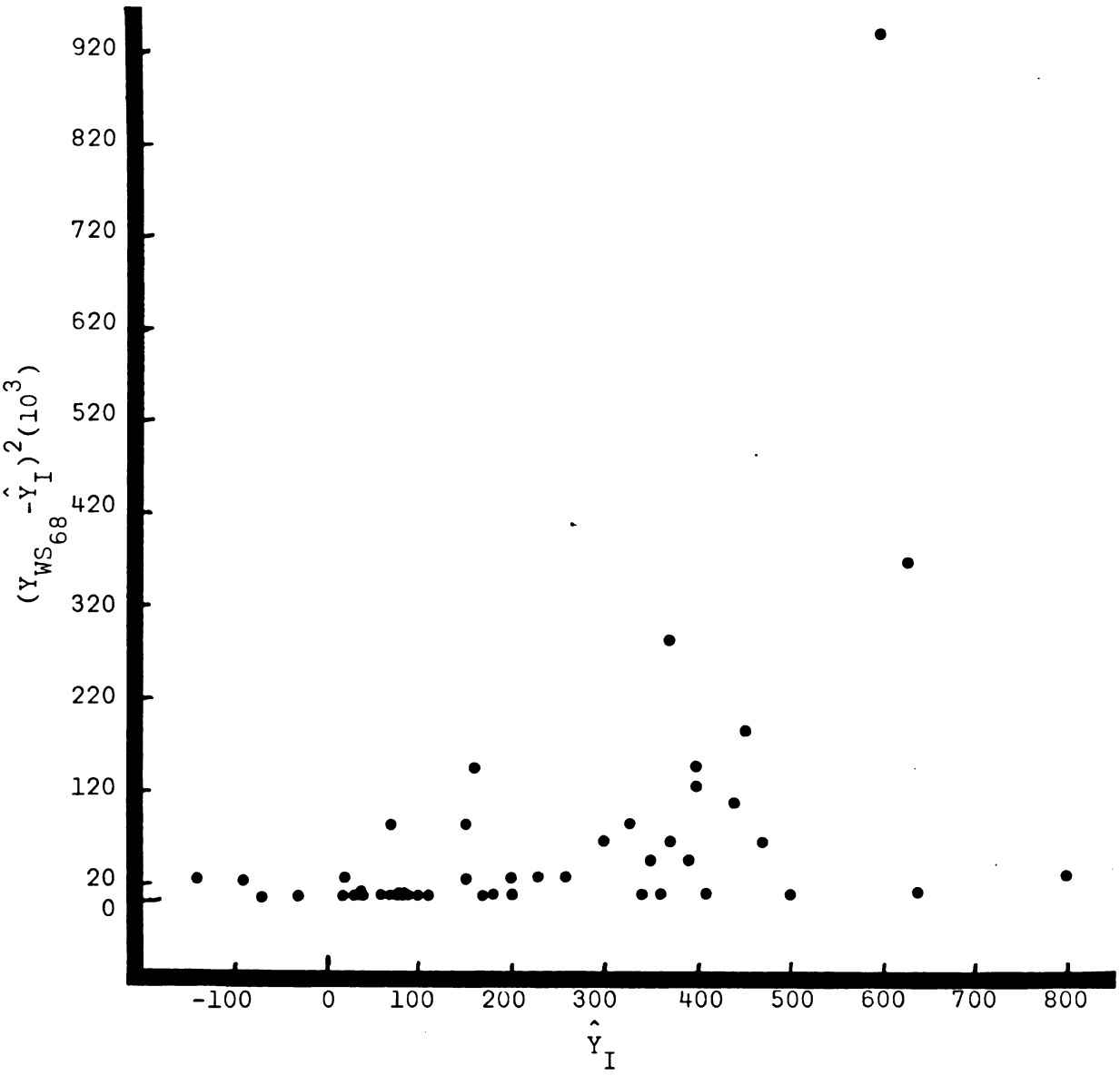

Figure 15.--Squared residual plots of estimated 1968 Winston-Salem retail sales with model I.

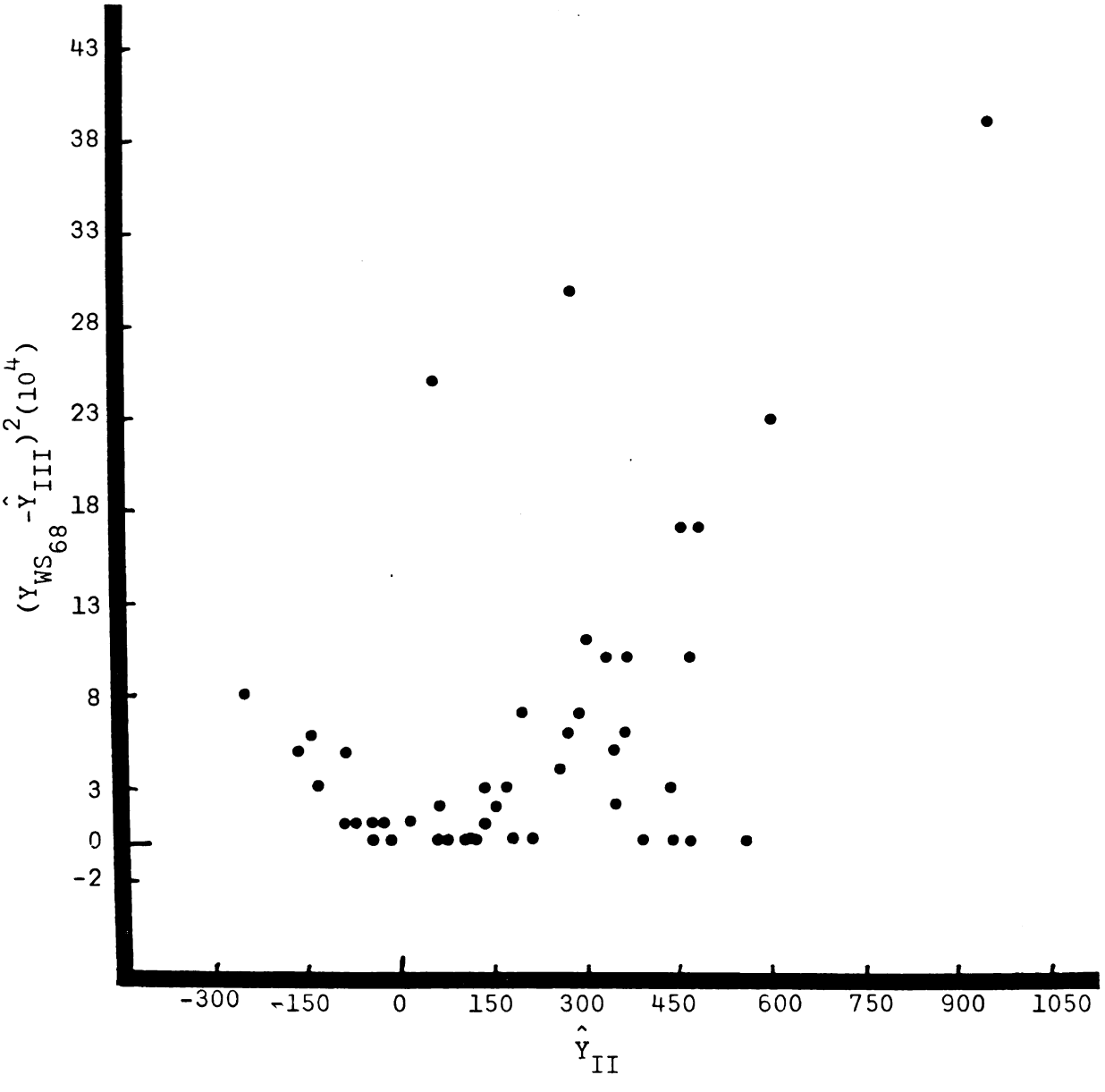

Figure 16.--Squared residual plots of estimated 1968 Winston-Salem retail sales with model III.

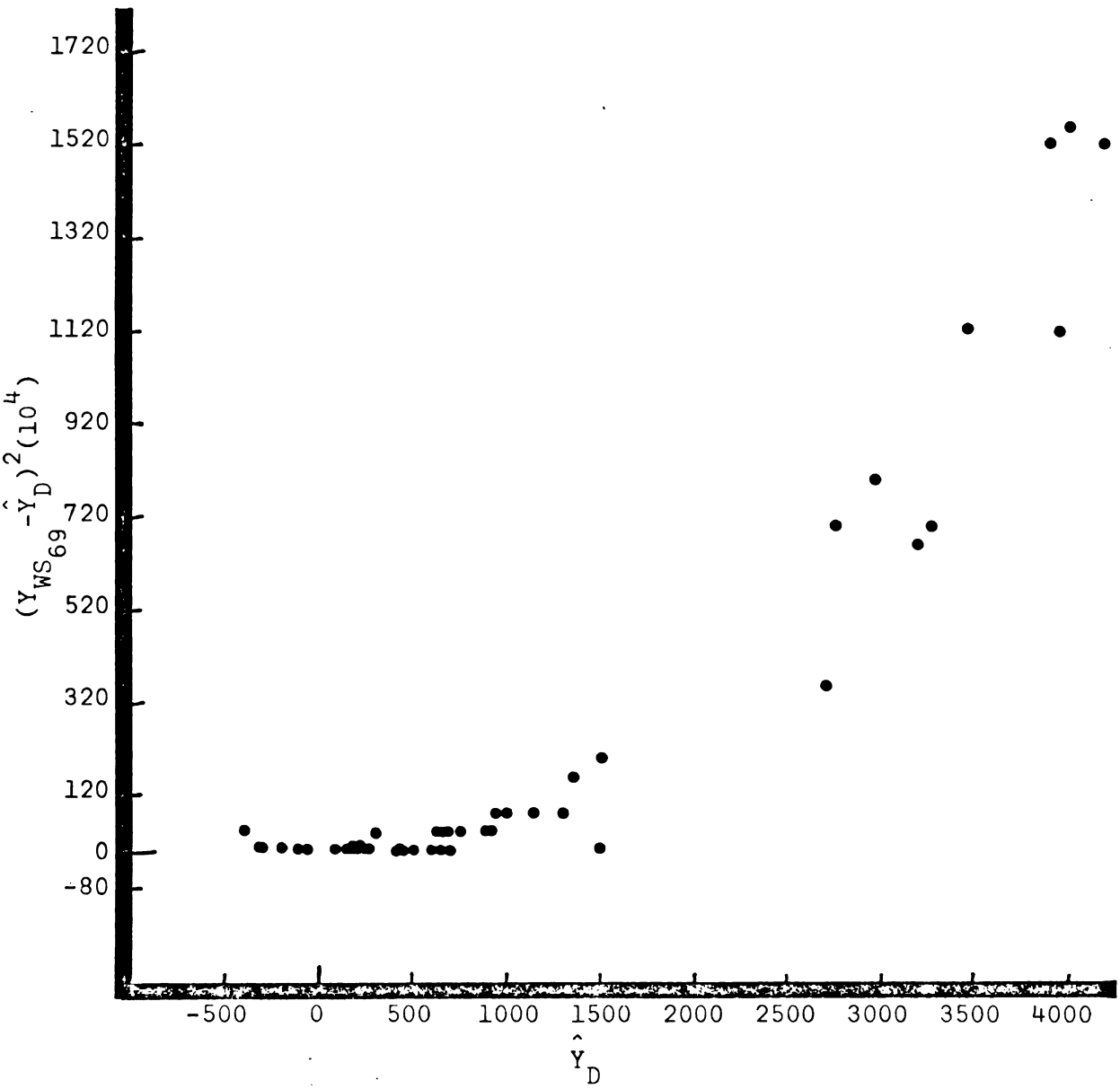

Figure 17.--Squared residual plots of estimated 1969 Winston-Salem retail sales with the Denver model.

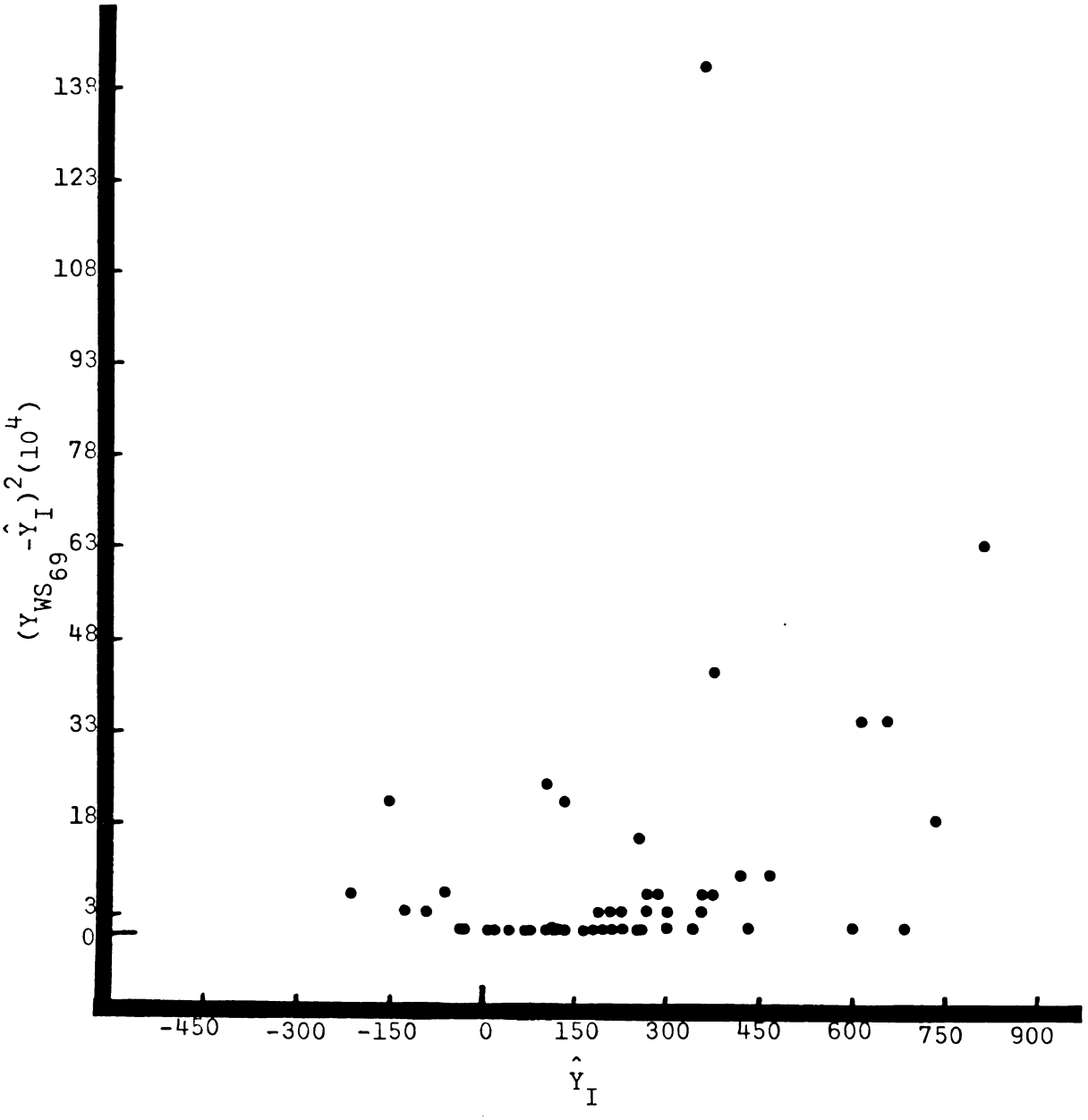

Figure 18.--Squared residual plots of estimated 1969 Winston-Salem retail sales with model I.

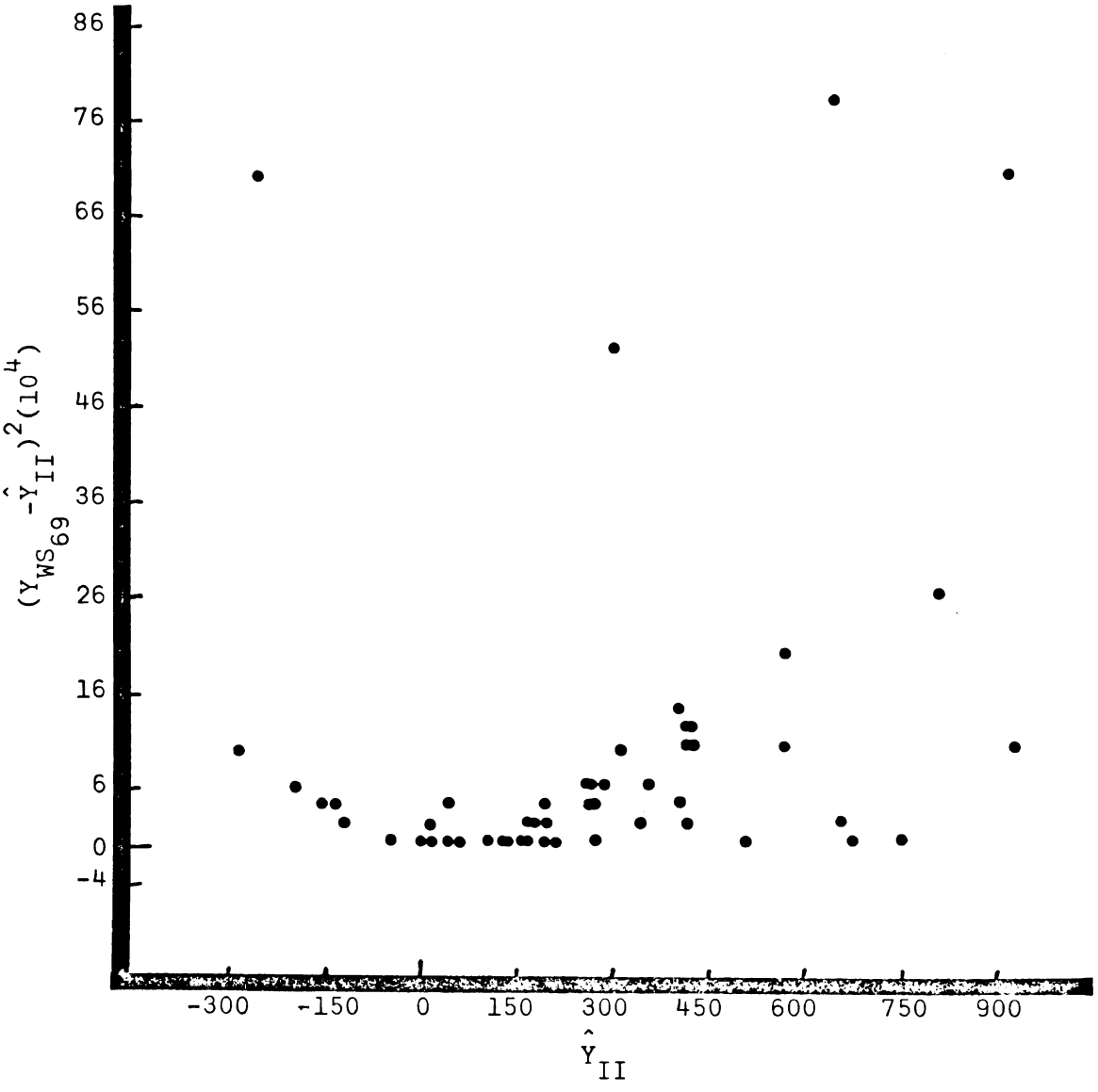

Figure 19.--Squared residual plots of estimated 1969 Winston-Salem retail sales with model II.

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