DEVELOPMENT OF A SALES FORECASTING MODEL FOR SMALL BUSINESSES WITHIN A SERVICE INDUSTRY

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TABLE OF CONTENTS

Chapter		Page
I.	INTRODUCTION	1
	Purpose and Objectives	3
	Assumptions	4
	Limitations	4
	Definitions	4
II.	REVIEW OF LITERATURE	7
	Product/Service Marketing	7
	Marketing Mix	7
	Selected Service Concepts	9
	Industry Related Research	12
	Evoked Set	12
	Perceived Risk	13
	High Customer Contact	14
	The Dichter Study	15
	Forecasting	16
	Sales Forecasting	17
	Time Series Data	18
	Basic Methods	20
III.	DEVELOPMENT AND PERFORMANCE OF THE MODEL	22
	Potential Variables	22
	Sample Business Description	23
	Selected Variables	25
	Sales Forecasting Method	31
	Multiple Regression Technique	31
	Model Development	33
	Correlation Coefficients	35
	Stepwise Regression	36
	Scatterplots	47
	Seasonal Variation	54
	Model Identification	56
	Model Performance	57
	Recommended Model	60

Chapter Page

IV. ASSESSMENT OF THE MODELS 69

Test Businesses 69
Selection Process 70
Descriptive Information 71
Data Treatment 72
Model Testing 73
Using Sample Business Data 73
Using Test Business Data 76
Discussion 79
Observations 80
Marketing Strategies 83
Guidelines 83

V. SUMMARY AND RECOMMENDATIONS 85
Summary of Procedures 86
Summary of Findings 87
Conclusions 88
Recommendations for Further Research . . 88

BIBLIOGRAPHY 90

APPENDICES 97

APPENDIX A - MATRIX OF POTENTIAL INDEPENDENT VARIABLES: ELEMENTS OF THE MARKETING MIX 98

APPENDIX B - INTERVIEW REACTION FORM 101

APPENDIX C - GOVERNMENT DOCUMENT RESOURCES . . 104

APPENDIX D - SELECTION OF A SALES FORECASTING METHOD 108

APPENDIX E - FORWARD SELECTION PROCEDURE FOR THE INDENTIFICATION OF INDEPENDENT VARIABLES 112

APPENDIX F - BACKWARD ELIMINATION PROCEDURE FOR THE IDENTIFICATION OF INDEPENDENT VARIABLES 116

APPENDIX G - MAXIMUM R SQUARE PROCEDURES FOR THE IDENTIFICATION OF INDEPENEDNT VARIABLES 122

APPENDIX H - COVER LETTER AND DATA COLLECTION FORM 130

APPENDIX I - SUMMARY OF MODEL PERFORMANCE FOR EACH OF FOURTEEN BUSINESSES . . . 133

Chapter Page

APPENDIX J - PROPOSED MARKETING STRATEGIES FOR SMALL DRYCLEANING BUSINESSES 138

LIST OF TABLES

Table		Page
I.	Description of The Dependent Variable (Sales) and Fourteen Independent Variables	28
II.	Correlation Coefficients and Probability Levels for the Dependent Variable (Sales) and Fourteen Independent Variables	37
III.	Analysis of Variance Table and Model Identified Using Forward Selection Procedure	40
IV.	Analysis of Variance Table and Model Identified Using Bacwkard Elimination Procedure	41
V.	Analysis of Variance Table and Model Identified Using Maximum R Square Procedure	43
VI.	Independent Variables, Analysis Criteria and Decision Matrix	44
VII.	Analysis of Variance Table for Model 1 Using Price, Number of Outlets, ALAG, and Seasonal Variation	59
VIII.	Analysis of Variance Table for Model 2 Using Price, Number of Outlets and Seasonal Variation	61
IX.	Analysis of Variance Table for Model 3 Using Time and Seasonal Variation	62
X.	Analysis of Variance Table for Model 4 Using Time, ALAG, and Seasonal Variation	63
XI.	Model 2 Prediction Results Compared With Actual Monthly Sales	64

Table		Page
XII.	Model 1 Prediction Results Compared With Actual Monthly Sales	65
XIII.	Model 4 Prediction Results Compared With Actual Monthly Sales	66
XIV.	Model 3 Prediction Results Compared With Actual Monthly Sales	67
XV.	Best Model Selected for Each of Fourteen Businesses Using Sample Business Data	74
XVI.	Summary of Model Performance Using Test Business Data	77
XVII.	Summary of Model 1 Performance For Each of Fourteen Businesses	134
XVIII.	Summary of Model 2 Performance For Each of Fourteen Businesses	135
XIX.	Summary of Model 3 Performance For Each of Fourteen Businesses	136
XX.	Summary of Model 4 Performance For Each of Fourteen Businesses	137

LIST OF FIGURES

Figure		Page
1.	Model Development Process	34
2.	Sales Volume Plotted in Relation to Monthly Time Frames	48
3.	Sales Volume Plotted in Relation to Dollars Spent for Packaging	49
4.	Sales Volume Plotted in Relation to Dollars Spent for Advertising	51
5.	Sales Volume Plotted in Relation to Number of Employees	52
6.	Sales Volume Plotted in Relation to Price for Mode Item	53
7.	Sales Volume Plotted in Relation to Number of Outlets	54
8.	Actual Monthly Sales Fluctuations for the Three Base Years and the Fourth Year Predicted by the Model	58

CHAPTER I

INTRODUCTION

The growth of service industries in the United States continues to be evident. In 1982, fifty-three percent of the National Income and fifty-six percent of all employees on nonagricultural payrolls were in service areas outside of the Government sector (U.S. Department of Commerce, 1984). Service sector growth has accounted for three-fifths of nonagricultural employment which doubled in size from 1950 to 1980 (U.S. Department of Commerce, 1984).

Growth and increased competition in service areas has been accompanied by the need for a clearer understanding of services marketing. In 1980, a study by Uhl and Udah revealed that seventy percent of published research on services marketing was reported in references dated 1975-80. Increasing interest in this area prompted the American Marketing Association to hold its first Service Marketing Conference in 1981.

The need to develop more detailed, reliable market data has been pointed out by Lovelock (1981) and other authorities in the service field. Guseman and Gillett (1981) contended that:

> The in-being and perishable nature of services place a burden upon the service marketer to be a good forecaster. The service marketer must be able to determine whether the demand will increase or decrease, how much, and when it is likely to occur (p.182).

Sales forecasting has typically been used by larger companies for long-term needs in product areas. Little research has been done to examine the feasibility of utilizing sales forecasting for short-term planning in small service businesses.

A problem which has prevented in-depth study of areas such as sales forecasting for service sectors is the need for accurate historical information (Booms and Bitner, 1981). Government statistical data typically provides historical industry information, however, most of the service areas have evolved so recently that data have not been collected and are therefore not available.

Industry data, published by the Government, is organized by codes established in the Standard Industrial Classification Manual. This manual makes it possible to tabulate, analyze, and publish data using standardized two, three, and four-digit code numbers.

Few service areas have established SIC codes. Drycleaning, a textiles and clothing related service industry, has an established code. This industry is recognized as a traditional service sector for which there is historical and industrial data. In a discussion of service economy trends, Kelley (1983), made reference to some traditional services:

> It used to be that there was a pretty clearcut definition of a service. Some person did something for you that you didn't want to or couldn't do for yourself. It was the corner dry cleaner or shopkeeper. The man who repaired your shoes. Waiters and waitresses at restaurants, hotel people, and cab drivers or railroad engineers (p.95).

The drycleaning industry is indeed a service sector comprised of small businesses. According to the 1977 Census of Service Industries, only 664 of the 69,419 firms recorded in the United States had annual sales receipts of over one million dollars.

Purpose and Objectives

The purpose of this study was to develop a sales forecasting model for small businesses within a selected service industry. The drycleaning and laundering service area, typically classified under the Standard Industrial Classification Code of 721, was selected for investigation.

The primary objectives of the study were to: 1) identify and quantify the marketing and other variables to be used in developing the sales forecasting model; 2) develop a sales forecasting model for use by small businesses within the selected service industry; and 3) assess the model and formulate guidelines for small businesses in the selected service industry based on services marketing literature and model performance.

Assumptions

1. The internal information available reflects historical business activity in drycleaning and laundering establishments.

2. An appropriate sales forecasting model would be a valuable marketing tool for small service oriented businesses.

Limitations

1. The internal information was obtained from an independently owned drycleaning and laundering establishment in the mid-western region of the United States.

2. Any variables for which data were not available, or not feasible to obtain internally or externally, were excluded from the model building process.

3. The sales forecasting method developed was to be feasible for use by small drycleaning businesses.

Definitions

The following terms are defined as they were used in the study:

Drycleaning and Laundering Business - An establishment primarily engaged in drycleaning, laundering and garment services typically classified as a service industry under SIC Code 7216.

Dummy Variables - Artificial variables used simply to denote the classification, not magnitude, of an observation of the independent variable. Also referred to as indicator variables.

Forecasting - To estimate a future value based on rational study and analysis of available pertinent data.

Function - A relationship among variables.

Goodness of Fit - A test to determine the degree to which the actual data agrees with the suggested model.

Interval Estimate - A calculation of two numbers from the sample data to be used as a range of values for the parameters of interest.

Marketing Variable - A variable used to make the estimate and identified as part of the marketing mix.

Model - A relationship between a response (dependent variable) and a set of independent variables.

Point Estimate - A calculation of a single number from the sample data to be used as the estimator of the parameter of interest.

Regression Function - A mathematical function that describes how the mean of the values of a dependent variable changes according to the value of an independent variable.

Sales Forecasting Model - A relationship between sales and a set of independent marketing and other variables.

Service Industries - Establisments, firms or organizations which engage in the performance of labor (rather than

creation of a good) for the benefit of individuals or groups.

Standard Industrial Classification - Used for the classification of establishments by the type of activity in which they are engaged.

Time Series - An arrangement of statistical data in accordance with its time of occurrence.

Trend - Refers to the upward or downward movement that characterizes a time series over a period of time.

CHAPTER II

REVIEW OF LITERATURE

In order to determine what approach would be taken in the development of a sales forecasting model for the selected service sector, three primary areas were investigated. The review of literature profiles product/service marketing, industry related research and forecasting.

Product/Service Marketing

In the book Marketing Theory: Conceptual Foundations of Research in Marketing (1976), Shelby Hunt asks the question "Is marketing a science?" Hunt (1976, p. 21) continued by explaining that marketing research is a science because it involves the "explanation, prediction and understanding of phenomena." Based on criteria proposed for a "science," Buzzell (1963, p. 37), contended that "marketing lacks the requisite theory and principles to be termed a science."

Marketing Mix

The marketing mix model of consumer goods marketing theory is commonly used by many marketing professionals. The marketing mix as defined by Kotler (1984, p. 68) is "the

mixture of controllable marketing variables that the firm uses to pursue the sought level of sales in the target market." Therefore, the marketing mix elements should be influential sales indicators.

Although there are several marketing mix modifications, the basic marketing elements have most frequently been referred to as the "four P's" (product, price, place and promotion) as summarized by McCarthy (1960). With the growth of service industries, major debates among marketers have dealt with whether marketing services is like marketing products as well as what criteria might be used to differentiate products from services (Uhl and Upah, 1983). Knisely (1984, p. 19) contends that the "number of variables involved in the marketing mix is normally larger in a service business than for a stable product."

Is there more involved than the "four P's"? Are the product (service), price, place, and promotion all important in the marketing of services? Should additional or different variables be recognized for forecasting services? Lovelock (1979) titled part of his article "Let's Dump the 'Four Ps'". In this section he noted:

> This classification pervades the entire marketing literature, a tribute to both its simplicity and the memorable nature of the '4 Ps' mnemonic. Unfortunately, the terminology imposed by the mnemonic (especially Promotion and Place) is restrictive and also inappropriate for many service and nonbusiness marketing situations (p. 159).

A great deal of effort has been put into attempting to develop a theoretical framework for the marketing of

services (Lovelock, 1983). Some researchers insist that marketing is marketing regardless of whether we are dealing with a product or a service. Others contend that we must reexamine traditional product classifications in light of new factors which appear to be important in the marketing of services. Lovelock (1983) basically recommends that we terminate the debate and get back to working on effective marketing efforts.

> Rather than continue to debate the existence of this broad dichotomy, it seems more useful to get on with the task of helping managers in service businesses do a better job of developing and marketing their products (p. 19).

Selected Service Concepts

Although service marketing has only been emphasized in the literature quite recently, several research findings and contentions are worth noting. Selected concepts are presented which are particularly pertinent to drycleaning businesses.

Most service industries, according to Bell (1981), lack distinctiveness and are largely undifferentiated in the market place. Bell (1981, p. 166) noted that "the intangibility of the offering and the great difficulty of protecting the service concept from copy cat marketers makes it difficult for the service firm to establish a strategic differential advantage." Additional difficulties relating to the intangible nature of services were noted by Booms and Nyquist (1981):

> Because services are intangible, the potential consumer finds it difficult to perceive and judge the value of committing to a purchase. There is little or nothing of the service itself that can be seen, tested, or tried prior to buying. Only after buying does one get to 'sample' the service, and then it is more than a sample because the service has been delivered and it is most often not possible to revise the purchase decision by 'returning' the service for credit (p. 173).

Booms and Nyquist also reported that with repetitious purchase experience, consumers tend to reduce time spent in investigating services and they respond habitually when in need of a service.

Evidence that consumers are less likely to shop for services is also presented by Guseman and Gillett (1981, p. 183). Rather than shop for service, consumers will continue "to patronize the first service performer that provides (a) satisfactory experience." They present an important finding related to price:

> Service shoppers will tend to patronize those stores they have used in the past, even if they are higher priced. And because of higher perceived risk, there is a greater tendency to develop price/quality relationships for services (p. 183).

Another relevant finding related to store patronage was reported by Zeithaml (1981) and highlights the importance of optimizing consumer satisfaction:

> A final reason why consumers may be more brand loyal with services is the recognition of the need for repeated patronage in order to obtain optimum satisfaction from the seller. Becoming a `regular customer' allows the seller to gain knowledge of the customer's tastes and preferences, insures better treatment and encourages more interest in the consumer's satisfaction. Therefore, a consumer may exhibit greater brand loyalty in

> order to cultivate a satisfying relationship with the seller (p. 189).

Consumer convenience appears to be lowest when only one service location is available. There is some indication, however, that trade offs may exist when attempting to provide convenience for the consumer. According to Lovelock (1984, p. 60) although convenience may be increased by adding new service outlets this "may start to raise problems of quality control, especially as this relates to the consistency of the service product delivered."

Perceived risk is an important factor in service marketing. In the Guseman study (1981, p. 202) research findings indicated that "for services, store loyalty, reference groups and brand loyalty were the most commonly used methods of reducing risks."

In a summary of the 1982 Services Marketing Conference (Upah, Berry, Shostack, 1983), thirteen key themes are identified by the editors. Included among the themes were the importance of service quality, taxonomy of services, dimensionalizing the physical service environment, impression management (advertising and personal selling) and customer evaluation. It is evident that we have become more familiar with the expanded dimensions of services marketing and recognize the potential impact on the traditional marketing theory base.

Industry Related Research

Drycleaning services have been classified in several ways in marketing literature. Sandeman and Sandeman (1981) classified drycleaning as 'service retailing' because the service activities are carried out in what the consumer sees as a shop. Bell (1981) classified goods based on buyer behavior. Drycleaning was classified as a 'convenience service,' health clubs as 'shopping services' and lawyers as providing 'specialty services.' The term 'owned good services' was used to describe drycleaning services by Guseman and Gillett (1981, p. 182) because they are services which "add value to a tangible product."

Evoked Set

Another way of looking at goods versus services marketing was suggested by Zeithaml (1981) who used the term "evoked set" to describe alternatives or options available to the consumer. She suggested that the "evoked set" for services is likely to be smaller than for products. Consumers generally shop in various retail stores which display competing merchandise. However, Zeithaml pointed out that with a service such as drycleaning, the business generally offers only one "brand." Also, unlike goods, service providers do not tend to be as geographically competitive and the consumer is not likely to have pre-purchase information. Zeithaml (1981, p. 189) also suggested that the consumer has

greater responsibility in service marketing "for a drycleaner's success in removing a spot depends on the customer's knowledge of its cause."

Perceived Risk

Perceived risk appears to play an important role in drycleaning services in particular. Guseman (1981) randomly selected ten products and ten services in order to study perceived risk. A larger proportion of services were classified as high risk than were goods. In ranked order by degree of perceived risk 'clothes cleaning' ranked second, just below 'appliance repair.'

In a 1981 Senate Hearing, the Better Business Bureau presented information related to consumer complaints. A rank ordering of seventy product/service businesses was provided based on the number of inquiries and complaints the Better Business Bureau received nationwide. Drycleaning/laundry companies ranked twelfth. Approximately sixty percent of the complaints for drycleaning businesses related to unsatisfactory service unrelated to repairs. Unsatisfactory repair was cited as the reason for complaints in approximately seventeen percent of the cases, thirteen percent noted delivery delay or damage, and approximately five percent were categorized in a group called product quality/performance. A majority of the complaints, sixty-five percent were virtually undefined due to the lack of

specificity in what is meant by words such as service, quality and performance.

High Customer Contact

Some services involve a high level of customer contact, and drycleaning services would be included in this category. Employees who deliver the service and work with the customer represent the service and the business in the customer's mind. Berry (1983) suggested a concept called 'relationship marketing.' This concept involves not only attracting new customers but improving the relationship a business currently has with its existing customer base. Berry (1983) recommended relationship marketing for service firms in which three conditions existed:

> 1. There is an ongoing or periodic desire for the service on the part of the service customer, e.g., telephone or janitorial service versus funeral home service.
> 2. The service customer controls selection of the service supplier, e.g., selecting dry cleaner or dentist versus entering the first taxi in the airport waiting in line.
> 3. There are alternative service suppliers and customer switching from one to another is common, e.g., patronizing various restaurants or airlines versus buying electricity from the one electric utility servicing a community (p. 25).

Drycleaning businesses clearly meet these three conditions and benefit by marketing strategies in order to accommodate Berry's concept of relationship marketing.

The Dichter Study

Drycleaning business owners and operators are probably familiar with research by Ernest Dichter Motivations, Incorporated. The most recent Dichter study, supported by the International Fabricare Institute (and previously the National Institute of Drycleaning), was published in 1982:

> The purpose of the study was to give drycleaners a tool to understand the modern customer and his or her motivations in order to help increase sales volume, improve customer retention, and prepare for the future by understanding the needs of customers of the 1980s (p. 2).

The Dichter report commented on new market segments that must be addressed, the renewed importance of clothing, the importance of the concept of quality, psychological and sociological changes, the importance of effective advertising and communications and consumer desires for the future.

Dichter made an effort to emphasize the need for drycleaning business owners to examine their image. He recommended a greater use of fashion in order to create a more updated image and used the term 'fabricare' plant instead of drycleaning plant. He also discusssed the importance of plant cleanliness and its link with the customer's perception of quality.

One of the questions asked in Dichter's study related to factors which were important in selecting a drycleaning service. Convenience was the most important factor followed by reliability in having clothes ready on time. Ample parking, reasonable prices, convenient hours, packaging,

ability to handle problems, appearance of the interior and adjustment policy for loss or damage were also frequently mentioned factors. Dichter (1982, p.8) noted that "over seventy-five percent of the respondents had been using the same drycleaner for many years."

When participants in the Dichter study were asked what they appreciated most about their drycleaner the responses included answers such as personable, helpful, knowledgeable, efficient, careful, mature, knows me by name, and gives me individual attention. The most influential advertising vehicle according to the Dichter study was word of mouth. Note that most of these qualities and factors mentioned in the Dichter study were based on qualitative judgement and, in order to quantify, would require some tool for measurement.

Forecasting

In recent years business, government and organizations have placed increased emphasis on predicting the circumstances that surround decision making (Wheelwright and Makridakis, 1980). One way of predicting is to utilize forecasting. In generating a forecast, that is an estimate of a future value or event, a forecaster must rely on information concerning events that occurred in the past.

Sales Forecasting

The importance of a strong "link between good marketing practice and profitable performance," (Eiglier, Langeard, Lovelock, Bateson and Young, 1977) has been emphasized by many researchers. A key element in attaining profitable performance is in the establishment of sales goals. Sales forecasting for small businesses is being encouraged but rarely facilitated. There is uncertainty as to what variables and methodology should be employed by small businesses. Hunt (1976) pointed out a typical academic dilemma in addressing practical problems versus theoretical questions.

> Almost all marketing practitioners, most marketing academicians and, sadly, too many marketing researchers perceive theoretical and practical as being at the opposite ends of the same continuum. This perception leads to the conclusion that as any analysis becomes more theoretical, it must become less practical. To puncture this misperception, one need only to note that a theory is a systematically related set of statements, including some lawlike generalizations, that is empirically testable. The purpose of theory is to increase scientific understanding through a systematic structure capable of both explaining and predicting phenomena (p. 3).

In the process of developing a sales forecasting model for small service businesses it is evident that the approach must be kept simple. Blackman (1983) emphasized the need for simplicity and the need to use data which could be maintained by small businesses. He further stated,

> Any measure which depends on gathering data OUTSIDE the business, is unlikely to be widely

> used. Most service businesses haven't the time, budget, or inclination to pursue such information (p.113-14).

Time Series Data

The forecaster analyzes past data in order to identify a pattern that can be used to describe it. Then this pattern is extrapolated or extended into the future in order to prepare a forecast. This basic strategy assumes that the pattern identified will continue in the future.

The past data used to prepare a forecast are called time series data. Business time series often involve yearly, quaterly, or monthly observations; but any other time period may be used. According to Bowerman and O'Connell (1979), a time series consists of four components. The components are the trend, the cycle, seasonal variations and irregular fluctuations.

Trend refers to the upward or downward movement that characterizes a time series over a period of time. Thus, trend, reflects the long-run growth or decline in the time series.

A cycle refers to recurring upward and downward movements around trend levels. These fluctuations can have a duration of anywhere from two to ten years or even longer.

Seasonal variations are periodic patterns in a time series that complete themselves within the period of a calendar year and are then repeated on a yearly basis. Ordinarily, series of monthly or quarterly data are used to

examine seasonal variations. Clearly, one single yearly observation would not reveal variations that occur during the year.

Irregular fluctuations are erratic movements in a time series that follow no recognizable or regular pattern. Such movements represent what is left over in a time series after trend, cycle, and seasonal variations have been accounted for. Many irregular fluctuations in time series are caused by unusual events that cannot be forecasted such as earthquakes, accidents, hurricanes, wars, strikes and the like.

These time series components do not always occur alone; they can occur in any combination or can occur altogether. Thus, no single best forecasting technique exists. Once an appropriate technique has been selected, the methodology usually involves analyzing the time series data in such a way that the different components that are present can be estimated.

Unfortunately, all forecasting situations involve some degree of uncertainty. This degree of uncertainty is recognized by including an irregular component in the description of a time series. If the effect of the irregular component is substantial, our ability to forecast accurately will be limited.

The fact that forecasting techniques often produce estimates that are somewhat in error has a bearing on the form in which we present forecasts. Forecasts are generally

presented either as point estimates or as confidence interval estimates.

A point estimate is a number that represents the best prediction of the value of the variable of interest at a given point in time. A confidence interval estimate is an interval or range of values that is calculated as an estimate for the true value. Point forecasts are often in error and therefore may not be adequate.

Basic Methods

Forecasting methods can be divided into two basic types referred to as qualitative methods and quantitative methods. Qualitative forecasting methods generally use the opinion of experts to subjectively predict future events. Such methods are often required when historical data concerning the events to be predicted either are not available at all or are scarce. Qualitative forecasting techniques are also used to predict changes in historical data patterns. Since the use of historical data to predict future events is based on the assumption that the pattern of the historical data will persist, changes in the data pattern cannot be predicted on the basis of historical data. Thus qualitative methods are often used to predict such changes.

Quantitative forecasting methods can be classified as either time series or causal. The most common quantitative forecasting methods are called time series models. Time series models are most useful when conditions are expected

to remain the same and are not very useful in forecasting the impact of changes in management policies.

The use of causal forecasting models involves the identification of other variables that are related to the variable to be predicted. Once these related variables have been identified, a statistical model that describes the relationship between these variables and the variable to be forecast is developed. The statistical relationship derived is then used to forecast the variable of interest.

Causal models are advantageous because they allow management to evaluate the impact of various alternative policies. However, causal models have two major disadvantages. First, they are quite difficult to develop. Secondly, they require historical data on all the variables included in the model, not only the variable to be forecast.

CHAPTER III

DEVELOPMENT AND PERFORMANCE OF THE MODEL

The purpose of this study was to develop a sales forecasting model for selected small businesses within the service industry sector. Drycleaning and laundering, typically classified under the Standard Industrial Classification Code of 721, was selected for investigation.

The primary objectives of this study were to:

1. Identify and quantify marketing and other variables to be used in developing the sales forecasting model.

2. Develop a sales forecasting model for small businesses within the selected service industry.

3. Assess the model and formulate guidelines for use by other small drycleaning and laundry businesses based on service marketing literature and sales forecasting model performance.

Potential Variables

Three primary literature areas were searched in order to identify marketing and other variables which were typically used in sales forecasting. The three primary areas searched were product/service marketing, research

related to the drycleaning and laundering industry, and forecasting.

A matrix was created including a list of the variables cited in the literature and the author or source of the information. The completed matrix can be found in Appendix A. The twenty-three variables identified in the literature were grouped into six categories. The categories accommodated the typical 'four p's' of marketing (product, price, place and promotion), as originally defined by Culliton (1948), plus two additional categories (profile and process) which were suggested in the literature for service industries.

Sample Business Description

The sample business used for this study met five criteria designated by the researcher: 1) A service retailer classified under SIC Code 721; 2) A service retailer having annual sales representative of the segment of the service industry with the largest receipts; 3) A service retailer experiencing growth in receipts over the last four years; 4) A service retailer experiencing seasonal variation in sales volume; and 5) A business which was independently owned and operated.

The sample business was a service retail operation classified under SIC Code 721. It was more specifically classified under SIC Code 7216, "drycleaning plants, except rug cleaning." According to the 1977 Census of Service

Industries this type of operation represents the largest portion of receipts in the "laundry, cleaning and garment services" sector.

The second and third criteria for selecting this sample business related to sales volume and growth. The sample business used in the study was a drycleaning and laundering business with annual sales of approximately $285,000 in 1980, increasing to $485,000 in 1983. During this three year period the operation added two new dry stores and one residential route, each served by the original processing location. Businesses in this service industry with receipts of $100,000 to $299,000 represent the segment with the largest receipts, the largest payroll and the greatest number of people employed, according to the 1977 Census of Service Industries. The sample business was in this sales volume bracket in 1980 and experienced growth in the next three year period. A thorough study of the sample business indicated that it was representive of a major segment of the businesses in the designated service industry. A forecasting challenge was provided since sales forecasting is particularly difficult during times when businesses are experiencing unusual growth or decline as well as monthly fluctuations in sales.

The fourth reason for selecting the sample business was its geographic location. Located in the central part of the United States, the sample business experienced seasonal variations in climate which added to the uncertainty of

monthly sales fluctuations. The fifth and last selection criteria was that the business must be independently owned and operated. This criteria eliminated consideration of franchised operations.

The list of potential sales forecasting variables was initially screened by a panel of four experts providing professional judgement and advice. The panel consisted of four individuals familiar with the selected sample business. Two of the individuals were drycleaning business owners. One had an expertise in finance and forty years of business experience while the other was noted for personnel and management abilities and had fifteen years of business experience. The other two experts selected to serve on the panel were managers of drycleaning establishments. One manager had four years of experience in sales and the other had six years of experience in production.

Selected Variables

The matrix of marketing and other variables was used to develop the interview reaction form, provided in Appendix B. The panel members were asked to individually react to a preliminary list of thirty-four variables identified in the literature. Two kinds of reactions were elicited by the researcher: 1) the potential impact of the variable on sales; and 2) the source or availability of information which could represent the variable.

The intention was to include data relating to, or representing, variables which were readily available from either business and financial records or from government documents. Utilizing information obtained in the literature search and advice from the panel of experts, potential variables were identified. Business and financial records were examined and determination was made as to what data could potentially represent each of the variables.

Primary data from the sample business were available on a monthly basis and data representing several variables appeared to be accessible. Secondary data gathered from government documents tended to be compiled annually, however, there was a two year delay before publications were available for use. The literature review also confirmed that small businesses were not likely to use outside reference data. It should be noted that forecasts for products and for large businesses would typically use such data. With concurrence of committee members, secondary information from government documents was used in this study for qualitative purposes rather than for quantitative analyses. A list of government document sources which were examined for use is located in Appendix C.

Fourteen independent variables were selected for the purposes of the study based on evidence of use in the literature, opinion of the panel of experts and availability of information from business and financial records. A brief description of the dependent variable, sales, and the four-

teen selected independent variables has been provided in Table I.

The dependent variable, sales (A), was defined as total monthly retail sales volume generated by a single drycleaning processing plant/package plant. Sales generated by dry stores and routes and processed at the same location were included in the total. Dry stores are business locations which serve as drop off and pick up points for the customer, and routes are the pick up and delivery services. The main processing location or package plant, each dry store and each route were counted as an outlet. The number of outlets the business maintained served as an indicator of market saturation and accessiblility of the service to the customer.

The variable, time (B), was selected in order to explore the effect of sales changes by sequential months. Charges (C), a customer service offered by the drycleaner, was reflected as monthly charges, rather than accounts receivable. Accounts receivable would reflect total credit extended for one to three months rather than monthly credit activity.

Advertising expenses are typically noted in the literature as variables included in sales forecasting models for products. Therefore, a composite advertising variable, called total advertising (E), was used along with subcategories of directory advertising (F), radio advertising (G) and newspaper advertising (H).

TABLE I

DESCRIPTION OF THE DEPENDENT VARIABLE (SALES) AND THE FOURTEEN INDEPENDENT VARIABLES

Variable	Letter I.D.	Description
Sales	A	Total monthly retail sales volume generated by a single drycleaning processing plant/package plant
Time	B	Number used to reflect monthly time frames. A sequential numerical series from one to thirty-six with each number representing one month. January of 1980 was number one, February of 1980 was number two and so on through December 1982 which was number thirty-six.
Charges	C	Monthly dollar figure representing sales which were not paid for in cash by the consumer, but were carried on a monthly account by the drycleaner.
Packaging	D	Costs incurred by the drycleaner in preparing processed items for presentation to the customer, such as plastic bags, hangers, hanger covers and tissue.
Total Advertising	E	Total of all monthly advertising expenses recorded by the business, measured in dollars. Included were: newspaper, radio, television and directory advertising and other paid promotional campaigns.
Directory Advertising	F	Monthly expenditures for any type of directory advertising such as the yellow pages or local business directories measured in dollars.

TABLE I (Continued)

Variable	Letter I.D.	Description
Radio Advertising	G	Monthly expenditures for radio advertising, measure in dollars.
Newspaper Advertising	H	Monthly expenditures for newspaper advertising, measured in dollars.
Number of Employees	I	Number of part and full time employees typically necessary to run the business.
Average Months of Employment	J	Sum of the number of months of employment with the company for each employee divided by the total number of employees.
Number of Outlets	K	Outlets included the main plant, dry stores and routes.
Repairs and Maintenance	L	Monthly costs incurred in the maintenance and repair of equipment or the building structure.
Claims	M	Monies paid during each month to customers who were not satisified with the service provided or whose garments were damaged in some way by the drycleaning process or handling.
Janitorial Costs	N	Monthly costs incurred in the cleanliness and general upkeep of the premises.
Price	P	Factor representing retail price for providing drycleaning service to consumers.

Packaging (D) is typically mentioned in discussing product marketing. In order to include this variable for drycleaning services, packaging expenses from the previous month were used. Packaging expenses from the previous month reflected the fact that items used for packaging were purchased at a rate to meet anticipated sales.

The number of employees (I) was included to reflect the importance placed on employee-customer contact in service businesses. The average months of employment (J) was used as a potential reflection of the degree of experience or expertise represented by company employees.

The importance of appearance in a service location was reflected by using the variables of repairs and maintenance (L) and janitorial costs (N). Claims (M) were used to reflect the degree of customer dissatisfaction with the service provider.

The price (P) is one of the four p's identified in marketing literature. Drycleaners service many different kinds of textile and apparel products which vary greatly in their cleaning price. The use of a mean price was considered unacceptable since some apparel items were more frequently cleaned than others and prices varied from item to item. A weighted mean was disregarded in favor of the mode. The price of servicing a pair of men's pants or women's slacks was used as a measure of the variable price. According to the panel of experts these items were the most frequently serviced items, were typically serviced for the

same price, and represented items cleaned for all family members.

Sales Forecasting Method

The selection of a sales forecasting method was the next procedure and the first activity outlined under the second objective of the study. Seven factors were considered in the selection of a sales forecasting method included: the type of sales forecast desired; the time frame involved; pattern of the data; cost of utilizing the method; desired accuracy of the forecast; and ease with which a small business owner could operate and understand the method. A summary and assessment of each of the seven factors has been provided in Appendix D.

Multiple Regression Technique

Based on the assessment of these seven factors a causal model, multiple regression, was selected. A discussion of the techniques of multiple regression with time series data follows. Multiple regression is used with time series data to obtain a causal model. This model can be used to forecast future values of the time series. The regression model is represented in statistical notation as

$$Y_t = B_0 + B_i X_{t1} + B_2 X_{t2} + \ldots + B_k X_{tk} + E_t$$

where B_0, $B_1 \ldots B_k$ are unknown constants. The left hand side of this equation Y_t represents the dependent variable, sales at time t. So Y_1 is the sales value at the first period.

The right hand side of the equation consists of the unknown constants B's, the independent variables X_t, and an irregular component E_t. The independent variables X_t are used to explain the dependent variable, sales. The unknown B_i gives an indication of the change in the dependent variable sales, when the level of all other variables except the one associated with B_i remains unchanged. For example, suppose a regression model has three independent variables X_1, X_2, X_3 then B_2 denotes that as X_2 changes by ten units we can expect sales to change by ten times B_2 if we keep X_1 and X_3 fixed. Since the B_i's are unknown we need to estimate them. This was done by using the historical data and the method of least squares.

The method of least squares minimizes the variance of the estimates of these B_i's. It provides us with the 'best' estimates possible. The regression model assumes that what has happened in the past will continue in the future. The model also assumes that the errors made are normally distributed with mean zero and a constant variance, i.e. we can expect most of the errors to lie close to zero. It also assumes that the error at any one time is independent of the error made at other times. This independence of errors are sometimes violated with time series data. However, if they are only weakly related then the regression approaches will still probably produce fairly accurate forecasts.

The model also assumes that there is no significant correlation between the independent variables. Multicollin-

earity as it is referred to, when independent variables are correlated in the model, confounds the analysis and can result in incorrect inferences.

Time series models are generally of the form

$$Y_t = f\ (B_0,\ B_1,\ B_2 \ldots B_r\ ;\ t)\ E_t$$

where $f(B_0,\ B_1 \ldots B_r;t)$ indicates that the dependent variable depends on several independent variables as well as time. The symbol E_t denotes that part which is unexplained by the model. It includes things that occur over which we have no control or are unexpected, such as, natural disasters. Hence the regression model is readily adpatable to time series data.

Regression analysis, when used as a means of forecasting in time series data, will only account for the trend component of the time series. It has to be modified to investigate the seasonal component. One such modification is through the use of dummy variables to reflect monthly time frames.

Model Development

Four models were created using a five step approach. A schematic of the procedure has been provided in Figure 1. The five steps included the analysis of correlation coefficients, stepwise regression, the use of a decision matrix, scatterplots of the dependent variables versus selected independent variables, and the use of dummy variables to account for seasonal variation. Each of the five steps will

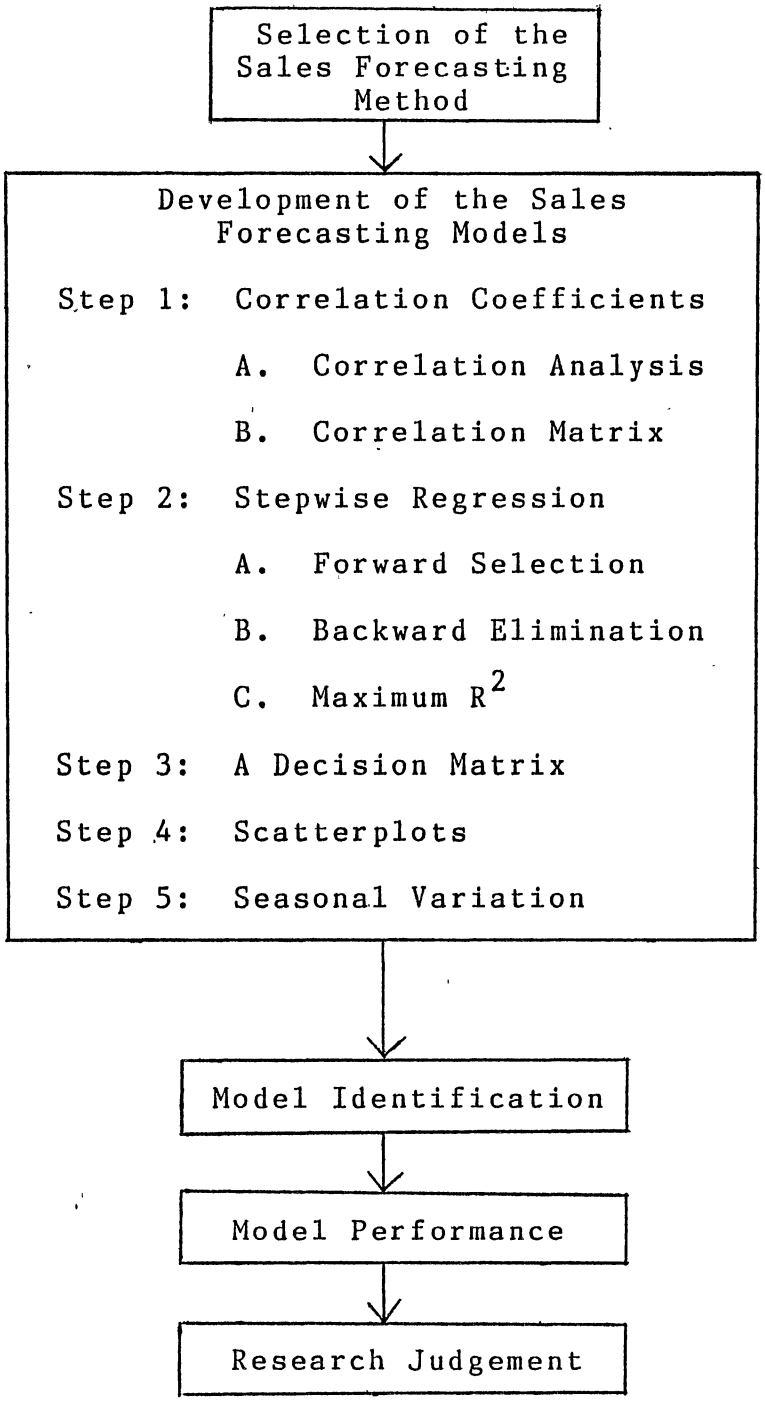

Figure 1. Model Development Process

be discussed in this section. Data analysis techniques were done using the SAS (Statistical Analysis System) package.

Correlation Coefficients. In step one a matrix of correlation coefficients was constructed for all possible variables. The correlation coefficient matrix was examined to determine which independent variables were highly correlated with sales. The correlation matrix was also examined to identify which pairs of independent variables were highly correlated.

Correlation analysis is a measure of strength between two variables. Correlation coefficients range from negative one to positive one. When two variables have a strong, positive relationship their correlation coefficient is expected to be close to one which indicates that high values of one variable will result in high values of the other variable. A correlation coefficient close to zero means there is little correlation between the two variables and that little or no relationship exists between the two values. A negative coefficient indicates that high values of one variable tend to be associated with low values of the other variable. However, significant correlation is not simply judged by the closeness to negative one or positive one. A statistical t-test makes these judgements.

The correlation matrix provides a rectangular array of all sample correlation coefficients between pairs of variables. The intersection of a row and a column provided the correlation information for the respective paired

variables. The matrix is symmetric so one expects to see the same thing above and below the diagonal. The upper number in each series in the correlation matrix, presented in Table II, was the value of the correlation coefficient and the number below was the probability level. Probability levels greater than the significance level of .05 for correlation coefficients between sales and the other variables were identified as ones which were likely to be eliminated as potential variables for the model.

A majority of the correlation coefficients had a probability of .0001, therefore, those which were not at this level were identified. Those with probabilities between .01 and .05 have been highlighted in light boxes and those with probabilities greater than .05 have been highlighted in darker boxes.

Sales (A) were correlated with all variables except repairs and maintenance (L), claims (M), and janitorial costs (N). Nine of the fourteen independent variables had a high significant correlation coefficients among themselves ($p = .0001$). The nine independent variables were time (B), charges (C), packaging (D), total advertising (E), newspaper advertising (H), number of employees (I), average months of employment (J), number of outlets (K) and price (P). Two variables directory advertising (F) and radio advertising (G), had probabilities between .0001 and .01.

Stepwise Regression. The correlation analyses indicated that several variables appeared to be contributing to

TABLE II

CORRELATION COEFFICIENTS AND PROBABILITY LEVELS FOR THE DEPENDENT VARIABLE (SALES) AND FOURTEEN INDEPENDENT VARIABLES

		A	B	C	D	E	F	G	H	I	J	K	L	M	N	P
Sales	A	1.00000 0.0000														
Time	B	0.85219 0.0001	1.00000 0.0000													
Charges	C	0.92897 0.0001	0.82823 0.0001	1.00000 0.0000												
Packaging	D	0.62939 0.0001	0.53307 0.0010	0.52648 0.0012	1.00000 0.0000											
Total Advertising	E	0.68113 0.0001	0.56475 0.0003	0.58695 0.0002	0.34153 0.0446	1.00000 0.0000										
Directory Advertising	F	0.47582 0.0034	0.67670 0.0001	0.49271 0.0023	0.16824 0.3340	0.44886 0.0060	1.00000 0.0000									
Radio Advertising	G	0.44892 0.0076	0.33753 0.0509	0.29800 0.0869	0.46612 0.0055	0.66624 0.0001	0.11563 0.5149	1.00000 0.0000								
Newspaper Advertising	H	0.62367 0.0001	0.51060 0.0024	0.62171 0.0001	0.46445 0.0074	0.83256 0.0001	0.27409 0.1227	0.64350 0.0009	1.00000 0.0000							
Number of Employees	I	0.86405 0.0001	0.95768 0.0001	0.83276 0.0001	0.60730 0.0001	0.60870 0.0001	0.60984 0.0001	0.35373 0.0345	0.57911 0.0004	1.00000 0.0000						
Average Months of Employment	J	-0.72056 0.0001	-0.83906 0.0001	-0.69448 0.0001	-0.56973 0.0004	-0.53853 0.0007	-0.58708 0.0002	-0.24846 0.1565	-0.52142 0.0015	-0.93740 0.0001	1.00000 0.0000					
Number of Outlets	K	0.92396 0.0001	0.88251 0.0001	0.90257 0.0001	0.59218 0.0002	0.65215 0.0001	0.47436 0.0035	0.46825 0.0052	0.65189 0.0001	0.91625 0.0001	-0.75396 0.0001	1.00000 0.0000				
Repairs and Maintenance	L	0.16233 0.3485	0.13791 0.4295	0.15809 0.3644	0.15262 0.3889	0.14800 0.3962	0.12430 0.4768	0.16214 0.3573	0.09727 0.5964	0.23566 0.1729	-0.20367 0.2406	0.27600 0.1085	1.00000 0.0000			
Claims	M	0.27264 0.1077	0.20536 0.2295	0.26603 0.1168	0.26186 0.1286	0.04392 0.7893	0.03907 0.8210	0.06928 0.6870	-0.04832 0.7894	0.17452 0.3087	-0.04795 0.7812	0.25959 0.1263	0.03329 0.8494	1.00000 0.0000		
Janitorial Costs	N	0.27043 0.1161	0.27609 0.1084	0.41219 0.0139	0.18568 0.2931	0.33025 0.0527	0.22297 0.1979	0.18054 0.3147	0.57035 0.0007	0.38424 0.0227	-0.46370 0.0050	0.38179 0.0236	0.17749 0.2153	-0.09506 0.5870	1.00000 0.0000	
Price	P	0.87368 0.0001	0.96656 0.0001	0.85902 0.0001	0.61038 0.0001	0.56954 0.0003	0.67020 0.0001	0.34525 0.0455	0.55748 0.0008	0.93541 0.0001	-0.86379 0.0001	0.88976 0.0001	0.19506 0.2615	0.19478 0.2550	0.38419 0.0227	1.00000 0.0000

Light boxes = probabilities between .01 and .05
Dark Boxes = probabilities greater than .05

the behavior of monthly sales. Stepwise regression was utilized in step two in order to obtain the best set of independent variables to be used as predictors of sales.

The stepwise regression procedure consisted of three different selection processes. First, the Forward Selection process was used to bring variables into the model one at at time and make a note of their significance to determine whether they must remain or be left out. Secondly, the Backward Elimination process began with all variables and eliminated, one at a time, those that were least significant. The third and final step was Maximum R^2 which attempted to find the model with the highest R^2. In this manner the program searched for the 'best' model adding or eliminating one variable at a time until the R^2 value was maximized.

The researcher attempted to reduce the number of independent variables to form a simpler, more economical prediction equation and yet maintain a significant R^2 (close to one). Decreasing the number of variables, however, will reduce the R^2.

The Forward Selection process, detailed in Appendix E, involved the calculation of an F statistic for each of the independent variables. The independent variable which had the smallest significance level was put into the model first. The process was repeated and the remaining independent variables were reevaluated based on their statistics. "Variables are thus added one by one to the

model until no remaining variable produces a significant F statistic," (Ray, 1982, p. 102).

The results of the Forward Selection process are presented in Table III. Seven independent variables were identified by the process. These independent variables were charges, packaging, directory advertising, radio advertising, newspaper advertising, janitorial costs and price. This model had an F statistic of 57.19 and was significant at the .0001 level. The R^2 for this model was .9479.

The Backward Elimination process, presented in Appendix F, begins with all of the independent variables included in the model. "Then the variables are deleted from the model one by one until all the variables remaining in the model produce F statistics significant at the level specified," (Ray, 1982, p. 102). Thus, with each step, the independent variable contributing the least to the model is eliminated from the model.

Backward Elimination identified, Table IV, seven independent variables to be included in the model. These seven independent varibles were charges, packaging, total advertising, number of employees, number of outlets, janitorial costs and price. This model had an F statistic of 53.81 which was significant at the .0001 level. The R^2 for this model was .9448.

According to Ray (1982, p. 102) the Maximum R^2 process, presented in Appendix G, "tries to find the best one-variable model, the best two-variable model, and so forth,

TABLE III

ANALYSIS OF VARIANCE TABLE AND MODEL IDENTIFIED USING FORWARD SELECTION PROCEDURE

Source	DF	Sum of Squares	Mean Square	F
Regression	7	1950315914.918	278616559.274	57.19****
Error	22	107184843.882	4872038.358	
Corrected Total	29	2057500758.800		

$R^2 = 0.94790532$

$$\hat{Y} = -10059.188 + \underset{(.391)}{2.197}\ X_1 + \underset{(2.106)}{4.852}\ X_2 - \underset{(16.919)}{12.824}\ X_3 + \underset{(4.028)}{5.325}\ X_4 + \underset{(3.941)}{4.491}\ X_5 - \underset{(1.649)}{5.140}\ X_6 + \underset{(7393.829)}{11093.292}\ X_7$$

$\hat{Y}$ = Predicted Sales
X_1 = Charges
X_2 = Packaging
X_3 = Directory Advertising
X_4 = Radio Advertising
X_5 = Newspaper Advertising
X_6 = Janitorial Costs
X_7 = Price

**** = .0001 level of significance
( ) = standard error terms

TABLE IV

ANALYSIS OF VARIANCE TABLE AND MODEL IDENTIFIED USING BACKWARD ELIMINATION PROCEDURE

Source	DF	Sum of Squares	Mean Square	F
Regression	7	1943965357.424	277709336.775	53.81****
Error	22	113535401.376	5160700.063	
Corrected Total	29	2057500758.800		

$R^2 = 0.94481878$

$$\hat{Y} = -10508.419 + \underset{(.448)}{1.969}\ X_1 + \underset{(2.085)}{5.388}\ X_2 + \underset{(1.363)}{2.935}\ X_3 - \underset{(740.936)}{679.856}\ X_4 + \underset{(994.370)}{1209.032}\ X_5 - \underset{(1.493)}{4.408}\ X_6 + \underset{(11435.340)}{12663.675}\ X_7$$

$\hat{Y}$ = Predicted Sales
X_1 = Charges
X_2 = Packaging
X_3 = Total Advertising
X_4 = Number of Employees
X_5 = Number of Outlets
X_6 = Janitorial Costs
X_7 = Price

**** = .0001 level of significance
( ) = standard error terms

although it is not guaranteed to find the model with the largest R^2 for each size." Each of the models is the 'best' model for the number of independent variables included. For example, the three variable model was the 'best' three variable model found in the study.

Results of the Maximum R^2 process are presented in Table V. Eleven of the fourteen variables were included in the model selected. The three independent variables not included in the model were newspaper advertising (H), repairs and maintenance (L) and claims (M). The model had an F statistic of 33.59 and was significant at the .0001 level. The R^2 was .9535.

To summarize and analyze the results from steps one and two a decision matrix was created and is presented in Table VI. Each of the fourteen independent variables was listed in the left hand column was reviewed on four analyses. The four analyses were: correlation with sales (A); identification in Forward Selection; identification in Backard Elimination; and identification in Maximum R^2. The decision regarding each variable was based on the four analyses and is indicated in the far right column of Table VI. Each independent variable is analyzed and discussed in this section.

The independent variable, time (B), was identified as a viable variable in the Maximum R^2 process. It was not highly correlated with sales (A) but was identified under the Maximum R^2 process. A decision was made by the

TABLE V

ANALYSIS OF VARIANCE TABLE AND MODEL IDENTIFIED USING MAXIMUM R SQUARE PROCEDURE

Source	DF	Sum of Squares	Mean Square	F
Regression	11	1961920143.163	178356376.651	33.59****
Error	18	95580615.637	5310034.202	
Corrected Total	29	2057500758.800		

$R^2 = 0.95354528$

$$\hat{Y} = 51655.132 + \underset{(377.601)}{346.277}\ X_1 + \underset{(.530)}{1.940}\ X_2 + \underset{(2.350)}{4.416}\ X_3 + \underset{(1.912)}{2.227}\ X_4 - \underset{(20.520)}{19.841}\ X_5 + \underset{(5.089)}{3.865}\ X_6 - \underset{(3765.662)}{5123.015}\ X_7 - \underset{(267.024)}{352.588}\ X_8 + \underset{(2683.875)}{3441.213}\ X_9 - \underset{(2.201)}{6.108}\ X_{10} + \underset{(15922.248)}{15294.146}\ X_{11}$$

$\hat{Y}$ = Predicted Sales
X_1 = Time
X_2 = Charges
X_3 = Packaging
X_4 = Total Advertising
X_5 = Directory Advertising
X_6 = Radio Advertising
X_7 = Number of Employees
X_8 = Average Months of Employment
X_9 = Number of Outlets
X_{10} = Janitorial Costs
X_{11} = Price

**** = .0001 level of significance
( ) = standard error terms

TABLE VI

INDEPENDENT VARIABLES, ANALYSIS CRITERIA AND DECISION MATRIX

Variable	Analysis Criteria[a] 1	2	3	4	Decision
B - Time				X	Retained
C - Charges	X	X	X	X	Eliminated
D - Packaging	X	X	X	X	Retained
E - Total Advertising	X		X	X	Retained
F - Directory Advertising		X		X	Eliminated
G - Radio Advertising		X		X	Eliminated
H - Newspaper Advertising	X	X			Eliminated
I - Number of Employees	X		X	X	Retained
J - Average Months of Employment	X				Eliminated
K - Number of Outlets	X		X	X	Retained
L - Repairs and Maintenance				X	Eliminated
M - Claims					Eliminated
N - Janitorial Costs		X	X	X	Eliminated
P - Price	X	X	X	X	Retained

[a] 1 = Correlated with Sales
2 = Identified in Forward Selection
3 = Identified in Backward Elimination
4 = Identified in Maximum R Square

researcher to keep the variable in the model for time series purposes.

The independent variable, charges (C), was highly correlated with sales (A) and was identified in all three steps of the regression process. Charges (C) was eliminated as a potential independent variable for the model because sales and charges were not mutually exclusive figures.

Packaging (D) and price (P) were the only two independent variables which correlated with sales (A) and were identified in all three steps of the regression process. Both price (P) and packaging (D) were identified in the literature as being significant contributors to sales forecasting models for products. Therefore, both packaging (D) and price (P) were selected to remain in the model.

The independent variable total advertising (E) was selected to remain in the model. This variable was correlated with sales (A) and was identified by Backward Elimination and Maximum R^2. Of the three independent variables of directory advertising (F), radio advertising (G) and newspaper advertising (H) the first two did not correlate with sales (A). These three variables were also not mutually exclusive of the independent variable, total advertising (E). The review of literature identified advertising as a typical independent variable when sales forecasting for products. Depending on the manner in which business expenses are recorded and on the marketing approach taken by the company, financial information may not be

subdivided into the specific areas of directory, radio and newspaper advertising. Therefore, the independent variables directory advertising (F), radio advertising (G) and newspaper advertising (H) were excluded from the model and total advertising (E) was included as representative of the three areas.

The number of employees (I) and the number of outlets (K) were originally selected as independent variables which would represent business growth. These variables correlated with sales (A), were identified in the Backward Elimination and Maximum R^2 processes and were selected to remain in the model.

Average months of employment (J) was found to be negatively correlated with sales (A) and was not identified in any of the regression processes. This independent variable was dropped as a potential variable for the model.

The three independent variables of repairs and maintenance (L), claims (M) and janitorial costs (N) were not correlated with sales and were eliminated from consideration for the model. These three variables were originally selected for testing because references in the literature supported their importance. These factors may be important to sales in service sectors, however, financial information may not be the most suitable representation of the contribution the three factors make to the prediction of sales. Appropriate qualitative measures may be more feasible.

In summary, six variables were selected as potential independent variables for the model. Two variables, packaging (D) and price (P), met all four analysis criteria. Three variables, total advertising (E), number of employees (I) and number of outlets (K), met three of the criteria. The variable, time (B), met only criteria number four, but was retained for time series purposes in the model development.

Scatterplots. A graph of the dependent variable, sales, was constructed for each of the six independent variables remaining as potential dependent variables for the model: time, packaging, total advertising, number of outlets, number of employees and price. These plots provided a graphic presentation of the degree of linear relationship between sales and each of these six independent variables.

The plot of sales, the dependent variable, versus time, an independent variable is shown in Figure 2. This scatterplot indicated a positive relationship between the two variables. No outliers were evident given the monthly sales fluctutations which were known to exist. Note that when new outlets were provided for the service (periods 19-22) the sales volume increased.

A scatterplot of sales versus packaging, Figure 3, demonstrated a positive relationship between the two variables. There appeared to be three outliers which indicated that packaging costs appeared to be inconsistent with sales volume. The outliers may be explained by

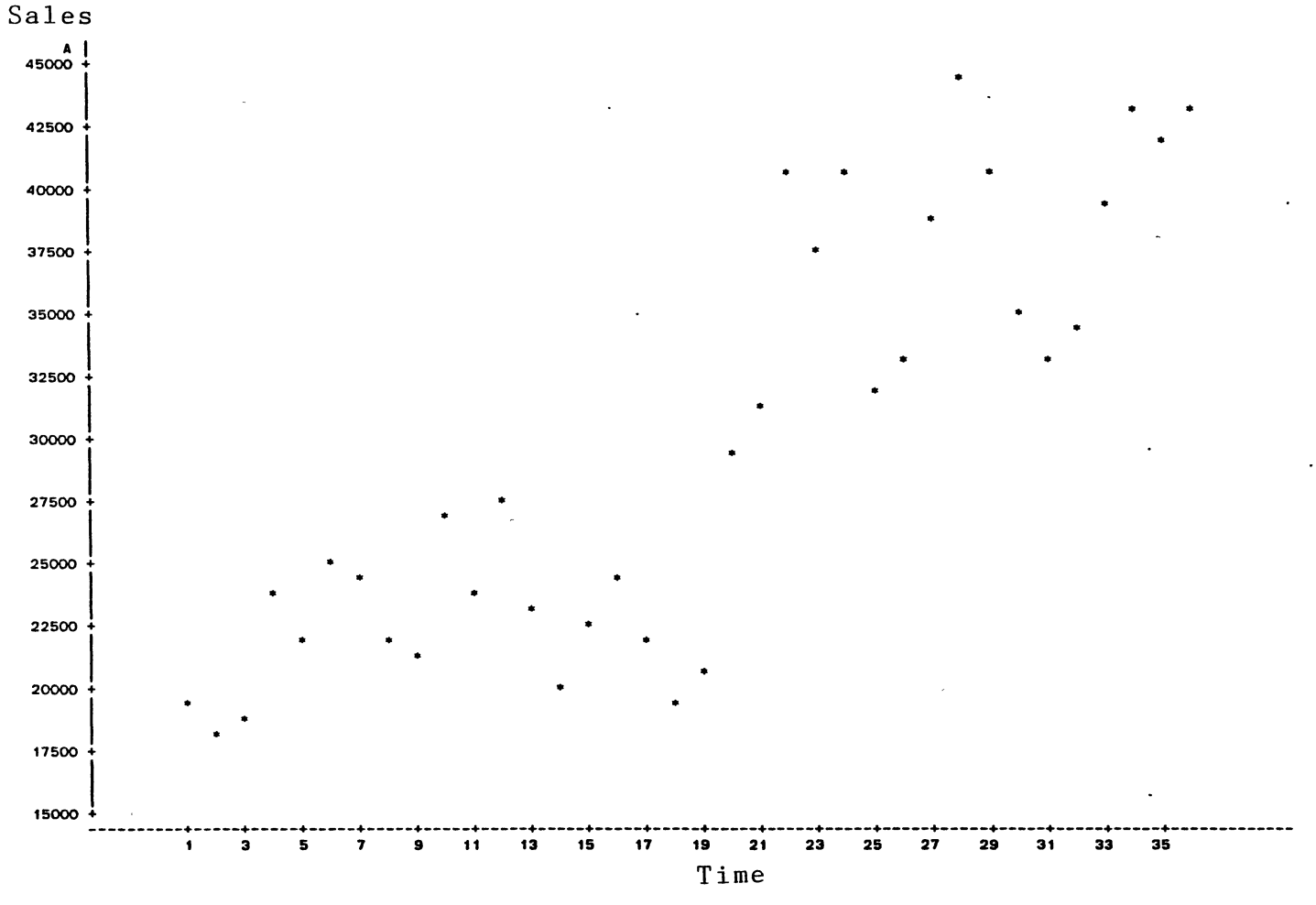

Figure 2. Sales Volume Plotted in Relation to Monthly Time Frames

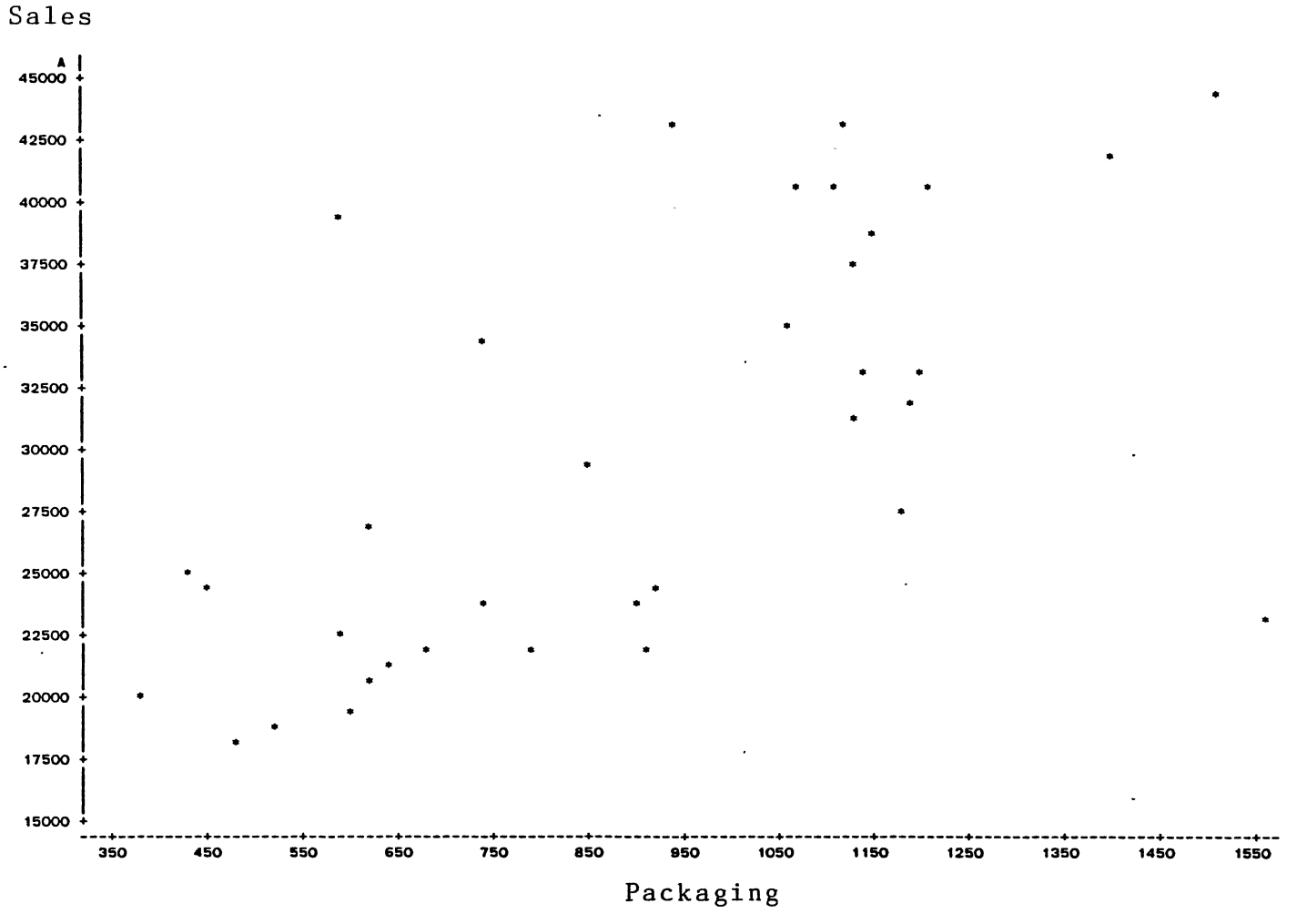

Figure 3. Sales Volume Plotted in Relation to Dollars Spent for Packaging

accounting procedures and stockpiling which related to packaging costs. For instance, items which are purchased for packaging are not always billed during the period they are used by the business. Items may also be purchased in volume and used over a period of time. This would cause packaging expenses to increase during the month the purchase was made and appear to decrease during the months packaging is being used and reorders are minimal. Therefore, although sales and packaging indicated a positive relationship in general, a causal relationship does not appear to exist.

The scatterplot of sales versus total advertising, Figure 4, illustrates a positive relationship between the two variables. There appeared to be two outliers and a clustering of vertical points between four hundred and six hundred dollars and between eight hundred and one thousand dollars. Both of the occurrences appeared to suggest that sales settle into a reasonably consistent pattern once the sales volume was established. In other words, prior to operating a new outlet the business may put more money into advertising; however, once established, advertising costs appeared to level off into a consistent range.

The scatterplots of sales versus number of employees, Figure 5, and sales versus price, Figure 6, indicated a positive relationship between sales and the respective independent variable. No outliers were evident for either scatterplot. The scatterplots suggested that as sales increased so did the number of employees and price.

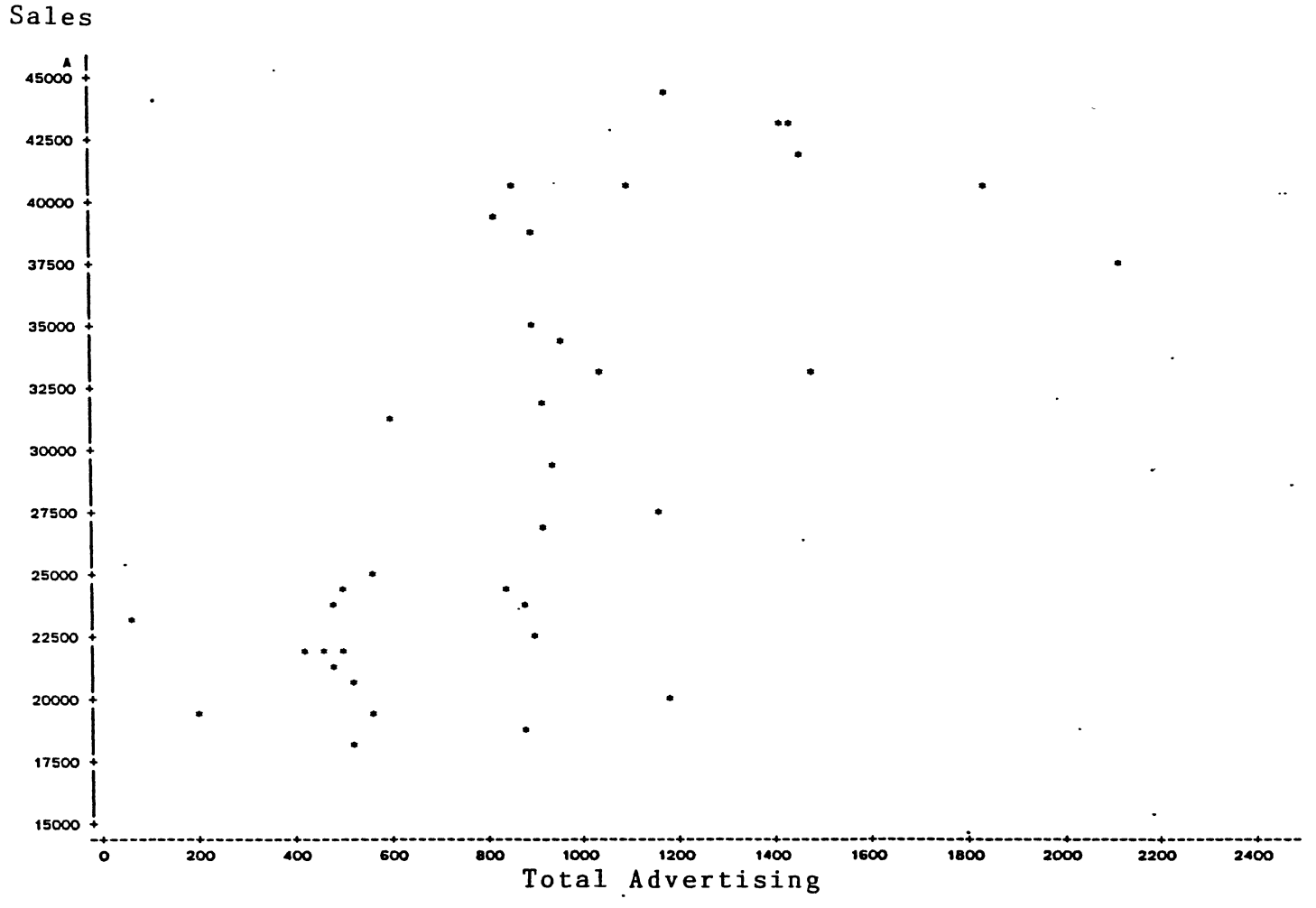

Figure 4. Sales Volume Plotted in Relation to Dollars Spent for Advertising

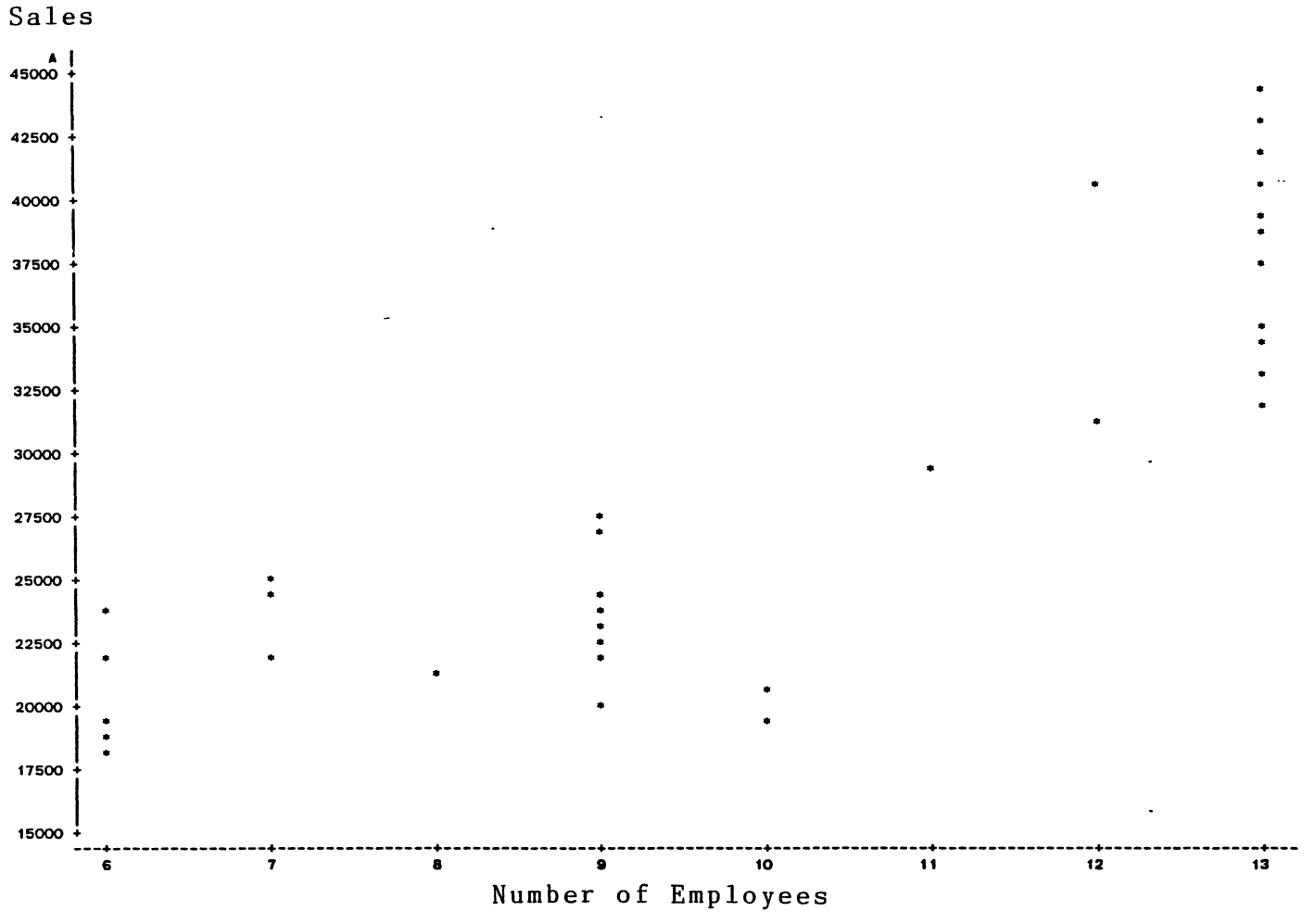

Figure 5. Sales Volume Plotted in Relation to Number of Employees

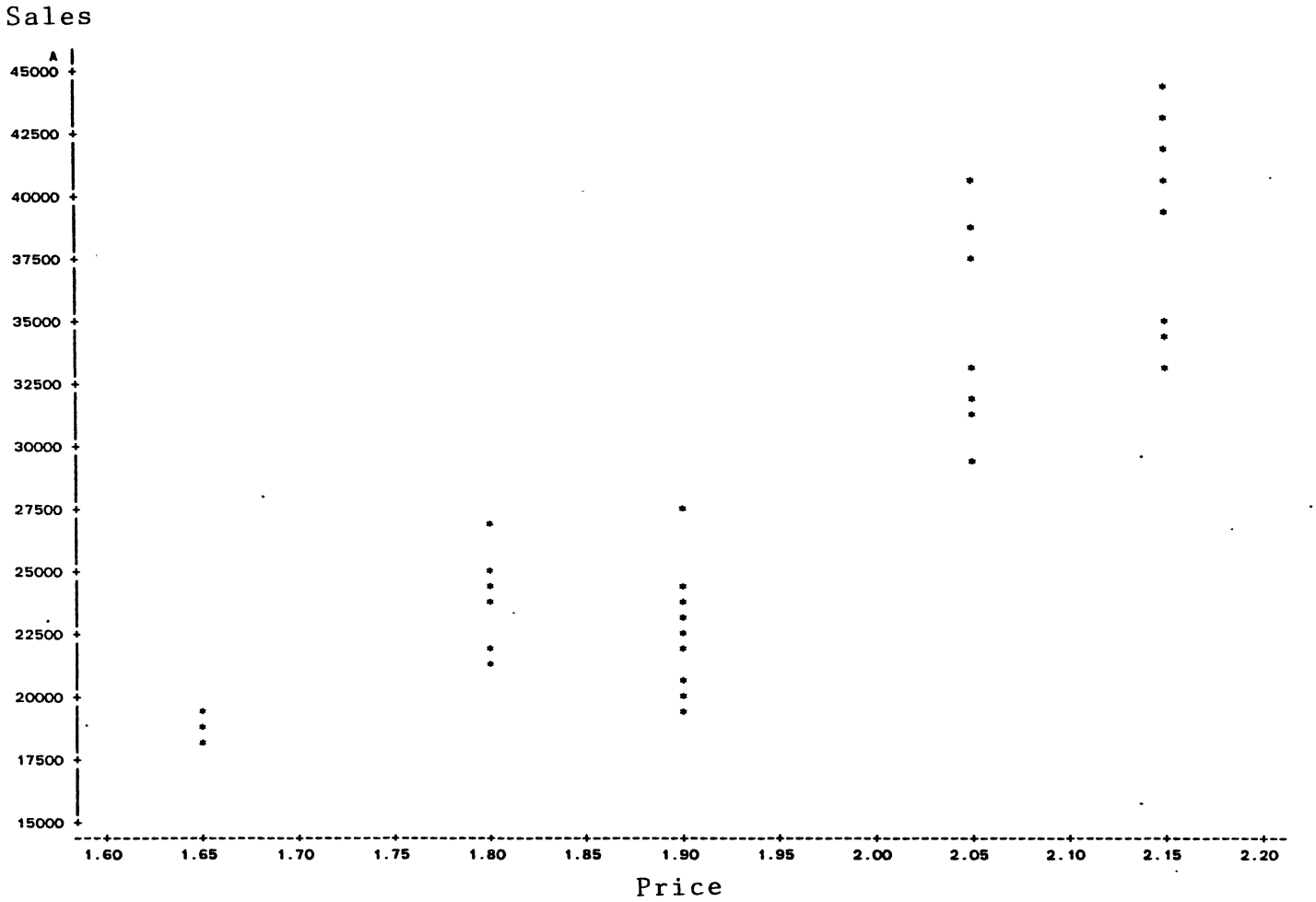

Figure 6. Sales Volume Plotted in Relation to Price for Mode Item

The last scatterplot was for sales versus the number of outlets, Figure 7. A positive relationship was evident between sales and the number of outlets and no outliers were evident. Note that this relationship would be positive only when the company was experiencing expansion. Growth in sales volume when the number of outlets remained stable would create a line perpendicular to the base line.

Seasonal Variation. The fifth step was to observe patterns in the data. A pattern that seemed to occur according to the month of the year (seasonal variation) was accounted for by adding dummy variables to the regression model. The dummy variables or indicator variables as they are sometimes called, took on the value of one when the particular month was noted and of zero otherwise. In the model there were eleven dummy variables, one each for the months of January through November. For example, suppose we were interested in forecasting sales for the month of February, then the variable Z_2 would take on the value of one but Z_1, Z_3, Z_4, $Z_5 \ldots Z_{11}$ would take on the value of zero. When Z_1, Z_2, $Z_3, \ldots Z_{11}$ each would take on the value of zero this would indicate that the model was predicting sales for December. Therefore, it would be impossible to have more than one Z_i, with a value of one, for any particular month. These dummy variables allow the model to make the necessary adjustments for the month of the year.

In the analysis of data, it appeared that sales from the previous month had an effect on sales of the present

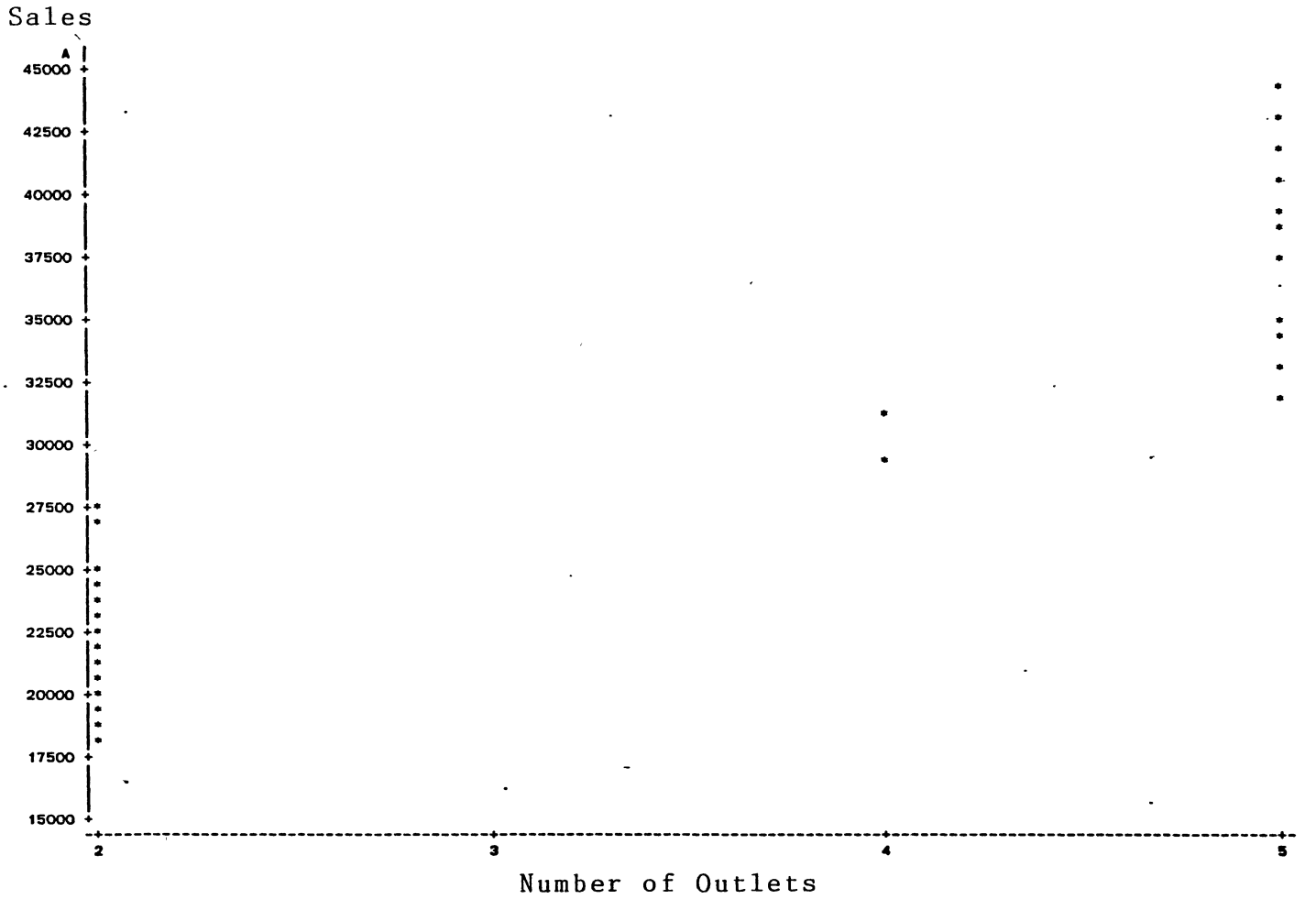

Figure 7. Sales Volume Plotted in Relation to Number of Outlets

month. Intuitively, this seemed to make sense for the drycleaning industry both because of the nature of the services and the fact that expenditures are not always posted to their respective accounts during the month they are utilized. To reflect this relationship the previous month's sales were treated as an independent variable (ALAG) and used in the model building process. Regression analysis assumes that what has happened in the past will continue in the future so the model is somewhat insensitive to detecting changes. With the presence of ALAG the researcher expected changes to be more easily detected.

Model Identification

Steps four and five led to the development of four sales forecasting models. The independent variables used in each of the four models are presented below.

Model 1:
1. Price
2. Number of outlets
3. ALAG - to reflect the previous month's sales
4. Zs - dummy variables used to reflect seasonal variation.

Model 2:
1. Price
2. Number of outlets
3. Zs - dummy variables used to reflect seasonal variation.

Model 3: 1. B - sequential numbers used to represent consecutive months.

2. Zs - dummy variables used to reflect seasonal variation.

Model 4: 1. B - sequential numbers to represent consecutive months.

2. ALAG - to reflect the previous month's sales

3. Zs - dummy variables used to reflect seasonal variation.

Each of the models was prepared using monthly data from 1980, 1981 and 1982 to project monthly sales for each month of 1983. The actual sales figures for 1983 were obtained by the researcher for purposes of comparison. An illustration of monthly sales fluctuations for the three base years and for the year to be predicted has been provided in Figure 8. In this manner the researcher was able to compare the projected sales figures of the four models with the actual sales figures for 1983.

Model Performance

Performance of the four models was assessed using the F statistic and the R^2 from each Analysis of Variance table and by examining the sum of the percentage variation between actual monthly sales and the predicted figures. Model 1, shown in Table VII, had the highest R^2 of .9616 and an F statistic of 35.78. Model 2 had a slightly lower R^2 of

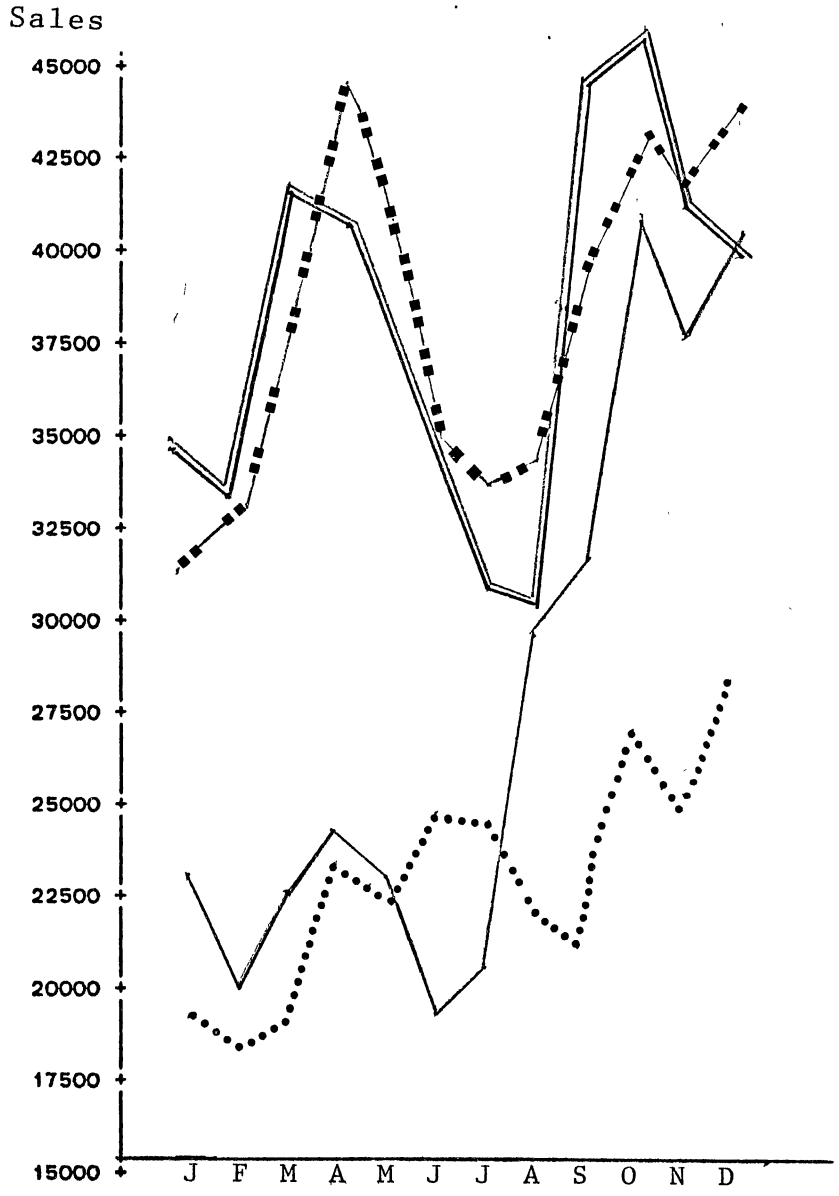

Figure 8. Actual Monthly Sales Fluctuations for the Three Base Years and the Fourth Year Predicted by the Model

••••• = sales for 1980
——— = sales for 1981
■■—■■ = sales for 1982
═══ = sales for 1983

TABLE VII

ANALYSIS OF VARIANCE TABLE FOR MODEL 1
USING PRICE, NUMBER OF OUTLETS,
ALAG AND SEASONAL VARIATION

Source	DF	Sum of Squares	Mean Square	F Value
Model	14	2346779878.102	167627134.150	35.78****
Error	20	93707885.498	4685394.275	
Corrected Total	34	2440487763.600		

$R^2 = 0.9616$

$$\hat{Y} = 1335.97 + 6434.37\ X_1 + 2811.11\ X_2 + .332\ X_3 - 7757.67\ X_4 - 6085.65\ X_5 - 3048.25\ X_6 - 451.69\ X_7 - 4235.16\ X_8 - 5322.51\ X_9 - 5090.91\ X_{10} - 4491.10\ X_{11} - 3335.84\ X_{12} + 1360.30\ X_{13} - 3645.91\ X_{14}$$

$\hat{Y}$ = Predicted Sales
X_1 = Price
X_2 = Outlets
X_3 = ALAG
X_4 = Z1 - Variation for January
X_5 = Z2 - Variation for February
X_6 = Z3 - Variation for March
X_7 = Z4 - Variation for April
X_8 = Z5 - Variation for May
X_9 = Z6 - Variation for June
X_{10} = Z7 - Variation for July
X_{11} = Z8 - Variation for August
X_{12} = Z9 - Variation for September
X_{13} = Z10- Variation for October
X_{14} = Z11- Variation for November

**** = .0001 level of significance

.9535 and an F statistic of 34.67 and is presented in Table VIII. Model 3, shown in Table IX, had an F statistic of 9.436 and an R^2 of .8312. The fourth model, shown in Table X, had an F statistic of 21.637 and an R^2 of .9305. The F value for all models was significant at .0001.

Model 2, presented in Table XI, had the smallest cumulative percent variation between the actual and predicted figures (108.69), followed closely by Model 1 (117.64), shown in Table XII. The performance of Model 4, presented in Table XIII, was slightly weaker (150.63), while Model 3, Table XIV, had the poorest prediction performance (212.24).

For all four models, prediction results were least accurate for the months of July, August and December. Each of these three months experienced a decline in sales. There were, however, four other periods of decline that were predicted within an acceptance range of ten percent above or below the actual monthly sales figures. Models 1, 2, and 4, each had a comparable number of over and under statements of prediction. Model 3, however, over estimated all twelve forecasts.

Recommended Model

Model 2, shown in Table XI, was selected as the recommended model by the researcher. It was selected over Model 1 which had a slightly higher R^2 because Model 2 was a simpler model and had better prediction results. Both Model

TABLE VIII

ANALYSIS OF VARIANCE TABLE FOR MODEL 2
USING PRICE, NUMBER OF OUTLETS
AND SEASONAL VARIATION

Source	DF	Sum of Squares	Mean Square	F Value
Model	13	2427641417.103	186741647.469	34.67****
Error	22	118504011.119	5386545.960	
Corrected Total	35	2546145428.222		

$$R^2 = 0.9535$$

$$\hat{Y} = 3463.48 + 8175.56\ X_1 + 4238.22\ X_2 - 6740.19\ X_3 - 7550.19\ X_4 - 4781.52\ X_5 - 1411.48\ X_6 - 3850.81\ X_7 - 5747.48\ X_8 - 6145.15\ X_9 - 6715.74\ X_{10} - 4676.74\ X_{11} + 220.19\ X_{12} - 2750.67\ X_{13}$$

$\hat{Y}$ = Predicted Sales
X_1 = Price
X_2 = Number of Outlets
X_3 = Z1 - Variation for January
X_4 = Z2 - Variation for February
X_5 = Z3 - Variation for March
X_6 = Z4 - Variation for April
X_7 = Z5 - Variation for May
X_8 = Z6 - Variation for June
X_9 = Z7 - Variation for July
X_{10} = Z8 - Variation for August
X_{11} = Z9 - Variation for September
X_{12} = Z10- Variation for October
X_{13} = Z11- Variation for November

**** = .0001 level of significance

TABLE IX

ANALYSIS OF VARIANCE TABLE FOR MODEL 3
USING TIME AND SEASONAL VARIATION

Source	DF	Sum of Squares	Mean Square	F Value
Model	12	2116280100	176356675	9.436****
Error	23	429865328	18689797	
Corrected Total	35	2546145428		

$$R^2 = 0.8312$$

$$\hat{Y} = 21553.583 + 645.27\ X_1 - 5243.06\ X_2 - 6698.33\ X_3 - 4574.93\ X_4 - 1168.86\ X_5 - 4253.46\ X_6 - 6795.40\ X_7 - 7838.33\ X_8 - 5819.93\ X_9 - 4426.20\ X_{10} + 1238.20\ X_{11} - 2105.40\ X_{12}$$

$\hat{Y}$ = Predicted Sales
X_1 = Time
X_2 = Z1 - Variation for January
X_3 = Z2 - Variaition for February
X_4 = Z3 - Variation for March
X_5 = Z4 - Variation for April
X_6 = Z5 - Variation for May
X_7 = Z6 - Variation for June
X_8 = Z7 - Variation for July
X_9 = Z8 - Variation for August
X_{10} = Z9 - Variation for September
X_{11} = Z10- Variation for October
X_{12} = Z11- Variation for November

**** = .0001 level of significance

TABLE X

ANALYSIS OF VARIANCE TABLE FOR MODEL 4 USING TIME, ALAG, AND SEASONAL VARIATION

Source	DF	Sum of Squares	Mean Square	F Value
Model	13	2270942623	174687894	21.637****
Error	21	169545140	8073578	
Corrected Total	34	2440487764		

$$R^2 = 0.9305$$

$$\hat{Y} = 6954.64 + 158.18\ X_1 + .77\ X_2 - 8559.01\ X_3 - 4216.47\ X_4 - 984.97\ X_5 + 785.50\ X_6 - 4918.11\ X_7 - 5102.75\ X_8 - 4204.45\ X_9 - 1394.07\ X_{10} - 1555.44\ X_{11} + 3032.78\ X_{12} - 4661.27\ X_{13}$$

$\hat{Y}$ = Predicted Sales
X_1 = Time
X_2 = ALAG
X_3 = Z1 - Variation for January
X_4 = Z2 - Variation for February
X_5 = Z3 - Variation for March
X_6 = Z4 - Variation for April
X_7 = Z5 - Variation for May
X_8 = Z6 - Variation for June
X_9 = Z7 - Variation for July
X_{10} = Z8 - Variation for August
X_{11} = Z9 - Variation for September
X_{12} = Z10- Variation for October
X_{13} = Z11- Variation for November

**** = .0001 level of significance

TABLE XI

MODEL 2 PREDICTION RESULTS COMPARED WITH ACTUAL MONTHLY SALES

Month	Actual Sales	Predicted Sales	Residual	% Variation
January	34706	35491.80	-785.80	2.26
February	32802	34681.80	-1879.80	5.73
March	41438	37450.5	3987.50	9.62
April	41021	40820.60	200.40	.48
May	42402	38381.20	4020.80	9.48
June	38858	36484.60	2373.40	6.11
July	30678	37313.20	-6635.22	21.63
August	30406	36742.60	-6336.60	20.84
September	43983	43019.80	963.20	.22
October	46095	47916.80	-1821.80	3.95
November	41630	44945.90	-3315.90	7.97
December	39617	47696.60	-8079.60	20.40
Total				108.69

TABLE XII

MODEL 1 PREDICTION RESULTS COMPARED WITH ACTUAL MONTHLY SALES

Month	Actual Sales	Predicted Sales	Residual	% Variation
January	34706	35879.50	-1173.50	3.38
February	32802	34662.20	-1860.20	5.67
March	41438	37067.40	4370.60	10.55
April	41021	42531.10	-1510.10	3.68
May	42402	38609.20	3792.80	8.94
June	38858	37980.40	877.60	2.26
July	30678	38000.50	-7322.50	23.87
August	30406	35884.60	-5478.60	18.02
September	43983	39760.60	4222.40	9.60
October	46095	48964.30	-2869.30	6.20
November	41630	44659.30	-3029.30	7.28
December	39617	46822.80	-7205.80	18.19
Total				117.64

TABLE XIII

MODEL 4 PREDICTION RESULTS COMPARED WITH ACTUAL MONTHLY SALES

Month	Actual Sales	Predicted Sales	Residual	% Variation
January	34706	40185.50	-5480	15.79
February	32802	39375.50	-6574	20.04
March	41438	42144.20	-706	1.70
April	41021	46195.50	-5175	12.62
May	42402	43756.20	-1354	3.19
June	38858	41859.50	-3002	7.73
July	30678	41461.90	-10784	35.15
August	30406	44125.50	-13720	45.12
September	43983	46164.50	-2182	4.90
October	46095	52474.20	-6379	13.84
November	41630	49775.90	-8146	19.57
December	39617	52526.50	-12910	32.59
Total				150.63

TABLE XIV

MODEL 3 PREDICTION RESULTS COMPARED WITH ACTUAL MONTHLY SALES

Month	Actual Sales	Predicted Sales	Residual	% Variation
January	34706	37543.00	-2837.00	8.17
February	32802	35368.50	-2566.50	7.82
March	41438	37297.80	4140.20	9.99
April	41021	45850.30	-4829.30	11.77
May	42402	39985.00	2417.00	5.70
June	38858	41017.80	-2159.80	5.56
July	30678	39356.00	-8678.00	28.29
August	30406	36050.50	-5644.50	18.56
September	43983	35838.70	8144.30	18.52
October	46095	50998.70	-4903.70	10.64
November	41630	45082.70	-3452.70	8.29
December	39617	46477.50	-6860.50	17.32
Total				212.24

1 and Model 2 used the independent variables of price, the number of outlets and the dummy variables for seasonal variation. These two models are useful when changes in price or the number of outlets are indicated. Model 1, however, also used ALAG which made it somewhat more complicated. Although the performance of Model 4 was good it was not as strong as Models 1 or 2 and would, therefore, not be the preferred model. Due to poor prediction results and a low R^2 (.83) Model 3 is not recommended for use.

Note that in all four sales forecasts, shown in Tables XI, XII, XIII, and XIV, the models performed more efficiently for the first six months of the year than for the second six months of the year. Therefore, Models 1, 2, and 4, can be recommended for short term forecasting of six months. These three models could be modified to accommodate data from the previous six months before completing each short term forecast.

CHAPTER IV

ASSESSMENT OF THE MODELS

The primary purpose of this study was to develop and test a sales forecasting model for businesses in the drycleaning service industry. The procedures and findings related to the development of a sales forecasting model were discussed in Chapter III. Chapter IV addresses procedures and findings concerned with testing of the four models which were developed along with the formulation of guidelines for use of a models by small drycleaning businesses.

Test Businesses

In order to effectively utilize sales forecasting for business decision making, accurate information must be provided as input for the model. To locate businesses with accurate and reasonably consistent financial information the researcher contacted a financial consultant who specialized in drycleaning and laundry businesses. A group of independent drycleaning business owners who utilized a common data processing center and consulting service was selected. The group consisted of twelve business owners, primarily from the central United States.

Selection Process

This group was selected because although some businesses were comparable to the sample business there were four areas of diversity. The four areas of diversity were: 1) the size of the population base served; 2) variation in sales volume ($120,000 to $2,000,000 a year); 3) the potential availability of multi-store data versus single store data; and 4) not all of the businesses would necessarily have a growth in receipts over the last four years.

Due to the confidential nature of the information which was anticipated for the study, members of the group were approached at a joint meeting in April and again in June of 1984 to assure confidentiality of the data and to stimulate interest in the project. A minimum of four businesses was arbitrarily established as the size of the test group for the study.

A data collection form was developed. A copy of the form was placed in Appendix H. The data requested were based on information needed in order to test the four sales forecasting models. The business owners were asked to provide monthly figures for 1982 and 1983. The information requested included sales volume, number of routes, number of dry stores, the retail price for a pair of men's pants or women's slacks and total advertising expenditures. Total advertising expenditures were ultimately not used in any of the models. For profile information the business owners

were asked to estimate the population served by their particular business location(s) and to estimate the percentage of their business which was drycleaning, family laundry, industrial and linen supply, uniform servicing and other areas. The data collection form was pre-tested using the two business owners serving on the panel of experts.

A copy of the cover letter, included in Appendix H, and three copies of the data collection form were sent to each business owner. Those business owners with more than one processing location were encouraged to provide information for each of their locations. Follow-up phone calls were made in order to screen questions and assist with completion of the form.

Descriptive Information

Eight business owners submitted data on fourteen separate businesses. Five business owners provided information for one of their operations. One owner provided information for two businesses, one provided information for three businesses and one provided information for four businesses. The test businesses ranged from $120,000 to $2,000,000 in annual sales volume.

Estimates of the trade areas served by the fourteen test businesses had from one to ten outlets and/or routes and served populations from 9,000 to 500,000. The geographical locations included Hawaii, Indiana, Iowa, Illinois, Michigan, Nebraska and Ohio. Thirteen of the

fourteen reported doing over eighty percent of their business in drycleaning which corresponded with the sample business. The balance of their business was done in the categories of family laundry, repairs, shirt laundering, uniform servicing, suedes, paper products, and rags.

One of the fourteen businesses indicated that forty-nine percent of their business was in industrial and linen supply, and twenty-one percent in drycleaning. The balance of revenue was provided in family laundry, uniform servicing and hotel valet guest work. This business was allowed to remain in the study to examine the potential use of the sales forecasting models for related service businesses not specializing in drycleaning.

Data Treatment

Data were obtained from nine of the twelve business owners. Three of the owners were able to provide data from more than one business. Information requested was submitted for fifteen individual businesses. One of the businesses was eliminated from the study because thirteen financial periods had been used instead of the traditional twelve monthly periods for which the sales forecasting models had been developed.

One business owner submitted data for three businesses each of which used a 4/5/4 business calendar. Instead of using monthly data these businesses used four and five week periods beginning with Mondays and ending with Saturdays.

These three businesses were allowed to remained in the study by adjusting the five week sales figures. The sales figures were adjusted by using only four-fifths of the sales volume reported in the periods covering five weeks.

Testing of the sales forecasting models was performed using a total of fourteen businesses owned by nine independent business owners. The mix of businesses provided for multi-unit as well as single unit operations and also allowed for experimentation with using the models for businesses using a 4/5/4 business calendar.

Model Testing

The four sales forecasting models were tested using two different approaches. The first approach used the variables identified in the sample business models and the level of influence of those variables. The second approach used the variables identified in the sample business models but measured the influence of each of the variables by using data from each of the test businesses.

Using Sample Business Data. An analysis of model performance using sample business data appears in Tables XVII - XX, Appendix I. Data indicate that the best model, in general, was Model 4 followed by Model 1. Model 4 was best for nine businesses and Model 1 was best for five businesses, as summarized in Table XV. The best model for each business was selected based on the model with the smallest cumulative percentage variation between the

TABLE XV

BEST MODEL SELECTED FOR EACH OF FOURTEEN BUSINESSES USING SAMPLE BUSINESS DATA

Business[a]	Best Model[b]	Nearest Estimate	Farthest Estimate	# w/i 10 %	# w/i 20 %
1	4	.64	-120.75	2	5
2	4	1.91	-58.48	5	10
3	4	1.09	-58.02	9	13
4	1	-.23	27.80	8	16
5	4	.40	-65.80	9	13
6	1	.20	24.84	9	20
7	4	-.74	-52.30	7	15
8	4	1.60	33.17	13	16
9	1	-.77	18.38	16	23[c]
10	4	-.41	-29.53	11	16
11	1	.42	-40.64	9	18
12	4	2.01	32.50	9	15
13	1	.42	28.95	14	19
14	4	-.71	31.85	4	10

[a]In order by sales volume from smallest to largest.

[b]Based on smallest percentage of residuals.

[c]All twenty-three estimates were within twenty percent of the actual sales figure.

observed and predicted monthly sales for a twenty-four month period. Models 2 and 3 were not found to be the best for any of the fourteen businesses.

Overall, Business 9 appeared to be most suited to utilize models developed for the test business. This research judgement was based on the percent variation of the estimated sales figures from the actual sales figures. Using Model 1 sixteen of the twenty-four monthly sales estimates for Business 9 were within ten percent of the actual sales figures and all estimates were within twenty percent of the actual sales figure.

Further examination of Business 9 suggested two similarities with the test business. First, the annual sales volume for Business 9 in 1983 was comparable to that of the sample business in 1982. Secondly, Business 9 was also located in the plains states, at approximately the same latitude as the sample business and may experience somewhat comparable climatic changes.

Three additional points should be noted regarding Business 9. First, it was one of three businesses using the 4/5/4/ business calendar. This would suggest that the method utilized for adjusting for this factor was successful. Secondly, two other businesses in the same region and owned by the same individual were not able to use the models as well as Business 9. Thirdly, Business 9 experienced a decrease in sales during the second twelve month period while the sample store experienced an increase. Therefore

it appears that the models were able to accommodate for a change in sales which varied from that of the sample businesss.

The business which experienced the poorest forecasting results using sample business data was Business 1. Only two of the estimates were within ten percentage points of the actual monthly sales figures to be predicted, and only five were within the twenty percent range. Business 1 is the smallest volume of the group and also experienced a decline in sales between 1982 and 1983.

Using Test Business Data. In the second approach to testing the models, each of the four models was tested using data from the respective test businesses rather than using data from the sample business. Data from each of the fourteen stores were used in testing each of the four sales forecasting models. The results were summarized in Table XVI, which provides the F value, and the R^2 by business and model. Selection of the 'best' model was made by examination of the level of significance and the R^2 performance of the models.

An examination of the R^2 indicates that Businesses 2, 6, 8, and 9 yielded the best over all results using the sales forecasting variables used for the sample business. For Business 9, two of the R^2s were .940602 and two were .925260. Business 8 had comparable results with two R^2s of .940602 and two of .922048. For Business 6, two of the R^2s were .925260 and two were .924707. The results for Business

TABLE XVI

SUMMARY OF MODEL PERFORMANCE USING TEST BUSINESS DATA

Business	Model	F Value	R^2
1	1[a]	3.35 *	.828663
	2[a]	4.59 **	.833427
	3	4.49 **	.830482
	4	3.30 *	.826714
2	1	7.63 **	.930290
	2	8.36 ***	.915733
	3	7.59 ***	.892291
	4	5.62 **	.890409
3	1[a]	3.29 *	.826133
	2[a]	2.25	.710250
	3	2.29	.713968
	4	3.50 *	.834989
4	1[a]	4.31 *	.861728
	2[a]	6.43 **	.875184
	3	8.73 ***	.904965
	4	7.03 **	.910329
5	1[ab]	5.03 **	.857987
	2[ab]	6.40 **	.854423
	3	5.50 **	.857179
	4	4.44 *	.864996
6	1[a]	8.50 **	.924707
	2[a]	11.35 ***	.925260
	3	11.35 ***	.925260
	4	8.50 **	.924707
7	1[ab]	6.42 **	.885166
	2[ab]	5.48 **	.833901
	3	8.77 ***	.905410
	4	7.10 **	.911159

TABLE XVI (Continued)

Business	Model	F Value	R^2
8	1[a]	11.82 ***	.944648
	2[a]	11.90 ****	.928498
	3	11.90 ****	.928498
	4	11.82 ***	.944648
9	1[a]	10.96 ***	.940602
	2[a]	10.84 ***	.922048
	3	10.84 ***	.922048
	4	10.96 ***	.940602
10	1[a]	4.58 *	.868701
	2[a]	4.59 **	.833681
	3	4.59 **	.833681
	4	4.58 *	.868701
11	1	2.77	.829113
	2	2.33	.751660
	3	2.70	.746435
	4	2.88	.806011
12	1[a]	3.13 *	.818769
	2[a]	3.99 *	.813294
	3	3.99 *	.813294
	4	3.13 *	.818769
13	1[a]	5.26 **	.883636
	2[a]	5.90 **	.865608
	3	5.90 **	.865608
	4	5.26 **	.883636
14	1	3.40 *	.856158
	2	3.88 *	.834402
	3	4.32 *	.824894
	4	3.85 *	.847637

[a]Number of outlets remains constant for this model

[b]Price remains constant for this model

**** = .0001 level of significance
*** = .001 level of significance
** = .01 level of significance
* = .05 level of significance

2 are particularly interesting since it is also owned, but not operated, by the owner of the sample business and is in the same geographic location. In this instance, a higher R^2 was indicated for Model 1 (.930290), however, Models 2 and 3 both with lower R^2s than Model 1, had higher levels of significance.

Businesses 4 and 7 each had two models with R^2s in the ninties. The remaining businesses had R^2s in the eighties with the exception of Businesses 3 and 11 each having two models with R^2s in the seventies. In this portion of the study it was noted that Businesses 3 and 11 appear to have the weakest compatability with the variables identified for the sample business. This suggested that for these businesses, other variables may serve more efficiently as sales predictors than those used in the study.

Based on the R^2 results, derived from this approach, Models 1 and 4 again appear to be the most successful models. Model 4 resulted in the highest R^2 for four businesses while Model 1 was highest for three businesses. In five instances the R^2s were identical for Models 1 and 4. For one business Model 2 had the highest R^2 and for another, Models 2 and 3 were identified as having the highest R^2s.

Discussion

Some of the variables traditionally used in sales forecasting for products were not found to function in the models developed for the drycleaning businesses involved in

this study. The following discussion includes observations made by the researcher and suggestions for marketing strategies supported by the literature and applicable to the drycleaning industry.

Observations

The results obtained by testing the models provided the researcher with ten observations. First, it should be noted, in Table XVI, that further examination of the computations for the models indicated there were cases in which one of the variables did not function in a model. For instance, if no new outlets came into being during the two year period the variable would would remain constant. In such instances the impact of the variable was null.

Secondly, price, time, the number of outlets, ALAG and the use of dummy variables to reflect seasonal variation appeared to be more influential in predicting sales than other marketing variables typically identified for products. For instance, advertising, which is typically identified in the literature as a predictor of sales for products, did not surface as a significant contributor to sales prediction for the service sector examined in the study.

The third observation was that although there appeared to be a reasonably efficient model for most of the businesses, based on the experience with the sample business, a model could be perfected for each of the test businesses. This procedure could increase the goodness of fit of the

individual business models. Some of the R^2 figures may be improved by as much as ten percent by examining pertinent, individual business data.

The fourth point was that the selected sales forecasting models could be improved for each of the test businesses by using each business' internal data instead of the base data derived from the sample business. In other words, the variables which contributed to the model may be the same, however, the degree of influence may vary among businesses. This degree of influence was not examined in the study.

The fifth observation was based on a cursory examination of monthly sales activity for all of the businesses included in the study. The sales activity would suggest that drycleaning businesses typically have dramatic monthly variations which make sales forecasting difficult. There may, however, be a seasonal index which could be derived for use in sales forecasting for the drycleaning industry. A monitoring of local climatic changes captured by the point of sale terminal would allow further refinement of such a variable for use in the forecasting model.

Observation six was that the technique for handling data compiled for a 4/5/4 business calendar appeared to be successful since the business which performed the best using sample business data used this approach. This approach could be explored in greater depth.

The seventh observation relates to test business data. The sample store models were built using three years of monthly information. When the models were tested using test business data only two years of data were used. Efficiency of the models may be improved by using an additional year of data.

The eighth observation was that the multiple regression technique, although simpler than other methods, does not appear to be efficient in detecting changes in monthly sales variation. The models also performed better for short term forecasting of six months rather than for long term forecasting beyond this point. Efficiency of the models is likely to improve if data from the prior six months is utilized in the model for each forecasting period.

Observation number nine reflects on the logic of the positive linear relationship between sales and the independent variables of price and the number of outlets. In the literature both of these variables are linked with the perception of quality. During a period of rapid growth price and the number of outlets may have a positive relationship with sales, but with time, both factors are likely to reach a point of diminshing returns. The price may become too high and result in a negative influence on sales. The number of outlets may increase to a point where quality could not be maintained.

The final observation is based on findings in the Dichter study which indicated that convenience was the most

important factor in selecting a drycleaning service. In geographic areas experiencing population growth the number of outlets may be more significant than in areas with minimal growth. As new areas are developed new businesses are needed to meet the demands of the consumers residing or working in the area. Therefore, the number of outlets may serve as a reflection of growth or decline for some businesses and not for others.

Marketing Strategies

The researcher identified the following key points for consideration in the development of marketing strategies for small drycleaning businesses. A more complete delineation of these points has been provided in Appendix J.

1. Attract new customers before they develop the habit of utilizing another service provider.

2. Strive to maintain customers by doing 'quality' work.

3. Maintain a good profile of the customer and use the information to build a stronger customer base.

4. Promote with service 'benefits' in mind.

Guidelines

Based on research findings and observations, the following major guidelines were formulated for utilization of the sales forecasting models.

1. Use Model 1 if the business has experienced price changes or a change in the number of outlets.

2. Use Model 4 if there has been little or no change in price or the number of outlets.

3. Employ a model developed from the sample business first. If the estimates are not within a predetermined acceptance range then use the same variables but derive parameters by using three years of data from the business for which the forecast is being developed.

4. Experiment with other variables which may strengthen the model selected.

A good sales forecast is based upon a carefully formulated and executed marketing plan, utilizing appropriate marketing strategies. These guidelines are intended to assist with sales forecasting and the development of marketing strategies which are feasible for implementation by drycleaning businesses owners.

CHAPTER V

SUMMARY AND RECOMMENDATIONS

The growth of service industries in the United States has prompted marketing researchers to examine services marketing primarily based on what is known of product marketing. In this study, sales forecasting, typically used by larger, product oriented companies, was explored for utilization by small service businesses.

The purpose of this study was to develop a sales forecasting model for selected small businesses within a selected service industry. Four sales forecasting models were developed using marketing and other variables generally recognized for forecasting. Drycleaning and laundering, typically classified under the Standard Industrial Classification Code of 721, was selected for investigation.

The primary objectives of the study were to: 1) identify and quantify marketing and other variables to be used in developing the sales forecasting model; 2) develop a sales forecasting model for small businesses within the selected service industry; and 3) test the model, formulate, and propose guidelines for use by small businesses in the drycleaning industry, based upon services marketing literature and model performance.

Summary of Procedures

Based on the literature review and input from a panel of experts potential marketing and other variables, which may impact sales, were identified. Business and financial information to represent the variables was sought from the sample business. Fourteen independent variables were identified for use in the study. The fourteen variables included time, charges, total advertising, directory advertising, newspaper advertising, number of employees, average months of employment, number of outlets, claims, janitorial costs and price.

Multiple regression was selected as the sales forecasting method. A five step process was employed resulting in the development of four forecasting models. The five steps included the use of: correlation coefficients, stepwise regression, a decision matrix, scatterplots and dummy variables to account for seasonal variation. The performance of the four sales forecasting models was accessed for fourteen similar businesses using two approaches. In the first approach each of the four models was tested, on fourteen businesses, using sample business data. In the second approach the four models were tested using data from each of the fourteen test businesses.

Summary of Findings

Four models were developed using the sample business data for the years 1980, 1981 and 1982 to predict monthly sales for 1983. The model selected as being the most efficient, Model 2, included the independent variables of price, the number of outlets and dummy variables used to reflect seasonal variation in sales. The model performed well with an R^2 of .9535 and an F value of 34.67 which was significant at the .0001 level. The efficiency of this model for short term forecasting of six months was noted.

The performance of the four models was assessed using fourteen test businesses. In the first approach the models used the sample business data. Monthly sales forecasts for nine of the fourteen test businesses were more efficient using models other than Model 2 which had been identified as the best model for the sample business.

In the second approach all four models were used to predict sales by using the same model variables, however, data from the sample business was replaced with data from each of the respective fourteen test businesses.

Based on the R^2 results, derived from this approach, Models 1 and 4 again appeared to be the most successful models. Model 4 resulted in the highest R^2 for four businesses while Model 1 was highest for three businesses. In five instances the R^2s were identical for Models 1 and 4.

For one business Model 2 had the highest R^2 and for another, Models 2 and 3 were identified as having the highest R^2s.

Conclusions

Based on the findings of this study the following conclusions were offered by the researcher:

1. Sales forecasting is feasible for service operations using a simple, but efficient method, such as multiple regression.

2. One model can be used as the basis for sales forecasting for drycleaning businesses regardless of sales volume, geographic location, price structure or number of outlets.

3. Independent variables included in a sales forecasting model may differ from business to business within the service industry.

4. The lag in availability of pertinent government information may make such resources inappropriate for use with current business information available on a monthly basis.

Recommendations for Further Research

Based on the findings of this study the researcher recommends further research:

1. to determine what attributes are used by consumers to assess such variables as quality, interior environment and service performance and how these variables might be

measured for use in sales forecasting for service businesses.

2. to determine if the recommended sales forecasting models could be useable for other sectors within SIC Code 721 or businesses in other service sectors.

3. to test efficient sales forecasting models for businesses utilizing a thirteen month or 4/5/4 business calendar.

4. to investigate influential predictor variables for specific businesses and to develop individual business sales forecasting models.

5. to analyze monthly sales variation in the drycleaning industry and develop a seasonal index to assist with sales forecasting.

6. to investigate the cost efficiency and comparative proficiency of more complex statistical analyses such as Exponential Smoothing or Box-Jenkins.

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APPENDICES

APPENDIX A

MATRIX OF POTENTIAL INDEPENDENT VARIABLES: ELEMENTS OF MARKETING MIX

Author

Element	Beckwith & Fitz. 1981	Bell, 1981	Berry, 1984	Bessom, 1975	Booms & Bitner, 1981	Booms, Davis, Gus, 1984	Booms & Nyquist, 1981	Czepiel, 1980	Dholakia & Dilts, 1981	Dichter, 1982	Dixon & Smith, 1983	Eiglier et al., 1977	Enis & Roering, 1981	Enis & Roering, 1980	Fisk, 1981	George, 1977	Gronroos, 1983	Grove & Fisk, 1983	Guseman, 1981	Knisely, 1984	Kotler, 1984	Liechty & Churchill,79	Lovelock, 1984	Lovelock, 1983	Lovelock, 1981	Murphy & Robinson, '81
PRODUCT																	✓									
Need										✓										✓						✓
Perceived Risk, Danger or Social Stigma										✓				✓												
Quality or Perceived Quality	✓		✓							✓		✓					✓			✓						
Satisfaction/ Dissatisfaction (redress)	✓	✓		✓	✓					✓	✓				✓					✓		✓				
PRICE			✓				✓	✓		✓										✓				✓		
Economic Shifts																										
Effort/Convenience ($, time, aggravation)													✓													
Spending Shifts																										
PLACE																						✓				
Location										✓												✓				
Appearance of Area		✓		✓						✓								✓	✓	✓		✓				
Competition		✓																				✓				
Distribution (Routes/Outlets)		✓			✓					✓												✓	✓			
PROMOTION		✓																		✓						
Advertising																				✓		✓	✓			
Merchandising/Display																										
Packaging										✓										✓						
Word of Mouth										✓																
PROFILE (of Consumer)						✓				✓										✓		✓				
Demographic Shifts																		✓				✓				
Size of Consumer Group (Population)																		✓								
Social Shifts										✓								✓								
Values										✓																
PROCESS																										
Customer Complaints (feedback)							✓			✓															✓	
Educating the Customer										✓															✓	
Personnel Training	✓	✓	✓		✓	✓	✓		✓	✓						✓	✓	✓	✓	✓		✓			✓	
Public Contact																				✓		✓				
Uniforms																										

Author

Element	Quelch & Ash, 1981	Sandeman & Sand., 1981	Sasser & Arbeit, 1976	Shostack, 1977	Smith & Houston, 1983	Stiff & Pollack, 1983	Tull, 1964	Uhl & Upah, 1983	Uhl & Upah, 1980	Upah et al., 1983	Zeithaml, 1981
PRODUCT											
Need										✓	
Perceived Risk, Danger or Social Stigma											✓
Quality or Perceived Quality	✓			✓			✓	✓		✓	✓
Satisfaction/ Dissatisfaction (redress)		✓			✓	✓					✓
PRICE		✓					✓	✓			
Economic Shifts		✓									
Effort/Convenience ($, time, aggravation)								✓			
Spending Shifts		✓									
PLACE		✓						✓			
Location										✓	
Appearance of Area				✓				✓		✓	
Competition											✓
Distribution (Routes/Outlets)								✓			
PROMOTION		✓		✓					✓		
Advertising										✓	✓
Merchandising/Display		✓									
Packaging							✓				
Word of Mouth											
PROFILE (of Consumer)											
Demographic Shifts		✓									
Size of Consumer Group (Population)		✓									
Social Shifts		✓									
Values											
PROCESS											
Customer Complaints (feedback)							✓			✓	
Educating the Customer											
Personnel Training			✓			✓		✓		✓	✓
Public Contact											
Uniforms											

APPENDIX B

INTERVIEW REACTION FORM

INTERVIEW REACTION FORM

Variable	Influence on Sales: Very much	somewhat	not at all
INTERNAL			
Advertising			
Radio Advertising			
Hang Tags			
Direct Mail			
Visual Merchandising			
Directory Advertising			
Promotion			
Number of Dry Stores			
Number of Routes			
Appearance of Facilities			
% of Repeat Customers			
Price Changes			
Employee Turnover			
Number of Employees			
Quality of Staff			
Employee Training			
Personnel Relations and Welfare			
Claims - Customer Satisfaction			

Inventory		
Cost of Production		
Packaging		
Minors Repairs for Customers		
Garment Inspection		
EXTERNAL		
Number of Competitors		
Population Base		
Population changes		
Discretionary Income		
Average Income		
Average Family Size		
Local Employment Figures		
Growth in Industry Base		
Technological Changes		
Textile Changes		

APPENDIX C

GOVERNMENT DOCUMENT RESOURCES

Government Document Resources

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APPENDIX D

SELECTION OF A SALES FORECASTING METHOD

Selection of a Sales Forecasting Method

Seven considerations were assessed in the selection of a sales forecasting method for this research project.

Consideration 1. The forecast desired, such as the decision between the point forecast and confidence intervals. Assessment: Point estimates create the image of an exact statement of anticipated sales, It was unlikely that a simple forecasting method would be this exact. Therefore, a confidence interval was preferred which would provide an anticipated sales range.

Consideration 2. The time frame. Forecasts are generated for points in time that may be a number of days, weeks, months, quarters or years in the future. This length of time is called the time frame or time horizon. An example is:

intermediate	- less than one month
short term	- one to three months
medium	- more than three months to less than two years
long term	- two years or more

A longer time frame makes accurate forecasting more difficult, with qualitative forecasting techniques becoming more useful as the time frame increases.

Assessment: Internal data which were quantitative were more accessible on a monthly basis and a short term sales forecast was sought.

Consideration 3. The pattern of data must also be considered when choosing a forecasting method. Whether the data pattern that exists displays trend, seasonal, or cyclical pattern components, or some combination, often dtermines the forecasting technique that will be used.
Assessment: Visual examination of the internal data indicated that trend and seasonality were evident.

Consideration 4. When choosing a forecasting technique, overall costs must be assessed. The cost of developing the method, the cost of storing the necessary data, and the cost of the actual operation or implementation must be considered.
Assessment: The intention of the research was to develop a cost efficient sales forecasting model which would be easily implemented.

Consideration 5. The desired accuracy of the forecast.
Assessment: A monthly forecast within ten percent of actual sales was sought.

Consideration 6. The availability of the data is a factor to consider.

Assessment: Primary data were available on a monthly basis. Secondary data were generally available with a distribution lag of two years.

Consideration 7. The ease with which the forecasting method is operated and understood is important.

Assessment: A simple forecasting method was sought which would be easily understood and implemented by small service businesses.

APPENDIX E

FORWARD SELECTION PROCEDURE FOR THE IDENTIFICATION OF INDEPENDENT VARIABLES

SAS

FORWARD SELECTION PROCEDURE FOR DEPENDENT VARIABLE A

WARNING: 6 OBSERVATIONS DELETED DUE TO MISSING VALUES.

STEP 1 VARIABLE C ENTERED R SQUARE = 0.84538302 C(P) = 24.23210484

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	1739376209.49407080	1739376209.4940708	153.09	0.0001
ERROR	28	318124549.30592930	11361591.0466403		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	9167.51193973				
C	3.15868657	0.25528738	1739376209.4940708	153.09	0.0001

STEP 2 VARIABLE D ENTERED R SQUARE = 0.90471131 C(P) = 6.95747509

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	1861444216.04379400	930722108.02189700	128.17	0.0001
ERROR	27	196056542.75620606	7261353.43541504		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	5896.84211772				
C	2.57784335	0.24843809	781797486.60059230	107.67	0.0001
D	8.15592867	1.98921296	122068006.54972326	16.81	0.0003

STEP 3 VARIABLE N ENTERED R SQUARE = 0.92458085 C(P) = 2.50224193

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	1902325802.54165410	634108600.84721800	106.25	0.0001
ERROR	26	155174956.25834602	5968267.54839792		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	6285.55776116				
C	2.79218262	0.23966057	810107648.66216920	135.74	0.0001
D	8.28090847	1.80405109	125749592.52874148	21.07	0.0001
N	-4.17676794	1.59588142	40881586.49786003	6.85	0.0146

SAS

FORWARD SELECTION PROCEDURE FOR DEPENDENT VARIABLE A

STEP 4 VARIABLE G ENTERED R SQUARE = 0.94018631 C(P) = -0.56767253

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	4	1934434038.03142450	483608509.50785610	98.24	0.0001
ERROR	25	123066720.76857556	4922668.83074302		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	5280.18913653				
C	2.76045836	0.21801123	789233089.49515040	160.33	0.0001
D	6.48292682	1.78326774	65059354.99303553	13.22	0.0013
G	8.07248221	3.16081579	32108235.48977045	6.52	0.0171
N	-4.29987141	1.45016302	43279068.28385208	8.79	0.0066

STEP 5 VARIABLE P ENTERED R SQUARE = 0.94330645 C(P) = 0.41865385

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	5	1940853726.51886110	388170745.30377220	79.87	0.0001
ERROR	24	116647032.28113899	4860293.01171412		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-5067.99223416				
C	2.45089956	0.34565332	244361067.00772269	50.28	0.0001
D	5.39857654	2.00747335	35149682.21181569	7.23	0.0128
G	8.22912702	3.14368246	33303711.74362310	6.85	0.0151
N	-4.23009171	1.44222473	41811537.97826991	8.60	0.0073
P	6728.12005894	5854.20574267	6419688.48743657	1.32	0.2618

STEP 6 VARIABLE H ENTERED R SQUARE = 0.94654475 C(P) = 1.36659061

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	6	1947516539.95825770	324586089.99304294	67.88	0.0001
ERROR	23	109984218.84174244	4781922.55833663		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-5452.99665709				
C	2.26220938	0.37828931	171009407.35025434	35.76	0.0001
D	5.32619172	1.99216672	34181000.26708741	7.15	0.0136
G	5.28962817	3.99059000	8401921.26914170	1.76	0.1980
H	4.60554130	3.90169327	6662813.43939654	1.39	0.2499
N	-5.16140802	1.63369907	47730369.73676640	9.98	0.0044
P	7740.45232643	5869.80578701	8315488.25985982	1.74	0.2003

SAS

FORWARD SELECTION PROCEDURE FOR DEPENDENT VARIABLE A

STEP 7 VARIABLE F ENTERED R SQUARE = 0.94790532 C(P) = 2.92456721

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	7	1950315914.91804700	278616559.27400666	57.19	0.0001
ERROR	22	107184843.88195312	4872038.35827060		
TOTAL	29	2057500758 80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-10059.18766683				
C	2.19705718	0.39139144	153522052.00349028	31.51	0.0001
D	4.85221948	2.10582528	25867050.03709453	5.31	0.0310
F	-12.82443906	16.91855202	2799374.95978932	0.57	0.4565
G	5.32460626	4.02828034	8512288.26647660	1.75	0.1998
H	4.49140593	3.94116293	6327418.14251956	1.30	0.2667
N	-5.14025806	1.64925687	47326451.21928855	9.71	0.0050
P	11093.29219876	7393.82941115	10967123.93094505	2.25	0.1477

NO OTHER VARIABLES MET THE 0.5000 SIGNIFICANCE LEVEL FOR ENTRY INTO THE MODEL.

APPENDIX F

BACKWARD ELIMINATION PROCEDURE FOR THE IDENTIFICATION OF INDEPENDENT VARIABLES

SAS

BACKWARD ELIMINATION PROCEDURE FOR DEPENDENT VARIABLE A

WARNING: 6 OBSERVATIONS DELETED DUE TO MISSING VALUES.

STEP 0 ALL VARIABLES ENTERED R SQUARE = 0.95382924 C(P) = 15.00000000

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	14	1962504376.40341370	140178884.02881526	22.13	0.0001
ERROR	15	94996382.39658638	6333092.15977243		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	48827.62078181				
B	331.80383739	511.33704506	2666638.23625249	0.42	0.5262
C	1.89700863	0.61989783	59308124.04635798	9.36	0.0079
D	4.53567547	2.67364206	18226078.02254095	2.88	0.1105
E	1.70671165	2.73101410	2473365.11123508	0.39	0.5414
F	-17.81564457	24.61233018	3318283.00197989	0.52	0.4803
G	3.52662891	5.69173630	2431340.54673173	0.38	0.5448
H	1.88970260	6.54337133	528201.45853911	0.08	0.7767
I	-4933.63302762	4652.14230679	7122681.27890672	1.12	0.3057
J	-336.15358722	334.27449110	6404494.18407400	1.01	0.3305
K	3327.90711648	3009.24526394	7745385.34423531	1.22	0.2862
L	-0.13970663	1.90748917	33972.35571593	0.01	0.9426
M	0.15709210	6.98866086	3199.90102670	0.00	0.9824
N	-6.32350513	2.58595385	37869539.02972827	5.98	0.0273
P	15442.33707228	18635.21961560	4348834.02803835	0.69	0.4203

STEP 1 VARIABLE M REMOVED R SQUARE = 0.95382768 C(P) = 13.00050527

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	13	1962501176.50238700	150961628.96172207	25.43	0.0001
ERROR	16	94999582.29761308	5937473.89360082		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	48965.44267142				
B	333.25617379	491.13992231	2733679.81608739	0.46	0.5071
C	1.90000312	0.58619961	62376253.65607409	10.51	0.0051
D	4.54451488	2.56063151	18701765.30875234	3.15	0.0950
E	1.71235989	2.63312084	2511020.31397514	0.42	0.5247
F	-17.89029074	23.61326877	3408193.85628717	0.57	0.4597
G	3.53963442	5.48254461	2474880.21513518	0.42	0.5277
H	1.84543052	6.04187312	553928.75029841	0.09	0.7640
I	-4935.66180548	4503.64547229	7131224.52014840	1.20	0.2893
J	-336.43800960	323.43337054	6424541.95815159	1.08	0.3137
K	3325.60337750	2912.04791851	7743647.65732730	1.30	0.2703
L	-0.13765175	1.84482727	33056.26290999	0.01	0.9414
N	-6.31969875	2.49850704	37986852.63166681	6.40	0.0223
P	15382.46800092	17858.53213025	4405165.55567630	0.74	0.4018

SAS

BACKWARD ELIMINATION PROCEDURE FOR DEPENDENT VARIABLE A

STEP 2 VARIABLE L REMOVED R SQUARE = 0.95381161 C(P) = 11.00572488

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	12	1962468120.23947700	163539010.01995642	29.25	0.0001
ERROR	17	95032638.56052308	5590155.20944253		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	51877.96043420				
B	354.49929072	388.32162531	4658771.97069486	0.83	0.3741
C	1.91072473	0.55144289	67114912.92479427	12.01	0.0030
D	4.57050168	2.46152034	19272797.41137362	3.45	0.0808
E	1.71467421	2.55476957	2518161.79627995	0.45	0.5111
F	-18.50273491	21.48345026	4146557.17742207	0.74	0.4011
G	3.56565712	5.30900047	2521607.54598489	0.45	0.5108
H	1.83499812	5.86092765	547977.07676362	0.10	0.7580
I	-5092.47675164	3864.94220287	9705009.58467378	1.74	0.2051
J	-348.15750192	274.34141912	9003111.31032688	1.61	0.2215
K	3371.14314655	2762.83594017	8322773.20973509	1.49	0.2391
N	-6.35160684	2.38855565	39529411.82480133	7.07	0.0165
P	14946.47447811	16374.52150337	4657621.14928716	0.83	0.3741

STEP 3 VARIABLE H REMOVED R SQUARE = 0.95354528 C(P) = 9.09225087

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	11	1961920143.16271340	178356376.65115576	33.59	0.0001
ERROR	18	95580615.63728670	5310034.20207148		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	51655.13226439				
B	346.27695014	377.60075564	4465589.27915695	0.84	0.3712
C	1.93977816	0.52978475	71187303.53367807	13.41	0.0018
D	4.41621209	2.35048601	18744843.60392497	3.53	0.0766
E	2.22715184	1.91175493	7206635.12825116	1.36	0.2592
F	-19.84123778	20.51950584	4964791.86617700	0.93	0.3464
G	3.86547206	5.08940792	3063147.24790684	0.58	0.4574
I	-5123.01516281	3765.66243230	9828015.42833153	1.85	0.1905
J	-352.58806658	267.02355406	9258345.70432289	1.74	0.2032
K	3441.21341745	2683.87487293	8729633.37640518	1.64	0.2160
N	-6.10840807	2.20140327	40884076.23664466	7.70	0.0125
P	15294.14580362	15922.24798466	4899356.06512539	0.92	0.3495

SAS

BACKWARD ELIMINATION PROCEDURE FOR DEPENDENT VARIABLE A

STEP 4 VARIABLE G REMOVED R SQUARE = 0.95205651 C(P) = 7.57592411

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	10	1958856995.91480660	195885699.59148065	37.73	0.0001
ERROR	19	98643762.88519354	5191776.99395755		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	50253.90441833				
B	344.69007288	373.36668345	4424889.77968121	0.85	0.3675
C	1.76632630	0.47268245	72496817.74690236	13.96	0.0014
D	4.64033558	2.30577683	21027142.85481925	4.05	0.0586
E	3.16401760	1.44421439	24918992.26293786	4.80	0.0411
F	-19.85349188	20.28972305	4970929.41622377	0.96	0.3401
I	-5428.80968101	3702.15083303	11163928.47936585	2.15	0.1589
J	-356.09272312	263.99401014	9446133.54272656	1.82	0.1932
K	3965.49828826	2564.54212627	12413432.53892835	2.39	0.1385
N	-6.19081313	2.17410671	42096860.31209869	8.11	0.0103
P	17618.12006014	15450.50183651	6750718.21145398	1.30	0.2683

STEP 5 VARIABLE B REMOVED R SQUARE = 0.94990590 C(P) = 6.27461753

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	1954432106.13512530	217159122.90390282	42.14	0.0001
ERROR	20	103068652.66487475	5153432.63324374		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	1851.15366954				
C	1.88990171	0.45165625	90231670.50310155	17.51	0.0005
D	4.20164585	2.24793368	18003979.26385949	3.49	0.0763
E	3.26212641	1.43497057	26632515.26458397	5.17	0.0342
F	-16.12453692	19.81004492	3414288.25623562	0.66	0.4253
I	-2590.28678957	2054.48046611	8191968.46486137	1.59	0.2219
J	-162.43850730	159.69217679	5332210.69224095	1.03	0.3212
K	2388.55517122	1905.81159325	8094820.60602334	1.57	0.2246
N	-6.00642002	2.15690317	39963793.22959913	7.75	0.0114
P	23775.12884637	13885.41065731	15108623.70596017	2.93	0.1023

SAS

BACKWARD ELIMINATION PROCEDURE FOR DEPENDENT VARIABLE A

STEP 6 VARIABLE F REMOVED R SQUARE = 0.94824646 C(P) = 4.81373620

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	8	1951017817.87888970	243877227.23486122	48.10	0.0001
ERROR	21	106482940.92111036	5070616.23433859		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	12206.03377870				
C	1.90413105	0.44767674	91732947.47248170	18.09	0.0004
D	4.67802555	2.15289834	23940812.06363152	4.72	0.0414
E	2.89476292	1.35115675	23274227.39102358	4.59	0.0440
I	-2882.14964750	2006.62692431	10460694.65538617	2.06	0.1656
J	-184.18046866	156.17215934	7052460.45526321	1.39	0.2515
K	2939.11900484	1767.36522321	14023049.73905285	2.77	0.1112
N	-6.20693583	2.12550177	43240659.75578604	8.53	0.0082
P	19350.84804981	12674.23257987	11819998.00095994	2.33	0.1417

STEP 7 VARIABLE J REMOVED R SQUARE = 0.94481878 C(P) = 3.92732500

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	7	1943965357.42362660	277709336.77480375	53.81	0.0001
ERROR	22	113535401.37637358	5160700.06256244		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-10508.41853017				
C	1.96921719	0.44819094	99625315.36179142	19.30	0.0002
D	5.38771116	2.08536866	34447010.91909818	6.67	0.0169
E	2.93500597	1.36267137	23941112.80768869	4.64	0.0425
I	-679.85611519	740.93568049	4344918.32525027	0.84	0.3688
K	1209.03239794	994.37049051	7629358.82452651	1.48	0.2369
N	-4.40755651	1.49290182	44982325.30187816	8.72	0.0074
P	12663.67477924	11435.34041115	6328924.59707681	1.23	0.2801

SAS

BACKWARD ELIMINATION PROCEDURE FOR DEPENDENT VARIABLE A

STEP 8 VARIABLE I REMOVED R SQUARE = 0.94270703 C(P) = 2.61339086

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	6	1939620439.09837630	323270073.18306266	63.07	0.0001
ERROR	23	117880319.70162384	5125231.29137495		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-185.14289198				
C	2.10797981	0.42045381	128827854.18025651	25.14	0.0001
D	5.38390360	2.07818597	34398476.06346329	6.71	0.0163
E	2.68046572	1.32954300	20831915.63041984	4.06	0.0556
K	754.16224654	859.01762880	3950380.16046753	0.77	0.3891
N	-4.45814064	1.48674800	46083586.43405592	8.99	0.0064
P	4304.64438346	6888.11800902	2001644.14024793	0.39	0.5382

STEP 9 VARIABLE P REMOVED R SQUARE = 0.94173418 C(P) = 0.92945197

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	5	1937618794.95812830	387523758.99162566	77.58	0.0001
ERROR	24	119881963.84187178	4995081.82674466		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	6615.60566053				
C	2.20050748	0.38849381	160258142.31169896	32.08	0.0001
D	5.78634163	1.95064707	43953488.44946611	8.80	0.0067
E	2.51329994	1.28571431	19087203.08218167	3.82	0.0623
K	1014.11169871	741.98609348	9330881.22242053	1.87	0.1844
N	-4.50159500	1.46614335	47089337.00137778	9.43	0.0053

STEP 10 VARIABLE K REMOVED R SQUARE = 0.93719913 C(P) = 0.40280511

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	4	1928287913.73570780	482071978.43392690	93.27	0.0001
ERROR	25	129212845.06429230	5168513.80257169		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	5903.98878851				
C	2.62759046	0.23480570	647237618.68011800	125.23	0.0001
D	6.97060946	1.77771660	79466142.02476362	15.38	0.0006
E	2.87011996	1.28059820	25962111.19405342	5.02	0.0341
N	-4.48090736	1.49129934	46662495.07905741	9.03	0.0060

ALL VARIABLES IN THE MODEL ARE SIGNIFICANT AT THE 0.1000 LEVEL.

APPENDIX G

MAXIMUM R SQUARE PROCEDURE FOR THE IDENTIFICATION OF INDEPENDENT VARIABLES

SAS

MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE A

WARNING: 6 OBSERVATIONS DELETED DUE TO MISSING VALUES.

STEP 1 VARIABLE C ENTERED R SQUARE = 0.84538302 C(P) = 24.23210484

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	1739376209.49407080	1739376209.4940708	153.09	0.0001
ERROR	28	318124549.30592930	11361591.0466403		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	9167.51193973				
C	3.15868657	0.25528738	1739376209.4940708	153.09	0.0001

THE ABOVE MODEL IS THE BEST 1 VARIABLE MODEL FOUND.

STEP 2 VARIABLE D ENTERED R SQUARE = 0.90471131 C(P) = 6.95747509

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	1861444216.04379400	930722108.02189700	128.17	0.0001
ERROR	27	196056542.75620606	7261353.43541504		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	5896.84211772				
C	2.57784335	0.24843809	781797486.60059230	107 67	0.0001
D	8 15592867	1.98921296	122068006.54972326	16.81	0.0003

THE ABOVE MODEL IS THE BEST 2 VARIABLE MODEL FOUND.

STEP 3 VARIABLE N ENTERED R SQUARE = 0.92458085 C(P) = 2.50224193

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	1902325802.54165410	634108600.84721800	106.25	0.0001
ERROR	26	155174956.25834602	5968267.54839792		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	6285.55776116				
C	2.79218262	0.23966057	810107648.66216920	135.74	0.0001
D	8.28090847	1.80405109	125749592.52874148	21.07	0.0001
N	-4.17676794	1.59588142	40881586.49786003	6.85	0.0146

THE ABOVE MODEL IS THE BEST 3 VARIABLE MODEL FOUND.

SAS

MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE A

STEP 4 VARIABLE G ENTERED R SQUARE = 0.94018631 C(P) = -0.56767253

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	4	1934434038.03142450	483608509.50785610	98.24	0.0001
ERROR	25	123066720.76857556	4922668.83074302		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	5280.18913653				
C	2.76045836	0.21801123	789233089.49515040	160.33	0.0001
D	6.48292682	1.78326774	65059354.99303553	13.22	0.0013
G	8.07248221	3.16081579	32108235.48977045	6.52	0.0171
N	-4.29987141	1.45016302	43279068.28385208	8.79	0.0066

THE ABOVE MODEL IS THE BEST 4 VARIABLE MODEL FOUND.

STEP 5 VARIABLE P ENTERED R SQUARE = 0.94330645 C(P) = 0.41865385

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	5	1940853726.51886110	388170745.30377220	79.87	0.0001
ERROR	24	116647032.28113899	4860293.01171412		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-5067.99223416				
C	2.45089956	0.34565332	244361067.00772269	50.28	0.0001
D	5.39857654	2.00747335	35149682.21181569	7.23	0.0128
G	8.22912702	3.14368246	33303711.74362310	6.85	0.0151
N	-4.23009171	1.44222473	41811537.97826991	8.60	0.0073
P	6728.12005894	5854.20574267	6419688.48743657	1.32	0.2618

THE ABOVE MODEL IS THE BEST 5 VARIABLE MODEL FOUND.

STEP 6 VARIABLE H ENTERED R SQUARE = 0.94654475 C(P) = 1.36659061

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	6	1947516539.95825770	324586089.99304294	67.88	0.0001
ERROR	23	109984218.84174244	4781922.55833663		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-5452.99665709				
C	2.26220938	0.37828931	171009407.35025434	35.76	0.0001
D	5.32619172	1.99216672	34181000.26708741	7.15	0.0136
G	5.28962817	3.99059000	8401921.26914170	1.76	0.1980
H	4.60554130	3.90169327	6662813.43939654	1.39	0.2499
N	-5.16140802	1.63369907	47730369.73676640	9.98	0.0044
P	7740.45232643	5869.80578701	8315488.25985982	1.74	0.2003

SAS

MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE A

THE ABOVE MODEL IS THE BEST 6 VARIABLE MODEL FOUND.

STEP 7 VARIABLE F ENTERED R SQUARE = 0.94790532 C(P) = 2.92456721

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	7	1950315914.91804700	278616559.27400666	57.19	0.0001
ERROR	22	107184843.88195312	4872038.35827060		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-10059.18766683				
C	2.19705718	0.39139144	153522052.00349028	31.51	0.0001
D	4.85221948	2.10582528	25867050.03709453	5.31	0.0310
F	-12.82443906	16.91855202	2799374.95978932	0.57	0.4565
G	5.32460626	4.02828034	8512288.26647660	1.75	0.1998
H	4.49140593	3.94116293	6327418.14251956	1.30	0.2667
N	-5.14025806	1.64925687	47326451.21928855	9.71	0.0050
P	11093.29219876	7393.82941115	10967123.93094505	2.25	0.1477

STEP 7 H REPLACED BY E R SQUARE = 0.94842049 C(P) = 2.75719930

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	7	1951375871.27050200	278767981.61007171	57.79	0.0001
ERROR	22	106124887.52949805	4823858.52406809		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-12749.73317437				
C	2.21522907	0.37956806	164305664.37333936	34.06	0.0001
D	4.38521332	2.13523811	20346203.65166856	4.22	0.0521
E	2.05945313	1.66419471	7387374.49497463	1.53	0.2289
F	-19.42279172	17.47654744	5958083.53754135	1.24	0.2784
G	4.88818255	4.11412562	6809799.08770266	1.41	0.2474
N	-4.39540240	1.44285576	44765764.98188247	9.28	0.0059
P	12382.29404169	7515.28645311	13095006.26191369	2.71	0.1136

THE ABOVE MODEL IS THE BEST 7 VARIABLE MODEL FOUND.

SAS

MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE A

STEP 8 VARIABLE L ENTERED R SQUARE = 0.94898960 C(P) = 4.57230503

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	8	1952546823.76939040	244068352.97117380	48.84	0.0001
ERROR	21	104953935.03060973	4997806.43002904		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-13178.09542715				
C	2.18707530	0.39070477	156606387.93713488	31.34	0.0001
D	4.38060243	2.17341629	20303049.51101005	4.06	0.0568
E	1.99212704	1.69963533	6865971.44677937	1.37	0.2543
F	-19.00409939	17.80987647	5690523.26946381	1.14	0.2981
G	5.21792596	4.24269493	7559475.21507992	1.51	0.2323
L	-0.61762159	1.27597611	1170952.49888831	0.23	0.6334
N	-4.27818402	1.48847188	41287357.37000869	8.26	0.0091
P	12761.72061815	7689.64499523	13765288.44354824	2.75	0.1119

THE ABOVE MODEL IS THE BEST 8 VARIABLE MODEL FOUND.

STEP 9 VARIABLE B ENTERED R SQUARE = 0.94950986 C(P) = 6.40328305

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	9	1953617255.52594490	217068583.94732721	41.79	0.0001
ERROR	20	103883503.27405521	5194175.16370276		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-22655.00760674				
B	-87.75956679	193.31843647	1070431.75655452	0.21	0.6547
C	2.20151951	0.39957525	157675606.72580733	30.36	0.0001
D	4.14999393	2.27318967	17311717.85757242	3.33	0.0829
E	2.12785817	1.75831117	7606948.51735760	1.46	0.2403
F	-18.31899398	18.21900237	5251346.15351117	1.01	0.3267
G	5.21671768	4.32524255	7555971.74835055	1.45	0.2418
L	-0.73686838	1.32705900	1601459.53700185	0.31	0.5849
N	-4.67343712	1.74947639	37065787.19124606	7.14	0.0147
P	18509.14304599	14891.03713196	8024894.31882322	1.54	0.2283

THE ABOVE MODEL IS THE BEST 9 VARIABLE MODEL FOUND.

SAS

MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE A

STEP 10 VARIABLE K ENTERED R SQUARE = 0.94999029 C(P) = 8.24720003

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	10	1954605743.64525440	195460574.36452544	36.09	0.0001
ERROR	19	102895015.15474568	5415527.11340767		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-23409.20429734				
B	-142.33887647	235.12727956	1984640.10560220	0.37	0.5521
C	2.08298530	0.49339702	96520619.35278363	17.82	0.0005
D	3.98663346	2.35240455	15553542.70149956	2.87	0.1065
E	2.11263903	1.79573924	7495572.11293228	1.38	0.2539
F	-13.65225564	21.57296417	2168851.98196767	0.40	0.5344
G	4.45876912	4.75944718	4752889.10575104	0.88	0.3606
K	559.26877582	1309.04692096	988488.11930953	0.18	0.6740
L	-1.04829188	1.53865994	2513737.26587040	0.46	0.5039
N	-4.90778447	1.86868310	37354281.10543934	6.90	0.0166
P	18973.71676206	15243.85435442	8389884.44887267	1.55	0.2284

THE ABOVE MODEL IS THE BEST 10 VARIABLE MODEL FOUND.

STEP 11 VARIABLE I ENTERED R SQUARE = 0.95032157 C(P) = 10.13957458

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	11	1955287345.57910500	177753395.05264591	31.30	0.0001
ERROR	18	102213413.22089505	5678522.95671639		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-25100.62816677				
B	-113.30976125	254.93179127	1121817.05861278	0.20	0.6620
C	1.99805343	0.56156829	71886018.42366134	12.66	0.0022
D	4.12990464	2.44408621	16213709.68877407	2.86	0.1083
E	2.36058034	1.97317931	8127179.50984141	1.43	0.2471
F	-13.95045004	22.10734256	2261198.76953078	0.40	0.5360
G	3.76214082	5.27213789	2891558.34403874	0.51	0.4846
I	-320.55686862	925.24633391	681601.93385062	0.12	0.7330
K	785.78394878	1491.40394255	1576344.43778784	0.28	0.6047
L	-1.07239622	1.57711360	2625548.12071455	0.46	0.5052
N	-4.75010943	1.96689665	33119176.82049649	5.83	0.0266
P	21049.51485540	16719.99913133	9000094.43361822	1.58	0.2241

SAS

MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE A

STEP 11 L REPLACED BY J R SQUARE = 0.95354528 C(P) = 9.09225087

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	11	1961920143.16271340	178356376.65115576	33.59	0.0001
ERROR	18	95580615.63728673	5310034.20207149		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	51655.13226439				
B	346.27695014	377.60075564	4465589.27915693	0.84	0.3712
C	1.93977816	0.52978475	71187303.53367815	13.41	0.0018
D	4.41621209	2.35048601	18744843.60392497	3.53	0.0766
E	2.22715184	1.91175493	7206635.12825117	1.36	0.2592
F	-19.84123778	20.51950584	4964791.86617701	0.93	0.3464
G	3.86547206	5.08940792	3063147.24790685	0.58	0.4574
I	-5123.01516281	3765.66243230	9828015.42833151	1.85	0.1905
J	-352.58806658	267.02355406	9258345.70432287	1.74	0.2032
K	3441.21341745	2683.87487293	8729633.37640515	1.64	0.2160
N	-6.10840807	2.20140327	40884076.23664465	7.70	0.0125
P	15294.14580362	15922.24798466	4899356.06512540	0.92	0.3495

THE ABOVE MODEL IS THE BEST 11 VARIABLE MODEL FOUND.

STEP 12 VARIABLE H ENTERED R SQUARE = 0.95381161 C(P) = 11.00572488

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	12	1962468120.23947700	163539010.01995641	29.25	0.0001
ERROR	17	95032638.56052310	5590155.20944254		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	51877.96043420				
B	354.49929072	388.32162531	4658771.97069485	0.83	0.3741
C	1.91072473	0.55144289	67114912.92479434	12.01	0.0030
D	4.57050168	2.46152034	19272797.41137362	3.45	0.0808
E	1.71467421	2.55476957	2518161.79627994	0.45	0.5111
F	-18.50273491	21.48345026	4146557.17742207	0.74	0.4011
G	3.56565712	5.30900047	2521607.54598490	0.45	0.5108
H	1.83499812	5.86092765	547977.07676362	0.10	0.7580
I	-5092.47675164	3864.94220287	9705009.58467375	1.74	0.2051
J	-348.15750192	274.34141912	9003111.31032686	1.61	0.2215
K	3371.14314655	2762.83594017	8322773.20973507	1.49	0.2391
N	-6.35160684	2.38855565	39529411.82480131	7.07	0.0165
P	14946.47447811	16374.52150337	4657621.14928717	0.83	0.3741

THE ABOVE MODEL IS THE BEST 12 VARIABLE MODEL FOUND.

SAS

MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE A

STEP 13 VARIABLE L ENTERED R SQUARE = 0.95382768 C(P) = 13.00050527

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	13	1962501176.50238700	150961628.96172207	25.43	0.0001
ERROR	16	94999582.29761311	5937473.89360082		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	48965.44267142				
B	333.25617379	491.13992231	2733679.81608737	0.46	0.5071
C	1.90000312	0.58619961	62376253.65607412	10.51	0.0051
D	4.54451488	2.56063151	18701765.30875234	3.15	0.0950
E	1.71235989	2.63312084	2511020.31397513	0.42	0.5247
F	-17.89029074	23.61326877	3408193.85628717	0.57	0.4597
G	3.53963442	5.48254461	2474880.21513518	0.42	0.5277
H	1.84543052	6.04187312	553928.75029841	0.09	0.7640
I	-4935.66180548	4503.64547229	7131224.52014837	1.20	0.2893
J	-336.43800960	323.43337054	6424541.95815156	1.08	0.3137
K	3325.60337750	2912.04791851	7743647.65732727	1.30	0.2703
L	-0.13765175	1.84482727	33056.26290999	0.01	0.9414
N	-6.31969875	2.49850704	37986852.63166679	6.40	0.0223
P	15382.46800093	17858.53213025	4405165.55567632	0.74	0.4018

THE ABOVE MODEL IS THE BEST 13 VARIABLE MODEL FOUND.

STEP 14 VARIABLE M ENTERED R SQUARE = 0.95382924 C(P) = 15.00000000

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	14	1962504376.40341370	140178884.02881526	22.13	0.0001
ERROR	15	94996382.39658641	6333092.15977243		
TOTAL	29	2057500758.80000010			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	48827.62078181				
B	331.80383739	511.33704506	2666638.23625247	0.42	0.5262
C	1.89700863	0.61989783	59308124.04635801	9.36	0.0079
D	4.53567547	2.67364206	18226078.02254094	2.88	0.1105
E	1.70671165	2.73101410	2473365.11123508	0.39	0.5414
F	-17.81564457	24.61233018	3318283.00197988	0.52	0.4803
G	3.52662891	5.69173630	2431340.54673173	0.38	0.5448
H	1.88970260	6.54337133	528201.45853911	0.08	0.7767
I	-4933.63302762	4652.14230679	7122681.27890670	1.12	0.3057
J	-336.15358722	334.27449110	6404494.18407398	1.01	0.3305
K	3327.90711648	3009.24526394	7745385.34423529	1.22	0.2862
L	-0.13970663	1.90748917	33972.35571593	0.01	0.9426
M	0.15709210	6.98866086	3199.90102670	0.00	0.9824
N	-6.32350513	2.58595385	37869539.02972826	5.98	0.0273
P	15442.33707228	18635.21961560	4348834.02803837	0.69	0.4203

THE ABOVE MODEL IS THE BEST 14 VARIABLE MODEL FOUND.

APPENDIX H

COVER LETTER AND DATA COLLECTION FORM

Oklahoma State University

CENTER FOR APPAREL MARKETING & MERCHANDISING

STILLWATER, OKLAHOMA 74078
HOME ECONOMICS WEST 306
(405) 624-7469

September 7, 1984

Dear

My doctoral research project at Oklahoma State University relates to sales forecasting for service retailers. I developed a sales forecasting model using data from Cleaners in . As you know, this is a retail plant processing for four dry stores and two retail routes. The accuracy of this forecasting model was extremely high in the experimental operation and we would like to see if the same model could function for other operations.

You are one of twelve service business owners we are inviting to test the sales forecasting model. The information required to test the model would include 1982 and 1983 monthly figures from one or more of your production locations (package plants). These figures include total sales volume, the number of routes and dry stores serving the location, the retail price for a pair of men's pants or women's slacks and total advertising expenditures. Please estimate the population in your trading area and percentage distribution for your production work profile purposes.

Three copies of a form for recording this information have been enclosed along with a self-addressed, stamped envelope. Please feel free to make additional copies of the form if you are able to provide the information for more locations. The information will remain confidential and the identity of your establishment(s) will remain annonymous. I plan to call within the week to see if you have any questions. I need your completed information form(s) by October 1st in order to finalize statements related to the model.

I plan to share implications drawn from my work with Cost Group members after completion of my dissertation. In advance, I thank you for taking time from your busy schedule to assist with this research project.

Most Sincerely,

Antigone Kotsiopulos
Graduate Research Associate

Kathryn M. Greenwood
Director

Enclosures

AK:ew

SALES FORECASTING MODEL
EXTERNAL DATA COLLECTION

COMPANY NAME _____

PRODUCTION LOCATION _____

(Select one production location, or use one sheet per location if you are able to provide information for more than one location.)

Please estimate the population of the area served by this location _____

Please estimate the percentage of business at this location which is:

_____ dry cleaning (retail)
_____ family laundry
_____ other (please specify) _____
_____ industrial and linen supply
_____ uniform servicing

		TOTAL SALES VOLUME	NUMBER OF ROUTES	NUMBER OF DRY STORES	RETAIL PRICE FOR PAIR MEN'S PANTS/ WOMEN'S SLACKS	TOTAL ADVERTISING $
1982	JAN					
	FEB					
	MAR					
	APR					
	MAY					
	JUN					
	JUL					
	AUG					
	SEP					
	OCT					
	NOV					
	DEC					
1983	JAN					
	FEB					
	MAR					
	APR					
	MAY					
	JUN					
	JUL					
	AUG					
	SEP					
	OCT					
	NOV					
	DEC					

APPENDIX I

SUMMARY OF MODEL PERFORMANCE FOR EACH OF FOURTEEN BUSINESSES

TABLE XVII

SUMMARY OF MODEL 1 PERFORMANCE FOR EACH OF FOURTEEN BUSINESSES

Business	F Value	R^2
1	3.35 *	.828663
2	7.63 **	.930290
3	3.29 *	.826133
4	4.31 *	.861728
5	5.03 **	.857987
6	8.50 **	.924707
7	6.42 **	.885166
8	11.82 ***	.944648
9	10.96 ***	.940602
10	4.58 *	.868701
11	2.77	.829113
12	3.13 *	.818769
13	5.26 **	.883636
14	3.40 *	.856158

*** = .001 level of significance
** = .01 level of significance
* = .05 level of significance

TABLE XVIII

SUMMARY OF MODEL 2 PERFORMANCE FOR EACH OF FOURTEEN BUSINESSES

Business	F Value	R^2
1	4.59 **	.833427
2	8.36 ***	.915733
3	2.25	.710250
4	6.43 **	.875184
5	6.40 **	.854423
6	11.35 ***	.925260
7	5.48 **	.833901
8	11.90 ****	.928498
9	10.85 ***	.922048
10	4.59 **	.833681
11	2.33	.751660
12	3.99 *	.813294
13	5.90 **	.865608
14	3.88 *	.834402

**** = .0001 level of significance
*** = .001 level of signifcance
** = .01 level of significance
* = .05 level of significance

TABLE XIX

SUMMARY OF MODEL 3 PERFORMANCE FOR EACH OF FOURTEEN BUSINESSES

Business	F Value	R^2
1	4.49 **	.830482
2	7.59 ***	.892291
3	2.29	.713968
4	8.73 ***	.904965
5	5.50 **	.857179
6	11.35 ***	.925260
7	8.77 ***	.905410
8	11.90 ****	.928498
9	10.84 ***	.922048
10	4.59 **	.833681
11	2.70	.746435
12	3.99 *	.813294
13	5.90 **	.865608
14	4.32 *	.824894

**** = .0001 level of significance
*** = .001 level of significance
** = .01 level of significance
* = .05 level of significance

TABLE XX

SUMMARY OF MODEL 4 PERFORMANCE FOR EACH OF FOURTEEN BUSINESSES

Business	F Value	R^2
1	3.30 *	.826714
2	5.62 **	.890409
3	3.50 *	.834989
4	7.03 **	.910329
5	4.44 *	.864996
6	8.50 **	.924707
7	7.10 **	.911159
8	11.82 ***	.944648
9	10.96 ***	.940602
10	4.58 *	.868701
11	2.88	.806011
12	3.13 *	.818769
13	5.26 **	.883636
14	3.85 *	.847637

*** = .001 level of significane
** = .01 level of significance
* = .05 level of significance

APPENDIX J

PROPOSED MARKETING STRATEGIES FOR SMALL DRYCLEANING BUSINESSES

MARKETING STRATEGIES

Introduction

Some authors suggest that formalized marketing strategies have experience slow adoption in service industries because such businesses have historically been inbred. The points which are provided in this section are based on services marketing literature and research which is applicable to the drycleaning industry. The points in this section are intended to assist the drycleaner with establishng marketing strategies. These statements are based on the premise that the small business drycleaner is typcially involved with processing and not promoting. They are also made with the understanding that not all services marketing ideas will work for all businesses. For instance, drycleannng consumers have a small 'evoked set', meaning a small number of alternatives or options available both in the number of service providers and the number of services offered. We also know that drycleaning is more likely to be 'want' driven than 'need' driven. In other words, people tend to have garments cleaned for time saving reasons, social or psychological reasons and because of personal preference as much as for need.

The drycleaning industry is a high contact service which means that your customer contact people tend to represent your service. Name recognition and meeting per-onal customer requirements will make a difference in this business. Unlike with products, which can be tested or purchased and then returned, once this service has been delivered the process cannot be reversed. The four areas of concentration for statements which may impact on your strategies include attracting new customers, maintaining quality standards, profiling your customers and promoting with benefits in mind.

1) Attracting new customers before they develop the habit of utilizing another service provider.

a. Drycleaners do not tend to be geographically competitive. If you are delivering comparable service at a comparable price, you are probably not competing with the drycleaning on the other side of town.

b. People do not tend to shop for services as they do for products, because there is really only one 'brand.' There are fewer tangible characteristics which differenital one service provider from another and they respond habitually when in need of the service.

c. The consumer will tend to keep using the services of the first service provider that appears to be satisfactory, even if prices are higher.

d. Attempt to differentiate yourself from your competitor with something that is important to the consumer.

e. Strive for consistency in your appeals, relevance to consumer needs, and execute them so as to achieve and enhance a good, solid image of you in the consumer's mind.

f. Promotion does not foster brand loyalty. If you periodically run specials people will wait for your special. This idea can, however, be helpful when attempting to smooth demand or to balance out high and low periods in your business. Time and effort should be put into the services your offer and not in planning promotions.

g. Specials may foster brand trial. Target newlyweds and people who are new to your community. Use coupons distributed through the 'welcome wagon' in your community.

2) Strive to maintain customers by doing 'quality' work.

a. There is little objective measure of the quality of your work. The customer is buying 'confidence' in the work you provide.

b. Service quality is perceived by the customer as a comparison between the expected serve (what they expected to get) and the perceived (what they feel they received).

c. Attitudes and ideas are built on perceptions and not on reality. You work may meet higher standards but that may not be the public`s perception.

d. When you expand the number of dry stores the consumer may begin to weigh convenience again quality

control. Encourage your employees to give the impression that they are running the show. They must express sincere interest in the customer's garments and build a partnership of caring for the garment.

e. One can never compensate inferior services with hard selling and advertising techniques.

f. Because your business is perceived to be a high risk experience there is a tendency to relate price and quality. Do not jeporadize your position in the market place by offering prices which may appear to be too low.

g. Drycleaning is very intangible and therefore, tangible signs of your care in handling the customers' items is helpful. Go beyond basic expectations is providing visable proof of your interest in their items by using drop tags, reminders, or cards which say "inspected by ..."

h. Your strategies must always incorporate the people who have direct contact with your customers.

3) Maintain a good profile of the customer and use the information to build a stronger customer base.

a. Since you expect to serve customers on a repeat basis, examine your records to see what you know about them. Determine what information you already have collected and what information you could or would like to collect. A schematic of a proposed information base has been provided.

b. Knowing who you customers are will enable you to organize and implement and effective use of direct mail and telephone selling.

c. Both you and the customer realize that you benefit one another through repeat patronage. You will get to know the customer's likes and dislikes and they will, hopefully, become better at communicating their needs. Obtain as much knowledge about your customer as you are able to. You will be demonstrating interest in the customer and facilitating customer satisfaction.

d. Word of mouth promotion costs you little except time and attention and is one of your most valuable marketing tools.

4) Promote and educate with service 'benefits' in mind.

a. Do not confuse benefits with services. The service is drycleaning. A benefit is clean cloths. The benefit of time savings is generally stronger for people than is the preservation of their clothing. The need for a perception of quality is generally stronger than a savings in money.

b. Services lack distinctiveness and are largely undifferentiated in the market place. What you are offering is difficult to perceive or judge in terms of value.

c. The benefits you offer cannot generally be seen, tested or sampled before buying, except by trial.

d. Educate the public about what your service and benefits are all about. Consumers, particularly the growing number of men who are caring for their own clothing, are not

likely to have prepurchase information. This is particularly important if you are offering new services. For instance, some people think that cleaning chemicals are hard on their clothes so you may have to educate and inform they of the affects of drycleaning on the item. Tailoring, repair and express services may be available but not visible to the customer.

e. The customer can assume some responsibility in the drycleaning process but you must let them know this. Let them know that if they know the source of a spot you are better able to remove it. Let them know that stains are more difficult to remove if they are allowed to sit and that they can be set by heat.

f. Consider linking your marketing efforts more to fashion. Higher income groups tend to use drycleaning services and these populations tend to be more fashion oriented. This will also assist in updating the image of the drycleaner.

g. Work with your employees on developing suggestive selling techniques.

Prior to developing marketing strategies you must seek to answer some very pertinent questions. Ask yourself:

1. Who are my customers and what markets are we serving.
2. Why are these customers using our service rather than our competitiors?
3. What do customers want from a drycleaners?

4. What changes should we make to meet the wants of our existing customers or of customers we would like to attact?

5. What messages should we use to best communicate with our customers?

6. What media should we use and how should it be used in order to ensure that our messages are are understood and believed by our customers?

VITA 2

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